
Making the Business Case for Hospital Information Systems—A Kaiser Permanente Investment Decision

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This article addresses an area of concern for many organizations contemplating significant investment in an Electronic Medical Record IT system. As such, Kaiser Permanente is committed to our greater social mission to improve health care and to our colleagues in the health care arena to share our perspective and work in this developing field. However, Kaiser Permanente would like to underscore that like any other investment business case, the information presented below represents our 'best thinking' at a particular time based on limited data—both internal Kaiser Permanente data and a striking paucity of relevant data in the broader health care and informatics literature. We hope that this work contributes a next step toward understanding the electronic medical record's contribution to health care and creation of value for patients and communities.

Further evidence in favor of the clinical IT business case is set forth in Kaiser Permanente's cost/benefit analysis for an electronic hospital information system. This article reviews the business case for an inpatient electronic medical record system, including 36 categories of quantifiable benefits that contribute to a positive cumulative net cash flow within an 8.5 year period. However, the business case hinges on several contingent success factors: leadership commitment, timely implementation, partnership with labor, coding compliance, and workflow redesign. The issues and constraints that impact the potential transferability of this business case across delivery systems raise questions that merit further attention. Key words: *hospital information system, electronic medical record, clinical information system, business case, return on investment, Kaiser Permanente.*

THE quality and safety of health care weighs heavily on the minds of many Americans, and for good reason. Health care is fragmented, error prone, and driven by inconsistent processes that produce inconsistent outcomes. Clinical information technology (IT) is recognized by champions of health care quality as a means to save lives, improve less than optimal care and reduce costs.¹

A growing body of empirical evidence demonstrates the benefits of clinical IT and its potential to transform care delivery, offering greater quality, safety, and efficiency.

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Reasonable scientific evidence shows that computer physician order entry (CPOE) systems can effectively reduce preventable adverse drug events.² Researchers and

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clinicians have demonstrated the efficacy of computerized reminders and prompts on disease management and preventive health guideline compliance.³ Considerable evidence also confirms that clinical IT tools can improve drug prescribing and administration.⁴

However, in an era of scarce resources, many health care providers are hard pressed to make a case that is strong enough to justify the significant investment of monetary and human capital needed to deploy clinical IT systems. Even the most ardent advocates recognize the elusive nature of the clinical IT business case and the high variability of hard evidence supporting a cost/benefit value proposition.⁵ Current knowledge leaves little doubt about the ability of IT to improve clinical outcomes; however, equally compelling evidence of positive financial return on investment to health care entities has yet to be established. In the broader context of the business case for quality, other observers have commented on the inadequate economic incentives for quality improvement and the need for policy action to align provider incentives and market demand.⁶

A variety of factors continue to obscure the clinical IT business case. For example, calculating the relative costs and benefits of IT tools and accurately measuring the actual and opportunity costs of using paper-based records is challenging, rendering decision making extremely difficult.⁷ Within the current business model, savings under non-capitated reimbursement arrangements tend to accrue to payers rather than the entity that invests in the technology. Furthermore, many clinical IT benefits such as provider convenience, patient satisfaction, and improved communication are not easily captured on the bottom line in terms of an

increase in revenue, a decreased in expense, or an avoidance of expense.⁸ Nevertheless, organizations are increasingly making clinical IT investment decisions based on the prospect of quantifiable value realization.

This article reviews the business case for the hospital information system (HIS) investment of a large, prepaid organized delivery system, Kaiser Permanente. After discussing the business case background and strategy, we highlight benefit findings and the rationale behind the organizational imperative for the HIS implementation. We conclude with a discussion of success factors and policy implications for Kaiser Permanente and for other organizations considering clinical IT investments.

Background

Kaiser Permanente—the nation's largest private organized delivery system, serving over 8.2 million members in nine states and the District of Columbia—is investing approximately \$3 billion over ten years in an initiative to deploy electronic medical systems to enhance the quality of patient care for its members. Kaiser Permanente *HealthConnect*TM (KP *HealthConnect*) is an electronic medical record and inpatient and outpatient information management system that integrates the clinical record with appointments, registration, and billing. It is grounded on a base system of standardized clinical content, workflow procedures, charting tools, and decision support rules that will be shared by all Kaiser Permanente regions. Epic Systems, a leading health care IT developer, is the software vendor for the project, which begins in earnest in 2004, and has an estimated 3-year implementation schedule. Upon completion of implementation,

KP HealthConnect will be the largest civilian clinical information network in the nation, in terms of the numbers of providers using it and lives covered—creating a unique laboratory for value demonstration.

Kaiser Permanente *HealthConnect*'s rollout will include implementation of a comprehensive HIS in 33 Kaiser Foundation Hospitals (KFH). Its inpatient suite will catalyze the transformation of Kaiser Permanente's hospital care by enabling more efficient, safer care, while reducing the risk of non-compliance with regulatory requirements. In tandem with *KP HealthConnect* implementation, Kaiser Permanente is undertaking a major redesign of inpatient workflow to take advantage of the new information system and the accelerated communication it will deliver.

Prior to investing in the HIS, the Kaiser Foundation Health Plan/KFH Board of Directors requested a strategic business case analysis to quantify the costs and benefits. This business case also provides tools and targets for financial, operational, and implementation planning. Another key objective was to verify that the functionality provided by the HIS was in strategic alignment with the organization's mission and vision. *KP HealthConnect* is a key element of Kaiser Permanente's long-term strategy to provide market flexibility, regulatory compliance, and the ability to better manage the organization's cost structure by means of the clinical and operational data that the system will generate.

Business Case Design

The business case encompassed Kaiser Permanente regions that operate inpatient facilities—Northern California, Southern

California, Hawaii, and the Northwest. Salient features and functions of the HIS were analyzed, including CPOE, inpatient medical records, clinical documentation, registration, scheduling and billing, as well as inpatient pharmacy, operating room, and emergency department modules. The study was structured to take into account the synergy and strategic benefits of a joint inpatient and outpatient product, which includes consistent data elements across geographic regions and care continuums, a single patient record, and enhanced enterprise-wide communication.

In-depth analysis of the major opportunity and implementation costs of the HIS relied on a baseline of data collected from a "typical" medical center for extrapolation to other facilities. In the absence of experience with the Epic Systems product, a project team carried out extensive primary and secondary research. They undertook best practice literature research to identify, define, and quantify benefits; conducted more than 150 interviews with subject matter experts; and performed in-depth quantitative analysis of Kaiser Permanente data where possible. To understand potential gains in workflow and efficiency and to validate secondary research findings, the project team gathered data through site visits and focus group interviews. The business case was then reviewed and refined in a validation process that involved key stakeholders, experts, and regional leaders.

Assessing the magnitude of the HIS investment was a critical component of the business case. Regional and enterprise-wide cost drivers were quantified and expressed as either one-time or on-going costs. One-time infrastructure costs including electrical wiring, desktop products, and networking

devices were amortized over six years. Labor costs for implementation, testing, training, backfill, and project management were also factored into the one-time expenses. Ongoing system support costs including “clinical content” maintenance, system administration, and desktop support were spread over a ten-year time horizon.

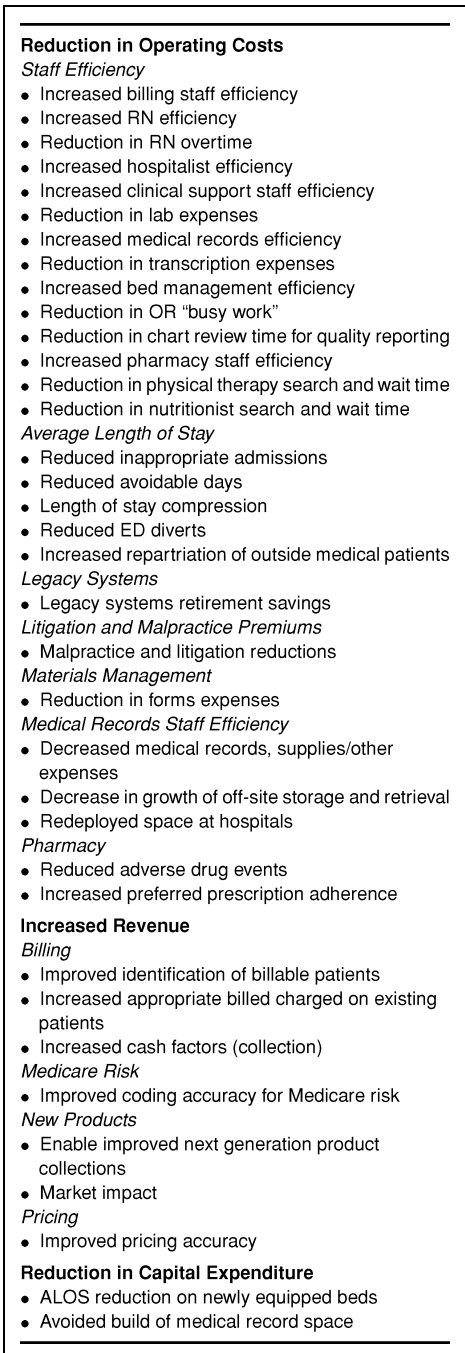
The project team modeled financial benefits and costs under three scenarios—conservative, medium, and aggressive—each spanning ten years. The aggressive scenario assumes full, expedient implementation and adoption by operating regions. The conservative scenario assumes a lower return on investment, with more moderate estimates of cost reduction and revenue increase. The medium, most likely scenario, lies between the two.

To calculate a net present value, two timing lags are taken into account. First is the implementation lag, the time between installation, training, and actual use. Second is the benefit realization lag, accounting for benefits, such as malpractice liability reductions, that may not manifest until many years after full use.

Business Case Findings

The data and analysis indicate that a strong business case is possible for the HIS investment, when paired with committed senior leadership, work redesign, and clear targets. The business case quantifies 36 financial benefits, which primarily fall under the broad categories of reduced operating costs, increased revenues, and reduced capital expenditure (see Figure 1). Additional areas of benefit were explored but ultimately not quantified. A positive cumulative net cash flow was calculated and a cost-benefit

Figure 1. Hospital Information System Business Case: Categories of Benefits



analysis identified a break-even point toward the end of the investment horizon. It is worth noting that many benefits were not easily quantifiable, such as quality improvement, patient safety, continuity of care, and patient-centeredness; nevertheless, these are important factors because they align with Kaiser Permanente’s strategic plans.

Financial Impact Summary

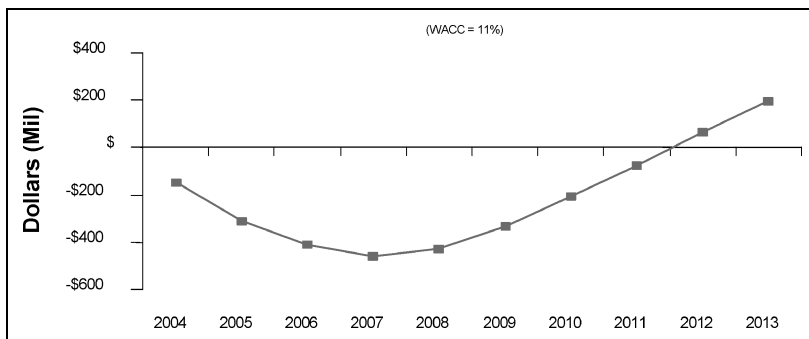
Net cash flow, the difference between the quantifiable benefits of the HIS and the cost of system implementation and support, was projected to the year 2012. A cumulative positive cash flow was forecast at 8.5 years (the conservative and aggressive scenarios forecast 10.1 and 6.1 years, respectively). Over \$2 billion realized cash flow is anticipated from the \$1 billion HIS investment over the investment horizon. Projected pay back of the HIS investment within approximately ten years confirms the potential for the system to generate long-term return on investment (see Figure 2). The time it takes to achieve break-even status is influenced by heavily front-loaded costs, while the bulk of the financial benefits are back-loaded. The business case project team determined that once financial benefits begin to mate-

rialize, they may reduce the organization’s long-term hospital cost structure trends by as much as 2.3 percent and increase revenue projections by 0.6 percent.

Average Length of Stay Reduction

Process improvements enabled by the HIS will impact the average length of stay (ALOS), a key indicator of efficiency and a major driver of savings in the HIS business case. Approximately 35 percent of net benefits identified in the business case are attributed to ALOS efficiency gains. Individuals familiar with hospital operations will recognize that many manual paper-based processes sustain delays in information flow. For example, when a hospitalist writes an order, it is collected by a nurse or unit clerk who then transmits the order by fax, vacuum tube, or by manually entering it into an independent, automated ancillary system. The order is received by the pharmacy or lab, which must enter it into an ancillary system (if not already there), then manually process and fulfill it. Currently it is not uncommon for orders in inpatient settings to be delayed by up to four hours. With CPOE the order is transmitted in seconds, delays are reduced, and timely delivery of care is enabled.

Figure 2. Discounted Cumulative Net Cash Flow



The HIS will provide emergency department and admitting physicians with an integrated and comprehensive view of the patient's medical history in a real-time environment. With immediate access to patient history and evidence-based clinical practice guidelines, the system will enable improved adherence to established care paths and protocols, improve decision support capabilities, and aid physicians' ability to manage patients.

Staff Efficiency

A reduction in operating costs, especially savings attributed to staff efficiency, is also a key driver of the HIS business case. Approximately 40 percent of estimated net financial benefits are attributable to efficiency gains achievable under full system deployment and maturity. The transition from paper to electronic medical records will reduce chart pulling, manual chart assembly, and data entry, thereby increasing the efficiency of billing processes and staff, who review, analyze, and code charts. Nursing time may be better utilized by reducing redundant documentation, in turn contributing to improved staff capacity and more time for direct patient care. The HIS will replace many of the manual processes that hospitalists currently perform, most notably handwritten orders in patient charts. Workflow improvements with the system's CPOE functionality interfaced with lab systems will reduce the potential for duplicate orders and will increase lab staff efficiency.

Transcription Costs

Currently, in the inpatient setting, patient histories, physicals, consults, procedure notes, and discharge and transfer summaries are often dictated and transcribed. The HIS

creates an opportunity to increase real-time, direct documentation and thereby decrease transcription expenses. Experts estimate that up to 60 percent of items currently transcribed can be captured by the system's structured text feature. The impact on transcription costs will be largely driven by organizational policy regarding electronic charting and extensive training of staff and physicians. Note that the conservative scenario estimates a 10 percent increase in transcription costs, due to potential physician resistance to data entry or typing.

Patient Safety

The electronic medical record and automated prescribing tools in the HIS will improve safeguards reducing the number of medical errors made due to poor or inaccurate documentation in the inpatient setting. The system will also provide medication alerts for physicians and pharmacists to help reduce adverse drug events, stemming from prescribing and transcribing errors. The impact of patient safety improvement on the business case is captured in two areas. First of all, Kaiser Permanente should see a reduction in the cost associated with injury-producing adverse drug events (ADE). Each injury-producing ADE results in an estimated 2.2 additional patient days.⁹ Consequently, Kaiser Permanente should see reduced levels of litigation and a corresponding drop in malpractice and litigation expense. Specific errors in diagnosis and treatment would be further prevented by using inpatient automated medical records—including handoff and continuity issues; altered, illegible, or missing documentation; and dispensing errors. Further, based on analysis of settled cases, approximately 5 percent of overall settlements could be

avoided. Of course, the primary benefit—improved quality of care for patients—falls outside the business case.

Medical Records and Forms

The cost to purchase, inventory, and distribute printed forms is surprisingly expensive. Because the HIS will enable electronic documentation, many paper forms and documents will be eliminated. The business case approximates a 30 percent to 50 percent reduction in medical record supplies and associated non-payroll expenses. All paper medical records will be moved off-site allowing current storage space to be redeployed. Savings were attributed to reductions in future off-site space needed for paper storage. In addition, efficiency gains are anticipated to allow more than 60 percent of medical records staff to be redeployed to other activities.

Legacy System Retirement

Currently, Kaiser Permanente has a patchwork of inpatient information systems overlapping in functionality with KP *HealthConnect*. Most of these disparate legacy computer systems will be retired once KP *HealthConnect* is implemented, which in many cases will reduce maintenance costs (*i.e.*, employee and licensing), as well as hardware operational costs.

Increased Revenues

The HIS will promote seamless and complete clinical data capture and improve billable charges, including medical supplies, drugs, procedures, and ancillaries. The system will produce more granular information for all inpatient encounters, more accurately reflecting care intensity; and its automated charge capture will also enable earlier iden-

tification of encounters that are potentially billable. Based on internal research, the business case estimates that collections can improve by 15 percent if bills are sent without delay. Additionally, improvement in the ability to capture clinical diagnoses should assure appropriate reimbursement for Medicare Risk patients and increase the accuracy of premium calculation.

Non-Financial Benefits

There are many benefits that are less tangible. Though non-financial, they are no less important to an overall investment decision. These include mission critical benefits such as quality of care, patient safety, and member service enhancement. Improved communication and expedited decision-making not only increase efficiency but also help to reduce errors. Likewise, the ready availability of patient information will prove extremely beneficial to assure continuity of care during the patient's transitions from one care setting to another. The HIS will also be a driving force behind the adoption of care management protocols and best practices known to improve health outcomes. Patients and families will benefit from streamlined care delivery and more efficient and informed admission and discharge processes. Although the strategic benefits derived from these enhancements are significant, the value attributed to them is difficult to compute and is therefore not quantified in the business case.

Similarly, the benefits from improved nurse recruitment and retention are also unquantified. Over the long run, the HIS may have the potential to improve job satisfaction among hospital-based nurses and enhance the organization's reputation among new nursing graduates. The HIS will enable

new care models that promote professional nursing practice and eliminate some of the mundane, low-value, high repetition tasks that can make up a substantial portion of nurses' work. Likewise, the system may reduce nurse burnout and improve working conditions by streamlining care processes, improving workplace communication, and enhancing the hospital staff's ability to ensure patient safety. Medium to long-term, nurse recruiting expenses could be reduced if staff turnover is decreased. If these benefits materialize, the organization will also minimize its reliance on registry nurses.

A societal benefit that accrues from the HIS investment is a rich information flow of population data for clinical, epidemiological, and health services research. Kaiser Permanente will have unprecedented quantities of patient data, allowing unparalleled research and analysis. The data will be used for benchmarking, best practice identification, quality improvement initiatives, and clinical outcome studies.

Success Factors

The success of the HIS deployment depends on a number of critical factors. First, the commitment of senior leadership to implement clear targets and expectations is crucial to the success of the business case. Changes to operational processes, job roles, and organizational culture will require resources and the strong and consistent support of leadership. All levels of management should be clearly informed and accountable for the key actions that need to be undertaken to maximize system benefits.

Second, timely implementation of the inpatient information system is imperative because the consequent impact of delays on benefits realization is costly. Estimates cal-

culated by the project team for the business case set the net present value for a one-year delay in implementation at equivalent to \$260 million.

Third, because the majority of Kaiser Permanente's annual expenses are from labor costs, senior management will need to partner with labor to take advantage of the efficiencies introduced to the workflow by the HIS. The net impact of ignoring such efficiency savings equates to approximately 38 percent of realized cash flow.

Fourth, internal policies must require physicians and frontline staff to comprehensively and accurately codify all hospital discharges and procedures. A significant portion of the business case hinges on improved coding to reflect the true illness burden and costs of patients.

Finally, workflows must be redesigned to incorporate and exploit the system's functionality.

Conclusions and Policy Implications

Underlying and contributing to this HIS business case is Kaiser Permanente's organizational model based on prospective payment and group practice within an integrated delivery system. Health systems with higher aggregation and organized around population-based care are better positioned with the scale to raise capital for the infrastructure requirements of clinical IT and can spread the cost across a broad customer base. Prepaid group practice organizations, such as Kaiser Permanente, have strong financial incentives to reduce the misuse, underuse, and overuse of care because they bear the cost of poor quality if it is not prevented.¹⁰ Prepayment facilitates the capture of the financial benefit associated with

improved care and increased efficiency. In contrast, smaller, fragmented care systems have fewer incentives to invest in IT in a market that is not structured to encourage efficiency and quality improvement. The payback on clinical IT is essentially a long-term proposition and organizations focused on short-term results may find a return on investment time horizon such as the one in Kaiser Permanente's HIS business case unacceptable. A salient question is whether Kaiser Permanente by virtue of organizational model, scale and scope is simply better positioned to absorb the capital costs of an HIS or are there key principles within this business case that are transferable across care delivery models?

Nevertheless, health systems are increasingly adopting clinical IT, and nationwide, physician interest in the technology is expanding. Spending on health care IT—a key indicator of IT implementation and use—is forecasted to grow approximately 9 percent over the next three years to over \$30 billion nationally by the end of 2006.¹¹ The accelerated spending not only reflects a shared

moral imperative within the health care industry to reduce avoidable medical errors and improve quality, but also a business imperative to streamline financial and operational processes. Yet, the significant up-front investment needed to put IT into action remains the single largest obstacle for most institutional providers.¹²

As noted, the costs of clinical IT are often borne disproportionately by health care providers, while many of the short- and medium-term benefits accrue to payers and to society as a public good. Moreover, the prevailing provider reimbursement mechanisms do not differentiate between good quality and less-than-optimal care. There is, however, growing recognition that government and private health care purchasers should be a more explicit part of the financial equation for quality improvement, as evidenced by a growing number of initiative programs that financially reward quality clinical performance. When these incentives become more widespread, they will act as a catalyst for the adoption of the IT tools that enable many quality innovations.

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