

**THE USE OF IT/ELECTRONIC MEDICAL RECORDS TO IMPROVE CARE
COORDINATION, EFFICIENCY, AND PATIENT SAFETY**

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Abstract

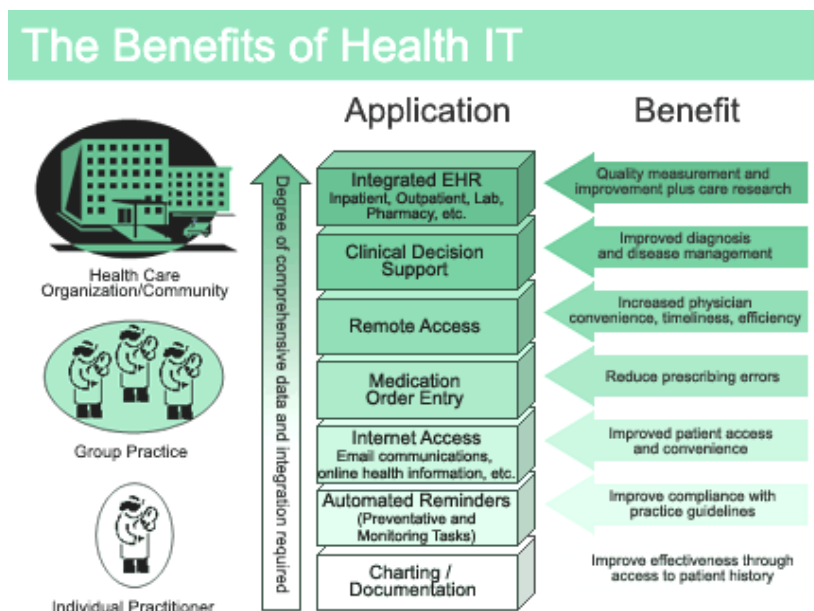
The electronic medical record (EMR) is the single most revolutionary innovation to impact medicine and health care since the invention of the stethoscope. Our capability as health care providers pivots precariously on the ability to obtain critical information on each patient in a timely, accessible and organized manner. This is particularly true for members with chronic illnesses who have long medical histories and complex conditions. We have begun to see the impact of an integrated EMR within Kaiser Permanente in the areas of care coordination, efficiency, patient safety and satisfaction. This technology, properly applied, will fundamentally change the delivery of health care.

I. Background

About Kaiser Permanente

Kaiser Permanente is the largest nonprofit health plan in the United States. Founded in 1945 as an integrated health delivery system, we serve more than 8.6 million members in eight regions, covering nine states and the District of Columbia. We provide and coordinate the entire scope of care for our members, including: preventive care, well-baby and prenatal care, immunizations, emergency care, hospital and medical services, and ancillary services, including pharmacy, laboratory and radiology. Nationwide, Kaiser Permanente employs approximately 156,000 technical, administrative and clerical employees and caregivers, and 13,000 physicians representing all specialties.

As an integrated care delivery system, we are able to leverage the full spectrum of clinical information technology (IT) to create value.



About Kaiser Permanente HealthConnect™

Our electronic health record, KP HealthConnect™, is a comprehensive health information system that includes one of the most advanced electronic medical records available. KP HealthConnect™ securely connects our members' records across both the ambulatory and inpatient settings; integrates billing, scheduling and registration; and allows members to access their personal health information and communicate with their health care teams online.

KP HealthConnect is already internationally recognized as the largest civilian deployment of an electronic health record system. Over the course of four years, we have implemented key components of the system in all of our 416 outpatient facilities and 32 hospitals.

- More than six million of our members are routinely cared for using an electronic outpatient record;
- 700,000 members now have the benefit of a fully integrated inpatient-outpatient record; and
- More than 8.5 million of our members can register to view their record and manage their health through kp.org.

Supporting every component of our integrated care delivery system, KP HealthConnect is a critical investment in the future of the organization. It is the foundation for transforming Kaiser Permanente's care and service delivery.

The Kaiser Permanente Vision for Care Delivery

In 2003, Kaiser Permanente sponsored a comprehensive planning process including internal and external thought leaders, executive leaders and clinical/operational managers to define the long-term vision for clinical care delivery. At the conclusion of that effort, Kaiser Permanente released an internal report entitled *KP Care Delivery in 2015: Blue Sky Vision and Implications*. The Blue Sky vision outlines strategies for utilizing technology and service transformation to create a consumer-centric model of care, building on our commitment to provide quality our members can trust, caring with a personal touch, convenience and ease of use, and affordability.

We envision a new care delivery model characterized by the following key elements:

Home as the Hub

- The home, and other settings, is a locale of choice for many care delivery processes.
- An individual's care delivery support system explicitly includes community and family resources.



Secure and Seamless Transitions

- Human skill sets and operational processes deliver care and service effectively, efficiently, and compassionately (known as ‘warm handoffs’).

Customization

- Each level of the members’ journey with Kaiser Permanente (choosing health plans, cost sharing, individual care pathways, and communication modalities) offers the member various choices.
- The member drives customization and Kaiser Permanente responds.

Integration and Leveraging

- Medical services are integrated with wellness activities; care delivery processes are integrated with health plan operations.
- IT functionality leverages scarce or specialized clinical resources, MDs, RNs and other clinical staff, and supports more efficient workflow.

KP HealthConnect is the foundation for realizing the Blue Sky vision.

II. Impact of KP HealthConnect

Like other technologies, KP HealthConnect can be used to forge new paths and change health care or it can simply be used as a very expensive typewriter. The technology does not automatically drive positive change. Thoughtful, consistent leadership is required to manage the significant level of change and create the desired results. The impacts on efficiency, patient safety and care coordination described below were borne from policy and process changes, coupled with the new technology.

Efficiency

As in other industries, efficiency is an expected benefit of transitioning from paper to electronic records. Our early research is already demonstrating changing patterns in patient demand for services related to the implementation and use of KP HealthConnect.

Kaiser Permanente has documented a **9 percent reduction in the age-adjusted total office visit rate**¹ following the implementation of an outpatient EMR. Two years after implementation of earlier versions of an EMR, age-adjusted office visit rates declined by 9 percent in two of our regions. Age-adjusted primary care visits decreased by 11 percent in both regions; age-adjusted specialty care visits decreased by 5 percent and 6 percent. Utilization decreases were statistically significant at $p < 0.0001$ for each region. The impact was greater with members who had a higher visit frequency with a decrease in members with 3+ visits per year of 10-11 percent. At the same time, the percentage of members with zero, one, or two visits per year increased by 10-11 percent. In one region, scheduled telephone contact increased from a baseline of 1.26 calls per member per year to 2.09 calls after two years in one region. Clinical laboratory and radiology usage did not change conclusively. Measures of health care quality remained unchanged or slightly improved.

Overall, these findings support our conclusions that readily available, comprehensive and integrated clinical information reduced ambulatory care utilization while maintaining quality and allowed physicians to replace some office visits with telephone contacts. Shifting utilization patterns suggest a reduction in unnecessary or marginally productive ambulatory care visits. Further study of the impact of the EMR on clinical laboratory and radiology services is warranted, although we experienced some suggestive declines in utilization of ancillaries.

The introduction of secure e-mail messaging was initially viewed with skepticism by providers. Did it simply increase clinician workload? Provider and patient surveys indicated that there was some substitution of e-mail messaging for face-to-face office visits. Therefore, we conducted the largest study to date of the impact of access to secure patient-provider messaging on provider workload. We demonstrated that **secure messaging is associated with additional decreases in office visit and documented telephone contact rates**, advancing the understanding of how internet-based strategies fit within the full spectrum of patient care activities. In the cohort study, we documented a 9.7 percent visits per member ($p < 0.001$) decrease in annual adult primary care office visit rates. In parallel work, the results of a matched control study indicated a 6.7 percent reduction in visit rates ($p < 0.003$). Annual documented telephone contact rates for EMR users were lower by 13.7 percent in comparison to their matched control group and were also statistically significant ($p < 0.01$).²

These examples of efficiency afforded by KP HealthConnect are not limited to primary care or even direct clinical work. In a recent article published by the Healthcare Financial Management Association,³ they noted a series (N=19) of organizations (among them, Kaiser Permanente) with streamlined operations and savings.

- Paper chart cost savings (11)
- Transcription cost savings (4)
- Billing cost savings (3)
- Liability savings (3)
- Medication cost savings (13)
- Procedure cost savings (10)
- Referral cost savings (5)
- Provider support costs (2)
- Provider productivity (1)
- Improved staff efficiency (4)
- Data mining (3)
- Space

The potential for process improvements is very significant as we redesign workflows and create new uses for the EMR. For example, with decision-support tools, clinicians are able to treat uncomplicated UTIs by phone, preserving quality outcomes while reducing UTI office visits by 20-30 percent.⁴

Clinical Quality and Patient Safety

As detailed in the Institute of Medicine report, *Crossing the Quality Chasm*, health information technology has enormous potential to improve clinical quality and patient safety. This occurs both by providing caregivers with the information they need to deliver the right care at the right time, as well as creating a valuable data repository to inform

ongoing evidence-based research. At Kaiser Permanente, we are pursuing both of these opportunities.

Clinical Content and Decision Support

Clinical content refers to a broad spectrum of material and tools that reflect the depth and breadth of KP knowledge and evidence based practice for our clinicians and physicians. This content supports improved workflow models, charting tools, decision-support reminders/alerts and patient education. Examples include:

- Documentation templates and order sets that reflect evidence-based recommendations, KP’s Care Management Institute protocols, best practice guidelines, and recommended medications
- Reminders for preventive and therapeutic treatments
- Alerts related to drug allergies and interactions
- Short cuts designed to enhance clinical documentation

To maximize the adoption and use of high-priority clinical decision-support content, best practices to promote patient safety are disseminated. Examples include Cervical Cancer Member Tracking, Elderly Medication Alerts, Weight-Based Ordering, and Mammogram and Pap Test Best Practice Alerts. For instance, the implementation of the Elderly Medication Alert resulted in a 17 percent reduction of high-risk medication prescriptions in the elderly population.^{5,6}

In another example, we have implemented “Level 1” (most severe) drug-drug interactions alerts. These alerts notify doctors when there is a potential interaction with the patient’s current medications, which may cause the physician to reconsider the medication they are about to prescribe. Without an integrated EMR, this level of precise intervention at the point-of-care is simply not feasible. Every day about 900 members’⁷ care is affected by having alternate medication or treatment offered to them. Although the adherence to such alerts is far below 100 percent, physicians in our Hawaii region⁸ overwhelmingly (75.9%) feel that having the alerts improves their confidence in the safety of their prescribing by providing timely, valuable information and serving as a reminder to discuss possible side-effects with the patient.

Care Coordination

Smooth transitions from one health care setting or provider to another are particularly important for members with chronic conditions. These members interact more frequently with the health care delivery system, whether it be for monitoring of ongoing conditions, managing an acute episode or addressing new complications. Electronic health information technology introduces new ways to actively engage members in their care.

Leveraging Technology across All Care Settings

The driving rationale for a common EMR across our program was the need for smooth and seamless care coordination and optimal clinical decision-making. Now, the primary care physician (PCP) is no longer the single or primary recipient of critical clinical information. The emergency department physician, for example, has instantaneous access to all care plans, medications and medical history for any patient that appears in the emergency department. Current electronic medical record availability is above 99.9 percent⁹ while statistics¹⁰ prior to the EMR indicate a range of 40-70 percent medical record availability depending on the care setting.

Indeed, this constant availability of EMR information fills a significant void across the inpatient and outpatient chasm. The hospitalist with reliable, easy access to the outpatient medication history is better equipped to reconcile the patient's medications. This is particularly important for the chronic condition patient with a long, complex list of medications. Past diagnostic test results, specialty consultations, the previous clinical course, and personal preferences are all readily available.

The inpatient discharge summary can be automatically sent to the PCP as a matter of course (we are in process with this functionality). In addition, the PCP has complete access to the entire inpatient record with a few clicks of the mouse.

Members as Partners

An engaged patient can also ensure better care coordination. KP HealthConnect offers new opportunities for patients to understand and actively participate in their care. An After Visit Summary (AVS) is printed for the member summarizing medications, patient education and doctor's notes from the visit. Member satisfaction scores on doctor-member communication, understanding and general satisfaction with provider interaction improved when an AVS was given to the patient compared to providers that did not distribute an AVS (9.5-14 point improvement; a statistically significant difference).¹¹ Additionally, providing members access to parts of their medical record through a secure Web site also appears to support members to "better follow PCP instructions"¹² and "more fully communicate needs to their PCP." As one member put it, "I feel more in control over my medical condition. I have access to information, access to people I need to consult with, so it puts me back in charge."¹³

Our many online services are critical components of patient engagement. Our members have a personal health record that is directly populated by their KP HealthConnect record. We seamlessly integrate their records into kp.org, enhancing access to personal health management tools. These tools include an online health encyclopedia which gives members up-to-date and easy-to-read information, a health risk assessment that provides a snapshot of their current well-being and a baseline for setting health improvement goals.

Member response to these features has been positive:

- Nearly 8 million visits to KP HealthConnect Online Features
 - More than 1 million KP members accessed one or more of the KP HealthConnect Online features
- More than 32 million lab results have been released on kp.org
 - 922,816 members used this feature to view nearly 7 million lab test results
- More than 2.4 million secure e-mail messages were initiated by our members
 - 628,506 members used this feature
 - 149,953 messages were initiated by our providers
- More than 41,685 parents/guardians registered to use Act for a Family Member
 - Proxy relationships established for more than 59,000 minors

Primary Care Redesign

Perhaps the most exciting examples of the transformative potential of KP HealthConnect can be seen in our 21st Century Care Innovation Project¹⁴. This project was designed to transform primary care enabled by KP HealthConnect pursuant to the Blue Sky Vision. With support from the Institute for Healthcare Improvement (IHI), nine teams were selected in 2005 to create and test care delivery innovations.

Each team was asked to identify approaches that leverage KP HealthConnect. After the first 18 months, the preliminary findings are promising. The changes they have identified are redefining ambulatory clinical practice, increasing both member and provider satisfaction, and improving selected clinical metrics. It is too early to have clear results in overall cost of care.

The key “change package” includes:

- Each clinical team (MD, RN, medical assistants) should understand the total needs of their population; design the work and build the care team to meet the needs of that population.
- Deliver relationship-based care and demonstrate that the team ‘knows’ the members.
- Provide alternatives to 1:1 face to face office visits by offering phone visits, group visits and secure e-mail options. Doctors, clinicians and staff are reporting increased efficiencies due to the new mix of patient interactions and improved communication across the care team. Members are reporting increased satisfaction due to new conveniences and flexibility, including phone and email visits, which also decrease the need for in-office appointments.
- Engage members in Collaborative Care Planning – member and family are actively engaged in decisions about member’s care and supported to manage their health.
- Embrace total panel ownership. Proactive in-reach and outreach activities (including the use of the integrated KP registry, the Panel Support Tool) by the

care teams is resulting in significant improvements in preventive screening (breast cancer/cervical cancer) rates and the management of chronic conditions (diabetes, cardiovascular artery disease).

The Panel Support Tool gives us new capabilities to view and manage all of the members in a PCP’s panel. It supports the PCP by enabling the PCP teams, supporting specialists, case managers, educators and others to help manage the panel.

Each patient is displayed in an integrated registry to review the treatment status of designated chronic conditions (e.g. diabetes, CAD, CHF, hypertension, and kidney disease). The PST is populated by data from KP HealthConnect and provides direct electronic linkage to the EMR with all its capabilities for workflow management among team members and electronic outreach to members. A ‘gap’ score is calculated from points assigned for each chronic condition based on the gap from recommended care. Prevention indicators will be added in the next phase.

Panel Management PCP: WILLIAM
Panel Size: 1332

Home Choose a Provider Search / Panel View Visit Info Risk Factors Help

MRN	NAME	Age	Sex	Prev	Gap	DM	CVD	CHF	HTN	CKD	Last Seen	Rev'd
001	J	67	M		16	Y					11/22/05	
001		70	M		16	Y	Y		Y		10/7/04	
000	IN	72	F		15	Y	Y		Y	Y	10/27/05	
000	ARY,	62	F		15	Y	Y		Y	Y	9/13/05	
000	ERT	63	M		15	Y	Y		Y			
000	KY,	62	M		15	Y					3/10/05	
000	WBE	54	M		14	Y	Y		Y	Y	7/8/05	12/6/05
009		50	M		13	Y	Y		Y	Y	9/16/05	
000	AY,S	45	M		12	Y	Y		Y	Y	11/16/05	
000	T	58	M		12	Y	Y		Y	Y	9/26/05	
002	NOR	77	F		12	Y	Y		Y	Y	10/31/05	
000	ORGE	76	M		12	Y			Y	Y	8/16/05	
009	ARY,	55	F		12		Y		Y			
009	ARL,	56	M		12	Y	Y		Y		11/15/05	
009		45	M		11	Y					7/13/04	
000	IC	58	M		11	Y					4/21/05	
003	E	49	F		11	Y					11/22/05	
000	J	60	F		11	Y	Y		Y	Y	11/29/05	
000	A	55	F		11	Y	Y		Y		9/12/05	
000		40	M		10	Y			Y		11/14/05	
000	JERIT	87	F		10	Y	Y	Y	Y	Y	11/22/05	

This year, we will be working with eleven new teams to test the replication of these outcomes in additional settings. If the knowledge transfer proves successful, the new practice models will be spread more widely. In addition, the initial teams will continue innovating, especially in the areas of secure messaging, patient support for self care, and collaborative care planning.

Clinical Research: Electronic Data Warehouse

Kaiser Permanente has innovated for many years in clinical informatics. We are now working to take advantage of KP HealthConnect, combining member demographic data and internal business management information to create a complete picture of our members. That effort extends all the way from capturing the data at enrollment and scheduling, through examination, lab and radiology, discharge, home health, and will eventually include imaging and telemetry from bio-medical devices. We are striving to

have the most accurate and complete picture of our members available to anyone, anywhere. And we will use that information to improve the health of our members and drive down our costs to serve those members.

We are building many components of our information capability simultaneously. On the front end of our information capture processes, KP HealthConnect has already changed the way we collect and store encounter data. We are improving the processes we use to ensure data accuracy, to ensure the consistent use of codes, and to capture information from multiple source systems. To facilitate information flow, we are using standard tools to move data between systems, developing a single longitudinal record of all transactions. On the back end, we have common data extraction tools, personnel trained in the use of the tools, and are standardizing the use of information across the organization.

We expect this effort to be ongoing, but are seeing early results on quality metrics reporting, panel support tool deployment and various other forms of organizational reporting. The enterprise electronic data warehouse we are developing will provide the basis for clinical research to add to evidence based knowledge as well as comparative research. The EMR makes clinical research feasible in a way never possible with paper medical records.

III. Implications for Future Research

As the Institute of Medicine has indicated, the challenges for American health care are many:

- Inability to reliably deliver recommended care
- Enormous waste in work processes and unnecessary care
- Significant and pervasive patient safety issues
- Complexity in health care processes that overwhelms the practitioner as well as the patient

The National Health Service may not have exactly the same magnitude of challenges, but it is likely that you also face these issues. We will continue to innovate, identify and share best practices that allow KP (and hopefully the American health care system) to make progress in addressing these serious issues.

KP HealthConnect may be the largest civilian electronic medical record in the world. However, it is far more than a health IT project. It is the foundation to achieve transformation of our care delivery system. As the early findings of our 21st Century Care Innovation Project demonstrate, KP HealthConnect allows our physicians and staff to optimize the ways we deliver care and service in partnership with our members not possible before.

With each passing day, we are coming closer to realizing our Blue Sky Vision.

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