- Expand Universal Service Funds to include funding for broadband service and hardware (e.g., PCs) and target in-home health care applications in determining the most efficient incentives for adoption.

- Subsidize broadband service and hardware for individuals suffering from chronic disease and/or aspiring to retain independent living in their homes consistent with FCC Lifeline requirements.

- Collaborate and leverage existing resources and ARRA funding in order to connect more sites and lower costs. Through interagency coordination with HHS, Department of Commerce, Department of Agriculture, Food and Drug Administration, Veterans Administration, and the Indian Health Service, comprehensive connected health plans for specific communities that rely on broadband networks to drive access and value could be developed. This funding process could be streamlined to build a community-wide public sector network. Additionally, the NTIA and RUS Broadband Technology Opportunities Program (BTOP) offering broadband funding for education and health care should be linked with the current funding to provide a seamless network in rural areas.

- Implement coordination between the FCC and the USDA's RUS as the Pilot Program is made permanent, particularly with respect to RUS's Distance Learning and Telemedicine (DLT) Program. The Pilot Program and DLT Program share the goal of bringing telecommunications technologies and health care opportunities to rural America. To that end, the DLT Program provides grants, loans, and loan-grant combinations to encourage and improve telemedicine services and distance learning in rural areas. For many Pilot Program recipients, the DLT Program may be a much-needed complement to the Pilot Program funding that presently is geared toward broadband deployment. DLT Program funds may be used for the purchase of user equipment, including video-conferencing and teleradiology equipment. Together, the Pilot Program and DLT Program can work to provide connectivity and equipment to rural health care facilities.

- Expand the Pilot Programs to include remote health care monitoring by providing health care technology solutions for elderly, disabled, and homebound patients, and those with chronic diseases. Rural and underserved patients should receive remote health care that is real-time and rich in detailed feedback, as well as education and instruction to enable more patient responsibility. Remote monitoring of patient vital signs by virtual clinicians also supports independent living for the elderly and disabled in their homes, using home sensors to detect falls, monitor medications, and even provide reminders to turn off the stove. These "smart homes" allow seniors to age in their homes, increasing well-being and avoiding the costs of institutionalization.

- Adopt the RHCPP on a permanent basis, as this would be an important building block toward rural broadband deployment. It would target an important rural constituency and create an important test bed for future developments.

- Allow health care providers to use Pilot Program funds for *wireless* broadband devices, as the use of these devices by health care providers will improve productivity and quality of service to homebound patients. Mobile health care workers, such as visiting nurses, are a vital part of the rural health care system. The possibilities for expanding care to unserved and underserved populations through mobile phones, laptops, and sensory devices are substantial.

- Expand the broadband capability for home-based patients, transitional care settings, and other community-based health care organizations by providing mobile wireless connectivity to community based clinics and institutions including hospital and long term care centers, in order to extend the continuum of care. For example, once the patient is dismissed from the hospital, the patient records and care plan travel from rehab to home aided by a community wide wireless broadband network.

- Use ARRA broadband stimulus and other funding to ensure ubiquitous usage of modern broadband networks that will enable health care applications, especially in

rural areas. This will improve America's health care by ensuring more Americans have access to modern broadband networks, and by extension, to interoperable personal telehealth systems. Broadband can provide new services for the rural patient who faces the barriers of time and distance in accessing the scarce supply of rural hospitals, physicians, and other health care services. These patients are often best served by house call doctors using physician broadband-enabled devices and home case remote monitoring.

6.0 Conclusion

Intel strongly believes efficient investment into the broadband infrastructure for health IT needs to be made, but simultaneously, the Federal Government needs to develop a policy across agencies to take health IT to the next level of care delivery.

Only by incorporating technology, including telehealth and remote patient monitoring, into every day health care delivery will the potential of these technologies be realized. Developing pilot programs through grants and demonstration projects is a worthwhile exercise because of the data yielded concerning outcomes and best practices, but such a strategy does not maximize the reach and the benefits of telehealth and remote patient monitoring. Because Medicare cuts across the health care sectors, developing a federal reimbursement policy is key to incorporation of these technologies and further innovation that can benefit quality of care, patient outcomes, and reduce spending. Medicare reimbursement policy could serve as a strong and significant driver in the adoption, integration, and further innovation of telehealth and remote patient monitoring.

Finally, in the further development of health IT, a more coordinated approach within the Federal Government is needed to reduce duplicative efforts and to move away from a patchwork of pilot projects. Within the U.S. Department of Health and Human Services, a myriad of agencies and offices promote telehealth and remote patient monitoring within their individual missions. Within the Department of Defense, DARPA, plays a role in developing these technologies. The Veterans Administration has provided important data concerning the

use of these technologies. The FCC through its Universal Fund also plays a significant role in this arena. As these comments illustrate, the Indian Health Service within the Department of the Interior could also serve a role in the broader adoption and use of telehealth. Yet there is no cross-cutting means of communications for these varied agencies, offices, and programs to share information about the data their investment has yielded, nor are there efforts to ensure that initiatives, when possible, are complimentary. The investment by each agency of the Federal Government is important and crucial, but to move beyond the pilots a coordinated approach would spur the broader adoption and integration of telehealth and other expanded health IT applications within the broader health care delivery system.

APPENDIX

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Case Study - Banner Estrella Medical Center: Determining the Benefits of Care Transformation and IT Implementation[1]

Introduction

Banner Estrella Medical Center (BEMC) in Phoenix, Arizona is a 172-bed hospital that opened in February, 2005. It is a new hospital in a new location, not a replacement facility. BEMC is owned by Banner Health, a nonprofit health care system. Banner Health's leadership decided to use the planning and design of Banner Estrella as a "conduit to transform how we deliver care throughout the organization. We would use the rollout of HIT (Health Information Technology) as a way to fundamentally examine and revamp how Banner delivers care at every hospital, looking for best practices and standardization." (Warden and Van Norman 2006) Banner Health functions as a single operating company rather than a holding company for hospitals operating under their own principles, operating structure and support systems. The health system began to plan a new care transformation design, with technology at the core. Implementation at each location would be completed by Dec. 31, 2008.

> "Banner Estrella is our prototype and test bed. Now, when I talk with the other hospitals, I don't have to ask them to take my word for anything. I say: The benefits are real – go see them. Go talk to your counterpart at Estrella. Care transformation is not just a concept any more." (Judy Van Norman, System Director, Care Transformation, Banner Health) (Intel 2007)

The Care Transformation effort is a multi-year plan that will cost more than $100 million for the entire Banner Health system. It utilizes enabling technology such as electronic medical records, automated alerts, and Computerized Physician Order Entry (CPOE) to transform patient care into safe processes that can be executed with little variation. The principal software is Cerner Millennium®, a product of the Cerner Corporation, which provides software to the healthcare industry (www.cerner.com).

Banner Health

Based in Phoenix, Banner Health is a nonprofit health care system with 20 facilities that offers an array of services including hospital care, home care, hospice care, nursing registries, surgery centers, laboratories, and rehabilitation services. These facilities are located in seven states - Alaska, Arizona, California, Colorado, Nebraska, Nevada, and Wyoming. Banner has 3,065 licensed acute hospitals beds, employs over 25,000 employees, and has $3 billion in annual

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[1] This case was prepared by Roger Kropf, PhD, Professor of Health Management in NYU's Wagner Graduate School of Public Service, for publication in Roger Kropf and Guy Scalzi, Making Information Technology Work: Maximizing the Benefits for Health Care Organizations (Chicago: Health Forum/AHA Press, 2007). www.nyu.edu/classes/kropf

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revenue. (www.bannerhealth.com)

Banner Health was created in 1999 by the merger of the former Samaritan Health System of Phoenix, Ariz., and the Lutheran Health System of Fargo N.D. Its hospitals range in size from 600-bed Banner Good Samaritan Hospital in Phoenix to 30-bed facilities in Wyoming and Nebraska.

Care Transformation

Care Transformation is the combination of technology, process re-design, evidence-based best practices and the cultural transformation necessary to make the adoption successful. Banner Health involved 300 clinicians from across the organization in identifying and standardizing best practices. Banner used culture change, workflow redesign and technology to implement them at Banner Estrella.

Each hospital employs a care transformation deployment manager. All of them are nurses. That person serves as the project manager for care transformation at their hospital. Half of their time is spent at the corporate level.. The other half is spent coordinating and managing the rollout of care transformation at their given hospital. Work re-design is supported by a group of management engineers[2]. Each hospital maintains a deployment council, made up of department managers and executives. "The council operates as the facility's care transformation sponsor, charged with training, communication and ultimately encouraging acceptance of the new methods and standardization." (Warden and Van Norman 2006)

> "Making a success out of Banner Estrella was vital. Other Banner hospitals would see what success looked like there, and quickly be able to make the connection about the importance and necessity of care transformation. While it's easy to naysay something in the concept stage, it's much more difficult to turn down a proven product or method. It's nearly impossible to say or to believe something doesn't work when, in fact, it does work." (Warden and Van Norman 2006)

Objectives for the redesign include (Warden and Van Norman 2006):

- Fewer hand-offs and work queues
- Intuitive system development to promote ease of use
- One set of screen formats and data definitions
- One set of consistent core reports across facilities
- Standard system outputs across facilities

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[2] Management Engineering is the name commonly given to the industrial engineering discipline when it is applied within healthcare settings. (HIMSS)

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To revamp Banner's care, the team assembled from across the system redesigned 92 processes in 11 key areas (Warden and Van Norman 2006) :

- Care management
- Clinical documentation
- CPOE
- Document imaging
- Emergency services
- Medication administration
- Obstetrics
- Orders management/nursing orders
- Pediatrics
- Scheduling
- Surgery

IT And Care Transformation

Banner Health had been using IT to improve clinical practice. A group began working in 1994 at Good Samaritan Regional Medical Center to develop a method of reducing injury from Adverse Drug Events (ADEs)[3] using the decision support capability of Cerner's Discern Expert information system. (Raschke, et al. 1998)

The Information Technology (IT) implemented at Banner Estrella included an inpatient and Emergency Department Electronic Medical Record (EMR), Computerized Physician Order Entry (CPOE) and decision-support software (DSS), and Picture Archiving And Communications Systems (PACS).

Banner Health wanted to implement "real-time" decision support for clinicians. In the two years preceding Banner Estrella's opening, Banner clinicians and informaticists[4] analyzed workflow and mapped Banner's needs to the capabilities of Cerner Millennium® and other IT applications. Nurses configured the nurses' portion of the EMR. Physicians reached consensus on evidence-based order-sets.

To develop order sets, Banner convened a physician advisory council. The group, comprised of a representative from every medical specialty offered, created approximately 120 cross-team order sets for Banner Estrella's launch. The order sets included a wide variety of

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[3] Adverse Drug Event (ADE) – An adverse event involving medication use. Examples: anaphylaxis to penicillin, major hemorrhage from heparin, aminoglycoside-induced renal failure, agranulocytosis from chloramphenicol. (Agency for Healthcare Research and Quality)

[4] An 'informaticist' applies information technology to a specific discipline.

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common diagnoses and procedures. "What quickly became apparent was the need to consolidate around specific drugs, specific doses and balancing order sets so that the vast majority of what a physician would need would be readily available. The valuable input from the council meant the care transformation team would begin from the start with guidelines championed by our physicians." (Warden and Van Norman 2006)

The care transformation team created a system where data elements, documentation and applications were built and standardized with naming conventions, forms, flowsheets and screen formats for all Banner hospitals. While physicians can utilize the order sets, they are not mandatory. They are intended to expedite the ordering process.

Banner Estrella has a new medical staff. Some physicians applied for medical staff membership while others were recruited. The medical staff bylaws for Banner Estrella were intentionally written to require that physicians use CPOE and receive system training. Physicians who utilize CPOE for less than 85% of their orders are asked to have a discussion with the Chief Medical Officer. "Rather than forcing them to sign off on it before their first day, however, we spent countless hours working for physicians' approval and belief in the care transformation vision." (Warden and Van Norman 2006)

> "Within 6 months of opening, we could have had physicians try to de-rail it. We tried to get physician champions to buy-in. It was taking them more time, but we asked them to wait and see the benefits. More and more people bought into it. They have to be willing to spend the time to learn how to use the system." (Charlie Agee, Chief Medical Officer, Banner Estrella)

Benefit Determination

Together, staff from Banner Health, Cerner and Intel examined data relating to key performance indicators for the operational period January-June 2006, the most recent period for which data was available. They used the Intel Healthcare IT Economic Model (www.intel.com/healthcare/healthit).

The benefits study will be used to sustain the momentum as Care Transformation is rolled out across the other facilities. The study fulfills a promise to the Board of Directors to do an analysis of the benefits received. Those who are oriented to the "bottom line" also want to know what effect Care Transformation is having. Those who believe that there are better department-specific IT solutions need to be convinced of the benefits of an integrated IT architecture. "Monetizing benefits is important because money is a common language, but the real reason we're doing this is to improve patient care." (Van Norman)

Banner Health also needs to know if this model is working before it is replicated for all its hospitals. Improvements can also be made in the systems operating at Banner Estrella. New features are piloted at Estrella before they are rolled out to other facilities.

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Since they couldn't do "before and after" analysis of a new hospital, the team compared BEMC to a "virtual hospital" based on the weighted average of eight Banner Health hospitals that had not fully implemented care transformation. The eight Banner hospitals were selected because they were of similar bed size as Banner Estrella or larger. A heart hospital was excluded because of the differences in services provided. Six of the eight hospitals were already using Cerner Millennium® in 2005, but none of them had implemented CPOE.

The team looked at 10 key indicators, and identified up to $2.8 million in financial benefits for the six-month period by calculating the difference between BEMC and the "virtual hospital". The result showed (Intel 2007) :

- Lower Average Length Of Stay (ALOS)
- Lower overtime expenditure per 1,000 admissions
- Lower drug expenditure per 1,000 adjusted admission (adjusted for case mix)
- Lower form expenditure per 1,000 admissions
- Lower document storage costs per 1,000 admissions
- Greater avoidance of costs for treating adverse drug events per 1,000 acute admissions
- Fewer medication-related malpractice insurance claims per 1,000 acute admissions
- Fewer days in Accounts Receivable
- Fewer nurses leaving voluntarily within the first year of employment
- More Emergency Department visitors treated (because fewer patients left without treatment)

The greatest "bottom line" impact resulted from improvements in ALOS, a drop in the number of patients who left the Emergency Department without treatment (LWOT), pharmacy cost reduction and ADE avoidance. (Figure 1). ALOS, adjusted for case mix, was 7 percent lower than at the virtual hospital, and pharmacy costs, also case-mix adjusted, were 18 percent lower.

The financial effect of ALOS reduction was measured by the variable cost per day avoided. ADE avoidance was measured by determining the number of alerts sent or "fired" by the system and the number of changes that were subsequently made to orders. Banner Health had been using this technology since the 1990s. (Raschke, et al. 1998). The benefit is the incremental improvement in how often a physician changes an order after an alert. Compared to facilities that had front-end pharmacy alerts in place but did not have CPOE, BEMC had 84 percent more therapy changes per 1,000 acute admissions, helping BEMC avoid the cost and resources (and its patients avoid the time and pain) of treating potential complications. The dollar value of an avoided ADE is assumed to be $4000, based on prior studies done elsewhere.[5]

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[5] Including a study by Bates and his colleagues. "The additional length of stay associated with an ADE was 2.2 days (P=.04), and the increase in cost associated with an ADE was $3244 (P=.04). For preventable ADEs, the increases were 4.6 days in length of stay (P=.03) and $5857 in total cost (P=.07). After adjusting for our sampling strategy, the estimated postevent costs

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Other benefits contributing to the $2.8 million in financial benefits for the six-month period:

- Overtime expense was 5 percent lower
- Forms costs were more than 40 percent less.
- Bills spent a day less in Accounts Receivable, allowing quicker payment.
- Retention of nurses in their first year of Banner employment was higher, reducing hiring and training costs.
- The cost of medication-related malpractice insurance claims per 1,000 acute admissions (adjusted for case mix) was 72 percent lower.

Some effects of changes could not be measured because of the limitations of existing data. For example, the time accounting system doesn't allow for the determination of nurse overtime related to documentation. While interview data suggested that the new systems were shortening documentation time, that specific effect couldn't be accurately measured.

Bottom Line Impact

The $2.8 million included only savings that would have an effect on the "bottom line", defined as Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA). With the exception of additional revenue in the ED, the benefits were achieved by avoiding costs (e.g., overtime and document storage).

The type of payment for an episode of care affects whether or not a hospital financially benefits from a change. For example, shortening the length of stay of a Medicare patient would reduce the hospital's costs but not decrease revenue, since payment is made on an all-inclusive case rate based on DRG. Shortening the length of stay when the hospital is paid a per diem rate would lower both costs and revenues. To adjust for the type of payment, a "bottom line" change was calculated for each benefit (Figure 1)

Per diem reimbursement is approximately 59% of Banner Estella's revenue. The remaining 41% of revenue is per case payment or capitation. Only 41% of the total savings from items related to ALOS was therefore included in the "bottom line change" (Figure 1). Savings from document storage cost reduction, medication-related claims avoidance, days in AR reduction, nurse retention, and fewer ED Left Without Treatment (ED LWOT) were considered to be unaffected by length of stay and were not adjusted.

Case-Mix Adjustment

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attributable to an ADE were $2595 for all ADEs and $4685 for preventable ADEs." (Bates, Spell and Cullen 1997)

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BEMC is a new facility that does not have some services, including specialized pediatrics. It is also a Level 2 and not a Level 1 Trauma center. The demographics of the community result in both a large elderly population and a significant number of births because of the number of young families moving into the hospital's service area in the West valley, a growing area of Phoenix. Differences in the case-mix of patients at BEMC and the "virtual hospital" could partially explain the differences in costs. Case-mix adjustment was used to attempt to compensate for differences in the types of patients seen. Figure 1 shows values with and without case-mix adjustment (CM).

Some effects are assumed to be sensitive to differences in case-mix. This includes ALOS reduction, pharmacy cost reduction, and medication-related claims reduction. An adjustment was made to account for differences in the case-mix at Banner Estrella and the 8 hospitals used to create a "virtual hospital". CMI adjustment was done for medication-related claims reduction with the assumption that more severe cases result in higher liability claims.

For pharmacy cost reduction and medication-related cost reduction, the following case-mix adjustment method was used. The data for Estrella was divided by its Case-Mix Index. The data for each of the 8 hospitals was also divided by its CMI. A weighted average of the results for the 8 hospitals was calculated using admissions (i.e., data for each hospital was multiplied by the percent of total admissions for the 8 hospitals at that hospital). For ALOS reduction, case-mix adjustment was done DRG-by-DRG. The ALOS for each DRG at Banner Estella was determined. This was compared to the ALOS at each of the other 8 hospitals.

Adjusting for case-mix and considering only "bottom line" impact, the benefits were estimated to be $1.3 million for a six-month period or $2.7 million annually. The total savings without ALOS Reduction is presented in Figure 1. Exeluding ALOS reduction lowers the savings. Banner Health wanted a high and low estimate of benefits. Results are also shown when the comparison is restricted to only Arizona hospitals, which results in a higher benefit estimate. (Figure 1) Because of the regulatory and pricing environment specific to Arizona, Banner wanted a separate estimate using data only for Arizona hospitals to create the virtual hospital.

Extrapolating to Other Facilities

The benefits study was undertaken to estimate the benefits from Care Transformation at Banner Estrella. Other Banner facilities may see higher or lower benefits. A major risk in extrapolating the results at Banner Estrella to other Banner hospitals is whether physicians will utilize CPOE, a requirement for getting medical staff membership at Banner Estrella. Transitioning away from the paper chart may also have to happen incrementally because of the comfort level of staff with using paper. The benefits may be achieved more slowly. "Implementing Care Transformation at existing hospitals is like re-wiring cars when they are running" (Van Norman)

The larger volume of patients at other Banner hospitals will result in higher total dollar benefits. Banner Estrella also has a higher proportion of per diem payment. Hospitals with a

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higher proportion of per case payment (for example, a larger Medicare population) would see greater bottom-line savings.

Why Are Benefits Received?

Banner Health is attempting to transform how care is provided. IT has enabled the changes to varying degrees. No attempt has therefore been made to separate the effect of changes in how care is provided (e.g., changes in workflow, use of order sets) from functions available through IT (e.g., automated alerts, decision support for ordering). Nor has any attempt been made to isolate the effects of Banner Estrella's innovative architecture and services. (Banner Health) (McGuigan 2006)

Some benefits are easy to explain. Bills spent a day less in Accounts Receivable, allowing quicker payment. Since the medical record is on-line, the medical coders in billing don't have to wait until a paper record reaches them to start their work.

To understand what changes were occurring, interviews were conducted to understand how staff, including physicians and nurses, viewed the changes. Interviews also identified multi-disciplinary workflow benefits. The interviews focused on the workflow for that person. The interviews revealed other data that should be acquired to augment the initial data request. The results suggest the reasons why the benefits were received. Some of the results are organized below by type of benefit.

ALOS Reduction

Physicians say the tools help them do a better job for their patients. "Your brain can remember most things most of the time. When you have a system, that system prompts you for the correct medications, doses and frequencies, it takes care of a lot of the rote memory work. It frees up brain cells so you can use your clinical acumen more creatively to optimize the care of this particular patient." (Charlie Agee, MD, CMO, Banner Estrella) (Intel 2007)

BEMC clinicians say the IT-rich Banner Estrella environment and the cross-enterprise care transformation process foster a more holistic, team-oriented approach to patient care – one they believe improves outcomes and enhances job satisfaction. "Physicians, nurses and ancillary services at Banner Estrella are more tightly integrated. We all have a better understanding of how we impact each other. It's a whole different mind set, and very beneficial for the patient." (John Placko, RPh, director of pharmacy, Banner Estrella) (Intel 2007)

Clinicians collaborate more effectively in real time. "In the paper world, there's ONE chart. With the EMR, we can have a hospitalist, a radiologist and a consultant all looking at the chart at the same time, to improve on outcomes in a quicker fashion. You can also sit down with the patient, use a tablet or a computer on wheels to show them their radiological studies in real time, and make decisions together right at the bedside." (Charlie Agee, MD, CMO, Banner

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Estrella) Everyone from respiratory therapists to dietitians can engage with the patient sooner and be a better informed partner in patient care. (Intel 2007)

ADE and Pharmacy Cost Reduction

> "Orders are dispatched with more immediacy because of the technologies. They're more likely to be the right orders because physicians are following evidence-based order sets, and they're alerted to any incompatibilities or allergies. Test results come back faster because we've removed the delays that are inherent in a paper system. Handwriting errors and unapproved abbreviations – both big sources of error – are eliminated. And when treatment guidelines change, we can embed it into the system and change our practices quickly." (Joel McAlduff, MD, system director for medical informatics and clinical innovation, Banner Health) (Intel 2007)

Pharmacists don't have to scratch their heads trying to figure out what the doctor has written. "They're free to focus on what's going on with the patient and the appropriateness of the therapy. That reduces errors and generates savings in the long run, and enables pharmacists to make a more valuable contribution."(John Placko, RPh, director of pharmacy, Banner Estrella) Pharmacy costs have also been impacted by process changes and by the standardization of care-sets, among other factors. "Care sets help reduce inventory costs because we've reduced the number of items we need to order." (Placko) (Intel 2007)

Data on orders and alerts can be used to avoid ADEs. The Food and Drug Administration had recently placed an alert on the use of the drug promethazine in patients under the age of 2, due to respiratory depression. Banner Health pharmacists were not overly concerned, as they were under the impression that the medication was rarely used by physicians for this age group. A quick search of the Cerner Millennium® database at Banner Estrella and another Banner hospital revealed seven uses of the drug. Within hours a rule was written alerting physicians to the FDA's warning on promethazine orders for patients under the age of 2. Days later, an audit of that specific alert determined the rule "fired" (appeared to the physician on the screen) six times, and in all six cases the physician cancelled the order. This is example of what Judy Van Norman calls "hard-wiring". The change doesn't rely on the memory of clinicians or the actions of administrative and clerical staff.

> "Without this technology, Banner could not have disseminated the alert so quickly, or known if it was acted upon. Physicians can immediately make a change where appropriate, before the initial order transaction occurs, whereas in non-CPOE facilities, a pharmacist would have to track down the ordering physician to relay the information." (Warden and Van Norman 2006)

Nurse Retention and Overtime Reduction

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Nurses see care transformation as a tremendous resource to make them better, more efficient nurses. "Because of the EMR, nurses have the whole picture. They can develop a better plan of care and intervene more effectively for their patients because they've got all the information at their fingertips. When a patient is admitted from the Emergency Department, the floor nurses are better prepared for them because they can see the information that's already been collected. They can utilize resources more effectively and move the patient along in their recovery more quickly. If they call a physician, they're not scrambling to find the chart when the physician calls back." (Diane Drexler, RN, Chief Nursing Officer, Banner Estrella) (Intel 2007)

Nurses also say they can manage their time more effectively, which relieves stress and enhances care. "Nurses have time to develop more empathy with the patient. They can listen more closely without feeling stressed out because they're not getting their charting done. It's a wonderful feeling." (Debbie Carter, RN, Deployment Manager, Banner Estrella). (Intel 2007)

Lessons Learned

Judy Van Norman believes it is important to do a benefit study to support the case for large investments like an EMR, even when we intuitively feel it is the right thing to do. However, it is difficult to determine the cause of the benefits when there are so many other changes going on as we try to improve quality and patient safety. It's important to have the anecdotal data to give you confidence that you are looking in the right places for the benefits. If clinicians tell you that the system is not creating a collaborative environment and that they hated using it, you'd have to look at the measured benefits with skepticism.

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Figure 1: BEMC Final Set of Findings

Economic Effect	Total Effect w/o CM	Bottom Line Change w/o CM	Total Effect w/ CM	Bottom Line Change w/ CM	Just AZ Bottom Line w/ CM
ALOS Reduction	$ 4,340,696	$ 1,781,544	$ 1,324,067	$ 543,434	$ 666,167
Overtime Reduction	$ 74,652	$ 30,639	$ 74,652	$ 30,639	$ (6,990)
Pharmacy Cost Reduction	$ 785,478	$ 322,382	$ 318,615	$ 130,769	$ 109,940
Form Elimination	$ 54,526	$ 22,379	$ 54,526	$ 22,379	$ 18,931
Document Storage Cost Reduction	$ 26,711	$ 26,711	$ 26,711	$ 26,711	$ 26,711
ADE Avoidance	$ 290,134	$ 119,079	$ 290,134	$ 119,079	$ 119,368
Med-related claims avoidance	$ 89,308	$ 89,308	$ 64,118	$ 64,118	$ 80,704
Days in AR Reduction	$ 18,416	$ 18,416	$ 18,416	$ 18,416	$ 18,416
Nurse Retention	$ 37,576	$ 37,576	$ 37,576	$ 37,576	$ 37,576
Fewer ED LWOTs	$ 339,766	$ 339,766	$ 339,766	$ 339,766	$ 584,284
Total with ALOS (6 mos)	$ 6,057,262	$ 2,787,801	$ 2,548,581	$ 1,332,888	$ 1,655,107
Total without ALOS (6 mos)	$ 1,716,566	$ 1,006,257	$ 1,224,514	$ 789,453	$ 988,940
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White Paper

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The Value of Healthcare IT (HIT)

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

Banner Health.

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

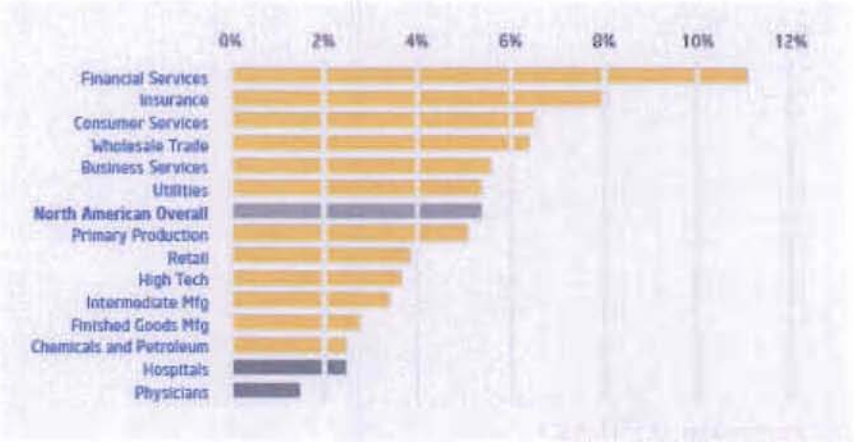
Information Technology for an Information-Based Enterprise

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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