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ЕВРОПЕЙСКА АСОЦИАЦИЯ НА СТАРШИТЕ БОЛНИЧНИ ЛЕКАРИ**

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Patient Safety Institute

Economic Value of a Community Clinical Information Sharing Network

Part I

Value to Payers (Private, Medicare, Medicaid and Self-Insured Employers) and the Uninsured

White Paper

**Prepared by
Emerging Practices
First Consulting Group**

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Patient Safety Institute Economic Value of a Community Clinical Information Sharing Network

Part I

Value to Payers (Private, Medicare, Medicaid and Self-Insured Employers) and the Uninsured

Executive Summary

Today's healthcare issues related to cost and quality have reached a critical juncture. Dramatic actions must be taken to change the status quo at all levels:

- healthcare costs continue to spiral up,
- reimbursement is down,
- professional resources are decreasing,
- healthcare quality and bio-terrorism concerns are often front page news, and
- health plans and patients are demanding more from providers.

Federal and state governments and a myriad of organizations and health quality initiatives such as The Leapfrog Group, eHealth Initiative, JACHO, and NCQA, are working to find answers. All of them see the use of information technology (IT) as a key enabler to help solve these issues. To be truly effective, however, the clinical applications and associated patient information must be available across all care delivery settings, anywhere the patient's providers need access to it.

Technology, fortunately, has advanced to the point where it can meet the growing demand for sharing clinical information. If architected correctly, a clinical data exchange network can leverage Internet technology to communicate across regions, states, and the U.S. A key remaining problem has been to identify a national "trusted third party" that can give all parties sufficient confidence that their needs are being addressed and, specifically, that confidentiality and security are fully met.

Recently the non-profit Patient Safety Institute (a national "trusted" third party-organization) has developed and deployed an open architecture and non-proprietary clinical data exchange network that delivers on both the data sharing and access requirements. Installed in Seattle hospitals and selected for state-wide deployment by the State of Delaware, the PSI network enables real time access to clinical information at the point of care or decision to bring healthcare providers together with technology in a similar manner to the way that VISA has been connecting banks, retailers, and consumers.

PSI has proven it can form and operate a national "trusted" third-party organization as well as meet the data and technical requirements of community data sharing. However, the missing component for a complete business case is an analysis of the economic value PSI can bring to care delivery.

To that end, PSI has engaged the Emerging Practices Research Department at First Consulting Group to conduct a study of the potential benefits starting with those paying the healthcare bills. Benefits for patients and providers will be analyzed in a separate study that is forthcoming. This study was based on published research, studies in progress, interviews with clinical and technology experts, and discussions with health plan, health association, and industry leaders.

The study's conclusions are dramatic. Conservative estimates on a limited number of measures implemented nationwide calculated an aggregated annual net savings of \$10 to \$14 per person per month, or almost \$40 billion per year (see page 5 for details). When integrated with advanced clinical applications installed at care delivery sites, the estimated total net benefits reach almost \$47 billion.

The total estimated cost to build a national PSI infrastructure (included in the net number) is approximately \$2.5 billion. Annual recurring costs to operate would be \$500 million. Using these estimates, the potential return on investment is nearly 20 to 1 in the first year and doubles that in the years thereafter.

Even with the magnitude of these numbers, experts believe that *many* of PSI's benefits are yet to be documented. Since PSI provides a secure data highway built using industry data and communications standards, other organizations such as clinical knowledge providers and state registries, can tap into the PSI infrastructure to enhance functionality and data sources. In addition, PSI data has significant value in support of disease management and population management programs. Although none of these areas have been quantified in this report, their value exists and is significant.

Background and Overview

The Patient Safety Institute (PSI) was formed to provide the healthcare industry with a commonly owned, utility-like, “trusted” third party, industry-wide organization that could inexpensively (through its non-profit membership model) develop a shared communications and operating infrastructure with the objectives to improve healthcare quality and lower costs. The PSI infrastructure enables real time access to clinical information at the point of care to bring healthcare providers together with technology in a similar manner to the way that VISA has been connecting banks, retailers, and consumers. However, in the PSI model, hospitals and other data sources both receive and provide secure and private clinical information at the patient’s request.

Recently PSI has successfully implemented its community demonstration project in Seattle, Washington, linking three hospitals. The feedback from the clinicians using the PSI network has identified benefits on patient care delivery and cost reduction. Working from these initial findings, PSI wanted quantification of the full range of benefits if the PSI application was implemented nationwide. To that end, PSI has engaged First Consulting Group’s Emerging Practices Research Department to conduct an analysis of the potential benefits to payers, initially, based on published research studies, studies in progress, interviews with clinical and technology experts and clinicians from the demonstration site, as well as discussions with health plan, health association, and industry leaders. This report reflects the collective findings from all areas, with appropriate references and assumptions.

Scope and Approach

The scope of the study focuses on achievable benefits when the care provider has access to patient clinical data electronically at the point of care. The approach used to quantify the benefits took two paths. Using results from similar studies, we applied comparable percentages to estimate probable benefits achievable from PSI. In addition we interviewed caregivers at the demonstration site to gain first hand knowledge of the impact of the system on operations and patient care.

Preliminary analysis based on these sources was discussed with industry experts and researchers also involved in technology value analyses for clinical systems. Their input refined the calculations and assumptions.

For purposes of this report, two different PSI applications were evaluated.

- **PSI Standalone** is the currently available product that includes display capabilities for patient demographics, allergies, medications, transcribed reports, problems/diagnoses, immunizations, and laboratory results as depicted below.

Figure 1: PSI Standalone Display

Patient Safety Institute - Patient Summary

logout | Susan Smith | February 05, 2003

Patient Information for JOHN SMITH

Home | Search Results | Patient Detail

Summary
This is a partial medical history containing confidential patient information. Any unexpected results or results inconsistent with clinical observation or history should be repeated or confirmed. Unauthorized use is subject to disciplinary action.

Problem List (5)

Problem	Date
COMP NEC D/T VAS DEV NEC	01/14/2003 00:00
PERIPH VASCULAR DIS NOS	01/14/2003 00:00
GANGRENE	01/14/2003 00:00
OTHER POSTOPERATIVE INFECTION	01/13/2003 00:00
RT. LOWER EXTREMITY GANGRENE/MRSA	12/17/2002 16:30

Medications (181)

Medication	Dosage	Freq	Fac.
MINERAL OIL (AS LAXATIVE)	30 ML	stock	PROVD
PREDNISONE	5 MG	qam	PROVD
SODIUM POLYSTYRENE SULFONATE	15 G	stat	PROVD
HEPARIN SODIUM	0 U	stock	PROVD
VANCOMYCIN	1 G	qod	PROVD

Allergies (2)

Name
MORPHINE
MORPHINE

Lab Results (145)

Date	Test Name	Result	Range	Fac.
12/23/2002 06:00	Na	136 mmol/L	135 - 145	PROVD
12/23/2002 06:00	K	4.3 mmol/L	3.5 - 5.3	PROVD
12/23/2002 06:00	Cl	99 mmol/L	98 - 109	PROVD
12/23/2002 06:00	CO2	30 mmol/L	22 - 32	PROVD
12/23/2002 06:00	Anion Gp	7 mmol/L	7 - 16	PROVD

CBC Date: 12/23/2002

8.7	293.
11.8	25.4

Chem7 Date: 12/23/2002

136.	99.	16.	130.
4.3	30.	0.9	

- **PSI Inside** is a future version that imports the above-mentioned patient information into the participating site's advanced clinical information system that includes a full range of clinical decision support capabilities and supports computerized physician/provider order entry (CPOE).

Study Assumptions for PSI Applications

To quantify benefits and savings for the two PSI applications on patient care delivery and operations, several key assumptions on data, product use, and benefits were made.

- **Data**
 - All data sources displayed in PSI (lab, radiology reports, allergies, immunizations, problems/diagnoses, clinical notes, and medications) are available electronically to all participating patient care delivery sites and are interfaced to the PSI system.
 - For PSI Inside, all data available in PSI is imported into the site's advanced clinical systems and is used for clinical decision support checking.
- **Product Use**
 - PSI Standalone is used by all caregivers at the point of care.
 - PSI Inside is used at sites that have advanced clinical systems.
 - In **physician practice settings**, we assumed that 30 percent of physician practices will have an EMR, and these applications will

incorporate PSI data for further processing (1). All other practices will use the PSI Standalone application.

- For **hospital/ED settings**, we assumed 37 percent will have advanced clinical systems with clinical decision support based on a recent survey by Dorenfest. (2) These sites will use PSI Inside with the remaining 63 percent using PSI Standalone.

- **Benefits**

- Benefits from PSI Standalone are based on the added value the PSI patient data brings to the decision making process. For example, reviewing patient allergies and deciding to order amoxicillin instead of bactrim because the patient is allergic to bactrim.
- PSI Inside benefits are more extensive because the PSI data is integrated with the site's advanced clinical application that includes knowledge-based decision support checking.

Summary of Findings

The following table provides a snapshot of benefits and costs of implementing PSI nation-wide:

Table 1: PSI Potential Benefits and Estimated Costs

	PSI Standalone – Nationwide⁽¹⁾	PSI Inside – Nationwide⁽²⁾
Potential Benefits:	Annual Savings	Annual Savings
1. Reducing inpatient hospitalizations resulting from lack of patient specific data ⁽³⁾	\$ 28.85 Billion	\$ 34.04 Billion
2. Reducing preventable inpatient ADEs	\$ 0.28 Billion	\$ 0.99 Billion
3. Reducing outpatient ADEs that require additional outpatient visits	\$ 0.01 Billion	\$ 0.02 Billion
4. Reducing number of repeat outpatient visits due to missing patient information	\$ 1.09 Billion	\$ 1.25 Billion
5. Lower ED expenditures	\$ 1.12 Billion	\$ 1.23 Billion
6. Decrease number of Laboratory tests	\$ 3.51 Billion	\$ 3.63 Billion
7. Decrease number of Radiology tests	\$ 2.35 Billion	\$ 3.06 Billion
8. Reduce redundant medication orders	\$ 2.07 Billion	\$ 2.15 Billion
9. Reduce overuse of antibiotics	\$ 0.27 Billion	\$ 0.51 Billion
Total Potential Benefits– Nationwide	\$ 39.55 Billion	\$ 46.88 Billion
Total for Medicare (17 %) ⁽⁴⁾	\$6.72 Billion	\$7.97 Billion
Total for Medicaid (16%)	\$6.33 Billion	\$7.50 Billion
Total Other Public (12 %) ⁽⁵⁾	\$4.75 Billion	\$5.63 Billion
Total Public (45 %)	\$17.80 Billion	\$21.10 Billion
Total for Private Plan (40% of total)	\$15.82 Billion	\$18.75 Billion
Total for Uninsured/ Out-of-pocket (15%)	\$5.93 Billion	\$7.03 Billion
Total Private (55%)	\$21.75 Billion	\$25.78 Billion
Per Person Per Month ⁽⁶⁾	\$ 11.72	\$ 13.89
Costs:		
One time	\$2.50 Billion	\$2.50 Billion ⁽⁷⁾
Ongoing	\$ 0.50 Billion	\$ 0.50 Billion
Net Potential Benefits:	Annual Net Savings	Annual Net Savings
First Year	\$ 36.55 Billion	\$ 43.88 Billion
– Per person per month	\$10.83	\$ 13.00
Second and subsequent years	\$ 39.05 Billion	\$ 46.38 Billion
– Per person per month	\$ 11.57	\$ 13.74
<p>(1) Assumes the application is used nationwide by all inpatient and outpatient care providers</p> <p>(2) Assumes 24 percent of practices and 37 percent of hospitals use PSI Inside and the remainder use PSI Standalone</p> <p>(3) Latest interim study report did not provide specifics on preliminary findings.</p> <p>(4) CMS—Highlights National Health Expenditures, 2002. The Nation’s Health Dollar http://www.cms.hhs.gov/statistics/nhe/historical/chart.asp.</p> <p>(5) Other Public includes programs such as workers’ compensation, public health activity, DoD, Department of Veterans Affairs, Indian Health Services, and State and local hospital subsidies and school health. http://www.cms.hhs.gov/statistics/nhe/historical/chart.asp.</p> <p>(6) Based on current population survey March 2002, Census Bureau.</p> <p>(7) Customization costs of core clinical system are not included as they will differ from vendor to vendor and are, therefore, borne by the individual clinical system vendor.</p>		

Overall, the potential annual benefits from PSI are significant, ranging from \$39.55 billion to \$46.88 billion nationwide. On a per person per month basis, the benefits are \$11.72 and almost \$14 for PSI Standalone and PSI inside, respectively.

The annual benefits for private plan population, which is approximately 40 percent of the total population (3), range from \$15.82 billion to \$18.75 billion, depending on the level of adoption and integration of the more advanced PSI Inside application in hospital and physician practice settings. In determining benefits associated with each insurance type, we assumed that all benefits are equally distributed. Therefore, savings were calculated by multiplying the total benefits by the percentage of the population with that insurance coverage (3).

Including costs to provide net benefits, the numbers are still very sizeable. Net benefits are more than \$39 billion for PSI Standalone and \$46 for PSI Inside, resulting in per person per month figures of \$ 11.57 and \$13.74.

Discussion of Potential Benefits

There were five major patient care related areas for our analysis of potential savings. These include reducing inpatient hospitalizations and expenses related to adverse drug events (ADEs), reducing outpatient visits and expenses related to ADEs, reducing Emergency Department (ED) expenses, reducing diagnostic testing, and reducing redundant and overuse of medications.

Benefits Analysis Framework

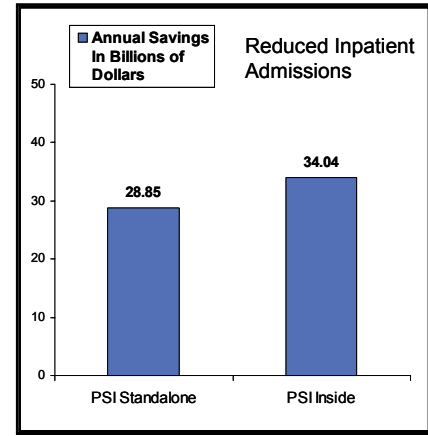
When comparing PSI application's potential benefits to published study results, the following framework was used:

1. Description of the existing body of research. This is typically published studies, but it may also include studies in progress, interviews with industry experts, and participants in the PSI demonstration pilot. As more results are available, the white paper will be updated to reflect the latest industry knowledge.
2. Comparison of the study's technology and findings to the PSI application. This includes comparing the application functionality, data, and environment and then assigning a percentage that indicates the degree of similarity.
3. Explanation of the calculation and final results for both PSI application solutions. Any assumptions and references to national statistics needed to support the calculation are provided.

Reduced Inpatient Admissions

Preliminary results from a community-wide data sharing study identified that one out of seven admissions resulted from missing information in the Emergency Department (ED) or primary care physician (PCP) setting (4). With \$412.1 billion spent on inpatient care (5) the total potential annual savings with all patient information is \$57.69 billion.

We made the assumption that PSI Standalone would address 50 percent of these admissions since not all patient data is captured. This results in an annual savings of \$28.85 billion. PSI Inside would address 80 percent since the inclusion of PSI in an advanced clinical system would present the most relevant data for the caregiver at the point of care. Using the percentages for level of adoption of PSI Inside with advanced outpatient clinical applications, the resulting annual savings would be \$34.04 billion. The comparable percentages will increase as PSI integrates with national insurers, independent laboratories, PBMs, and pharmacy chains.

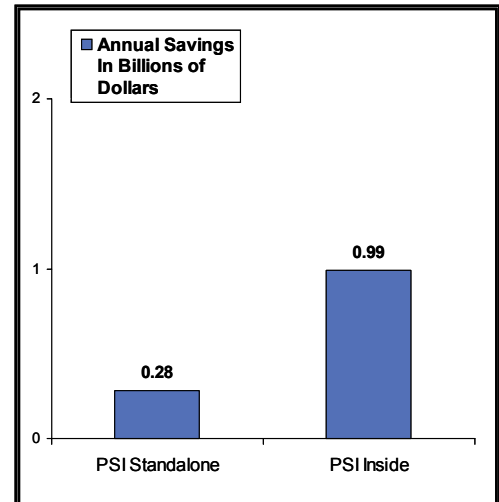


Unfortunately the latest interim report published in July 2003 focused solely on operational efficiencies and does not include any specifics on these clinically-related measures (6).

Reducing Preventable Inpatient Adverse Drug Events (ADEs)

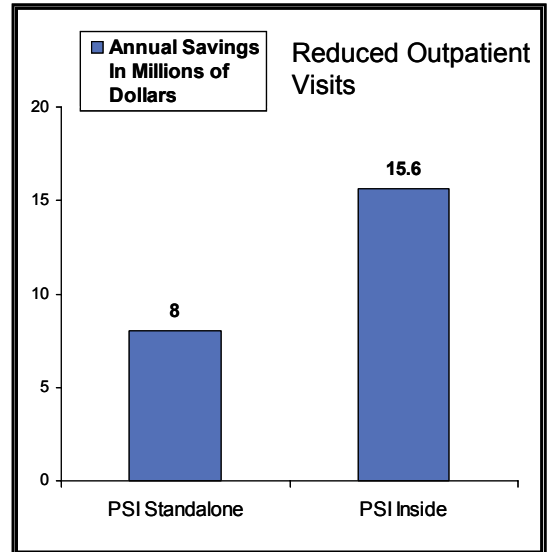
A 1997 study conducted by Bates, Spell et al (7) showed that inpatient adverse drug events (ADEs) have an associated additional length of stay (LOS) and cost. In this study the rate of preventable ADEs was 1.46 percent with an associated LOS of 4.6 days and a cost of \$5,957. With 31.7 million admissions (8) annual savings could reach \$ 2.75 billion if all preventable ADEs were avoided.

To relate this savings to the use of PSI, we made the assumption that the availability of all patient data from other hospitals and physician practice sites would have a relatively small impact on the ADEs, only 10 percent. However, the inclusion of this data into advanced clinical systems with CPOE and clinical decision support would have a much greater impact, especially in cases where medication dosing is critical. Our estimate of the impact of PSI Inside on preventable inpatient ADEs is approximately 80 percent. Using these assumptions, the annual savings is \$0.28 billion for PSI Standalone and \$0.99 billion for PSI inside.



Reducing Outpatient Visits related to Outpatient ADEs

A recent study on Ambulatory Computerized Physician Order Entry (ACPOE) published by the Center for Information Technology Leadership (CITL) analyzed the impact of ACPOE on patient care and cost reduction. The analysis concluded that ACPOE would have a substantial impact on reducing the number of preventable ADEs. With more than 900 million visits, the study predicts there are approximately 8.8 million outpatient ADEs, 3 million of which are preventable. Using the assumption that 62.8 percent of preventable ADEs require at least one follow-up visit, visits prevented by ACPOE systems annually range from 136,000 for basic e-prescribing applications to 1,293,000 for advanced ACPOE systems (9).



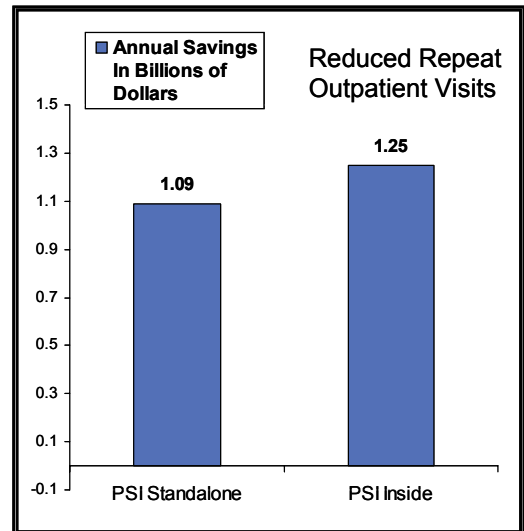
For purposes of comparison we have made the following linkages between the ACPOE systems and PSI:

- PSI Standalone functionality is more robust than the basic standalone e-prescribing application that does not include any patient specific data, but not as sophisticated as the "intermediate" application which includes CPOE and clinical decision support. We estimated the value of PSI to be at least 20 percent greater than the basic application savings, mainly based on the availability of patient-specific clinical data from multiple sites.
- PSI Inside is the equivalent to the intermediate ACPOE application since they both include physician order with clinical decision support.

We used the above percentages to calculate PSI's impact on reducing outpatient visits and concluded that PSI Standalone would eliminate 20 percent more than the 136,000 visits that could be prevented using basic e-prescribing. Assuming the average outpatient visit is \$50 (10), the savings for PSI Standalone is \$8 million. For PSI Inside, the number again is much more significant, namely 783,900 visits or \$15.6 million.

Reducing Repeat Outpatient Visits Due to Missing Information

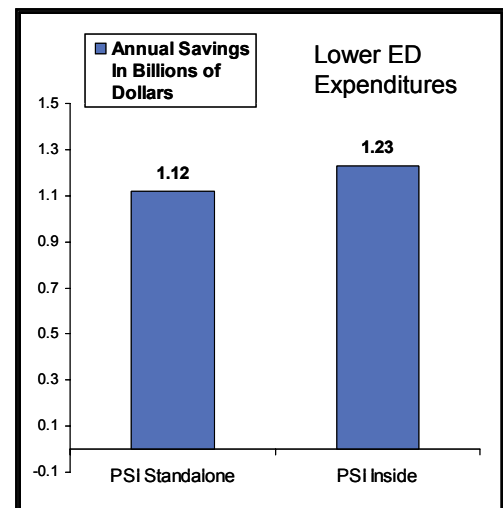
A government-funded research study investigated the impact of missing patient information on outpatient care (11). Conducted at four separate care facilities, physicians completed a quick survey attached to the patient's encounter form. On the survey the physician indicated if all necessary patient information was present at the time of the visit. If the response was NO, the physician indicated what was missing and the impact of not having this information. During this study 18 to 20 percent of all patients had missing data. Results from the study indicated that on average four percent of clinic patients seen needed repeat visits due to missing patient information, mostly lab and radiology results. Using these findings, we calculated that there is a potential of \$1.81 billion in annual savings. This is based on eliminating four percent of the 907 million total outpatient visits (12) at a per visit cost of \$50.



Since these are government facilities, they represent a fairly similar situation as the PSI model: a closed system of facilities with a single technology system. Therefore, we are estimating that PSI Standalone would address at least 60 percent since it displays all of the patient's lab and radiology results. PSI Inside would address 90 percent since it not only displays the information but can selectively display the relevant results to the physician for the specific care function. Annual savings for both PSI and PSI Inside is \$1.09 billion and \$1.25 billion, respectively.

Lower Emergency Department Expenditures

A Regenstrief study in two Emergency Departments (ED) showed an overall decrease of \$26/case when clinicians had access to prior clinical formation in at least 50 percent of the cases (13). In this study the prior information was provided in the form of a hard copy patient summary report which was attached to the patient's chart. With 108 million ED visits a year (14), the total potential savings nationwide is \$1.4 billion.



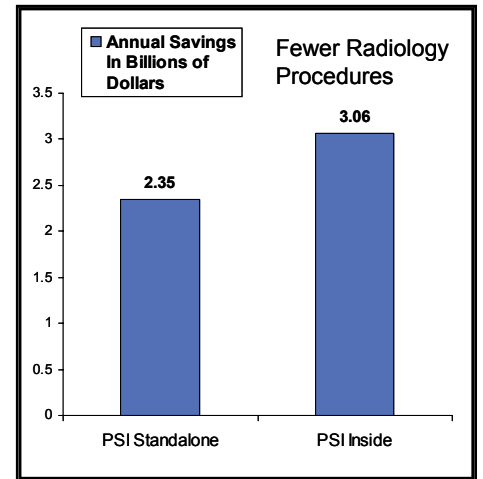
For the purposes of the PSI benefits analysis, we made the assumption that having all available labs, radiology, and medication information would decrease costs in a similar manner as described in the Regenstrief study at least 80 percent of the time with PSI Standalone and equivalent to PSI Inside. The savings, therefore, would be \$1.12 billion with PSI standalone and \$1.23 billion with PSI Inside.

Decrease in Diagnostic Tests

Numerous studies have shown that patient visits where the clinician has had access to prior diagnostic test results have led to a reduction in test ordering, especially when coupled with CPOE and clinical decision support checking (8) (15). The study done at Regenstrief in the General Internal Medicine clinics identified a 13 percent decrease in test ordering. The C!TL study estimates that nationwide savings range from \$97.2 million to \$4.7 billion in laboratory and \$417 million to \$10.4 billion in radiology, depending on the sophistication of the ordering and clinical decision support software used by the clinician. Finally, the Santa Barbara project preliminary results found a 20 percent duplication rate for labs and radiology tests (16).

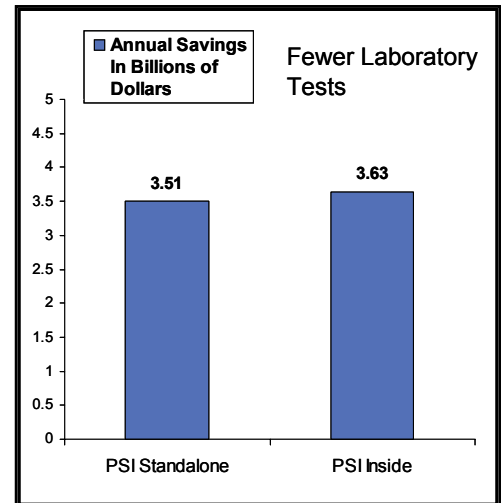
Radiology Savings

For this report, we used the C!TL report findings for Intermediate CPOE of \$4.7 billion and related them to the PSI solutions. We concluded that the PSI Standalone product that displays the prior results with no clinical decision support would address 50 percent of the savings. PSI Inside is the equivalent of the Intermediate CPOE solution and, therefore, would address 100 percent of the savings cited for this clinical application. Using the percentages for adoption of advanced clinical systems in outpatient settings described earlier, the PSI savings would be \$2.35 billion for PSI Standalone and \$3.06 billion for PSI Inside.



Laboratory Savings

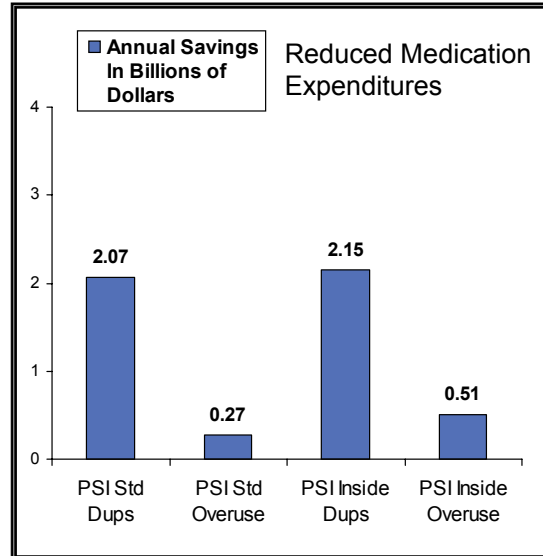
Using the results from the Regenstrief study as the basis for the PSI calculations, we estimated that PSI Standalone would address 90 percent of the reduction since all available test information can be easily displayed for clinician review. The addition of clinical decision support capabilities included with PSI Inside would make it directly comparable to the Regenstrief clinical application and, therefore, we assigned 100 percent of the savings. With national spending for laboratory tests approximately \$30 billion (9), the savings potential with PSI Standalone and PSI Inside is \$3.51 billion and \$3.63 billion, respectively.



Reduced Medication Expenses

The focus on medication usage for this report was solely on redundant orders and overuse. Other studies that analyze the savings when a medication order is changed from brand to generic or from off formulary to formulary were not included because the PSI solutions do not yet include detail patient health plan information but expects to in the future. One community-based study identified an 11 percent duplication in medication orders when community data was available. In this study 50 percent of these duplicates were filled (16).

Assuming 1.24 billion new prescriptions (9) and an average cost of \$38, the total potential savings is \$2.53 billion. To relate this savings to the PSI system, another community-based model, we assumed that 80 percent of the duplication or \$2.07 billion would be eliminated by using the display active medications function in PSI Standalone and 90 percent with PSI Inside (\$2.15 billion).



The second area is overuse of medications. While there are few published studies on this topic, the ones on the overuse of antibiotics show the potential for many other categories of medications including cholesterol-lowering agents (9). The C!TL study calculated an overuse of antibiotics by at least 35 million prescriptions using information from several studies done in the 1990's. If we assume that PSI Standalone would prevent 20 percent of this overuse and PSI Inside with clinical decision support checking would prevent 80 percent, the savings is substantial. Specifically, we calculated that PSI Standalone would save \$.27 billion and PSI Inside would save \$.51 billion.

PSI Demonstration Site Findings

The PSI Standalone application has been installed at three hospitals at Swedish Medical Center in Seattle, Washington (Ballard, First Hill and Providence campuses), since January 2003. It is used by ED and Family Practice starting with a pilot group of 120 physicians. Clinical data are extracted from the information system applications of all three hospitals' and available to all users. The data sources include laboratory results, radiology reports, consults, medications, allergies, and diagnoses.

Quantitative results are not currently available since the project is in its early stages. Specifically, the population of physicians using the system is still growing, and other Seattle hospitals and some reference labs are not yet integrated to make it a true community data sharing model. However, participating physicians have reviewed the comparable findings and agree that PSI has the potential to address the cost and patient care areas cited. At the demonstration sites, PSI in the ED setting provides the greatest value since it is the care setting with the largest crossover of patients.

Based on preliminary findings from using the PSI application at Swedish, the following areas for cost reduction and more effective care delivery have been identified: (17)

- Eliminates time waiting for faxed sections of medical records from other hospitals prior to starting treatment
- Decreases likelihood of an error or ADE with the availability of allergy and current medication data
- Reduces repeat tests that may have been done days or hours before in another care setting
- Alerts physicians to patients with special conditions (e.g., recently discharged CHF patients returning to the ED)
- Identifies redundant medication orders for frequently returning ED patients

Non-Direct Care Related Savings

There are several areas of potential savings that were identified, but at this time cannot be fully quantified.

The cost of measuring quality is one such area of savings for PSI data. The need to conduct chart audits in support of Hedis measures requires health plan nursing professionals to travel to physician offices and health delivery organizations. This work is time-consuming and costly for both health plans and practices. In addition, quality-related research studies involve numerous nursing hours to complete chart reviews and abstracts. For example, a recent quality study published in the New England Journal of Medicine staffed 20 nurses to complete chart abstracts for more than 6,700 patients (18).

Conservative cost estimates for chart review range from \$10/chart for simple measures, such as cholesterol checks, to \$20/chart for diabetes reviews. At this time, the LDL and A1C hemoglobin measures could be done using PSI data instead of chart audits, resulting in a savings of \$10 million to \$15 million across all health plans. Costs to complete chart reviews and abstracts for quality-related research studies can be several factors more expensive, depending on the complexity of the study. As other measures are added that require results and visit data and the scope of PSI data increases, the savings from PSI data could also grow substantially.

PSI data is certainly very valuable in support of disease management and population management programs. The availability of patient diagnoses, lab results, and medications is critical to care managers who monitor healthcare usage. Based on this information they are able to determine the best set of products and services and then place patients into appropriate disease management programs. An analysis of the quantifiable impact for health plans is currently ongoing but not valued for purposes of this white paper.

Finally, healthcare costs are only one component of the total cost of medical errors. In one study analyzing discharges from 28 hospitals in Colorado and Utah, Thomas et al estimated the total cost of 459 ADEs to be nearly \$662 million, of which healthcare costs totaled \$ 348 million. The remaining \$314 million accounted for lost income, lost household production, and disability costs (19). By providing the needed data to providers to help reduce ADEs, PSI also creates significant savings in the reduction of

directly related non-healthcare costs. These non-healthcare savings are likewise not quantified in this white paper.

Coupling PSI Data with a Knowledge System

Another important service PSI data can provide is as an aggregator of patient clinical data to a knowledge engine or clinical decision support knowledge system. Consider, for example, using PSI along with Active Health's CareEngine. Currently CareEngine takes data from health plan claims, commercial labs, and PBMs. Running this information through the CareEngine System, Active Health is able to identify potential care issues of both omission and commission and alert providers by phone, fax, or e-mail. Cost savings attributable to CareEngine range from one percent to three percent for commercial populations and two percent to four percent for Medicare and Medicaid populations. A study of 50,000 patients showed a benefit of \$6 pmpm (\$4-5 pmpm net savings) for patients in the program versus the control group (20).

PSI can add two benefits to this knowledge service: additional patient data and a faster, more effective way of communicating with participating clinicians. Since PSI extracts data from all care delivery sites, inpatient test results and medications can be incorporated into the knowledge system, providing a more complete picture of patient care, delivery testing, and medications. CareEngine alerts can then be sent to the caregiver via PSI, eliminating the need to phone or fax, and reducing the time for the physician to take action.

PSI Cost Model

Benefits are only one-half of the net savings equation. Costs for implementation and support of the PSI network must be included in any benefits analysis to accurately depict the impact of the system. The preliminary PSI national cost model, based on actual spending figures for the demonstration site implementation, is \$2.5 billion for one-time costs and \$.5 billion annually for ongoing maintenance and support. These figures include conversion of three years of historical data.

The Bottom Line

Once installed, PSI, like the Internet, provides the secure data highway, standardized data communications, and Web-enabled end user interface that others can tap into to provide a wide range of services with considerable savings. Using PSI in support of bio-terrorist networking or as a comprehensive source of data for knowledge engines are just a few examples of its future capabilities. Health plan experts suggest that the availability of diagnosis, result, and medication information offered by PSI has an equally high value to health plan's disease management and population management programs. Although none of these savings have been quantified, their value exists and is significant.

Even with conservative estimates on the limited number of measures that are available for comparison, PSI on a scalable national model has the potential of a 20-to-1 return on investment. Currently, quantifiable areas of highest return as published in leading

journals and industry reports relate to avoiding inpatient admissions, reducing diagnostic testing expenses, and better management of patient medications. The demonstration site participants concur with the areas of potential benefit and have already identified new avenues where the data provided by PSI can prevent re-admissions and shorten treatment wait times.

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