White Paper

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The Value of Healthcare IT (HIT)

A Practical Approach to Discussing and Measuring the Benefits of HIT Investments

Executive Summary

The Intel® Healthcare IT (HIT) Value Model provides an industry-tested approach to discussing and measuring the benefits of HIT investments, with a focus on quantifiable benefits that produce a financial impact. The Value Model offers an intuitive strategic framework and reusable calculations to identify measurable changes in healthcare business metrics that we call value dials. Value dials include quality of care, clinician satisfaction, clinician productivity, revenue enhancement, cost optimization, patient access and more. Use of the HIT Value Model can help healthcare institutions:

- Make more data-driven investment decisions
- Manage HIT-enabled change more effectively
- Evaluate the impact of HIT-based initiatives
- Build support for HIT adoption

Organizations that have used the model have identified significant financial benefits from their HIT investments. Banner Health, one of the largest U.S. nonprofit healthcare systems, found that its comprehensive, HIT-enabled care transformation initiative delivered an annual bottom-line impact of USD1.6 million adjusted for case mix.[1]

Intel offers program resources to assist healthcare organizations in applying the HIT Value Model as part of its mission to remove roadblocks to the effective use of healthcare information technology. Contact your Intel representative to learn more and see a demonstration.

[1] Pre-tax cash flow or Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA) Savings did not consider infrastructure costs.

Introduction

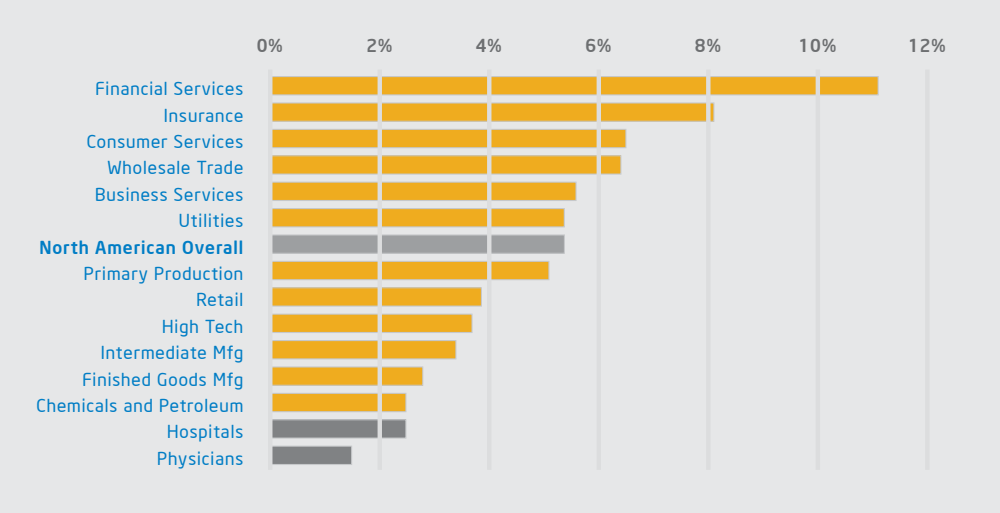
Information Technology for an Information-Based Enterprise

From patient records to clinical reference materials, healthcare runs on information. But while HIT adoption rates are rising, healthcare continues to lag other information-intensive industries in using IT to achieve strategic business objectives.

There are many reasons for this, including cultural resistance, competing priorities and a perception that IT deployment is fraught with difficulties. Adding to the mix is a lack of clear information on the costs and benefits of HIT. Do HIT investments improve the delivery of high-quality, cost-efficient healthcare services and deliver financial benefits to hospitals and physicians?

For decision makers who still view IT as a cost center rather than a value generator, the lack of clear answers to this question can lead to delays or avoidance of HIT investments. Faced with a choice of funding revenue-generating medical equipment or an HIT initiative whose impacts seem uncertain and whose deployment often involves hard work and culture change, many understandably invest in the former. Yet, given rising demands on healthcare systems around the world and competitive pressures on many U.S. hospitals, healthcare urgently needs the improvements HIT can enable.

Percent of Revenues Spent on IT by Industry



Sources: Lewin Group, Forrester Research

An Industry-Proven Approach to Discussing IT Value

Healthcare IT investments should address core objectives focused on improving the delivery of high-quality, efficient healthcare services.

Intel's Digital Health Group is collaborating with healthcare leaders worldwide to remove roadblocks to successful adoption of healthcare IT. As part of that commitment, we're sharing a free model, simple yet powerful, for discussing and measuring the value of HIT investments.

The Intel HIT Value Model is based on an approach developed at Intel IT Innovation Centers and employed at Intel for more than five years.[2] Originally used to analyze Intel's own IT investment strategies, the approach has been refined with companies and organizations from finance, manufacturing and other industries, which have used it to plan IT investments and evaluate the benefits of IT-enabled transformation initiatives.

Most recently, clinicians, IT staff and financial analysts from the Digital Health Group have worked with global healthcare leaders to adapt the model for use by organizations such as hospitals, physician networks, government agencies and ministries of health. The model has been refined and tested through collaborations with healthcare chief financial officers (CFOs), chief information officers (CIOs), chief medical officers (CMOs) and other healthcare decision makers.

This paper offers an overview of the Intel HIT Value Model. A set of free resources based on the model, along with advisory services, are available to organizations that want to conduct a customized analysis. By offering a practical, reusable framework to foster discussion and measurement of the value of IT investments, we hope to enable hospitals, physician practices, and healthcare systems to accelerate the successful adoption of HIT-enabled change initiatives.

[2]For more about the Intel IT Innovation and Research Centers, see http://www.intel.com/technology/techresearch/itresearch/. For further discussion of the business value of IT, see the white paper *Measuring IT Success at the Bottom Line* at http://www.intel.com/it/pdf/measuring-it-success-at-the-bottom-line.pdf and David Sward's *Measuring the Business Value of Information Technology* (Intel Press, 2006, http://www.intel.com/intelpress/sum_bvm.htm).

Delivering Strategic Value

The Value Model helps organizations answer two questions: What core organizational objectives do we want to achieve, and how will we know when we've achieved them?

The Intel HIT Value Model starts from Intel's core belief that all IT investments are business investments that should support strategic priorities and deliver a sustainable advantage to the company or organization. IT should be seen from the perspective of value rather than as a cost center, and IT investments should be evaluated in terms of how well they help the company, agency or other organization meet critical business objectives. Whatever the industry, IT solutions and services should help organizations meet business needs and challenges, generate business cost savings and benefits (not simply IT cost savings), and improve revenues or market position.

IT investments can help businesses gain a competitive advantage and empower governments and nonprofits to better fulfill their core missions. In other industries, successful IT investments have improved business success and profitability by:

- Enabling manufacturers to design more innovative products and bring them to market faster and at lower cost.
- Allowing retailers to increase sales by better understanding and predicting consumer preferences, optimizing their product mix, keeping products in stock and providing a compelling shopping experience.
- Making it possible for investment banks to increase revenues by introducing more sophisticated financial instruments at lower risk.
- Helping governments increase citizen satisfaction and make optimum use of tax dollars by delivering services more efficiently and economically.

For healthcare, IT investments should address core objectives focused on improving high-quality, efficient healthcare services. The Intel HIT Value Model defines seven value dials: broad categories of benefits through which HIT investments, deployed as part of comprehensive, well implemented initiatives, can deliver strategic value.

- **Patient safety.** Medical errors have been identified as a significant problem with serious clinical and economic consequences. Investments in electronic medical records (EMRs), computerized provider order entry (CPOE), mobile point of care (MPOC) and other solutions, along with clinical workflow redesign, can reduce the risk of adverse events and thereby in this context work to improve patient safety by enabling access to accurate, timely information when and where it is needed to enhance clinical decision making.
- **Quality of care.** High-quality healthcare delivers the right services at the right time and in the right way to achieve optimal results. HIT investments can help improve the efficiency of healthcare services, allow colleagues to collaborate more effectively in real time, and increase adherence to clinical protocols. By saving time for busy professionals, HIT investments can enable clinicians to spend more time with the patient. When these factors are combined, patient satisfaction can increase.

- **Patient access.** Overcrowding and long wait-times can increase patients' frustration and anxiety and decrease their satisfaction with the healthcare system. HIT can help improve access to care by streamlining previously inefficient processes and increasing clinician and staff productivity. HIT investments that improve asset tracking can optimize bed utilization and enhance use of other scarce resources. Patient-facing web portals can improve patients' ability to interact efficiently with the healthcare system, again improving both patient satisfaction and system efficiency.

- **Physician and staff productivity.** Many countries and regions face pervasive shortages of highly skilled healthcare workers, in tandem with rising demands for care due to aging populations and growing rates of chronic diseases. HIT investments can contribute to productivity improvements by reducing inefficiencies—for example, enabling all clinicians to easily access information at the point of need rather than having to hunt for the patient's chart.

- **Physician and staff satisfaction.** HIT-rich clinical environments can improve provider satisfaction by optimizing workflows and enabling clinicians to spend less time chasing paper and more time caring for people—the reason they went into healthcare in the first place.

- **Revenue enhancement.** HIT-enabled efficiencies can increase the volume of patients seen and procedures performed, improve resource utilization, improve charge capture and streamline the billing cycle—all of which can generate increased revenues.

- **Cost optimization.** The rising cost of healthcare is a global concern that threatens both profit-based and not-for-profit health systems. Labor wages and benefits are a significant expense for healthcare providers, and one that can be improved by enhancing productivity, as outlined above. With better care, it becomes possible to lower the costs associated with medical errors and liability. Higher-quality, more-efficient care can also reduce average length of stay, which may provide a positive impact depending on case mix and payment model. Better utilization of expensive resources such as diagnostic equipment and surgery suites can generate significant cost savings. For integrated healthcare networks, electronic medical records and other HIT solutions can enable economies of scale across the system. Finally, the move to a digital environment can generate significant savings on forms management costs, as well as floor space and handling costs for records storage.

A Framework for Value Dials and Key Performance Indicators

Some of the most significant benefits arise in the discussions of what performance indicators are most relevant.

The Intel HIT Value Model helps organizations answer two questions: what core organizational objectives do we want to achieve, and how will we know when we've achieved them? The value dials are a starting point for specifying what you want to achieve. But how do you meaningfully measure changes in each area?

The Intel HIT Value Model addresses this challenge by associating each value dial with a set of observable, quantifiable, operational metrics called key performance indicators (KPIs). For example, improvements in the value dial of patient safety may be seen by tracking the performance indicators of numbers of adverse drug events (ADEs), surgical errors, and transfusion errors.

When used for managerial purposes, many performance indicators can be applied to multiple value dials. For instance, a reduction in average length of stay is a primary metric for quality of care. It may also reflect improvements in efficiency—tests and procedures are performed in a more timely fashion and results are reported more quickly in a digital hospital environment—and patient safety—a shorter stay means less exposure to errors. It also has intrinsic value to patients. Yet, for determining the financial value and bottom-line impact, it is important that each value dial be counted only once.

Each key performance indicator is usually derived from an underlying calculation. That calculation generally has multiple variables that are built on data that hospitals typically collect to track performance, such as basic operational data, financial metrics, and clinical metrics. They may also include throughput data and other information generated by newly deployed HIT solutions.

Table 1 lists representative performance indicators and measurements for the seven value dials. The indicators that Intel suggests are a starting point. Many other performance indicators can be used, and indeed, some of the most significant benefits from using the Value Model arise in the discussions of what performance indicators are most relevant to specific HIT-enabled projects, as well as to organizational goals and culture.

For example, staff productivity gains can be measured in terms of clinician time spent providing direct patient care or number of patients seen. Seeing higher numbers of patients can mean greater patient access and increased provider revenue, but spending more time with patients may result in better quality of care and increased satisfaction for providers and patients. There are no right answers, but the discussion of such issues can help any hospital, practice or other organization clarify its objectives and achieve greater consensus about them. The goal is to reach a set of objective, standardized metrics that map to the goals of the given hospital or organization.

Table 1. Value Dials with Representative Key Performance Indicators

Value Dials	Sample Key Performance Indicators	Measurements
Patient safety	Adverse drug events	Percentage change in number per 1,000 doses
	Admissions with an Adverse Drug Event (ADE)	Change in number of admissions
	Incidents of surgical errors	Percentage change-estimated cost of surgical error
	Transfusion errors	Percentage change-estimated cost of transfusion errors
	Malpractice expenses	Malpractice expenses as a percentage of practice revenue
Quality of care	Reduced length of stay	Percentage change in the average length of stay in days
	Diagnosis Related Group associated lengths of stay	Percentage change in length of stay in days
	Physician time with patients	Percentage change in time; additional intrinsic value to patient is not measurable
	Registered Nurse time with patients	Percentage change in time
	Certain averse outcomes	Percentage change of adverse outcomes
	Complication measures	Percentage change in complications
	Hospital acquired infection rates	Percentage change in infections
	Recognized accreditation	Certification achieved through use of IT solutions, such as JCIA accreditation
Patient access	Response time to patient inquiries	Percentage change in time
	Waiting times for elective surgery	Percentage change in time
	Waiting times for outpatient appointments	Percentage change in time
	Response time for billing	Percentage change in time
	Lab results report wait time	Percentage change in time
	Online viewing and self-management	Availability
	Online prescription renewal	Availability
	Online scheduling	Availability
	Chronic disease self-management	Availability
	Availability of preventive care such as vaccinations and screening	Availability
	Increased number of consultations per day	Percentage change or actual delta increase

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Table 1. Value Dials with Representative Key Performance Indicators (continued)

Value Dials	Sample Key Performance Indicators	Measurements
Staff productivity	Increased face time with patients	Percentage change of actual delta increase
	Reduced time spent doing administrative work	Percentage change of actual delta increase
	Reduced number of steps to perform a specific task or medical procedure	Actual delta change
	Reduced time to perform a specific task or medical procedure	Time change
	Clinical staff turnover	Percentage change in turnover
Staff satisfaction	Physician referrals	Percentage change in referrals
	Hours of overtime worked	Percentage change in overtime work
	Internal satisfaction survey scores	Percentage change in scores indicating change satisfaction
	Patient volume	Percentage change in volume
Revenue enhancement	Bed turns per month	Percentage change in bed turns
	Length of stay	Percentage change in length of stay
	Days in Accounts Receivable	Change in days spent waiting for payment
	Number of elective surgeries per week	Percentage change
	Unit cost of diagnostics and treatment	Actual cost change
Cost optimization	Administrative cost of healthcare system	Actual cost change
	Inventory cost	Change in cost of inventory in stock, including drugs and other supplies
	Cost per patient day	Percentage change

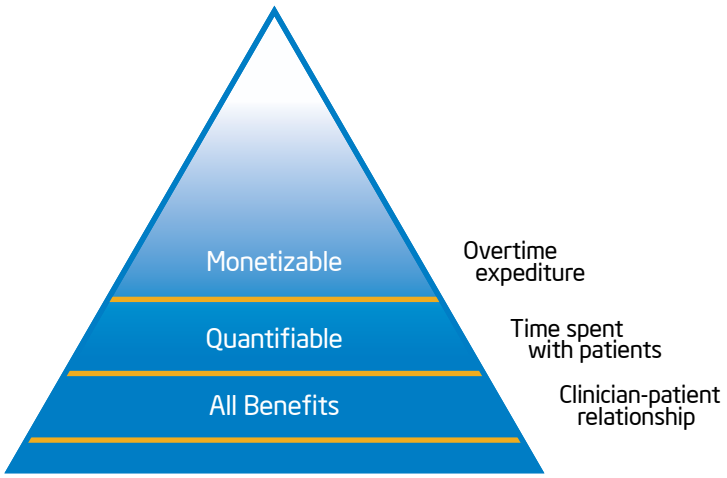
Quantifiable, Monetizable Benefits

The Value Model focuses on quantifiable benefits that produce a measurable financial impact.

The HIT Business Value Model emphasizes quantifiable benefits that produce a financial impact, so many performance indicators also have an associated monetary value. For example, the performance indicator of improved avoidance of adverse drug events can be measured in terms of the number of ADE alerts resulting in therapy changes for a weighted average of the number of acute admissions. The financial benefit can be determined by factoring in the average cost per ADE.

For any given HIT investment, an organization can identify key performance indicators for the value drivers that an investment is intended to address, determine a current baseline, and measure improvements against this baseline. Results can be adjusted for case mix and reimbursement model, to determine financial effects more precisely.

HIT investments produce many benefits that are not quantifiable, and many quantifiable benefits may not be monetizable—that is, they may not have a measurable financial impact. For instance, many clinicians who work in HIT-enabled environments say the clinician-patient relationship is enhanced because clinicians can deliver more efficient, responsive care and spend more time at the bedside. However, an improvement in the relationship would be difficult to quantify, and it would be even harder to assign a dollar value to such improvements. In other words, time spent with patients can be measured but not easily monetized. By contrast, overtime expenditure can be measured, and the financial impact can be clearly identified. Employee satisfaction is quantifiable; improved nurse retention is monetizable.



Not all HIT benefits are quantifiable or monetizable. The Intel HIT Value Model focuses on quantifiable benefits that have a measurable financial impact.

The Value Model's Value

The Intel HIT Value Model starts from Intel's core belief that all IT investments are business investments that should support strategic priorities and deliver a sustainable advantage to the organization. IT should be seen as a value rather than a cost center.

By helping hospital executives and other decision makers discuss and measure the value of HIT investments, the Intel HIT Value Model can assist in turning information technology benefits into a reality. Using the model can generate insights that deliver value throughout the project life cycle:

- **Align HIT investments with strategic goals.** By emphasizing IT's contribution to achieving core clinical and business objectives, the Value Model helps hospitals, governments and other stakeholders use HIT investments to drive improvements to healthcare quality, cost, and accessibility.
- **Improve IT investment strategies.** Making more data-driven investment decisions helps reduce investment risks and identify which investments are likely to deliver maximum value. The information and insight gained can be used to build the business case for HIT investments and secure funding.
- **Enhance project planning.** During project planning, the HIT Value Model can facilitate the process of discussing and clarifying intended outcomes and exploring ways of measuring them. Understanding likely outcomes can help to evaluate competing investment priorities and gain insights into which projects or outcomes are more likely to address your objectives.
- **Improve project management.** Defining a current baseline and specifying the benefits sought helps clarify expectations and enable more effective project management. Measurement of expected and achieved benefits provides the basis for an analytical approach to evaluating pilot studies and full implementation, and understanding their impact. Is the project delivering the expected results? Are you seeing unanticipated benefits? The model won't tell you why the results occurred, but having a clearer picture can provide a starting point for fruitful discussion over how to optimize changes.
- **Inform and educate.** Enlisting the support of clinicians is critical to successful HIT adoption. If the model shows that pilot programs or initial, limited-scope deployments demonstrate objective, measurable improvements, clinicians and other end users are likely to accept the change more willingly.
- **Build on your success.** HIT deployment is a process of continuous improvement. Insights and information gleaned from using the Value Model can prove valuable in communicating your successes—to generate pride in what's been accomplished and build support for subsequent projects.

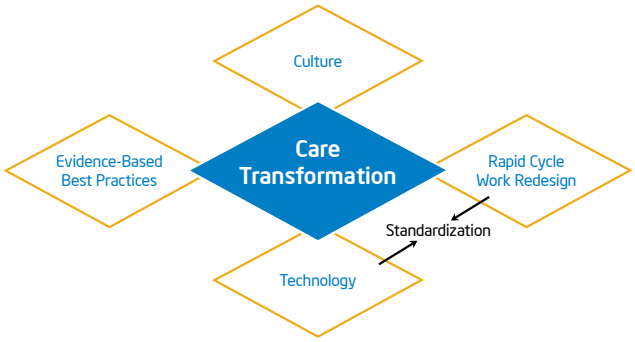
Evaluating Care Transformation at Banner Health

Banner Health used the Intel HIT Value Model to identify 10 key performance indicators that together produced an annual bottom-line impact of USD1.6 million adjusted for case mix.

Banner Health, a USD 3.3 billion company headquartered in Phoenix, Arizona, used the Intel HIT Value Model to evaluate the impact of a comprehensive care transformation initiative. Banner Health first implemented care transformation at the opening of a new hospital, 172-bed Banner Estrella Medical Center, in February 2005. One of the largest U.S. nonprofit healthcare systems, Banner Health operates 20 hospitals in seven states, and is in the process of replicating care transformation across its network of facilities by the end of 2008.

Care transformation is the name Banner Health has given its holistic change initiative. To develop the initiative, Banner Health brought together 300 clinicians from across their organization to design new workflows and establish standardized, evidence-based order sets. Supporting the new workflows and order sets are HIT investments including EMRs, CPOE, decision-support software, and picture archiving and communications systems (PACS), as well as wireless networks, and Intel® technology-based nurses' workstations, tablet PCs, and servers.

Technology alone doesn't produce transformation. Banner Health built the success of its initiative through strong organizational leadership at multiple levels, deep clinician involvement, and detailed attention to the complex interplay between technologies, cultural readiness, and clinical work practices.



Banner Health's care transformation combines elements of evidence-based best practices, culture change, workflow redesign, and healthcare information technologies across all stakeholders in the patient care experience to achieve an optimal health outcome.

Banner Health worked with Intel and Cerner, two of its key suppliers and trusted advisors, to apply the Intel HIT Value Model. Since we couldn't do a before and after comparison with a new facility, we created a baseline virtual hospital that was a weighted average of eight Banner hospitals and analyzed the 10 key performance indicators listed in Table 2. These 10 indicators produced USD1.6 million in annual bottom-line impact adjusted for case mix.[3] In addition, while patient satisfaction was not one of the performance indicators, it is worth noting that Banner Estrella opened to patient satisfaction ratings that are the highest in Banner's 20-hospital network. Table 3 shows financial, operational and other data used to determine the changes, along with the calculations performed.

Table 2. Changes to Key Performance Indicators at Banner Estrella Medical Center[1]

Key Performance Indicators	Metric description	Economic Impact[2]
Avoidance of adverse drug events (ADEs)	Therapy changes per 1,000 acute admissions	84.3% more
	ADE cost avoidance per 1,000 acute admissions	84.3% higher
Reduction in medication related claims	Medication related claims per 1,000 acute admissions	21.9% fewer[3]
	Cost of medically related claims per 1,000 acute admissions	71.8% lower[3]
Increase in nurse retention	Nurses leaving voluntarily within the first year	15.8% fewer
	Nurse replacement cost avoidance	15.8% lower
Reduction in patients leaving ED without treatment	ED visitors treated per month	1.8% more
	Revenue per month from treating more ED visitors	1.8% higher
Overtime reduction	Overtime expenditure per 1,000 admissions	5.3% lower
Pharmacy cost reduction	Drug expenditure per 1,000 admissions	17.8% lower[3]
Forms elimination	Form expenditure per 1,000 admissions	41.6% lower
Reduction in paper document storage costs	Document storage costs per 1,000 admissions	95.6% lower
Reduction in Accounts Receivable cycle	Days in patient A/R	2.2% fewer

[1] Compared to a mean of eight other Banner Health facilities that had not fully implemented care transformation.
[2] Annualized impact extrapolated from data for January – June 2006.
[3] Adjusted for case mix.

[3] Pre-tax cash flow or Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA). For a fuller discussion of care transformation at Banner Health, see the Intel case study: *Healing Environment, Proven Value: IT-enabled care transformation at Banner Estrella Enhances Patient Care and Nets a USD 1.6 million annual impact.*

Table 3. Financial Impact at Banner Estrella Medical Center

Key Performance Indicators	Data	Calculations
Avoidance of adverse drug events	▪ Number of ADE alerts resulting in therapy changes ▪ Number of acute admissions	Total benefit: Total # of ADE alert-triggered therapy changes * average cost per ADE Incremental benefit[1]: (# of ADE alert-triggered therapy changes per acute admission at BEMC – mean # of ADE alert-triggered therapy changes per acute admission)* # of acute admissions at BEMC * average cost per ADE
Reduction in medically related claims	▪ Total medication error-related claims costs ▪ Total number of acute admissions	(Mean medication error-related claims cost/acute adms – BEMC medication error-related claims cost/acute adms) * # of acute admissions at BEMC
Increase in nurse retention	▪ Estimated voluntary nurse turnover percentage ▪ Number of nurses with <1 year of service ▪ Total number of nurses leaving with <1 year of service ▪ Estimated cost of nurse replacement	(Mean voluntary nurse turnover of new nurses (<1 year of service) – BEMC new nurse turnover) * average replacement cost per nurse

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[1] Incremental benefit is the benefit resulting from car transformation and from the higher level of CPOE adoption at BEMC than at hospitals included in the virtual hospital.

Table 3. Financial Impact at Banner Estrella Medical Center (continued)

Key Performance Indicators	Data	Calculations
Reduction in patients leaving ED without treatment	▪ Average monthly ED visits ▪ Average LWOTs ▪ Average net OP revenue	BEMC Incremental # of treated patients (Mean % ED LWOTs of Total Visitors – BEMC % ED LWOTs of Total Visitors) * net revenue per outpatient visit
Overtime reduction	▪ Total overtime expenditure ▪ Total number of admissions	(Mean overtime exps/admission – BEMC overtime exps/admission) * # of admissions at BEMC
Pharmacy cost reduction	▪ Total pharmacy cost ▪ Total number of admissions ▪ Case mix index	Mean CMI adjusted pharmacy exps/adms – BEMC CMI adjusted pharmacy exps/adms) * # of admissions at BEMC
Forms cost reduction	▪ Total form cost ▪ Total number of admissions	(Mean form exps/adms – BEMC form exps/adms) * # of admissions at BEMC
Document storage costs reduction	▪ Total document storage and retrieval cost ▪ Total number of admissions	(Mean document storage/retrieval cost per admission – BEMC document storage/retrieval cost per admission) * total # of BEMC admissions
Reduction in Accounts Receivable cycle	▪ Days in AR ▪ Net patient AR	Value of fewer days in A/R (182/Days in A/RBE) * (Net Patient A/RBE)*(1+cost of capital)^(Days in A/R saved/365)-1)

Free Resources to Build Your Success

The Intel HIT Value Model provides a practical, industry-proven approach to help evaluate the potential and actual impact of HIT-enabled initiatives.

HIT investments—as part of well implemented initiatives supported by interoperable, standards-based solutions—can positively impact core healthcare objectives such as quality of care, patient safety, and provider productivity. They can also deliver measurable, bottom line value. But in an era of constrained IT resources, HIT must compete with other investment priorities, and multiple HIT-enabled initiatives may compete with each other. The Intel HIT Value Model provides a practical, industry-proven approach that CIOs, CFOs, CMOs, and other healthcare decision makers can use to understand and evaluate the potential and actual impact of HIT-enabled initiatives, and thereby accelerate progress toward achieving the benefits of healthcare IT.

Intel offers a set of free resources based on the HIT Value Model, as well as advisory services to organizations that want to conduct a customized analysis. We can also share best practices on ways to use healthcare information technology to achieve core healthcare objectives. Please contact your Intel representative to see a demonstration of the Intel HIT Value Model.

Learn More

Intel Healthcare Solutions:

http://www.intel.com/healthcare/healthit/hospitals.htm

About the Authors

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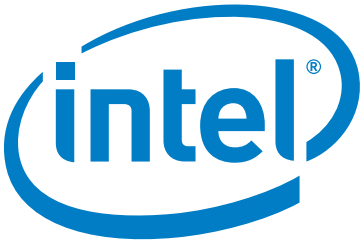

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