Permanente Journal

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The Permanente Journal

Special Journal Supplement
A FOCUS ON KP HEALTHCONNECT

Guest Editors: Andrew M Wiesenthal, MD and Jon Stewart

As the KP HealthConnect system is rolled out across the regions, the editors of *The Permanente Journal* gathered some of the significant participants in the development of the electronic medical record (EMR) to share their thoughts, processes, insights, and learnings. This Special Feature delves into the history of the EMR at KP, the process for implementation throughout the regions, some valuable lessons on using the computer in the exam room and as a clinical tool, on the interface with the Clinical Library, and the potential to transform the medical encounter.

Kaiser Permanente HealthConnect
Crossing the Quality Chasm

Sadly, most of us have become used to practicing medicine with incomplete information. Thanks to the significant effort and investments that The Permanente Medical Groups have expended over the years, we have far better information than most physicians have available to them. However, it still falls short of a fully integrated information system that parallels our integrated structure. Our integrated structure is the core of who we are and is our strongest competitive advantage. KP HealthConnect will significantly increase our ability to manage care across all settings, including the patient's home. It will strengthen our partnership with our patients and help them take ownership of their health.

The Care Management Institute has spent years understanding what is truly evidence-based medicine. This knowledge will now be available literally at our fingertips when we are making decisions in the exam room with our patients. Health information, patient instructions, and self-care tools to support patients will be easily available. Busy patients will have a more efficient option than an office visit or phone call via secure messaging. Our experience at Kaiser Permanente Northwest (KPNW) and Group Health Permanente has taught us that patients are very judicious in their use of this option and will stay with us because of it. Phone call visits will be more effective with immediate access to all clinical information. Clinicians and staff will be able to personalize care for patients based on their recorded preferences. Testing and diagnostic results will always be available, eliminating repeat studies and delays in care. Myriad adverse drug events because of unreadable or unavailable information will be eliminated.

The experience of KPNW and Colorado Permanente Medical Group with electronic medical records has taught us that we have the potential to improve our already nationally recognized clinical performance to world-class levels. No other health care organization in the world is better positioned to cross the quality chasm so well described in the Institute of Medicine's recent reports.[1] Our comprehensive longitudinal database will enable us to make significant contributions to medical knowledge to help other health care organizations "cross the quality chasm." Each of us chose medicine knowing that we were embarking on a lifelong journey in search of the best care we could provide our patients. Implementing KP HealthConnect will help us reach that goal.

At the same time, as we are poised to attain clinical excellence, we are beleaguered by demands for lower-cost health plan coverage. Hardly a week passes without a newspaper story describing the burden that health care costs place on individuals, employers, and government programs. Even employers and purchasers who believe that integrated, comprehensive care is the best model have been demanding information that demonstrates the value we add. KP HealthConnect will give us both the data to document our added value and the administrative processes to administer deductibles and other cost-sharing products the market demands. This will ensure that we can continue to make care available to millions of patients.

But KP HealthConnect is not primarily about technology. It is about leveraging our integrated structure and changing how we work with each other and with our patients. Like most very important work, it will be challenging and difficult. Each of us will learn new skills and processes. I recognize the personal stamina it takes to change such a fundamental part of how we practice. In addition, your clinical team will look to each of you for leadership in this change. You can help provide the important clinical and competitive context for the $3.2 billion investment that we are making over the next ten years. We hope that this issue of *The Permanente Journal* will give you a view of the many ways that we expect KP HealthConnect to affect your work life, your team, and your patients.

The KP HealthConnect national team works very closely with your regional team, Medical Group, and Health Plan leadership to support the regional goals you have established. Together we are committed to ensuring as smooth an implementation as possible. Nonetheless, we are undertaking a very complex transition and there will be setbacks, frustrations, and long days for everyone involved. Despite this, I have not met a single physician who wants to stay with our current fragmented systems. In the end, our shared commitment to the excellence we can achieve together will vault us over the quality chasm. ❖

Louise Liang, MD,
Senior Vice President, Quality and Clinical Systems Support Kaiser Foundation Health Plan and Hospitals Co-Executive Sponsor, KP HealthConnect

Dr Liang was the Founding CEO and President of Group Health Permanente

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Special Feature
INTRODUCTION

This is Getting Serious

By Andrew M Wiesenthal, MD
Associate Executive Director, Clinical Information Support
The Permanente Federation

At a recent meeting, my boss, Jay Crosson, MD, was heard to say, "This is getting serious."

Indeed it is. Some time during 2004, every region will have launched a part of the KP HealthConnect suite of systems. Issues and problems that were theoretical in 2003 now have real operational significance. Everyone in the organization will need to learn new software, learn new ways of performing their work, and begin to think about how to build the future of Kaiser Permanente (KP) using this new set of tools.

The implementation of complex software like KP HealthConnect can usefully be divided into three phases: adaptation, sophistication, and transformation. Adaptation is the process by which people get comfortable with the basics—performing the essential tasks of patient care and other parts of our operations through a limited, "get-through-the-day" approach to learning the software. "I've got to document my work, write orders, and manage results, and I probably won't learn anything else until I learn how to do those things." Once a user has adapted to the software, they can move on to sophistication. This advance involves a richer exploration of all the features and functions of the software, making it possible to perform those basic tasks and produce better results—of higher quality, safer, or more efficient. Transformation occurs when a user or group of users figures out how to do something completely new, something perhaps that couldn't have been done before, by using the new tool.

All of us who have worked to implement electronic health record software in KP during the past two decades have expended a great deal of energy making sure that all users adapt. Adaptation is essential. If people cannot use the system to do their basic work, the implementation will fail. We also know that most users remain at that stage, because additional investments in training are required to help them progress to a more sophisticated level of use. Sophistication is desirable because the system will not benefit members or staff in any substantial way if all that is achieved is limited automation of current processes. We want users to take the fullest advantage possible of the capabilities of the software.

The real goal is transformation. What we really want is to do new and better things as we work with members, abetted by the software. Here, it is more a question of creating an environment that fosters the creative use of the tool, observing the impacts of that creativity, and widely propagating the successful ideas while pruning out the unsuccessful ideas or the old processes that the new approaches have supplanted. When transformation becomes our routine, the implementation of KP HealthConnect can truly be characterized as successful.

We have asked some noteworthy experts to help describe approaches to moving our KP HealthConnect users through adaptation to sophistication and beyond to transformation. George Halvorson shares his vision for the

The dynamic duo of KP HealthConnect, Drs Andy Wiesenthal and Louise Liang have served as point persons for the top leadership of the medical groups and the health plan in ensuring a successful implementation of KP HealthConnect in all of KP's regions.

future and how KP HealthConnect plays a key role. Peter DeVault, from Epic Systems, gives us the benefit of our vendor's broad experience in implementing their system, and Homer Chin, MD, who helped lead implementation of Epic in the Northwest, shares some valuable lessons learned from their experience. Paul Wallace, MD, Executive Director of KP's Care Management Institute, describes how KP HealthConnect combines with our capacity to understand medical evidence to enable our clinicians to do the right thing. There are also some historical tidbits,

commentaries from various champions of KP's implementation initiatives, and more. We thought you would enjoy having the benefits of all these experiences, and we welcome hearing from you about your own.

Thinking about my role in the development and implementation of electronic health records at KP brings to mind a Jerry Garcia quote —"What a long strange trip it's been." I have been on it for a long time, and, as I contemplate the rich possibilities described in the articles that follow, I am excited about the next leg of the journey. ❖

Reengineering Care with KP HealthConnect

By George C Halvorson

Excerpted from Epilogue: Prepaid Group Practice and Computerized Caregiver Support Tools; Toward a 21st Century Health System: The Contributions and Promise of Prepaid Group Practice *by Alain Enthoven and Laura Tollen, editors. (April 2004; $30.00; Cloth) by permission of Jossey-Bass/A Wiley Imprint*

Many of America's health care costs, financial and otherwise, result from its current paper-based approach to maintaining patient records. This nonsystem often leads to inconsistencies in patient care (poor quality) and dysfunctional information transmission systems (inefficiencies). It is an outmoded, ineffective support system for caregivers. A fully computerized system, including patient-specific medical records, reminders, and treatment protocols, is needed to provide complete information about each patient to the caregiver in the exam room. That electronic tool is the missing link between current inconsistent care and best care. After years of experimentation and development, these tools are now ready for practical use by caregivers, and multispecialty group practices (including prepaid group practices) are the logical environment for the initial large-scale use of these approaches.

Poor Quality and Inconsistencies

Evidence compiled by researchers from several high-profile organizations—including the Institute of Medicine, the National Committee for Quality Assurance, RAND, and the Dartmouth Atlas Project—points toward the fact that the actual delivery of health care in this country too often varies from science-based best practice.[1-6] Study after study of health care performance shows wide variations in both treatment approaches and care outcomes—with levels of performance inconsistency that would be unacceptable in any other area of the American economy.

Some specific examples of variation from best practice include the following:

- Heart disease is America's number one killer (approximately one person dies each minute from a coronary event),[6] yet nearly half of America's heart attack patients do not receive the most effective follow-up care.[1]

- More than 6% of the American population has diabetes,[6] but fewer than half of America's diabetics receive the levels of care necessary to reduce or prevent complications.[5]

- High blood pressure (hypertension) is the most treatable cardiovascular disease; however, roughly 40% of America's hypertension patients do not receive the most current and appropriate levels of care, resulting in 68,000 premature deaths each year.[5]

Another sad fact for the current practice of medicine is that with rare exceptions, no one external to the caregiver or patient has an ongoing quantitative sense of whether or not the approaches used are effective or add optimal value for a given patient or for populations of similar patients. Unless care is so out of line as to constitute malpractice—an extremely rare event—there is almost no process in most settings for determining what is or is not working in any comparative sense for individuals or groups of patients or for any aggregation of caregivers.

In fact, using today's nonsystematic methods of communicating new medical science, it can take many years for a valuable new best practice to become the routine standard of care. As noted, the normal compliance level with best practice typically falls short for many important care approaches. No other industry or portion of the economy takes anywhere near this long to disseminate new approaches. Most industries retool yearly, if needed. Reengineering is a constant fact of life. Health care has been a glaring exception to that rule.

Dysfunctional Information Transmission

Quality deficiencies and inconsistencies are exacerbated by the fact that the noncomputerized care improvement processes used by most providers and health plans rely on the distribution of paper-based patient status reports and information about best care. Attempting to distribute pieces of paper about these topics to each caregiver is at best inconsistent and at worst expensive, time-consuming, and frustrating. Care sites are typically unconnected, and passing on best-practice information at a one-on-one, doctor-to-doctor, teacher-to-caregiver level can be a logistical nightmare even in a group practice setting.

> Reengineering is a constant fact of life. Health care has been a glaring exception to that rule.

Health care is an information-dependent profession that is operationally handicapped by a remarkably dysfunctional information transmission nonsystem. In an era when practically every other major segment of the economy relies on computers for data flow, decision support, and production improvement, health care still stores all-important patient-based data on inaccessible, incomplete,

George C Halvorson is Chairman and Chief Executive Officer of Kaiser Foundation Health Plan, Inc, and Kaiser Foundation Hospitals. He is a frequent lecturer and writer on health care topics.

Special Feature
THE PROMISE

sometimes inaccurate, and frequently illegible paper files. Filing systems are almost always set up and segregated by individual care providers or treatment sites, not by individual patients. In this country, a patient who receives care from three separate doctors generally ends up with three separate paper folders, with different contents, located in three separate metal file boxes.

Dysfunctional information transmission means that neither physicians nor patients nor researchers can benefit from the full spectrum of useful or timely data. Keeping up to date on current best practices is difficult. Doctors who want to keep up on medical research in their specialty are confronted by information overload; an estimated 1500 medical articles are published each day, and there are about 4000 health-related journals to choose from.[7] It is simply beyond the ability of any single physician to keep up with all this information, let alone remember it when confronted with a patient for whom that information would be relevant.

As a result, when the typical solo-practice doctor enters an exam room to see a patient, s/he often has no systematic tools at hand to remind him/her of the patient's specific needs or the full scope of care most appropriate to the patient's particular diagnosis, condition, and treatment plan. The physician typically relies on memory for large portions of each patient's current and future treatment regimen—including dosages of drugs and duration of therapies. The physician seldom, if ever, receives any systematic follow-up information about the patient or the patient's compliance with care. The patients themselves often leave the exam room trying hard to remember the four or five key points that the doctor told them about their follow-up care.

The Solution: Computerized Caregiver Support Tools

Anyone who looks closely at the inconsistency of health care practice must conclude that computerized caregiver support tools—

> Health care is an information-dependent profession that is operationally handicapped by a remarkably dysfunctional information transmission nonsystem.

including "electronic," "automated," or "computerized" medical or patient record systems and treatment protocols—are the best way of achieving optimal care for large numbers of patients. These tools can make best care easier and more likely to occur.

Giving physicians, other health care practitioners, and researchers appropriate access to this information is the key to moving care delivery and quality to the next level of performance. Each physician should be able to quickly track the care given to each patient against the very best and most current protocols. This system should enable them to remember what tests need to be done, what drugs need to be prescribed, what follow-up care needs to be accomplished, and even when referral to specialty care is advisable. The data system also needs to be accessible to medical researchers so that they can tell, on an ongoing basis, which drugs are working, which procedures are creating value for the patient, and which technologies are leading to the very best improvements in patient outcomes.

Another critical function of a clinical information system is to generate complete and easy-to-use information for patients about their condition and their care. The information for each patient can be programmed to be culturally competent and multilingual, reducing the misunderstandings and miscommunications that now occur far too often in an increasingly diverse society. In the best situation, the system should also provide patients with direct, confidential access to their own medical history and information—along with patient-focused medical protocols and best practice information.

Benefits of Computerized Caregiver Support Tools: The Evidence

New and more reliable computerized caregiver support tools (or clinical information systems) have the potential to achieve

many of the ideal system qualities described in the Institute of Medicine's Crossing the Quality Chasm report.[1] In a comprehensive analysis of the peer-reviewed literature, Raymond and Dold found strong evidence to support the notion that such systems do in fact improve safety, efficiency, timeliness, and quality.[8-12] They also found that these systems have potential for improving service and patient satisfaction through enhanced communication and information sharing.

In their review of nearly 100 published studies spanning 30 years of research, Raymond and Dold document improvements in preventive health services, disease management, drug prescribing and administration, documentation of data, access to clinical information, and avoidance of medical errors—all resulting from the use of clinical information systems.[8]

Clinical information systems also show promise for increasing administrative efficiency through improved work flow and time savings, streamlined information storage and access, and enhanced billing efficiency.[8] Use of electronic medical records saves resources, including physician and clerical staff time,[13] storage space,[14] and ultimately money.[15]

The successes have all resulted from at least a partial computerization of care: in each case, the computer was used to enhance a particular aspect of care delivery. But the impact of a complete care support tool has yet to be fully tested. There is every reason to believe that the more complete systems will achieve even more success than the partial systems tested to date.

Pioneers of Clinical Information Systems

Although most health care practitioners and institutions in the United States are not yet ready to implement clinical information systems, a few have positioned themselves as pioneers in their use of such systems.[9] Multibillion-dollar technology investments are being made by Kaiser Permanente (KP), the Mayo Clinic, Intermountain Health Care, the Henry Ford Health System, and Geisinger Clinic, among others.[a] Group Health Cooperative has demonstrated through research the value of automated records in improving chronic care management; in particular, diabetes care.

KP's own work with clinical information systems dates back over 40 years to 1961 when Morris Collen, MD, a founding partner of The Permanente Medical Group and the first director of the organization's research arm, piloted a computerized medical records system in San Francisco (see page 34). This effort ultimately provided researchers with a vast database of member health conditions, which is still used by researchers today to study care delivery.[16-17]

Although withdrawal of federal funding prevented the regionwide deployment of Dr Collen's automated record system, KP has continued to innovate in the use of information technology to improve care.[17] Within the organization, computer-based technologies have included an automated appointment booking and registration system (PARRS) piloted in 1977; a computerized hospital information system (ADT), in place by 1985; an outpatient pharmacy dispensing and tracking system (PIMS) implemented in 1988; and the Clinical Information Presentation System (CIPS), which began delivering real-time, patient-specific, clinical information to physicians' desktops in 1993.

Fulfilling Dr Collen's vision of a truly automated medical record, KP is currently investing nearly $3 billion over the next several years to build an integrated clinical information system for its more than eight million members nationwide. This system moves beyond electronic medical records and includes electronic documentation of patient visits, order entry for medications and procedures, and linking of inpatient and outpatient care. Kaiser Permanente estimates that when fully implemented, the new system will result in annual savings of approximately $500 million, due to cost avoidance, cost savings, and improved and more accurate reimbursement.[b]

Although only a small portion of the industry is currently on track to implement systemwide clinical information technology, a critical mass of multispecialty group practice users are choosing the same software vendor,

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including KP, Cleveland Clinic, Sutter Health, University of California at Davis, and Palo Alto Medical Foundation.[c] These developments may lead to increased opportunities for interoperability among care systems. Under the auspices of the Council on Accountable Physician Practices, some of these group practices are beginning to meet with each other to standardize data flow and share learning.[d]

Conclusion

Just about every informed observer of the health care system now recognizes and deplores what the Institute of Medicine identified as a vast and dangerous inconsistency of care.[1] We can reduce some of that inconsistency by making improvements in the context of our current medical processes and paper-based patient information systems. But we can't have highly reliable, up-to-date care and optimal value for the health care dollar until we have a complete electronic medical record for each patient and until we make usable, efficient clinical tools and information about each patient available to the physician at the exact point and time of care. Without such clinical information technology, the current cost burden will continue to grow, and vast numbers of patients will continue to receive inconsistent, often inadequate, and sometimes dangerous care.

Once best care has been demonstrated—through the use of computerized caregiver support tools by America's leading multispecialty and prepaid group practices—market competition will force the rest of American caregivers to follow (particularly if employers and government create appropriate market conditions). This will not happen until best care is thoroughly demonstrated, however. Because of their inherent advantages, prepaid group practices are natural laboratories for learning about the benefits and uses of these systems.

Reengineering of care support is an evolu-tion, as opposed to a revolution. Once the benefits of clinical information systems become obvious to policymakers, purchasers, and the public, it is logical to expect that major segments of the health care delivery nonsystem will figure out how to work with payers or each other to create functional equivalents of the integrated approach. This should ultimately result in the building, in multiple settings, of virtually integrated groups and plans. Delivery systems with the size, scale, and incentives to overcome the barriers to technology adoption will likely emerge from mergers, acquisitions, and affiliations. Technology diffusion will accelerate as the clinical information system business case is repeatedly validated with measurable and significant return on investment and as successful strategies are replicated and found to be transferable across organizations.

Narrowing the performance gap between integrated and fragmented care will clearly require greater information connectivity, which does not come easily or cheaply. The ultimate beneficiaries, however, will be patients. ❖

a   See also: Coddington DC, Fischer EA, Moore KD. Strategies for the new health care marketplace: managing the convergence of consumerism and technology. San Francisco: Jossey-Bass, 2001.

b   The total estimated annual savings is expressed in current dollars. The programwide estimate is based on an extrapolation from two board-reviewed business cases developed by Kaiser Foundation Health Plan, Inc: National Clinical Systems Planning Consulting, "Southern California Outpatient AMR Business Case" (February 2002) and "Regionalized HIS Business Case" (August 2003).

c   The software vendor chosen by many of these organizations is Epic.

d   For information about the Council of Accountable Physician Practices, go to: www.amga.org// CAPP.

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Notable Winners

History has demonstrated that the most notable winners usually encountered heartbreaking obstacles before they triumphed. They won because they refused to become discouraged by their defeats.

BC Forbes, 1880-1954, financial journalist, founder Forbes

KP HealthConnect: Fulfilling the Vision of KP's Founding Physician

By Tom Debley

When the centenary of the birth of founding Kaiser Permanente (KP) physician Sidney R Garfield is marked in 2006,[a] full implementation of KP HealthConnect the same year will be a fitting tribute. The reason: It was Dr Garfield who first urged KP to embrace computer technology in May 1960 "to acquire and store medical information."[1]

Dr Garfield's call came at KP's first interregional management conference in Monterey, CA, which focused on forecasting and planning for the decade of the 1960s. Dr Garfield argued—in the words of John G Smillie, MD—that KP "should not be a sick plan but a health plan in the full sense of the term: an ongoing commitment to the maintenance of health in the membership."[1]

To accomplish this, he envisioned information technology as part of a three-pronged approach described by Dr Smillie:

"New methods of providing health care as opposed to sick care must be tested.

"New technology must be used to acquire and store medical information.

"Non-physician medical personnel must be brought further into the health care process, under physician supervision, so as to extend the scope and efficiency of physician treatment."[1]

Over the decade, Dr Garfield's technology challenge triggered a proliferation of early research and implementation—first in Northern California, led by Morris F Collen, MD, but quickly expanding into Northwest Permanente (NWP) and the Southern California Permanente Medical Group (SCPMG) and, in the ensuing decades, across KP.

The first step was to dispatch Dr Collen to a national congress on medical electronics in New York. He returned "to confirm that Dr Garfield was correct: medical electronics was beginning a period of great innovation and diffusion, and … we should begin to take advantage of the potential of electronic digital computers."[2]

Early on, the vision developed of an electronic medical record that could serve patients across the nation—far ahead of any capability of early computer systems. In 1965, Cecil C Cutting, MD, then Executive Director of The Permanente Medical Group (TPMG), predicted it in a speech to scientists at a meeting of the American Association for the Advancement of Science at the University of California Berkeley.

"Each member," he said, "would automatically and periodically be called in for service. All histories and findings would be recorded by computers and made available to the physician wherever members go for needed definitive medical care."[3]

As interesting as the story is of the research and implementation of projects that evolved—including development of both new hardware and software for the job—equally fascinating is the vision of Dr Garfield in historic retrospect. He saw the potential for tracking medical information that could help patients achieve "optimal health"—a vision being taken into the 21st century with KP HealthConnect.

"… The great promise of computers for medicine lies in making an entirely new medical care system possible," Garfield wrote in 1974.[4] "Such a new system is just now beginning to take form and emerge from the old.

"… *Health care* [emphasis in original] is a new division of medicine that does not exist in this country or any country. Its purpose is to improve health and keep people well.

"The system holds great promise for the provision of truly preventive care. We need no longer generalize, but instead we can instruct each individual about what he should do for optimal health on the basis of his

> Dr Garfield … saw the potential for tracking medical information that could help patients achieve "optimal health"—a vision being taken into the 21st century with KP HealthConnect.

Tom Debley is Director of Heritage Resources for Kaiser Permanente. Heritage Resources is a Program Offices endeavor launched in 2003 to continue to collect, preserve, and share the history of Kaiser Permanente. Mr Debley has been with KP since 1995. E-mail: tom.debley@kp.org.

own updated profile. Such personalized instruction should lead to maximum motivation and cooperation on the part of patients.

"This change from episodic crisis sick care to programmed total health care forces a new look at the recording and processing of medical information …

"Continuing total health care requires a continuing life record for each individual …. The content of that life record, now made possible by computer information technology, will chart the course to be taken by each individual for optimal health."

In another article, Dr Garfield concluded, "Matching the superb technology of present-day medicine with an effective delivery system can raise US medical care to a level unparalleled in the world."[5]

It was quite a prediction more than a quarter of a century ago—one confirmed in the view of some today. As Richard Feachem, Executive Director of the Global Fund to Fight AIDS, Tuberculosis and Malaria, recently told *The Economist:* "There is no perfect system in the world; every one has serious flaws and makes serious mistakes which people suffer from, but Kaiser *comes closer* to an ideal than any system I know."[6] ❖

[a] Sidney R Garfield, MD, was born April 17, 1906, in Elizabeth, NJ.

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Smokescreen

The Wright brothers flew right through
the smokescreen of impossibility.

— *Charles Franklin Kettering, 1876-1958, engineer-inventor*

The Driving Vision: Pioneers of the EMR

The Permanente Journal *asked some of the pioneers of KP's commitment to the electronic medical record to talk about the visions that drove them to dedicate much of their careers to translating the promises of the EMR into reality.*

The Pioneering Physician
Morris Collen, MD

Our original vision (of clinical information systems) started with Sidney Garfield, MD, as always, and my objective was simply to carry out Dr Garfield's vision. He'd come up with all these wonderful ideas. He always said, "We can never be perfect, and so we must continually try to improve our program."
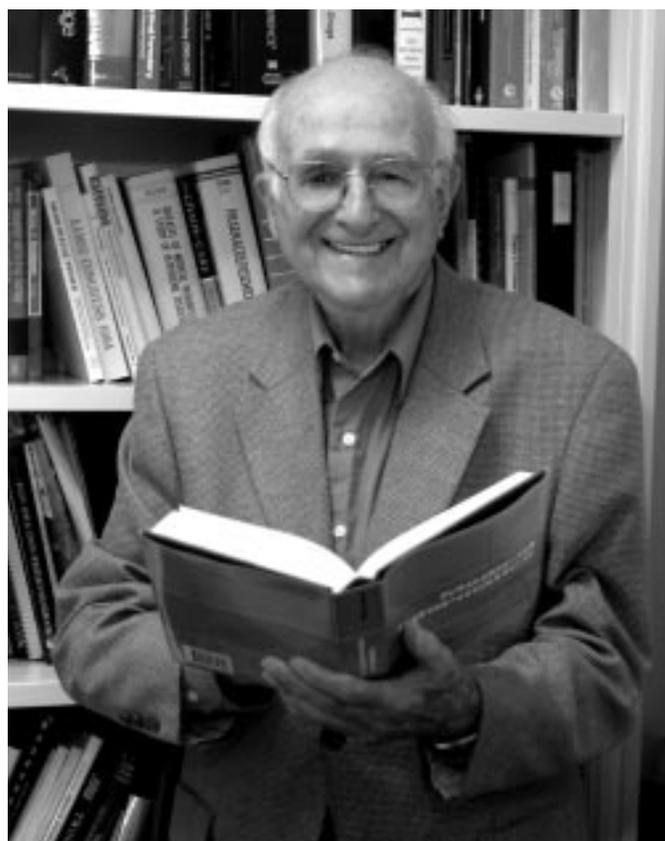
Dr Garfield knew that I had a degree in electrical engineering in addition to medicine. So he asked me to attend the first congress on medical informatics in New York and to come back and advise him. I remember getting all fired up at that congress about what was happening and the great potential for computers in medicine. So he and Cecil Cutting, MD (then Medical Director of The Permanente Medical Group) set up a new department so that I could devise and test computer applications, and that was the Medical Methods Research Department, which later became the Department of Research.

At that time, about 1960, we were already doing multiphasic health screenings for the Longshoremen's Union, but we were doing it manually, and that seemed like the ideal way to test computers on essentially healthy people. Everything about the multiphasic screening program was routine. People would go through the tests, and I would sit at the end of the line and check them off and arrange whatever follow-up they needed. After a year of that, I got tired of it, so I asked our resident physicians to do it, and after a few months they got tired of it and asked the interns to do it, and they got bored with it because it was such a routine chore. It was exactly the kind of process that computers were suited for. And so automated multiphasic health testing became our first application of computers in medicine for patient care.

The government was impressed enough that they gave us some money to build a separate building for it. The computer alone was so big it took up a whole room with its own air conditioning, and it had less power than we now have on our desktop computers. We used punch cards, and as the patient went from station to station the information was punched in a card and at the end of the line we printed it all out and gave it to the physicians. My objective was to use these tools to provide better quality technically and to save physicians' time by not having them need to ask 200 questions when only 10% of them would be answered yes. So the physician would get a report on each patient with just those questions to which the patient had answered yes, and he wouldn't have to ask all the others.

Later on in the 1960s, we got another grant for the Medical Care Delivery System program, which included computerizing the inpatient and outpatient service at our San Francisco Hospital. We were going to have the computer do essentially the beginnings of what is happening now, including physician order entry and results reporting. We didn't have it all, but we were looking forward to the time when we could. It was our goal to provide a comprehensive medical information system for all of our facilities, with patient records available no matter where the patient presented. For our San Francisco patients, we had every outpatient visit, every drug dispensed, every lab test—it was in the computer to be called up in the middle of the night or anytime. It was a giant step, and we visualized essentially doing what the new EpicCare system will do for us today.

Then, in 1970, the country had an economic recession and our grants were eliminated and that terminated our program. The Emergency Room physicians in San Francisco almost wept because they lost this great service. Donald Lindberg, MD, who was the director of the National Library of Medicine, said that at the time, we had the leading system in the whole world.

And so that's how it got started.

For more than 40 years, Dr Morris Collen, a founding physician of The Permanente Medical Group, has been a driving force in bringing the electronic medical record from dream to reality in Kaiser Permanente, and throughout American health care.

Special Feature
THE PROMISE

Clinical Information Technology
Allan T Khoury, MD, PhD

We started planning for our clinical Information Technology (IT) implementation in 1988. Our Medical Director at the time was Ron Potts, MD, and he realized that computers were going to play a big role in medicine. He asked me to explore the field.

I've always viewed clinical IT as a great way to improve the quality of care we deliver to our members. I thought this could happen in two ways: first, by providing a synopsis of crucial, relevant information from each patient visit, so the doctor wouldn't be treating the patient blindly. Second, it had become clear by the mid-1980s that computers could enhance quality by generating reminders to physicians at the moment of care—so-called decision support—about things that needed to be done but were simply being overlooked. We set out to build our own system that would do these two things. The initial goal was not to replace the paper record but to use the computer as a quality improvement tool.

We started with the printed chart summaries in 1990; and in 1993, we printed reminders at the point of care. We were on a shoestring budget, just $83,000 the first year. That is probably one of the reasons we were successful; since the number was small, we were allowed to experiment. Our early success led to deployment of a more complete electronic medical record, starting in 1994 and 1995, when we realized that by using scanning we could capture progress notes and probably eliminate the need for the paper chart entirely.

When I took this on, I did it on the condition that I retain control of disease management and prevention activities, because it was clear to me that unless we could move quickly to improve quality, the IT project would be seen as something that consumes lots of money without much benefit.

Without having that dual role, disease management and clinical IT, we wouldn't have been able to demonstrate benefit as quickly as we did.

What I'm looking forward to in KP HealthConnect is the robust decision support capability, such as drug-drug and drug-disease interaction reminders generated by the order entry system. Our current system doesn't have this functionality. We should be able to reduce admissions from errors in outpatient drug ordering by as much as two thirds. That's pretty compelling.

There are some things that KP

> **We should be able to reduce admissions from errors in outpatient drug ordering by as much as two thirds. That's pretty compelling.**

With an initial budget of just $83,000, Dr Allan Khoury (shown here in front of KP-Ohio's "GuitarMania II" art piece) lead the creation of a home-grown electronic medical record for KP Ohio a decade ago. His vision of the EMR as a key tool for quality improvement has helped pave the long road to KP HealthConnect.

HealthConnect won't do. I'd like there to be an artificial intelligence engine overlooking what the physician is doing. Since KP HealthConnect will be able to code patient symptoms and capture test results, it should be able to evaluate the diagnoses recorded by the doctor and, if necessary, suggest alternatives. Also, I think as the hardware gets better, we'll eventually have notepad computers that are light enough to carry around, permit charting anywhere, and allow clinicians to draw pictures, which will help dermatology, ophthalmology and some other specialties. We're not there yet, but all this is possible.

The Dream: Availability of Information 24/7
Peggy Latare, MD

In this day and age, with the number of diagnostic tests and the complexity of medical science being what it is, it feels so backward to try to still practice medicine in the way we did before we had a clinical information system, when the only information we had was what we could piece together from the mainframe system and what the patient might remember. That's really the prize that I've kept my eyes on for so long—that availability of information 24/7. No matter what else the electronic medical record does, that's the dream: to have that information available and to have people out there making decisions with all the information they need.

Here in Hawaii, we're on our third implementation of an Information Technology solution—two less robust technologies preceded the KP HealthConnect implementation—and it's quite remarkable that people still have the energy and the excitement to do it one more time. But it's because of the power of having that information available and the connectivity from primary care to specialty care, from small clinic to large clinic and from island to island, that the excitement is still there.

Since we first began to implement the earlier CIS system here, the objectives have evolved. Although the availability of the medical record is still key, the amazing decision-support capabilities in Epic compared with the earlier systems is now a key driver—the ability to reduce variation and track results and outcomes. The other thing that's different now is that Epic has brought our business colleagues and inpatient colleagues into the picture, and so now the vision of truly being able to follow information across the continuum of inpatient/outpatient and ER is a major part of the excitement.

In terms of transformation, we saw that even within three or four months of implementation, some really innovative things were happening—such as physicians spending an hour or two a few days a week on the phone, just doing triage to handle patients' concerns and avoid some appointments. That practice is still diffusing, so that in a number of our clinics three or four days a week, one of the doctors will be on the phone working on follow-up questions that are easily handled on the phone. Eventually, I see that

> … with the MyChart and messaging capabilities of KP HealthConnect, we're going to end up having a good deal of our care happen virtually.

Peggy Latare, MD, is the KP HealthConnect Project Executive for the Hawaii Permanente Medical Group.

happening all over the region and not just in primary care but in specialty care, where we can offer a lot more alternatives to care. And with the MyChart and messaging capabilities of KP HealthConnect, we're going to end up having a good deal of our care happen virtually. That's very exciting. ❖

The Future

The future belongs to those who dare.

— *Anonymous*

Special Feature
THE PROMISE

Entering the Decade of Health Information Technology

By Brian Raymond, MPH

> … Americans will one day experience a health care system in which disparate providers across an otherwise fragmented delivery system will share health records in real time by means of a national network of electronic medical record systems.

Health information technology (HIT) is the underpinning of a vision for the future of American medicine that is gaining consensus among public and private policymakers nationwide. As envisioned today, Americans will one day experience a health care system in which disparate providers across an otherwise fragmented delivery system will share health records in real time by means of a national network of electronic medical record systems. The architects drafting the IT blueprints for an interconnected electronic health infrastructure represent a public-private partnership that is actively paving the way toward what the Bush Administration calls the "decade of health information technology."

A National Health Information Infrastructure

The National Committee for Vital and Health Statistics (NCVHS) has set forth perhaps the clearest articulation of the vision for health information technology in its description of a National Health Information Infrastructure (NHII). It is described as "a comprehensive knowledge-based network of interoperable systems of clinical, public health, and personal health information that would improve decision making by making health information available when and where it is needed." The NHII is not just a network of information systems but the standards, applications, and rules that support all facets of individual health, health care, and public health. The NHII as envisioned by the NCVHS is based on decentralized networks of voluntary health information.

The federal government has ramped up its leadership role in accelerating health information technology, and recent national policy developments targeting rapid HIT adoption are worth highlighting.

- On March 21, 2003, the federal government announced the first set of uniform standards for the electronic exchange of clinical health information to be adopted across the federal government as part of the Consolidated Health Informatics (CHI) initiative.
- On July 1, 2003, the Department of Health and Human Services announced its purchase of a license that allows all public and private sector parties to use a medical vocabulary known as the Systematized Nomenclature of Medicine, Clinical Terms (SNOMED-CT) at no cost.
- On December 8, 2003, the Medicare Prescription Drug, Improvement, and Modernization Act of 2003 (MMA) was signed into law. The landmark legislation establishes a voluntary electronic prescribing program and creates financial incentives for acquiring information technology and authorizes several demonstration projects on using information technology to improve quality.
- In January 2004, President Bush emphasized the importance of electronic records in his State of the Union address stating that "by computerizing health records, we can avoid dangerous medical mistakes, reduce costs, and improve care."
- On February 25, 2004, the Food and Drug Administration issued a rule that requires "barcodes" on most prescription drugs and on certain over-the-counter drugs as a means to reducing medication errors in hospital settings. Barcodes on drugs and barcode patient wristbands reduce the potential for medication errors when used with a barcode scanning information system.
- On April 26, 2004, President Bush established a goal for every American to have a personal electronic medical record within ten years as part of an aggressive health information technology plan. He created the new Office of the National Coordinator for Health Information Technology within the Department of Health and Human Services to lead the national HIT effort. In addition, the Presi-

Brian Raymond, MPH, is a senior policy consultant in the Kaiser Permanente Institute for Health Policy where he analyzes emerging policy issues and supports the health policy decision-making process within KP. E-mail: brian.raymond@kp.org.

dent doubled funding to $100 million for demonstration projects on health information technology.

- On July 21, 2004, Health and Human Services Secretary, Tommy G Thompson, and the new National Coordinator for Health Information Technology, David J Brailer, MD, PhD, unveiled a strategic plan[1] for health information technology promotion over the next ten years. The plan identifies four major goals:
  - "Inform clinical practice" by bringing information tools to the point of care, especially by investing in EHR systems in physician offices and hospitals.
  - "Interconnect clinicians" by building a health information infrastructure.
  - "Personalize care" by using technology to give consumers more access and involvement in health decisions.
  - "Improve population health" by expanding the capacity for public health monitoring and by implementing research advances in public health care.

Although health care still lags far behind other industries in information technology investment, many observers view the recent policy development as a sign of new momentum gathering the critical mass needed to galvanize the HIT vision. Whether we are at or near the "tipping point" for HIT—where the technology adoption rate suddenly switches from incremental to exponential growth—is yet to be determined. Nevertheless, the health policy community has clearly moved from talk to aggressive action on health care transformation with information technology. ❖

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Reference
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Lessons of Wisdom

When you make a mistake, don't look back at it long. Take the reason of the thing into your mind and then look forward. Mistakes are lessons of wisdom. The past cannot be changed. The future is yet in your power.

— *Hugh White, 1773-1840, US politician*

Special Feature
IMPLEMENTATION

Adopting an Enterprise Health Care Automation and Information System: The Initial Implementation

By Peter DeVault

Epic's experience in implementing a wide variety of clinical, access, and financial systems extends back 25 years. As a growing company dedicated to changing the way health care is delivered for the better, much of what we encounter is necessarily new and challenging. There are, however, as in any field, certain constants and useful propositions that can be shared and employed to the same profit in new endeavors as well as they were in the old. Although the idea—and, even more so, the fact—of an enterprisewide health care information and automation system is relatively recent, successfully installing one depends on many of the same facts as other implementations. We would like to share with you what we have learned during the many years of implementation.

The initial implementation of a health care automation and information system forms part of the foundation for the transformation of health care. It is not that transformation itself. Although it is important not to replicate inefficient workflows or poor data collection, the focus of the initial implementation should not be to explore brave new worlds but it should be on building the ship and learning to navigate.

More concretely, the proper focus of the initial implementation should be on those things that will allow the greatest long-term benefits: achieving widespread use of the system across as many care settings, specialties, and departments as possible; standardizing data representations; and establishing long-term interaction and communication plans with the user community. If these three goals are achieved, an organization will be well poised to take advantage of sophisticated tools and techniques that will change the way health care is delivered.

Three major areas of an implementation must be well understood in order to maximize the chances of its success: standardization, variations across care settings, and training strategies.

> ... the focus of the initial implementation should not be to explore brave new worlds but it should be on building the ship and learning to navigate.

Adaptation and Standardization

The process of implementing a health care automation and information system begins with modeling the organization in software. The degree to which adaptation of the system to the organization is successful places an upper limit on the degree to which adoption will be successful. A mature and well-designed system will allow an organization to dictate how the software works rather than the other way around, and the system will allow for a great deal of variation in how different parts of the organization operate. Although that is the case, choices must be made about how detailed a model is necessary for a complex organization. In a very large organization, a precise model is far too expensive to be a realistic proposition.

We can liken the software modeling phase of the implementation to making a map of a geographic region. The more details there are, the more topography represented, the larger the map must be, and the longer it will take to create it. Its size may make it impractical to wield as a tool; its expense in time and resources may make it impossible to afford. A pocket-sized map giving a general but accurate knowledge of the terrain is much more useful and can be created in a reasonable amount of time, making it also affordable. It won't indicate every tree root to step over or every stream to cross, but if you know how to step over roots and cross streams, you don't usually need that information anyway.

With a health care software system, you don't need a specialized workflow or data collection form for every possible clinical presentation or registration situation. You need a few tools that encapsulate the variation in a majority of your work practices, some special tools for infrequent but important situations, and the ability to branch away from standard templates in the remaining situations. That means that you can model the large-scale features of the organization, mapping them to system functionality and tools, teach users how to

Peter DeVault helped develop Epic's implementation methodology and contributed to the design and development of Epic's clinical systems. He is also very active in the development of industry standards for electronic health records and interoperability and is an author of *HL-7's Functional Model of an Electronic Health Record System*. E-mail: pdevault@epicsystems.com.

handle unknown terrain, and get them using the system in a reasonable amount of time.

The question inevitably arises—which organization to model, the existing one or an ideal one? This question leads to a discussion of standardization and rationalization. Standardization, improperly pursued, is often the rock on which good implementation founders. Two kinds of standardization deserve attention: that of workflow and that of data representation.

Standardizing Workflow

Workflow standardization simply means taking two or more similar parts of an organization and having them perform some work function in the same way. As a result, people in similar roles in the different parts of the organization perform the same tasks in the same sequence using the same tools and interact with users in other similar roles in the same way.

Two kinds of motivation generally exist for standardizing workflows during an implementation. The first is that it is easier for an implementation team to design a system around one workflow for everybody rather than around everybody's individual workflows, even though a properly designed workflow automation system will allow for a great deal of practice variation. The second motivation exists when there is an agreed-upon best practice workflow that the organization would like to adopt or when there is reason to think that such a workflow might be discoverable.

The ease-of-implementation motivation typically leads an organization to analyze workflows to find commonality in the component steps and wherever there is commonality to make it standard. The sum of these steps then becomes the standard around which a workflow system is modeled. In this form, workflow standardization can be highly artificial and abstracted from the concrete realities of the clinical workplace. Lacking any real motivation to comply with the standard, users of the system will find ways to subvert the standard to reproduce necessary pieces of the original workflow or pieces perceived as necessary. In many cases, this will lead to a breakdown in the standardization of data representation as well. The tradeoff in this method of standardization is between ease of implementation and risking the integrity of the design and the data generated during the execution of the workflows.

The second motivation to standardize workflows assumes there is a best practice or that one is discoverable. Agreement on a best practice or even the necessary criteria in the organization is very rare prior to the implementation. The larger the organization and the more vague the criteria for what counts as a best practice, the more difficult it is to arrive at this level of agreement. A more difficult tradeoff is involved here: implementing best practices for clinical care, shorter registration times, or reduced billing cycle times are often key factors in deciding to implement a system. On the other hand, a requirement to implement best practices in a large organization, whatever the criteria, can easily increase the time to go live beyond an interval that will be considered acceptable, successful, or affordable.

Epic's experience suggests that workflow standardization should play a minor role during the initial implementation. This isn't to say that there aren't some workflows that couldn't be standardized: if there is already general agreement on some key workflows, they should be standardized. In general, however, standardization, especially in the best-practice sense, is best addressed during subsequent optimization efforts rather than during the initial push to go live and rollout.

Workflow standardization can usefully be contrasted with workflow rationalization. The latter involves analyzing a process into information and patient flows, analyzing these into their component steps, and then improving efficiencies or removing redundancies. Once this has been accomplished, system modeling should address the rationalized workflow.

Rationalized workflows need not be the same across an organization. Although a good argument could be made that only rationalized workflows should be standardized, it does not follow that all rationalized workflows should be. There may well be defensible reasons behind workflow variations across the organization, but there is usually no justification for redundancies.

Standardizing Data Representation

Although workflow standardization serves a minor purpose during the initial implementation of a successful health care automation system, the standardization of data representation should occupy a large slice of the system modeling time. Data representation determines how information that is collected during patient care, registration, or other use of the system is stored and retrievable at a later time, how it can be compared with other data, and the ease with which both of these can be done.

Let's take the example of a lab test. We'd like a red blood count value to be stored the same way in the information repository whether it was obtained in the hospital, in a clinic, in California, or in Ohio. Similarly, when we query the system for all of a patient's red

blood count values, we'd like to retrieve them all—regardless of their origin—and be able to trend them over time. This task requires a common vocabulary for describing lab values. We would also like a common vocabulary for describing flowsheet rows, care plan interventions, diagnoses, and any number of other data elements. Standard vocabularies are available for same data elements, such as CPT codes for performed procedures or ICD for diagnoses. Many data elements, however, require standardization during the course of implementation.

But data retrieval at the point of patient care is not the only purpose for standardizing vocabularies. A standardized vocabulary is also a prerequisite for sophisticated clinical studies, population management, solving billing problems, and a number of other transformational activities that can be pursued after the initial implementation and rollout are complete.

Care Setting Variations

Installing an enterprise typically involves two or more care settings, including hospitals, physician offices, or ancillary service departments. Many of the systems' users will work in more than one care setting. For example, physicians often work in their offices and one or more hospitals. Different care settings obviously have different workflow and data collection requirements. A well-integrated system will account for this variation by using similar pieces put together in different ways rather than as different pieces altogether, as you would find in a nonintegrated or interfaced system solution.

Another variation to account for is that of the linearity of workflows. For example, a physician office visit is typically very linear, flowing from registration to check-in to collecting vital signs, placing orders, writing a note, and signing an encounter. During the course of a hospital admission, however, many caregivers and other users will interact with the patient in an unpredictable sequence. Nor will the data collection and data presentation requirements of these interactions be completely predictable.

When analyzed, it is typical that component pieces of these interactions show themselves to be linear, even though the course of care may not be. An enterprise system should account for these variations in linearity by using similar workflow navigation tools as in linearized care settings but to allow for easy departures from linearity. For example, a rounding navigator can collect together all of the component pieces of system interaction required for a physician doing rounds (reviewing meds and vitals, placing orders, writing a progress

note) while keeping I&O flowsheets, results review, and the interdisciplinary care plan for the patient one click away from the navigator. The rounding navigator will be instantly familiar to someone who sees patients in the office, having similar components but with the required variations in order and content.

An enterprise system should also use similar data representation methods in different care settings. Even though the data originates in a variety of settings, it is often very similar data and should be represented comparably. For example, vitals taken at home, in the office, or in the ICU should all be represented in the enterprise information system in a way that allows their direct comparison. The same is true of lab values, allergies, and medications.

A well-integrated enterprise automation and information system will reduce training time by using similar navigation and data collection tools across the variety of care settings and will allow viewing and interaction with data, regardless of its source, in a comparable fashion, thus improving patient care and the user experience.

Training Strategies

Different training strategies are suited to the nature of different care settings. In a typical physician office, the users are to some degree a captive audience. There is not a need to teach the users everything at once because you only have one shot at getting their time. Individual groups of physicians may come up on the system independently of their neighbors. In a hospital, on the other hand, there are many shifts of users, some of whom may only be in the hospital a few hours a week or even less. Furthermore, so many different clinicians and other potential system users interact with a patient that it becomes very important for all of them to be using the same system to document their patient care.

The virtues of a well-integrated enterprise health care information system allow an organization to tailor the training experience to fit the needs of users in these different care settings. Importantly, a system that uses similar or identical tools and navigation methods regardless of care setting allows a user to become comfortable using the system in one care setting and then leverage that knowledge using the system in other care settings.

For ambulatory sites, Epic has developed over several years a highly successful incremental training approach. During the course of three to four weeks, clinicians learn incremental sets of functionality. During the first week, basic navigation, chart and results review, and "In-Basket" tools are taught and used for the duration of the week. The following week, clini-

> The virtues of a well-integrated enterprise health care information system allow an organization to tailor the training experience to fit the needs of users in these different care settings.

cians learn to place orders and document diagnoses. Finally, general charting and more advanced functionality are taught the third week. The training is typically a combination of classroom-based scenario development and one-on-one support. Computer-based training may also be a useful adjunct.

In the hospital setting, it is important that clinical users in particular learn most of the basic functionality for a given phase of the implementation before seeing patients. Longer blocks of training are required to support this strategy, and large sections of a hospital typically go live all at once on a particular set of functionality.

However, because tools are so similar across care settings, if clinicians go live first in their offices or clinics, the transition to using the same system in the inpatient setting is much easier. If it is possible to stage the rollout in this fashion, the benefits can be substantial—both with regard to training time as well as to ease of adoption by users.

In any case, it is important to keep the scope of the training narrowed to the basics required for day-to-day patient care and related work. More sophisticated use of the system can be nurtured through regular user group meetings, online forums, or other forms of communication. Maintaining a manageable scope is just as important for training as it is for standardization and other aspects of the implementation.

Setting and Managing Expectations and Scope

Armed with this information about standardization, variation, and training practices, an implementing organization should spend some time thinking about what will and what will not be accomplished during successful implementation? This must be defined at the outset. Decide that, and then set the expectations to match the definition. Expectations set too low will result in employees asking pointed questions about the expense of the implementation and the scope of the changes they'll be asked to make in their work practices. Setting expectations too high will result in incredulity during the implementation (and unwillingness to be associated with it) as well as inevitable disappointment after the system is live.

Although "internal sales" is an important activity during an implementation, it is possible to oversell the system being implemented, thus raising expectations beyond what is reasonable. The implementation's champions should publicly recognize the system's weaknesses as well as its strengths. For example, some tasks will definitely take longer using an electronic system (think CPOE). Acknowledge this, and also stress the workflow points where time will be gained, such as in locating clinical information, rather than downplaying justified worries about extra time spent placing orders.

Managing expectations is inseparable from managing scope, which describes the schedule of modules and functionality as well as the breadth of user interaction expected at key points during the implementation timeline. It has been Epic's consistent finding that a successful implementation is one that defines a manageable scope for the initial implementation with the idea in mind that it will be the foundation for more sophisticated practices later. Focusing on the right kind and level of standardization and the encapsulation of variation across care settings will ensure that the implementation scope, in addition to being manageable, will also lead to success. ❖

Vacuum Tubes

Where a calculator on the ENIAC is equipped with 18,000 vacuum tubes and weighs 30 tons, computers in the future may have only 1000 vacuum tubes and perhaps weigh 1 1/2 tons.

— *Popular Mechanics, March 1949*

Special Feature
IMPLEMENTATION

The Reality of EMR Implementation: Lessons from the Field

By Homer L Chin, MD, MS

Kaiser Permanente Northwest (KPNW) has more than a decade of experience working with Epic Systems in the development, implementation, maintenance, and continued improvement of the electronic medical record (EMR). EpicCare was initially implemented in two primary care clinics in 1994 and was completely rolled-out to the rest of the region by year-end 1997. This article will describe the most salient lessons that KPNW has learned in the interest of informing other KP regions as they embark on implementing KP HealthConnect (KPHC).

Some of these lessons were learned the hard way. Some things we "lucked into" naturally. Some of these lessons are backed up by hard data; some were gleaned through our experience and have been reinforced by similar learnings from other organizations. We have learned many more lessons than we are able to encapsulate in this short article. For anyone who has additional questions that are not answered here, please contact me directly and I will share whatever experience and knowledge we might have in a particular area. There are very few aspects of implementing an outpatient EMR with which we have not had some experience.

> **For members who have joined us since 1998, no paper record is created.**

Overview

KPNW began the implementation of the EMR by developing and deploying an extensive Results Reporting System in 1992. In 1993, after an extensive evaluation of vendors, KPNW chose Epic Systems as our partner to deploy EpicCare, a comprehensive outpatient EMR. In 1994, we began a pilot deployment of EpicCare in two primary care clinics, involving approximately 50 primary care clinicians. After Epic Systems enhanced their system in response to our requirements, we embarked on a rollout of EpicCare to the rest of primary care, clinic by clinic. In 1996, we started the rollout of EpicCare to our specialty clinicians, department by department. After additional software enhancements, including the implementation of a prenatal record, we completed our rollout to our Ob/Gyn clinicians and to the rest of the specialty departments in 1997. In 1998, we implemented our Emergency Department and installed a document scanning system for any residual paper. At that time, we fully retired the paper chart. For members who have joined us since 1998, no paper record is created. Over the years of implementation, our geographically based chart rooms were gradually downsized and consolidated, and the personnel were retrained for other roles and functions throughout our organization.

EpicCare is not only an electronic version of the outpatient medical record; it also automates all information transmission processes in the outpatient setting. Health care pro-

viders use this system to document, order, refer, and message other health care staff. EpicCare has a two-way interface for order and results transmittal to our lab and pharmacy systems, giving our clinicians a complete and accurate picture of the laboratory and medication status of a patient. Guidelines, information, and medication suggestions are provided "in-line" to clinicians as they use the system to provide care for their patients. With the implementation of Epic's MyChart and Epic's Home Health System, we are extending secure access to the medical record and messaging into our members' homes.

Lessons Learned

I have organized our experience and learnings under the following themes: Organizational decision making and project management, system deployment, application software, benefits realization, content management, and other insights that transcend categorization.

Organizational Decision Making and Project Management
Empower Project Leaders Who Are Close to The Ground

Although the high-level budgeting and direction were set by the leaders of the Health Plan and Medical Group, the project team was empowered, within broad bound-

Homer L Chin, MD, MS, is the Assistant Regional Medical Director for Clinical Information Systems for the Kaiser Permanente Northwest Region and Assistant Professor in Medical Informatics and Clinical Epidemiology at the Oregon Health and Sciences University. A Board Certified Internist, he completed fellowship training in Medical Informatics at Stanford University, prior to joining Kaiser Permanente in Northern California in 1988. He moved to the NW Region in 1992 to help lead their clinical systems efforts. E-mail: homer.l.chin@kp.org.

aries, to make decisions—enabling quick resolution of issues that arose during system deployment. Many of the project team members were end users of the system, providing a close link between decisions made and the impact of those decisions.

The Three-Legged Stool

The close coordination and cooperation of Operations, Permanente Medical Group, and Information Technology in joint management and decision making was an important factor in our success. For efforts in which we had only one or two legs of the three-legged stool, progress was often slow, the result somewhat off-target, or the effort unsuccessful. The close coordination of Operations for project management expertise, the Medical Group for the clinical expertise, and Information Technology (IT) for technical expertise was an important ingredient in our success.

Beware "Scope Creep"

As an information systems project progresses, it is easy for additional functional requirements to creep into the project. Most additional requirements that are added in this way appear benign at first but have significant hidden downstream impacts. For large, complex projects, scope creep may introduce a lack of clarity that may result in significant delays and rework. Although some increases in scope cannot be avoided, it is important to understand that any change in scope may reduce the probability of success of the overall project.

Begin With the End in Mind (and Think of Everything in Between)

It is important to think through all the steps in a project from beginning to end. We embarked on a number of efforts only to find that we had not thought through the intermediate steps required to reach our goal. If we had done a more complete analysis of all the steps necessary to achieve an objective, we would have realized that our approach was missing critical steps, dooming it to failure from the start.

Bridgers

Bridgers are special people who are able to bridge the gap and the cultural divide between the end user, the organization, and IT. These people are able to think systematically and can understand and translate between end users, the project team, and the organization. They are often able to trade-off the benefit of a specific functionality against the effort and risks in developing and implementing that functionality. By focusing on the end goal and thinking globally, they are often able to find the 80/20 solution—where 80% of the benefit can be achieved at 20% of the effort. These Bridgers are often able to identify easy-to-implement functionality that will have significant benefit and distinguish them from requests for functionality that are difficult to implement and have unclear long-term benefits.

System Deployment and Roll-out
You Won't Get It Right (Don't Try For Perfection)

Implementing an EMR is analogous to trying to find your way through a dimly lit forest. You have a general sense of the direction to head in and a general timeframe as to when you will reach the other side, but you would not be successful if you charted a rigid course in advance. Implementing an EMR is still more art than science. Tried and true methods for implementation do not exist. And you will not imple-

ment it without significant problems the first time. In the deployment, be prepared to make changes "on the fly" in response to identified issues. Trying to reach perfection prior to go-live will add effort and precision that is not warranted for the situation.

Pilot and Improve, Rollout and Improve

As a corollary to the "don't try for perfection," the flip side is don't roll it out further until the system is at least "good enough" in the locations that you have already implemented. In other words, if you have identified significant problems or issues, fix them and delay further roll out until those

Homer Chin is the medical group leader responsible for the pioneering implementation of EpicCare in the Northwest Region in the 1990s. His continued persistence in demonstrating success helped lead the way for the eventual adoption of KP HealthConnect as the information system strategy for the KP Program. His firm belief is that Kaiser Permanente is in a unique position to leverage information systems technology to support its unique strength—integrated comprehensive health care.

issues or problems are sufficiently addressed. Another way to put it is to "put out the fire" before rolling the system out to further locations. Keeping to a rigid schedule for rollout before "putting out the fire" in implemented locations may result in an uncontrolled blaze that will eventually engulf the entire project in flames.

Value the Curmudgeons

End user critics of an implementation are a godsend. Listen to, carefully evaluate, and respond to any complaints about the system. By the time you hear of a complaint, many others will probably have silently suffered through similar problems. Although each of these problems and issues may be small, the cumulation of a large number of these "small problems" can be overwhelming. Some organizations have gone as far as to add a "complaint" button to their system, allowing end users to complain at any time and at any point in their use of the system. Although these complaints are occasionally misdirected, they are often warning signs as to where the road may be in need of repair. Ignore these signs at your peril!

Get Feedback and Use It

A corollary to "value the curmudgeons" is to solicit feedback about an implementation early and often. The system will not be perfect, and it will need improvement. If you are not hearing from clinicians, actively solicit feedback so that you can implement improvements in advance of significant problems.

Look for the Opportunity and the Easy Win

In implementing a system, you will occasionally come across an opportunity where a "tweak" to the system or use of the system in a way that

> In an evaluation of our clinicians, we found that more than 50% of our clinicians remembered less than 50% of what we felt was essential material taught to them in the initial system deployment.

was not previously foreseen may result in significant improvements in efficiency or quality. An example of this was in our development of the SmartRx functionality within EpicCare. EpicCare had an Alternative Medication functionality that would alert clinicians to potentially better alternatives to the medication they were prescribing. Our pharmacists tweaked this functionality slightly by adding disease conditions to our medication file (Acute Sinusitis SmartRx, for instance) that allowed clinicians to enter a disease name in the medication field to get guidance on recommended therapy while improving the efficiency of the prescribing process.

Training Never Ends

Many people believe that the training task is done when a clinician has undergone initial training and is using the EMR. In our experience, clinicians know enough to "get by," but most quickly forget much of what they learned in the initial system training. In an evaluation of our clinicians, we found that more than 50% of our clinicians remembered less than 50% of what we felt was essential material taught to them in the initial system deployment. In addition, information systems and capabilities are constantly changing. Ongoing and continued evaluation, education, and training are necessary to optimize clinician efficiency and effectiveness.

Implementation Never Ends

Many system implementers believe that once a system is implemented, their work is done. The truth of the matter is that these systems are constantly changing. Application software, operating systems, hardware, technology, and medical knowledge about diagnosis and treatment are constantly changing. The myriad combinations and interactions of all

these changes will keep a project team "implementing" at all times.

Your Users Are Beta-Testers

It is impossible to completely replicate the production use of a system in a test environment. This results in a system that is not fully tested prior to deployment. At the time of an initial go-live or significant upgrade, your end users become beta-testers of the system. It is not unusual for hundreds of issues, problems, and bugs to surface soon after go-live.

Jack Be Nimble, Jack Be Quick

In systems that are used for patient care, problems and "bugs" may have patient safety and medical-legal implications. The project team will need to be nimble and quick to fix identified problems—especially those that affect patient safety. Slow resolution of clearly identified problems may also demoralize end users and result in loss of credibility in the project team. A quick identification and resolution process is critical during the first few weeks of go-live.

Clinician Efficiency Comes First!

Implement the system in a way that tries to maximize a clinician's efficiency at first. After successful implementation, additional tasks can be gradually added as clinician capacity to absorb these additional tasks increases. If a clinician is saddled with many additional tasks at go-live, the clinician may never learn the system well enough to achieve a good level of comfort and efficiency.

Application Software Keep It Simple!

With EMR software, transparency, reliability, and simplicity are impor-

tant characteristics that should be valued over system sophistication. In some cases, EMR software is becoming so complex that it is difficult to tell in advance what the system will do in a given situation. When it comes to an EMR, transparency, reliability, and simplicity allow easier detection of errors that may adversely affect patient safety.

Efficiency and Response Time

The top three important factors in an EMR are: 1) Clinician Efficiency, 2) Clinician Efficiency, and 3) Clinician Efficiency. Having a quick response time is a prerequisite to supporting clinician efficiency.

Clinical Content
Simple and Effective Ways to Embed Decision-Support Content

With an EMR, the opportunity exists to use an order requisition as a way to communicate not only from the clinician to the ancillary department but also as a way for the organization to communicate to the clinician at the time of ordering. By embedding guiding information in an order requisition, guidance can be provided to the clinician seamlessly during the ordering process. Another example of a simple but effective way to embed useful content is to automatically print patient information related to an order on the after-visit summary that is given to the patient at the end of the visit. Decision support can also be embedded through Alternative Orders, Smart Orders, Alternative Meds, and SmartRxs. Medication content and decision support include formulary and cost information for medications, drug-drug and drug-allergy interaction checking, and dis-

ease-specific interaction checking. Additional types of decision support include Order Panels, Smart Text, Smart Phrases, and Smart Sets. In general, the goal is to embed decision support in a seamless way that makes doing the right thing the easiest option in most cases. EpicCare allows the easy embedding of content in a myriad number of ways throughout the system.

Content that Supports Clinician Efficiency

Report formatting, layout, and content can have a significant impact on efficiency and effectiveness. For instance, our Previsit Summary automatically scans the last three lab test results for each lab test type. If any of the last three CBCs, for instance, are abnormal, a spreadsheet of the CBCs is printed. In this way, the system supports a quick and comprehensive review of the laboratory status for the patient. Other content areas that support clinician efficiency include key word synonyms that significantly improve the efficiency of ordering, prescribing, and diagnosis entry and well-thought-out departmental preference lists that improve clinicians' ability to find the terms they are looking for. Careful thought and work in these areas will yield significant benefits in clinician efficiency and system usability.

Keep a Tight Loop Between Content Management and the End User

End users determine the success or failure of content that is implemented in the system. Because the content in the system directly affects the end user, it is important to have a tight loop between the end user and the content embedded in the system. Content management in EpicCare is easy enough to learn and use that it is possible to

teach designated end users how to build content and to make them responsible and accountable for developing useful content for a given constituency of users. One of our areas of success is in developing and maintaining pharmacy content. Decisions made by our Pharmacy and Therapeutics Committee are immediately programmed into EpicCare by a pharmacist that same afternoon. We are attempting to disseminate that model of increased end user accountability for content to our clinician group.

Content Maintenance Never Ends!

Because medical care is constantly advancing and changing, the content within an EMR will need constant updating. Because content is embedded in many different ways and in varied locations in the EMR, the need to determine all the areas in which a change in content needs to be propagated is not a trivial task. KP is in the process of working with Epic Systems on tools to improve our maintenance of embedded content within KPHC.

> Decisions made by our Pharmacy and Therapeutics Committee are immediately programmed into EpicCare by a pharmacist that same afternoon.

Benefits Realization
Implementation of Information Technology is Just a Tool

It is important to realize that the implementation of information technology, in and of itself, is not the goal. The goal should be to improve the efficiency and effectiveness of our health care delivery system. One of our goals is to improve the efficiency of our clinicians. We have found that for some tasks, reviewing information on paper is still the most efficient way to impart information quickly and effec-

tively. Because of this, our costs for paper (for Previsit and After-visit summaries) have gone up rather than down.

Organizational Policies Should Reinforce the Behavior Promoted in KPHC

Programming functionality into the system without supporting organizational policies and efforts yields less than optimum results. EpicCare clearly and effectively informs the clinician of the formulary status of medications. However, because our organizational policies do not enforce restrictions around formulary ordering, our compliance with formulary prescribing is not where we would like it to be.

Enabling a More Effective Data Warehouse

With the implementation of an EMR, the ability to evaluate organizational performance and to systematize health care is significantly enhanced. New paradigms and models for case identification, tracking, monitoring, alerting, and providing feedback are possible. Regions must look carefully at these new capabilities and leverage those that will improve cost-effective high-quality care.

Clinicians Are Not Optimized for Population Care

Clinicians are optimized for one-on-one care for members. With the implementation of the EMR, significant capabilities to systematize care through care, case, and disease management are enabled. Because these population care approaches are an effective way to reduce cost and improve quality, it is possible to off-load work from the clinician by systematizing care, leaving the clinician more time to devote to the one-on-one care for which they are essential.

Other Insights
Clinicians Won't Necessarily Be Faster, But They Should Be Better

It was often assumed that unless the EMR made the clinician "faster" it would not be accepted. In our experience, clinicians are initially slower after EMR implementation. Over time, some clinicians will become faster than they were before, but many will remain slower. Even the slower clinicians recognize the value of information technology—and given the choice, would not want to return to the pre-EMR days. Our theory is that clinicians are able to trade-off their own increased workload against the improvement in care and professional satisfaction that they see with the use of the EMR. With changes in the paradigm of care delivery that the EMR enables, even the "slower" physicians will be more efficient in their overall care of a given population of members.

The Great Magnifier

The EMR is the "great magnifier." If an organization already does something very well, then the implementation of information technology will probably further improve its performance in that area. However, if an organization is dysfunctional in an area, then the implementation of an EMR will probably magnify that dysfunction. Identifying and addressing potential areas of organizational dysfunction prior to implementing the EMR may improve the overall results of EMR implementation.

Conclusion

Implementing an EMR is a complex and difficult multidisciplinary effort that will stretch an organization's skills and capacity for change. It will be a challenging and occasionally stressful continuous learning experience.

Seeing the systematic benefits of an EMR in improving the care of a large population of members, however, is a gratifying experience that makes the effort of EMR implementation worthwhile. Even after a decade of EpicCare experience, we continue to learn and find ways to use information technology to more fully realize the potential of our integrated health care delivery system. ❖

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Inspiring a Shared Vision

A leader who Inspires a Shared Vision is one who describes ideal capabilities; looks ahead and communicates the future; is an upbeat and positive communicator; finds common ground; communicates purpose and meaning and/or is enthusiastic about the possibilities.

— *The Leadership Challenge, J Kouzes and B Posner, Jossey-Bass*

Special Feature
IMPLEMENTATION

Computers in the Exam Room—Friend or Foe?

By Ward R Mann, MSN, FNP
Joanne Slaboch, MBA

At first, it might be hard to imagine how using an electronic medical record in your practice and in the exam room could improve communication with patients. In fact, it may be easier to see the computer as just another thing that gets in the way of our having meaningful interactions with patients—a third wheel, so to speak. Because patients view communication as the most important factor in the clinician-patient relationship, we certainly don't want to compromise it in any way.[1] Does the computer in the exam room assist or hinder good clinician-patient communication?

The Experience

Our experiences in Kaiser Permanente's Northwest and Colorado Regions have shown that patients give a positive rating to clinicians' use of computers in the exam room. Initially, clinicians experienced a period of time in which they were not as efficient as they were with the paper record. There might be some discomfort with the new equipment, with necessary new computing skills, with the changes in workflow and, importantly, discomfort in the conversations with members related to the computer.

We learned that this discomfort fades as confidence is gained in new skills, in a sense of consistency and reliability about critical patient data, and in satisfaction with the comprehensive level of care that the clinicians are able to provide. The information available from computers helps to demonstrate comprehensive knowledge of the patient. Additionally, exam room computing helps involve patients in decisions about medical care, something patients highly value. As reflected in the chart, A Synthesis of Recent Evidence (Figure 1), shows ample evidence that exam room computing can enhance the overall clinician-patient interaction in the exam room.

Personal Challenges

What about you and your practice? How are you supposed to maintain good communication with

Table 1. Interregional Clinician-Patient Communication HealthConnect work group members
Sara Faulkner, MD (Group Health)
Rich Frankel, PhD (Indiana University)
Diana Burks-Goodman, MPA (Southern California)
Jim Hardee, MD (Colorado)
Charles James Kinsman, BA (Garfield Memorial Fund)
Peggy Latare, MD (Hawaii)
Maureen Leahy, MBA, MPH (Mid-Atlantic States)
Ward R Mann, NP, Chair (Northwest))
Debra Mipos, MPA (The Permanente Federation)
Jan Nedin, MS, CCDC, CEAP (Ohio)
Vivian Nagy, PhD (Southern California)
Joanne Slaboch, MBA (The Permanente Federation)
Sue Hee Sung, MPH (Garfield Memorial Fund)
Richele Thornburg, MS (Hawaii)
Robert Tull, PhD (Group Health)
Elizabeth Wu, MA (Southern California)

Ward R Mann, MSN, FNP, (left) is a clinician and consultant for NWP in Portland, OR. Most recently he's helped to create curriculum for regions to use as they implement KP HealthConnect. E-mail: ward.r.mann@kp.org.
Joanne Slaboch, MBA, (right) has been a Project Manager for the Care Experience Council since 2001, focusing on issues related to technology-enabled cared. E-mail: joanne.m.slaboch@kp.org.

your patient and deal with this new "thing" in the exam room? Will you be able to make eye contact and type your note? Will you be able to keep the patient involved and not be distracted by the computer? Will you remember to secure the screen? Sound a little overwhelming? We believe that you will find the following suggestions helpful to make certain that the computer becomes a solid friend of yours in the exam room, and definitely not a foe.

Solutions

The Interregional Clinician-Patient Communication (IRCPC) Leaders of Kaiser Permanente (Table 1) have pooled their collective experience and understanding about clinician-patient communication and exam room computing. As a result they have identified five key communication behaviors to foster smooth integration of computers into practice:

Let the patient look on
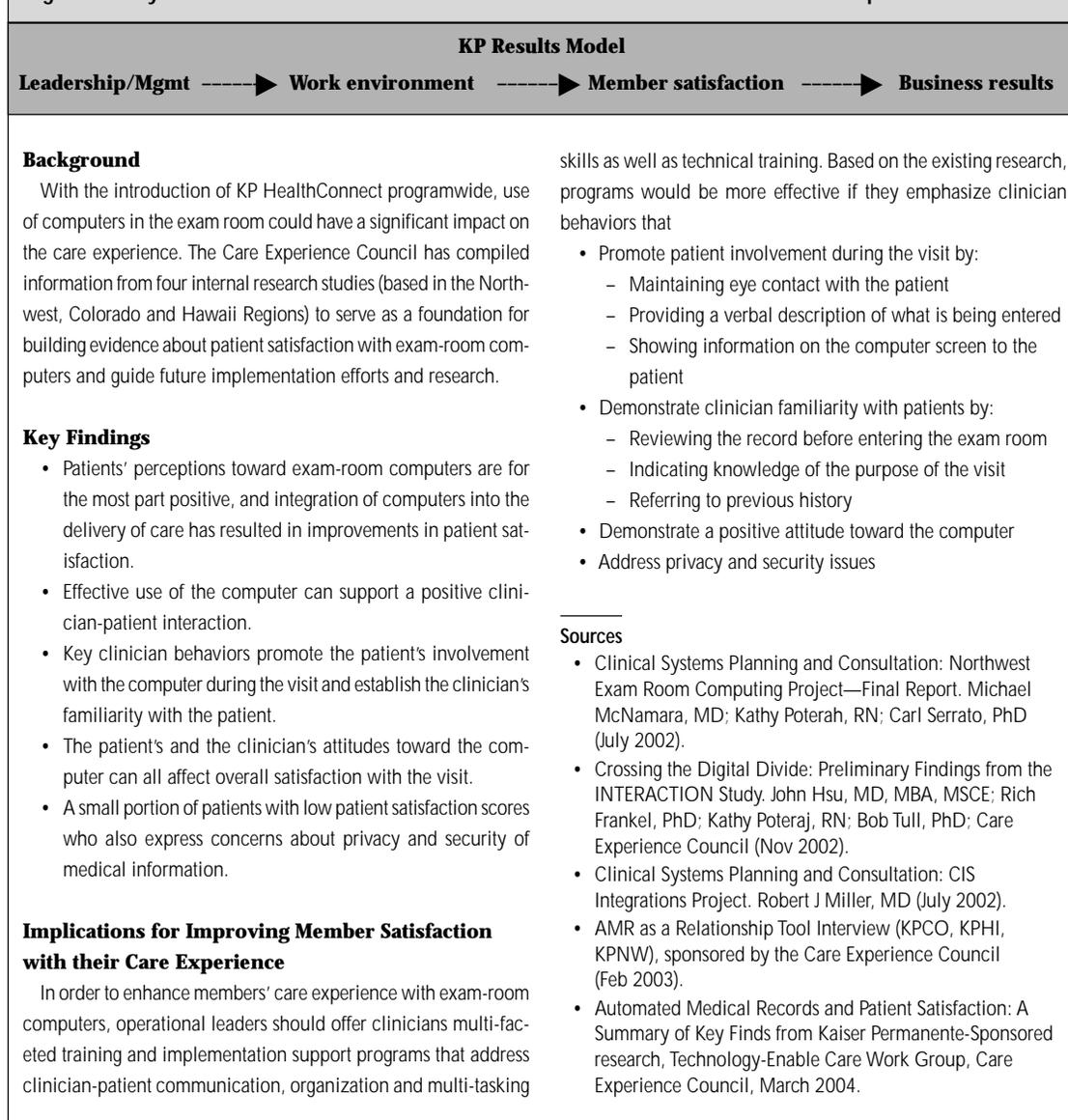**E**ye contact with the patient
Value the computer as a tool
Explain what you are doing
Log off and say you are doing so

The accompanying chart, Do Your LEVEL Best With the Computer in

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Figure 1. A synthesis of recent evidence—member satisfaction with exam room computers

KP Results Model

Leadership/Mgmt ------> Work environment ------> Member satisfaction ------> Business results

Background

With the introduction of KP HealthConnect programwide, use of computers in the exam room could have a significant impact on the care experience. The Care Experience Council has compiled information from four internal research studies (based in the Northwest, Colorado and Hawaii Regions) to serve as a foundation for building evidence about patient satisfaction with exam-room computers and guide future implementation efforts and research.

Key Findings

- Patients' perceptions toward exam-room computers are for the most part positive, and integration of computers into the delivery of care has resulted in improvements in patient satisfaction.
- Effective use of the computer can support a positive clinician-patient interaction.
- Key clinician behaviors promote the patient's involvement with the computer during the visit and establish the clinician's familiarity with the patient.
- The patient's and the clinician's attitudes toward the computer can all affect overall satisfaction with the visit.
- A small portion of patients with low patient satisfaction scores who also express concerns about privacy and security of medical information.

Implications for Improving Member Satisfaction with their Care Experience

In order to enhance members' care experience with exam-room computers, operational leaders should offer clinicians multi-faceted training and implementation support programs that address clinician-patient communication, organization and multi-tasking skills as well as technical training. Based on the existing research, programs would be more effective if they emphasize clinician behaviors that

- Promote patient involvement during the visit by:
  - Maintaining eye contact with the patient
  - Providing a verbal description of what is being entered
  - Showing information on the computer screen to the patient
- Demonstrate clinician familiarity with patients by:
  - Reviewing the record before entering the exam room
  - Indicating knowledge of the purpose of the visit
  - Referring to previous history
- Demonstrate a positive attitude toward the computer
- Address privacy and security issues

————
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Table 2. Courses for clinicians and health care team members	
Introduction to CPC Issues and Future Support	10-15 minutes
LEVEL Tips for Technical Training	5-15 minutes
Connected Communicating and Computing in the Exam Room Web-Based Training Course http://internal.or.kp.org/cis/training/erc.html	30 minutes
CONNECTED CONDENSED	a two-hour workshop session
Course for Exam Room Coaches RECONNECTED	

the Exam Room (Figure 2), applies these five communication behaviors and details some recommended actions to use and scripts to say to effectively integrate the computer into your exam-room interaction with your patient. The IRCPC has developed five courses to help clinicians and support staff integrate the computer into the patient visit using these LEVEL skills (Table 2).

By including a few new communication behaviors into everyday practice, a computer in the exam room will enhance the overall care experience for the patient. ❖

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Figure 2. Do your LEVEL best with the computer in the exam room		
Skills	**Actions**	**What to say**
Let the patient look on	• Move the screen for patient to see. • Invite the patient to move closer to the screen to view information. • Ask the patient to verify information as you type. *(This builds trust, actively involves the patient, and demonstrates "we know you.")*	*"Let's look at the lab results to see how your cholesterol is doing."* *"Let me show you this part of the medical record so we can confirm some information together."* *"Here are the injections we have in our records. Have you had other injections outside KP that we need to add?"*

Eye contact with the patient	• Greet the patient. Make a personal connection away from the computer
	• Keep that connection throughout the visit by:
	  - Maintaining eye contact with the patient.
	  - Turning toward the patient when the patient speaks or engaging in conversation.
	
	(Maintaining eye contact promotes active involvement.)
		"Good morning, Mr Jones. I see you hurt your ankle."
		"Let's spend a few minutes discussing your options."

Value the computer as a tool	• Acknowledge the computer. • Let the patient know how the computer improves care. • Stay positive when faced with computer challenges. *(From the patient's perspective, great medical technology is equated with great medical care.)*	*"The computer makes getting and sharing information with other health care team members so easy and efficient."* *"This computer is great. I have all your background information at my fingertips—medications, prior visit notes, and lab results from all KP visits."*
Explain what you are doing	• Keep the patient informed about your thought process and actions. • As you are documenting, let the patient know what you are doing—entering information you have just discussed, ordering lab tests/medicines, accessing patient information. *(Patients who receive no explanation about what you are doing may think you are working on unrelated business.)*	*"I am printing some instructions, which we can go over together in a moment."* *"I am recording the details of your sore throat so our records will be complete. I'll order the medication we just discussed, so it will be available at the pharmacy."* *"I'll add the leg swelling to your problem list, so we can keep it in mind for future visits."*
Log off and say you are doing so	• Tell the patient that you are "logging off the computer" to safeguard their information. *(Some members are concerned about privacy and confidentially. If their concerns are not addressed, satisfaction may decrease.)*	*"I'm logging off the computer now to keep your information private."*

Making the Right Thing Easier to Do

Paul Wallace, MD
Executive Director
Care Management
Institute

At the Care Management Institute (CMI), our guiding philosophy is to make the right thing easier to do, and the implementation of KP HealthConnect expands dramatically the possibilities for us to make this philosophy a reality. With the advent of KP HealthConnect, we have at our disposal new tools to answer our perennial question: How can we most effectively support clinicians and members in having the best possible information they need, when they need it? Assembling and clearly presenting the right clinical information and knowledge—what's known as well as what isn't—is the core of evidence-based medicine (EBM). CMI has been able to benefit from and complement decade-old efforts within the KP Regions to rigorously engage in developing and disseminating EBM. Our multiple and evolving efforts seek always to improve health outcomes through the identification, implementation, and evaluation of nationally consistent, evidence-based, population-oriented, cost-effective health care programs. To the extent that we bring the right information to the right people at the right point in a clinical encounter, clinicians and members can be optimally prepared to make key decisions.

> **When rigorous evidence is readily available at the right time and in the right way, clinicians are liberated to address preferences and values—theirs and those of members—in clinical encounters.**

Knowledge Management

The process of knowledge management is vital to providing content for KP HealthConnect, and the input and experiences of practicing clinicians in the KP Regions are foundational at every step. Knowledge management assembles existing knowledge in medicine and identifies concerns and inquiries that are critical to clinicians. We investigate the degree to which evidence exists to answer these pivotal clinical questions and identify key elements of evidence that should be available during practice.

Once knowledge has been assembled and distilled into core elements, it must be "triaged" into an appropriate level of decision support. What point in the clinical encounter is the right one at which to present the evidence? Is it appropriate to "intrude" in the visit with alerts, reminders, and redirection of care? What information needs to be just "a click away"?

The answers are evolving out of an increasingly clear understanding of the process of clinical decision-making. Clinical decision-making involves understanding the evidence and interpreting its implications depending on individual circumstances as well as on the preferences and values of the involved parties. When rigorous evidence is readily available at the right time and in the right way, clinicians are liberated to address preferences and values—theirs and those of members—in clinical encounters.

With the homework of discovering and distilling the evidence addressed before the clinician even begins work with a patient, visits can be increasingly devoted to the unique aspects of individual situations. For this reason, EBM is a key enabler of the ultimate goal of patient-centered care.

Visit Workflow

Workflow—how exams and discussions proceed—is of central importance to both clinicians and members. The unique relationship that goes on behind the closed door of an exam room must always be respected. KP HealthConnect offers a system with a range of ways to provide evidence and support decision-making within the clinical encounter.

Some clinical issues are important enough to justify interrupting workflow in order to present pertinent information. For instance, missed screening tests and medication incompatibilities are generally worth interrupting the flow of a visit to prompt clinicians and members to do something differently. Alerts and reminders represent the first order of intrusiveness. Instances like these, in which the evidence is strongest and the risks of overlooking it are highest, are relatively rare.

The second order of intrusiveness makes information available the instant a question is posed within the visit workflow. For instance, one medication may be more cost-effective or appropriate than another initially selected. Redirection can be provided with the option to preserve the original order. References are provided on demand, supporting the clinician's need for more

Special Feature
SOPHISTICATION

"Making the right thing easier to do" has been the guiding philosophy behind Dr Paul Wallace's inspired leadership in bringing information technology to bear in realizing the promises of evidence-based medicine within Kaiser Permanente, first in the Northwest Region, and now as director of the KP Care Management Institute.

details about options and choices. In KP HealthConnect, an alternative medication functionality provides this type of information and facilitates redirection if the clinician agrees this is best for the patient.

The third order of intrusiveness provides facilitated access to decision supports such as clinical guidelines and other references. One example is treating acid peptic disease caused by *H pylori,* which requires a mixture of antibiotics that changes frequently and is difficult to remember. KP HealthConnect can leverage what several KP Regions have previously achieved through protocols and clinician agreement to field and help fill a pharmacy order for treating *H pylori* that brings all currently recommended medications up for approval. Additionally, a clinician may have started to order a diagnostic test and have a question about it. Within the order form, s/he can find links out to general reference information on the Web through the Clinical Library.

Alerts and reminders, redirection and reference on demand, and general reference availability support the whole range of clinical inquiry, and the flexibility of the KP HealthConnect system allows us to triage evidence

into the appropriate level of decision support. Most important, the leverage of knowledge, including the degree of intrusiveness for knowledge within the encounter—like the actual guidelines themselves—is under the guidance and oversight of practicing KP clinicians.

Quality Assurance Process

Completing the knowledge management cycle is the need for a consistent quality assurance process in which we ask the question: Does the information that appears in KP HealthConnect accurately represent the evidence on which it is based? The ability to make something easier carries with it the accountability to insure that facilitated care is indeed the right care.

Involving the Member

An integrated knowledge management process needs to also take into account the fact that members must have a view into existing knowledge. This is key for self-care of some acute illnesses, such as uncomplicated respiratory infections; support for members in sharing in decisions about their care; and support and engagement of members in their own self-management of chronic medical conditions such as diabetes, heart failures and asthma. Patient information concordant with that available to clinicians is being made readily available to members. The member functionality (referred to as "MyChart" by Epic) creates a new forum for communicating medical knowledge with our members and empowering them to determine their own health status.

Final Comments

Finally, although our efforts to date have focused on putting the right thing into KP HealthConnect to support care for our members, as we look toward the future, we can anticipate harvesting an expanded and extended knowledge base about our members and their clinical experience from KP HealthConnect. Despite the best efforts of CMI, regional experts, and trusted third-party sources, gaps in the evidence base persist and will continue to do so for the foreseeable future. KP HealthConnect will generate an unprecedented data stream reflecting the clinical paths of millions of people. It is incumbent on all of us to use it optimally for research purposes to address these gaps.

It is, in short, the right thing to do. ❖

Population Care Information Systems (PCIS): Managing the Health of Populations with KP HealthConnect

By Joel Hyatt, MD
Warren Taylor, MD
Leslee Budge, MBA

KP HealthConnect creates an opportunity for Kaiser Permanente (KP) to practice population care management (PCM) on a scale unparalleled elsewhere on the planet. The Care Management Institute (CMI) is spearheading an effort to make sure that this potential is realized.

PCM, conducted by the KP Regions in collaboration with CMI leadership and support, is already a core strength of KP. Regions, learning from one another and building on innovations, have developed PCM programs that demonstrate a clear impact on health outcomes.[1]

Information systems that identify and stratify populations, support inreach decision support (member-specific point-of-service messages to providers that prompt certain actions) and outreach (communication to members by mail, telephone, or e-mail), and track outcomes are key to PCM. All eight KP Regions independently developed PCM information systems and migrated toward interregionally consistent population definitions and outcomes measures. From a KP Program perspective, regional information systems currently support PCM in patchwork fashion. The advent of KP HealthConnect, on the other hand, represents an opportunity to create a finely woven tapestry of PCM that covers every KP member programwide—consistently, effectively, and efficiently.

What's Possible

As an example, consider important research findings like those of the recent Heart Protection Study.[2] The finding that a moderate dose of lipid-lowering statins protects against adverse cardiovascular (CV) events in members with coronary artery disease and diabetes has clear implications for managing the population at risk for adverse CV events. Currently, ongoing outreach efforts in all KP Regions seek to make sure that every member at risk for an adverse CV event has the opportunity to benefit from the protective effect of statins. Outreach efforts vary between the Regions; so, too, does the rate at which the percentage of members with diabetes on statins increases.

Once KP HealthConnect—and customer relationship management (CRM) software—is fully in place, every KP member throughout the program could receive notification in the manner of their choosing about the importance of taking new medication, such as statins. Members would also benefit from the best and most recently published research as soon as it became accepted policy; PCM staff could send prescriptions for the newest appropriate and affordable medication to hundreds and even thousands of members at a time—with little effort or technical expertise. Similarly, depending on their preferences—which would be available in the electronic health record—some KP members would receive personalized outreach messages by mail or phone. Others would prefer to access them through MyChart, the member interface into KP HealthConnect.

Depending on their preferences, which would be stored in the electronic health record, some KP members would receive personalized outreach messages in the mail or over the phone. Others would receive them through MyChart.

MyChart has significant potential to enhance PCM by helping individuals access both the information and health resources to take the steps they need to manage their own health care. Particularly in chronic disease, the member and the member's family must take key steps toward lifestyle modification and improving health status.

MyChart also holds the potential

> The advent of KP HealthConnect, on the other hand, represents an opportunity to create a finely woven tapestry of PCM that covers every KP member programwide—consistently, effectively, and efficiently.

Joel Hyatt, MD, (right) is the Assistant Associate Medical Director, SCPMG. E-mail: joel.d.hyatt@kp.org.
Warren Taylor, MD, (not pictured) is Director of Chronic Conditions Management, KPNC. E-mail: warren.w.taylor@kp.org.
Leslee Budge, MBA, (left) is practice leader for cardiovascular disease for KP Care Management Institute. She co-facilitated the development of CMI's Coronary Artery Disease, Secondary Prevention guidelines. E-mail: leslee.budge@kp.org.

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to liberate some health care from the confines of inpatient and outpatient settings. Although clinic visits and hospital stays will continue to be necessary elements of health care, the potential for fast, direct communication between clinician and member means that some care can take place outside both traditional settings. One likely scenario is in diabetes care. If members are able to electronically transmit data on blood glucose home monitoring and clinicians can recommend insulin or oral hypoglycemic changes via e-mail, the member's home becomes the locus of care.

KP HealthConnect will also create the largest and most diverse database in the country—and in the world. Cradle-to-grave data will be available on eight million people. The potential for research into disease risk factors and causative factors, including genomics, and for effective treatment is staggering.

But none of this will happen overnight—or without concerted effort.

Population Care Information Systems

To make sure that KP receives the maximum PCM benefit from KP HealthConnect, an interregional group of stakeholders, KP HealthConnect management, and representatives from Epic, KP-IT, and the Regions assembled to address the question: How can KP HealthConnect support PCM in the near future and over the long term? The process of finding answers is called Population Care Information Systems (PCIS). Co-led by Joel Hyatt, MD, Assistant Associate Medical Director (SCPMG), and Warren Taylor, MD, Regional Director of Chronic Conditions Management (KP Northern California), PCIS involves CMI staff and regional contacts.

It was clear to PCIS members that

KP HealthConnect supports encounter care superbly. However, the potential for population-based functions within KP HealthConnect hadn't been addressed by Epic, KP HealthConnect's vendor, in any previous application. Nor was there a precise picture of the key elements of PCM that KP HealthConnect, or any enterprise-level information system, should support.

Defining the Elements

A first step for PCIS was to define core requirements for PCM. That required a close examination of the existing PCM mix, including visits to all eight KP Regions, interviews with more than 100 staff and clinical and operational leaders, observations of over 30 population care management systems, and documentation of more than 300 PCM requirements. Led by CMI Practice Leader Leslee Budge, the exhaustive investigation yielded a clear idea of what KP HealthConnect needs to do to support PCM well.

As a result, PCIS specified eight key functions needed to support PCM in the KP HealthConnect environment:

- population identification—determining population membership through reproducible processes and criteria
- population stratification—identifying population subsets according to level of illness or risk
- member tracking—following members through episodes of care
- care/case management—care plan documentation, communication, prioritized list of members, and smart algorithms to maximize care/case management efficiency
- inreach—alerts and reminders triggered at any point of ser-

vice (decision support)
- outreach—individual or mass communication with members by telephone, mail, or Internet
- member data entry into KP HealthConnect—input of data from MyChart, devices, or questionnaires
- monitoring and reporting—generating reports to meet strategic and quality needs

In partnership with Epic and KP-IT, PCIS began a process of matching these functions to KP HealthConnect. Where gaps existed, the group identified KP HealthConnect functionalities that could be adapted to meet PCM needs. Epic proved robust and flexible; as members of PCIS brought detailed questions to the table, they found functionalities to support many identified PCM needs. Where there were gaps, analysis of alternative solutions yielded a workplan, which was approved and funded by the Care Delivery Portfolio Approval Council.

Several groups within KP are collaborating with and supporting the efforts of PCIS. For example, the clinical data warehouse project is working with PCIS to create a programwide dataset, starting with data for Clarity, Epic's database, and other sources such as some lab and claims data. PCIS is working in partnership with that project and with Information Management to select software for back-end data-mining functions. Enterprise Architecture-Health Plan Operations is working on the applicability of CRM software to support outreach efforts. CRM will eventually hold all member information, including contact preferences, and be able to support campaignlike marketing efforts to reach members. PCM will be able to take full advantage of CRM service capabilities to target specific patient audiences and receive feedback on the results. Patient encoun-

ters through CRM will be stored in the medial record.

An important byproduct of PCIS is a meeting of minds about PCM. For the first time, operational and clinical leaders from the KP Regions have gathered with staff and consultants from CMI, PCM's home within KP, to develop a shared vision of what PCM could look like in an integrated health care delivery system and what functionalities within KP HealthConnect support that vision. Regional and CMI leaders collaborate frequently; until now, they've focused on best practices for clinical priority areas. PCIS is their first opportunity to look across the PCM landscape and toward the horizon.

Between Here and There

There are some intermediate landmarks between the current state of PCM at KP and the PCIS vision outlined above.

For one, consider the impact of KP HealthConnect on communications. When the electronic health record is live, information about care plans for individual members will be shared instantaneously and continuously. This represents a quantum leap in communications at KP.

Take the care of a member with chronic pain, for instance. The care team may consist of a behavioral medicine specialist, a physical therapist, a care manager, and a pain specialist, in addition to the primary care provider. Often, documentation about care management is siloed from the medical record and maintained separately. Primary care providers often find it difficult to have a clear picture of the plan of care for chronically ill members. With the advent of KP HealthConnect, the care plan will be readily available to the primary care provider, making that clinician an active part of the team and ensuring that his or her time is well spent.

Increased communication can only improve PCM. So, too, will SmartTools that incorporate clinical practice guidelines improve PCM.

Back end data queries will allow care managers or support staff to identify population members who, for instance, need better glucose or lipid control or who need to be on an ACE inhibitor.

EpicCare's Reporting Workbench will enable providers to easily create queries that provide panel-level information about members who may be at risk and need some form of intervention or monitoring. As this process gets refined, the health care team will be able to produce a summary on specific subsets of members.

As KP HealthConnect rolls out over the next few years, it's essential that population care management activities continue uninterrupted. To that end, the KP Regions will maintain parallel PCM systems until the last regional medical center goes live with KP HealthConnect.

A methodical approach to transitioning from existing systems to KP HealthConnect-based PCM systems will ensure that, while providers are busy learning the ins and outs of the encounter-focused electronic health record, PCM continues. CMI will take a leading role in ensuring that no members fall through PCM cracks. Individual PCM resources, like care management summary sheets, will be transitioned gradually to KP HealthConnect-embedded information. The vision of PCIS is that from the perspective of care providers, the transition from current systems to the PCM of the future will be incremental and seamless. ❖

> When the electronic health record is live, information about care plans for individual members will be shared instantaneously and continuously. This represents a quantum leap in communications at KP.

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Discovery

The real voyage of discovery consists not in seeking new landscapes but in having new eyes.

— *Marcel Proust, 1871-1922, French novelist*

The Clinical Knowledge Management Process Behind KP HealthConnect

By Karen Woods
Melodi Licht, RN, MS
William Caplan, MD

Clinical Knowledge Management and Patient Care Intersect in SmartTools

SmartTools are the part of clinical knowledge management that clinicians will see as they use KP HealthConnect. Some SmartTools, like preference lists, SmartText[a] and SmartLists[b] streamline workflow for clinicians by, for instance, reducing repetitive documentation or making orders or diagnoses easier. Others offer more pointed decision support. SmartSets, for example, bring together diagnoses, lab and imaging orders, medication and procedure orders, patient information, and supporting documentation in a template.

The Care Management Institute (CMI) is coordinating an ongoing effort to make high-quality knowledge available to clinicians at the point of care in these tools.

Creating Clinical Content

The primary focus of the clinical knowledge management process behind KP HealthConnect is the collaborative creation of rigorous, evidence-based content for clinicians to use at the point of care.

The CMI clinical knowledge management process is well established. Interregional workgroups consisting of clinical experts from medicine, pharmacy, and nursing, evidence-based methodologists, and CMI care management consultants have created clinical practice guidelines for a core set of conditions and health care issues: asthma, coronary artery disease, chronic pain, cancer, depression, diabetes, elder care, heart failure, and self-care and shared decision-making. These guidelines have been approved on a national level by the Guideline Directors Group and are revised at least every two years.

Clinical practice guidelines appear in a variety of print formats, including full-length technical and summary documents, as well as on the Clinical Library (CL), (http://cl.kp.org) formerly called Permanente Knowledge Connection (PKC). CMI care management consultants also developed clinician-friendly tools, like trifold brochures and pocket cards, to facilitate guideline implementation.

For conditions outside its core list, CMI is facilitating the work of interregional domain (specialty) groups. Each domain group, consisting of clinical experts, chooses three clinical conditions to address with KP HealthConnect SmartTools. Within these conditions, domain group members submit questions or clinical issues for the evidence consultants to research. For example, the rheumatology domain group chose to examine the efficacy of recently introduced medications compared with long-standing treatment options.

A CMI evidence consultant, working under a physician evidence-based medicine methodologist, then follows a specified procedure for synthesizing available evidence on the topic. The knowledge synopsis is delivered to the domain group, whose responsibility it then is to build clinical content in collaboration with regionally based KP HealthConnect builders.

CMI also facilitates design, build, and validate (DBV) sessions (see sidebar). DBV sessions bring together physicians, nurses, pharmacists, evidence methodologists, coders, representatives from patient safety and health education, and other experts from across the program to Oakland to create content for KP HealthConnect.

The effort to create high-quality, evidence-based knowledge and decision support for KP HealthConnect also extends to the emergency department and inpatient settings. More than 40 people, including emergency room physicians, hospitalists, and nurses, are working on the inpatient content to support KP Regions with KP hospitals.

The goal of all processes is the synthesis of the best available evidence and information. The domain group, DBV—or the CMI core condition workgroup—then considers how to represent it within KP HealthConnect.

Plugging it into the Right Point of Care

Once an evidence synopsis exists, the recommendations are integrated into the process of care. Statins, for instance, are indicated for the prevention of acute car-

Karen Woods, (top), is Director of Clinical Quality and Process Management, CMI. E-mail: karen.e.woods@kp.org.
Melodi Licht, RN, MS, (left), is Director of Knowledge Management, CMI. E-mail: melodi.licht@kp.org.
William Caplan, MD, (right), is Director of Clinical Development, CMI. E-mail: william.m.caplan@kp.org.

diovascular events in members with diabetes over the age of 55. A prompt should appear at some point in a clinic visit to alert the provider if an appropriate candidate for treatment isn't receiving a statin.

CMI priority area workgroups and domain groups make sure that the processes of care drive the creation of tools—not the other way around. The focus is on creating solid knowledge and making it available at the right point in the process of care by using the possibilities that SmartTools present.

All this means thinking about guideline content in a new way. Even though previous tools like pocket cards have aimed at making guideline implementation easy for clinicians, the process of creating SmartTools requires content experts to think in great detail about the moment-by-moment flow of care within a clinic visit. At exactly what point in the visit should a statin alert appear? When the provider is reviewing the list of current medications? When he or she is signing off on any orders or plans? Within domain groups, clinicians, pharmacists, nurses, and representatives from utilization management and health education also discuss the flow of clinic visits at the same level of detail.

With a solid understanding of the process of care, KP HealthConnect builders can begin to create documentation and decision support tools that support the process and reflect the evidence.

A good understanding of the process of care allows both consistency and flexibility. Consistent standards about documenting orders and plans must be maintained across Regions; at the same time, local preferences for KP HealthConnect tools must be accommodated. For example, some users might want a pull-down menu for documentation; others might prefer a SmartText module that they can further personalize to reflect their individual practice patterns.

Validating the Tools

Quality assurance (QA) is a key part of the process of creating KP HealthConnect content, and QA's primary aim is to ensure that SmartTools reflect the evidence on which they are based. In 2003, more than 400 SmartSets from the KPNW EpicCare system were reviewed for consistency with CMI-generated evidence-based summaries and clinical guidelines.

For content created de novo, validation sessions take place as Web and teleconferences, at which the builder responsible for creating the SmartTools posts them online for participants to view. Domain group members review each section, making sure that their input

has been accurately translated. Constituent members, such as lab, pharmacy, utilization management, and evidence-based medicine methodology representatives, sign off on the SmartTool or request changes.

To shorten the feedback loop, the builder responds to requests for changes in real time. The goal is to revise the SmartTools to the satisfaction of all participants during the course of the Web conference.

Lively discussions can arise, all leading to the eventual betterment of the SmartTool. Notable recent debates included the utility of MRIs for diagnosing early-stage breast cancer and the routine use of brain natriuretic peptide (BNP) for diagnosing heart failure in inpatient settings; both tests were ultimately removed as default options from the SmartTool being discussed on the basis of the published evidence.

Design, Build, Validate

Clinical decision support tools for ambulatory KP HealthConnect are created in three-day sessions called Design/Build/Validate. Physicians, nurses, pharmacists, utilization management representatives, evidence methodologists, regionally based KP HealthConnect clinical content builders, and representatives from Epic meet to plan, build, and perform quality assurance on KP HealthConnect tools. Adult primary care was the topic of a DBV session in February 2004; a July session targeted pediatric ambulatory care. These sessions yielded content for 10 to 20 conditions.

DBVs are also conducted for the inpatient application. These DBVs typically run one to three weeks and address workflows, configuration design, documentation tools, and order sets. Starter sets have been completed for hospitalists, general surgery, medical/surgical nursing, and emergency departments. An integrated inpatient/outpatient DBV to address obstetrics is planned for October/November.

Lengthy preparation on the part of involved clinicians and representatives precedes the meetings. Evidence synopses and clinical practice guidelines, posted on the Clinical Library and the I KNOW Web site, form a critical foundation. Armed with this information, participants determine how best to incorporate recommendations into workflow by mentally walking through a clinic visit moment by moment. "There's only so much time in the flow of care. Our goal is to prioritize the key points in a clinical practice guideline. We focus on creating SmartTools that clinicians will find easy to use and that also support them in making the right decisions," says Michelle Wong, MPH, MPP, CMI Care Management Consultant.

Builders then create the suggested tools, and the entire group validates that their input has been accurately translated into KP HealthConnect. Clinicians participating in the process feel their time is well spent. "Clinicians are really energized and excited, despite the very tight timelines involved," says Ms Wong.

When—and How Much—to Roll Out

Content for KP HealthConnect is built in the order in which it's needed. In April of 2004, the Hawaii Region went live with HealthConnect in internal medicine, family practice, pediatrics, gynecology, and behavioral health. As medical and surgical specialties come online, clinical content will be ready.

The efforts to date don't yet cover the vast array of clinical conditions that KP primary and specialty care providers may encounter. Clinical knowledge management in the context of KP HealthConnect is best thought of as a process, not an end. As clinicians become familiar with the electronic health record and its potential for offering decision support, the clinical knowledge management processes will already be in place to meet accelerating demand for more SmartTools. New technologies under study, like active guidelines and Web-enabled documentation templates and order sets, will also enable new kinds of SmartTools.

Regional Variations

The process described above will yield a collaborative national version of KP HealthConnect, which maximizes the economies of scale involved. However, KP Regions can customize it to create versions sensitive to local conditions and preferences.

The ultimate goal of the KP HealthConnect clinical knowledge management process, though, is standardized, high-quality care and improved health outcomes throughout the KP Program. Members with diabetes, asthma, coronary artery disease, or any one of the conditions identified by the domain groups should receive the same standard of care across all the regions. The SmartTools within KP HealthConnect are a key mechanism for making that happen. ❖

[a] Standardized text templates that streamline documentation by presenting prewritten elements of patient care notes. They can also include patient care instructions, care protocols, or other text-based information.

[b] Predetermined lists of symptoms, physical findings, pertinent patient history, and the like. They can also appear within SmartText as options for individualizing patient care notes.

Walk Into The Future

You need people who can walk their companies into the future rather than back them into the future.

— Warren G Bennis, b 1925, Professor of Business Administration and author of books on leadership

A Universe at Your Fingertips:
The Clinical Library and KP HealthConnect

By Brad Hochhalter
Tom Stibolt, MD
Aaron Snyder, MD
David Levy, MD
Robert H Dolin, MD

Imagine you're in the middle of a Kaiser Permanente (KP) clinic visit and wondering if there's any evidence for using aspirin in members with heart failure. Or when you next need to see the person for whom you're prescribing an antidepressant medication. Or how long your patient with diabetes needs to be NPO before a colonoscopy.

What Do You Do?

Here's a likely scenario—before the implementation of KP HealthConnect. You instantly decide how important your question is. You only have time to pursue critical information, because three more patients are waiting to be seen. So the question about aspirin gets sidelined; you'll look it up later. You guess that six weeks is about the right interval for a return visit. But you have to know how to help your patient adjust insulin, so you leave the exam room and make a quick call to the GI lab.

Thanks to Web-based resources provided by KP's National Clinical Library (http://cl.kp.org), KP HealthConnect can provide the answers to these questions—and an infinite number of others—almost instantaneously. In the exam room with your patient, you run a quick Google™ search of the site and find no evidence to support adding aspirin for your patient with heart fail-

ure. You click on a hyperlink within the visit page to go directly to the section of the depression clinical practice guideline pertaining to follow-up, then ask your patient to return in a month. You click on a link to your personal home page, MyEpic, and find links to departmental home pages. Two more clicks take you to the prep instructions for colonoscopy.

The Clinical Library (CL) makes sure that all the information clinicians need is only a click or two away. From a single user interface, KP care providers can deliver and document care and quickly find reliable, up-to-date medical knowledge.

Portal to Resources

The KP CL, sponsored by the Care Management Institute (CMI) and the Regional Permanente Medical Groups, is a clinical knowledge Web portal and the Web-based reference library in the KP HealthConnect environment. Formerly named Permanente Knowledge Connection (PKC), CL has long been the reference library resource link for KP clinicians. In keeping with the CMI mission of "making the right thing easy to do," CL/PKC houses a rapidly expanding base of clinical knowledge that is available to KP clinicians, researchers, and employees KP Programwide. The new name

reflects a merger between PKC and online clinical libraries in KP Northern California (KPNC) and KP Northwest (KPNW) and a nod to regional constituencies that both use and fund centralized CL resources.

Long before KP HealthConnect was identified as the electronic health record vendor, CMI staff ensured that the CL would be compatible with whatever application eventually supported patient care documentation. Instead of embarking on a plan to embed CL resources into KP HealthConnect, planners pursued a portal strategy. While a Web site has static pages that are designed and posted, a portal links users to other sites as well as having content directly on the site. The CL functions as the gateway between KP HealthConnect and an expanding universe of medical knowledge.

It's a largely invisible gateway though. Unlike previous versions of PKC, no log-in is required except for online continuing medical education. The CL provides a seamless interface between the processes of caring for KP members and finding rapid, precise, and reliable medical knowledge.

That knowledge is in the form of KP-created clinical content like national, CMI-sponsored clinical practice guidelines, content from the KPNC, KP Southern California,

> **The Clinical Library functions as the gateway between KP HealthConnect and an expanding universe of medical knowledge.**

Brad Hochhalter, is Director, Clinical Library. E-mail: brad.hochhalter@kp.org.
Tom Stibolt, MD, is Senior Physician, Medical Informatics, KPNW. E-mail: tom.stibolt@kp.org.
Aaron Snyder, MD, is Director, Clinical Decision Support, KPCO. E-mail: aaron.j.snyder@kp.org.
David Levy, MD, is Associate-Physician-in-Chief, Information Technology and Innovation, Diablo Area, KPNC. Email: david.levy@kp.org.
Robert H Dolin, MD, is Department of Internal Medicine, SCPMG Physician Lead, National Terminology Team, KP HealthConnect. E-mail: robert.h.dolin@kp.org.

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and KPNW regional clinical libraries, and other internal content. The CL also provides third-party resources such as more than 1200 full text journals and 180 textbooks, OVID, and a secure link to Clin-eguide, a proprietary subsidiary of Wolters Kluwer Health with evidence-based and consensus guidelines for 300 conditions that are tailored specifically to Permanente Medicine. Ultimately, the Clin-eguide content alone will bring 84,000 pages of KP-modified documentation to clinicians.

In terms of cancer care alone, for instance, clinicians can access CMI-generated tools like an oncology resources page with links to internal and external sites and content resources. There are guidelines; member education resources; and reference links to textbooks, data-bases, and all noteworthy national organizations—all focused on oncology and hematology care.

The CL functions as a database that links to all these data sources. Each source document is categorized along criteria such as keywords, approving body, clinical category, intended audience, type of document, and so forth. Whereas Google™ returns results ranked by relevance, the CL search functionalities can return results sorted by any of these criteria in combination. One particularly useful search process pulls up documents by type. For example, a clinician could quickly find diabetes-related documents that are patient education tools.

Personalizable

KP HealthConnect includes a page called MyEpic within the visit navigator. MyEpic is like a personal home page from which clinicians can link directly to the Web-based information and services most important to them. Access to the CL will appear here, and in hyperlinks throughout the KP HealthConnect environment.

CL is rendered as one of eight regional and a single national version, depending on the physical location from which clinicians access it. All sites have the same look and feel, but each Region decides what to put on their version of the MyEpic home page. For example, the KPNW CL site emphasizes protocols and provides call lists to serve up the kind of operational information clinicians need (see sidebar). With MyEpic, individual clinicians can further customize their Web access by adding links to clinical practice guidelines, OVID, or any other Web-based resource.

What Kind of Information Do Clinicians Really Need?

Early on, the CL Advisory Board asked a fundamental question. *What kind of information do clinicians need?* A CMI-sponsored study examining the information-seeking behavior of KP clinicians provided insight. Researchers found that clinicians sought four general kinds of information, as depicted below.

	Patient-specific	Nonpatient-specific
Medical	Patient medical record	Medical science
Nonmedical	Social/demographic	Operational

- Patient Medical Record—Medical questions about the individual patient in a clinical visit
- Social—Nonmedical questions about a specific patient
- Medical Science—Clinical questions of a general nature. This is the domain of most decision-support systems. Most previous studies of clinical questions have been limited to this question type.
- Operational—General nonmedical questions that often have to do with workflow issues.

KP HealthConnect will provide patient-specific medical information key to any clinical encounter. How important to clinicians are the other types of information?

Operational information about topics like how to refer a patient for a particular service, which physicians are on call, and what services are covered is the most frequent type of query for clinicians. This finding helped identify priorities for the MyEpic page of KP HealthConnect.

Social information is also quite important, allowing clinicians to ascertain whether they've seen a particular member before, to plan care that's appropriate to the context of the member's life, and to build effective relationships.

When medical science information was sought, it was important to clinicians that the process reliably yielded meaningful results. To that end, the CL assembles top-of-the-line medical resources and makes them optimally accessible to clinicians through hyperlinks embedded in KP HealthConnect and familiar search tools like Google™.

Interoperability

Simultaneous computer applications typically run in parallel fashion; you can't work on a PowerPoint presentation, for instance, from within a Word document.

Interoperability is the opposite of parallel operation, and maximizing interoperability between KP HealthConnect and the CL is the ultimate goal. Users can already run Web-based searches from within the KP HealthConnect environment, and much work has gone into making that happen.

For a start, the two programs have a vocabulary that allows them to "talk" to each other with precision. Convergent Medical Terminology (CMT) is the lingua franca between KP HealthConnect and the CL. CMT is the result of nearly a decade of work within KP that began as an effort to create a terminology database to serve the needs of KP Colorado's clinical information system. Leaders in that effort embarked on a collaboration with the developers of SNOMED (Systematized Nomenclature of Medicine) to enhance its usefulness for KP, so CMT and SNOMED developed as closely related systems. Years later, SNOMED CT emerged as the lexicon of choice for electronic health records and resources.

This base of common terminology forms the foundation for more complete interoperability between KP HealthConnect and the CL, which, in turn, offers considerable potential for streamlining high-quality patient care.

The Future of the Clinical Library

Active clinical guidelines are an interoperability function looming in the not-too-distant future. Here's how they might work: A clinician, working in KP HealthConnect while seeing a patient with diabetes, enters SmartText pertaining to the patient's cardiovascular status. An icon labeled "evidence-based guideline" pops up. The patient clicks on it and goes directly to the portion of the diabetes clinical guideline addressing the role of aspirin, lisinopril, and lovastatin in preventing adverse cardiovascular events.

Referring to the guideline for statin use, s/he decides it's indicated for the patient and clicks on the suggested medication and dose. This information appears in the patient's record as a pending order. The clinician signs off on it, and a prescription is generated in the pharmacy two floors down.

Still working in the patient's record, s/he initiates a patient-specific CL query built automatically by KP HealthConnect, selecting patient education tools as "document type" from a pull-down menu. S/he finds a handout that covers starting statins and prints it out for the patient.

Building the interoperability to enable this scenario takes imagination, time, and clinical and information technology expertise, but this kind of workflow-integrated knowledge resource is the ultimate goal of the CL.

Initially, users may feel hard-pressed to use even the Web portal functions available when KP HealthConnect goes live. Their priorities will necessarily be on mastering key tasks: accessing the patient record, charting care and entering orders, diagnoses, and level of service. As their comfort with KP HealthConnect grows, though, they'll find more use for the knowledge efficiencies built in. And, as user sophistication increases, so will the sophistication of interoperability between KP HealthConnect and the CL. ❖

A Moment

There's a moment coming. It's not here yet.
It's still on the way.
It's in the future. It hasn't arrived.
Here it comes. Here it is …!
It's gone.

— George Carlin, b 1937, comedian

Special Feature
TRANSFORMATION

KP HealthConnect as a Transformational Tool

By Allan Weiland, MD

A Vision of Better Health Care Enabled by Information Technology

Telemedicine applications are commonplace. Specialists use videoconferencing and telesensing methods to interview and even to examine patients who may be hundreds of miles away. Computer-aided surgery with Internet-based video is used to demonstrate surgical procedures to others. Powerful high-end systems provide expert advice based on sophisticated analysis of huge amounts of medical information. Patients are empowered in making decisions about their own care through new models of interaction with their physicians and ever-increasing access to biomedical information via digital medical libraries and the Internet. New communications and monitoring technologies support treatment of patients comfortably from their own homes.[1]

We are early into the information age of health care, and Kaiser Permanente (KP) is investing large sums of money and effort to implement KP HealthConnect to lead American health care into this new age. Since the late 1950s and early 1960s, when Permanente pioneer Morris Collen, MD, developed his computerized medical record prototype, we have been trailblazers in the use of just about every type of clinical information technology to improve medical practice (see Debley article, page 32).[2]

Introduction

In this article, I will call on work done by the Blue Sky Vision group for the KP Care Delivery Portfolio, the KP research community and many others, to paint a picture of how clinical practice could be transformed through the use of these technological tools over the next few years. Technology has the potential to change health care drastically by increasing access to patient and medical information, by increasing efficiency and timeliness of care, by simplifying complex tasks, by reducing medical errors, and by facilitating the tracking of outcomes and development of outcomes-based research.[3]

Imagine the health care system of the future. Every encounter is "paperless" from the reception desk to the exam room, laboratory, and pharmacy. All data are electronic, and most data enter the system automatically. A larger system, or data warehouse, stores the data and generates reports about patients and populations (across conditions and over time) as well as longitudinal studies of diseases and treatment patterns. Communication is seamless, with orders and test results transmitted almost instantaneously across departments and with real-time sharing of information among clinicians, no matter their physical location. Clinical encounters aren't confined to the clinic—they meet patients' varying needs, including "virtual" visits with clinicians and home-based monitoring of chronic conditions.

As attributed to William Gibson, a science fiction author, "The future is already here, it's just not evenly distributed yet." Much of what I described above is happening right now in many KP regions and elsewhere.

Assumptions

In order to describe potential transformations achieved through KP HealthConnect, first we need to make some assumptions about the delivery of health care in the future. These are extensions of current trends, with no major discontinuities.

Assumption 1: *Health care information continues to grow at an exponential rate and is widely accessible via the Internet.*

This is a safe bet and recognizes current growth trends of health care information plus the increasing amount of knowledge spinning off from the Human Genome Project. Not only is the rate of knowledge creation increasing but also accessibility of knowledge to consumers, primarily through the Internet and World Wide Web. In several markets, at least 70% of KP members have computer access, and the number of "hits" on health-related Web sites is now well over 100 million annually.

The amount of medical knowledge available to clinicians is also increasing dramatically. On top of newsletters, updates from specialty societies, and online information, about 1500 medical articles are published each day.[4] In this age of medical malpractice, physicians are expected to keep current on best practices, yet the amount of medical knowledge that we have gained in the last 20 years surpasses humankind's total prior understanding of medicine.[3]

Assumption 2: *Point of care (home-based) testing and therapeutic interventions will grow rapidly.*

Multiple home monitoring systems are currently available, all linked to information networks, including "smart houses" that monitor physiologic functions and "smart toilets" with diagnostic capabilities. Remote cardiac and uterine contraction monitoring have been available for years, and other types of monitoring are possible. NASA, for example, conducts remote physiologic testing on its astronauts in space, monitoring an enormous amount of information. Additional home-based interactive capabilities are being de-

Allan Weiland, MD, is President of Northwest Permanente. He is also Co-Chair of the Care Delivery Portfolio Approval Committee. E-mail: allan.weiland@kp.org.

veloped all the time and will shift much of our office-based care to the home setting.

Assumption 3: *Many specialized technologies will be "global," bridging both time and space.*

Electronic transfer of information now makes it possible to read imaging studies in other locations, regardless of where the image was generated. Robotics, miniaturization of cameras into swallowable or implantable sizes, and nanotechnology will all allow remote diagnostic and therapeutic care interactions. We will move information, not people. Individual experts can be housed anywhere and connected everywhere to support specific technologies. We are already using remote radiologic-imaging reading services in a number of regions.

Assumption 4: *KP will have successfully implemented the entire suite of HealthConnect products across the whole program.*

HealthConnect will unify existing and new technologies across all KP regions and will do more than just digitize current information. Although it includes a unified electronic medical record for each patient, which spans the spectrum of care and can be immediately accessible, HealthConnect is more than that. It will be supported by robust data warehousing, allowing aggregation of information by episode of care, diagnosis, treatment, complication, cost, frequency, and individual. The inpatient and outpatient clinical decision support and other functions enabled by HealthConnect will create synergies that move clinical care into a new realm.

Transformations

Assuming the above, one can imagine major transformations over the next few years in the nature of clinical interactions at KP: interactions between clinicians, members, and the organization as a whole, clinician-clinician interaction, and clinician-patient interaction.

Organization-Member Interaction

Member interactions with the organization will be much closer to seamless. Billing, sched-

uling, prescription refills, and benefit information will all be accessible online at www.kp.org. Each new member will be enrolled in a primary care panel and take a health risk assessment that allows us to tailor services to add value to their care. All members will be automatically enrolled in chronic disease registries, health education classes, and medication counseling sessions, as appropriate. In the not-to-distant future, members will have interactive audio-visual capabilities in their home, through which they can access a variety of KP services.

KP will be considered a reliable source of information about care, and the existence of the technology itself will give members confidence in the care they receive. We will provide members with training on accessing and interacting with their medical records, libraries of medical knowledge, and clinical guidelines for all health conditions. Use of current information sources, such as the HealthWise handbook, will be much expanded and enhanced by interactive triaging of questions to the appropriate KP resource. We will use technology to enhance communication with members about how we can provide assistance in acute situations or with chronic illnesses, and what resources are available to optimize health. Interactions with KP will be supported with a robust technologically enhanced system that helps members more easily navigate the complexities of care.

Organization-Clinician Interaction

The interaction between KP and clinicians will be transformed to better support provision of care in the "information age." The growing body of medical knowledge adds complexity, which can be simplified using technology. KP will provide tools that integrate the most up-to-date and relevant practice data, drug information, patient history, clinical guidelines, and screening recommendations into electronic reminders and prompts, enabling clinicians to provide informed and specific care. When a patient has a specific question about their health, clinicians will be able to draw from a database of aggregate experience to provide the evidence for a recommendation. For instance: "In your specific circumstance, with your genetic

makeup, this is the probability of a future problem, and these therapies are consistent with being effective for you."

KP will create new models for organizing the daily work of all KP employees, as technology changes the way care is delivered. Support staff may be trained to manage information flow, more and more triage will occur electronically, and many needs will be met remotely. Instead of call centers, KP may have "information centers" or "electronic patient care centers" that can match the type of issue to the appropriate resource, no matter where in the system it happens to be.

Clinicians will also be supported by the further automation of many care processes. Laboratories can do "cascades" of diagnostic testing, using guidelines and algorithms established from our enormous data capture and analysis. Instead of ordering one test and waiting for the result, the lab could automatically do all subsequent tests based on the results of the first one, until the full complement of testing is done to get to the diagnosis on the first specimen. This specific and membership-wide data will also tie into care protocols that enhance clinician decision-making.

Clinician-Patient Interaction

The basis for creating value in the health care interaction between clinicians and patients is the transfer of knowledge, in a form that is customized to the needs of the patient. The majority of health care decisions are made by individuals, in their homes, with the advice of trusted others, not in our traditional doctor/office milieu. These technologies will enable us to use what tools we have available to bring the best evidence of effectiveness and cost-effectiveness to our patients in the "teachable moment," when a problem arises and a decision needs to be made.

Interactions will be more flexible and continuous and less beholden to geographic barriers. As the availability and use of clinical information expands, clinicians will interact more robustly with members' health care decision making that occurs on a 24/7 basis. Nonprocedural interactions will move beyond the exam room, since many types of lab testing and physiologic monitoring will be done

at home, and KP members will be communicating with clinicians online. Patients in nonmetropolitan areas will have greater ability to interact with their providers, and some surgeries will even be performed remotely.[5]

Clinical decisions will be more transparent to members, and navigation through the system can occur efficiently. The electronic health record will be an interactive tool to be accessed along with the member. It will provide in-the-moment information about continuity of care (particularly for chronic conditions) and will incorporate the best available evidence relevant to that member's needs. Further procedures and testing can be scheduled before the patient leaves the exam room, and results of previous tests can be called up and discussed. Medications can be prescribed and transmitted to the pharmacy online, mitigating medication errors and eliciting conversations about possible allergies or contraindications.

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Clinician-Clinician Interactions

This area is likely to change dramatically over the next few years. The capability of having a small group of highly specialized consultants available to all KP clinicians, no matter what region, will be very helpful—particularly in the field of genetics and in other areas where there is likely to be a supply shortage. Today, in the Northwest Region we have electronic chart consults, so patients don't have to physically go to the consultant's office. In the future, we could have videoconferences to coordinate patient care, convened by the primary care clinician and involving multiple caregivers, potentially in distant geographic areas. Health care teams will be both physical (at the care site) and virtual (across the care system). No matter where in the system a member receives care, his/her "care team" will have simultaneous access to his/her medical information, and when the team needs to confer about his/her care, they will be looking at the same updated information.[6]

Our ability to rapidly assess new technologies and disseminate the results will be enhanced by common information platforms. Optimizing the use of these tools will take a concerted effort to create common definitions of terms, agreement about how information will be formatted and displayed, and rules about how we decide what constitutes good evidence. Work is going on in all of these areas but requires a mindset shift from locally autonomous decision making to "community standard." The KP community becomes all of us, leveraging the capabilities and values of our group practice model to lead the next revolution in health care.

Conclusion

The wide availability of clinical information systems, linked seamlessly together, will have an enormous impact on the ability to provide high quality, culturally sensitive, cost-effective health care. While the locus of much of the care will shift toward the home; there will be process improvements across the entire continuum of care.

Will KP be able to compete and differentiate itself in this world? We are uniquely qualified to succeed. Our clinicians, working in and supported by our systems, can be world-class information managers and knowledge-transferers. As a national group of Permanente staff, we can leverage our size and our approach to Permanente Medicine to provide value seamlessly. KP is committed to preventive care and chronic care management, both of which are greatly supported by HealthConnect. It will be very difficult for other, nonintegrated systems of health care to have the same types of information available at their fingertips.

These changes will be more evolutionary than revolutionary, because they all exist now. Our challenge will be to identify those technologies with the most potential, to incorporate them into practice, and to disseminate them quickly. What a challenge! What an opportunity! ❖

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