AN ABSTRACT OF THE DISSERTATION OF

Seth E. Wolpin for the degree of Doctor of Philosophy in Public Health presented on November 7th, 2003.
Title: An Exploratory Study of an Intranet Dashboard in a Multi-State Healthcare System.

Abstract Redacted for privacy

Leonard H. Friedman

Introduction: Management of complex systems is facilitated through effective information systems that provide real-time data to decision makers. For example, instrument panels in airplanes ensure that pilots have well-designed feedback concerning the status of mission-critical variables. **Problem:** While pilots have dashboards for feedback and communication, healthcare executives may be unaware of effective use of evidence-based guidelines within their healthcare system. **Purpose:** The first objective of this research was to design and implement an automated intranet dashboard reporting performance measures for a geographically dispersed health system. The second objective was to describe how this dashboard might increase cooperation and coordination for individuals and organizations involved with healthcare delivery. **Design:** This research was exploratory in nature, employing descriptive research approaches. A convenience sample of healthcare executives completed a baseline survey at the start of the study assessing levels of communication and cooperation. After three months of exposure to the dashboard, participants were asked to complete a follow-up survey. All visits to the dashboard were recorded in a web server log file. Semistructured qualitative exit interviews were also conducted to explore reactions to the dashboard, experiences with receiving outcome reports, and barriers to communicating and coordinating with counterparts. **Results:** Descriptive analysis of paired survey scores found substantial increases on a number of survey items, suggesting that the dashboard contributes toward increased communication and coordination for healthcare executives. This finding is balanced by the limited rigor in the research design and an analysis of the web server log file, which found few visitations to the dashboard by research participants. Qualitative data analysis suggests that current reporting mechanisms are suboptimal for healthcare executives and that one solution is the use of dashboards. **Conclusion:** This study resulted in a number of important discoveries and avenues for further research. A more rigorous research design is needed to explore the role of intranet dashboards in healthcare settings.

An Exploratory Study Of An Intranet Dashboard In A Multi-State Healthcare
System

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Introduction

Preface

Management of complex systems is facilitated through effective information systems that provide real-time data to decision makers. For example, instrument panels in airplanes ensure that pilots have well-designed feedback concerning the status of mission-critical variables. Embedded within these instruments are tools for coordination and communication with other aircraft, ground control, and internal stakeholders.

Managing healthcare may be compared to flying an airplane (Berwick & Leape, 1999). Both are human endeavors involving enormous complexity, environmental uncertainty, and risk. Comparisons between managing an aircraft and managing healthcare are particularly telling when one considers the quality of medical practice. In 2000 the Institute of Medicine released *To Err Is Human: Building a Safer Health System,* a report that galvanized the public around medical errors (Millenson, 2003). The report cited previous studies that estimated the annual death toll from hospital medical error could be as high as 98,000 people in the United States alone. This is the equivalent of 235 fully loaded 747-400 airplanes being lost each year by accidents.

To improve patient outcomes, healthcare organizations are working to adopt and implement evidence-based guidelines into the care continuum. In many

cases, implementation of these guidelines is far from complete. McGlynn et al. (2003) surveyed over 7,000 participants in 12 metropolitan areas in the United States. The researchers received written consent to review medical records and found that on average the participants received only half the recommended care processes. For Community Acquired Pneumonia only 39% (95% CI = 32.1-45.8%) of the recommended care was delivered. Other researchers have noted that while guidelines currently exist for many conditions, there is still widespread practice variation (Gallagher, 2002; Gleason et al. 1999; Kilbridge, 2002).

Additional pressures are increasing calls for healthcare organizations to report internal quality measures to stakeholders. Both regulatory agencies and health consumers want to ensure that the best possible care is being provided (Marshall et al., 2002). The Institute of Medicine Report *Crossing the Quality Chasm* (2001) maintains that organizational performance metrics should be available to patients in their decision-making process. One function of these measures is to provide information to consumers and employers about healthcare (Austin & Boxerman, 1998, p. 334). To this end, various states have mandated reporting requirements. Barr et al. (2002) report the Rhode Island legislature has mandated public reporting of outcome information related to nursing homes and home health. However, support for public reporting at the national level has been limited, provided mainly through the National Committee on Quality Accreditation (NCQA), Health Plan Employer Data and Information Set (HEDIS), and the Joint Commission on Accreditation of Healthcare Organizations (JCAHO). Internationally, some countries have established mandatory reporting

requirements. For example, healthcare systems in the Netherlands are legally required to report quality results and to carry out quality improvement practices based on these results (van der Bij & Broekhuis, 2000).

Problem Statement

While pilots have dashboards for feedback and communication, healthcare executives may unaware of effective use of evidence-based guidelines within their healthcare system. Information systems in healthcare have typically focused on decision support and documentation at the point-of-care where the provider interacts with the patient (Austin & Boxerman, 1998, p. 335). These systems are not designed to support the population-based feedback that healthcare executives need. For effective management, executives need to know where operational deficits are occurring so that corrective action may be taken. For example, one evidence-based practice is to assess the oxygenation status of newly admitted patients with pneumonia (American Thoracic Society, 2001). The provider needs to know this oxygenation level so that a decision can be made whether to provide supplemental oxygen. From a management perspective, executives need to know how often providers are assessing oxygenation status within the organization. If only 65% of patients are being assessed for oxygenation status, resources need to be allocated to correct substandard processes. If one hospital in a geographically dispersed system is assessing 100% of patients for oxygenation status, executives may want to identify this success so that it may be shared with other hospitals in the system that are not performing as well.

Calculating performance measures has traditionally required resource-intensive chart reviews or observational studies. However, the digitization of healthcare information presents the possibility for creating automated measurement systems. In their search for performance measurement, health organizations have followed other industries in creating data warehouses. Bringing organizational data into a single data warehouse, where queries can be run and analytical reports generated, is a primary reason for building a data warehouse (Hagland, 1998;Hoyo-Barbollo & Lees, 2002). While data warehouses represent the potential for more efficient performance measurement across the entire organization, the problem with this solution is that data warehouses do not address how to extract performance measures and how to deliver them to stakeholders. Organizations may have considerable difficulty tapping data warehouses and delivering measures to the stakeholders most in need of information. Figure 1.1 reflects these deficits by presenting traditional reporting processes at HealthFirst[1], a medium-sized health system where this research took place.

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[1] HealthFirst is a pseudonym used to protect the confidentiality of the organization and participants where this research took place.
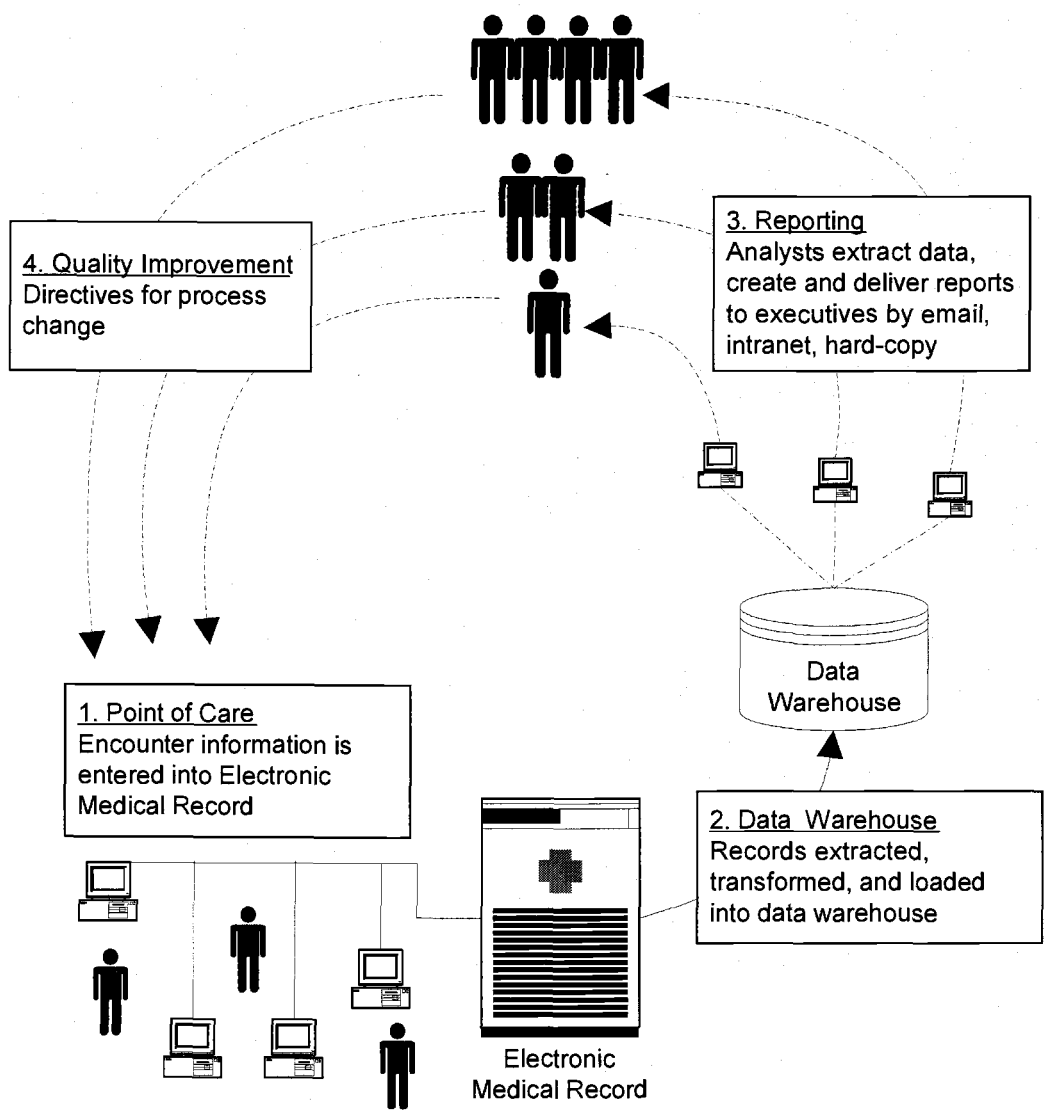
Figure 1.1 Traditional performance measurement reporting at HealthFirst

Inefficiencies exist in the third step of this figure where three computers represent data analysts working in various hospitals. These analysts are tasked with extracting and aggregating performance measurements for delivery to healthcare executives. This process is resource intensive as analysts work with query tools to extract relevant data from the data warehouse. Retrieved data is

then formatted using report writing tools. This results in a variety of information

designs ranging from tabular lists to graphical line charts. Reports are then

delivered to healthcare executives using diverse delivery mechanisms such as E-

mail attachments, "posting" on a specific intranet site, or hard copies. Three

problems are evident in this approach to reporting performance measurements:

1. **Difficulty tapping the warehouse:** Analysts may not utilize information management tools that can automate their reports. Many reports are needed on a reoccurring basis. This results in repetitive work, decreased employee satisfaction, and a lack of resources available to address new reporting needs.
2. **Lack of information design and interactivity with reports:** Executives may not able to quickly find the information they need. They may not have the time, or skill, needed to "dig out" needed information from numerous reports created in a variety of formats. Moreover, reports are typically static - providing little or no ability for the executive to manipulate the information to answer new questions. For example, if the report presents measures stratified by calendar quarter and the executive wants to see the measures stratified by month, a new report request must be submitted.
3. **Failure in linking stakeholders and tools for implementation:** Executives may read these reports in isolation with little awareness that a similar process is occurring in another hospital within the same system. Reports may also fail to link the executive with other resources that make the information actionable such as guidelines for implementation.

The Solution

One solution may be an automated intranet dashboard, presenting measures

in a graphical display alongside tools for learning and collaboration. Consider

Figure 1.2, which represents how an intranet dashboard may supplement the

reporting of performance measurements.

3b. Reporting
Analysts extract Reports and delivery to executives by email, intranet, hard-copy.

4. Quality Improvement
Directives for process change

3a. Intranet Dashboard
Automatically updated, familiar design, tools for implementation and collaboration.

Data Warehouse

1. Point of Care
Encounter information is entered into Electronic Medical Record

2. Data Warehouse
Records Extracted, Transformed, and Loaded into data warehouse

Electronic Medical Record

Figure 1.2 Traditional reporting supplemented by an intranet dashboard

Data warehouses and organizational intranets are two information management technologies that can work together to automatically display data residing in a data warehouse. Queries embedded within an intranet page can extract data from a data warehouse and return individual or aggregated values for display on the web page. As the underlying data warehouse is refreshed, the intranet page automatically displays updated performance measurements. This approach decreases the need for an analyst to extract, format, and deliver

performance measures. The result is a savings in resources and an improvement in the timeliness and usability of reports. Analysts are still visible in this process as ad-hoc and customized reports will still be needed. In this sense the intranet dashboard is simply another tool, or synergy of tools, that an analyst may employ to help meet the information needs for healthcare executives.

Principles of information design and web usability can be applied to these intranet pages so that performance measures are displayed in an understandable and usable format. Johnson and Frack (2001, p. 42) found that the dashboard format resulted in increased satisfaction for senior management and board directors at one health system. The dashboard allowed managers and directors to see the status of the organization, "similar to the way a pilot scans cockpit instruments for altitude, heading, speed, location, and alerts for failure of mission critical systems." This graphic representation provides at-a-glance assessment of organizational performance measurements, decreasing the need for executives to "dig out" relevant measures from dense, or poorly designed, information displays.

Should deeper exploration of these high-level measures be desired, the executive could use hyperlinks to alter the query that is executed against the data warehouse. In this sense the information display may be more usable. For example, if the dashboard presents system-wide measures and the executive wants to see a particular hospital, the selection of a hyperlink bearing the hospital name can retrieve a new set of values that updates the dashboard display. Similarly, if the default display of the dashboard presents measurements for the latest calendar quarter and the executive wants to see a previous quarter, or the measurements

stratified by month, hyperlinks can be selected to tailor the display. This alleviates the need for the executive to request, and wait for, a new report from an analyst. While these steps may parallel "digging" information out of a paper report, the desired view can be saved in the form of a bookmark so that the same steps do not have to be repeated on subsequent visits. For executives who desire more than high-level dashboard displays of measurements, automated reporting tools can be leveraged to supplement the dashboard. These tools can be used to post reports to the dashboard depicting data in a variety of formats such as histograms, line charts, data tables, and statistical process control charts.

An intranet dashboard can also facilitate access to performance measurements. McGlynn et al. (2003) note that a key component for any solution in improving care practices is the routine availability of performance information. By accessing measures in one location on the organization intranet, executives do not have to struggle with finding reports that may be buried in E-mail folders or desk drawers.

Dashboards can do more than provide information on performance measures. They can also be used to connect people both within and between organizations. McGovern (2002, p. 32) describes the intranet as "vital glue," reinforcing corporate values, communication, and objectives in organizations that are physically dispersed. If the dashboard displays performance measures for multiple facilities in a healthcare system, counterparts can identify successes and failures within the organization and share their knowledge. In this manner, quality improvement efforts can become more coordinated across geographically

dispersed healthcare systems. In discussing the development of integrated delivery systems, Friedman and Mullins (1995) note that these type of relationships need to be identified and exploited. An intranet dashboard may include tools for communication similar to the way pilots have tools for communication embedded within their instrument panels. Threaded discussion boards can be used to share knowledge and to create relationships. An executive may notice that a peer hospital in the system is doing much better on a particular performance measure. With this awareness, a line of communication can be created on the discussion board, seeking clarification on how success is being achieved in the other hospital.

In addition to linking executives with counterparts via threaded discussion boards, resources can be integrated into the dashboard to make the information actionable. Evidence-based guidelines for adoption may be provided for download and implementation. Links to professional organizations and literature sources that detail successes may also be provided in an effort to place context and tools for action around the measures.

Purpose

The first objective of this research is to design and implement an automated intranet dashboard that reports performance measures for a geographically dispersed health system. The second objective is to describe how this dashboard might increase coordination and cooperation for individuals and organizations involved with healthcare delivery. Achieving these objectives will

provide a basis for understanding how to design and implement future dashboards, the value of dashboards in healthcare settings, and avenues for further research.

Significance

The significance of this study is to explore an approach to performance measurement that may help geographically dispersed healthcare executives in the implementation of evidence-based medicine. This intervention may ultimately result in decreased morbidity and mortality in the patient population. Furthermore, this dashboard model could generalize to all functional levels of the organization by providing decision support for clinicians, managers, and healthcare consumers. It could be used to display broader measures than adherence to particular guidelines, supporting balanced scorecard efforts that report performance across a broad spectrum of measures.

The intranet dashboard developed in this research is also significant with respect to adoption by other health systems. This dashboard model does not require sophisticated programming skills to implement or modify. If an organization lacks a data warehouse but already has performance measures available from manual chart reviews or observational studies, the dashboard may still be used to display these measures, link stakeholders, and provide tools for process improvements.

Although dashboards and automated performance-measurement feedback systems have been tried in health settings, there is a lack of information about graphical dashboard models that can be automatically updated and implemented

with minimal investment (Gordon, 1998; Johnson & Frack, 2001; Oliveira, 2001). This research will produce a low cost, adaptable, model that can be implemented with non-proprietary tools.

Last, there is an ethical basis for developing effective systems for reporting quality measurements from a data warehouse. If data are available that tells of dysfunctional processes causing harm, failure to examine this data may be tantamount to turning a blind eye. For example, a provider who is aware that a contraindicated treatment is documented in a patient chart would be remiss not to open the chart and correct the ongoing error. Similarly, an organization should leverage data warehouses to identify and address performance deficits that may be resulting in patient harm. Automated reporting mechanisms that display aggregate performance measures can also help preserve confidentiality, as there is less human review of identifiable medical records by analysts.

Research Questions

Because so little is known about the use of dashboards in geographically dispersed health systems, this research seeks to descriptively examine five broad questions:

1. What trends may be evident related to coordination and cooperation after introduction of the dashboard?
2. Will executives actually use the intranet dashboard?
3. What perceptions will executives have related to the design and usability of the dashboard?
4. What barriers will executives report with respect to coordinating and cooperating with counterparts within the healthcare system?
5. What perceptions will executives report with respect to receiving outcome reports?

Research Parameters

This study has certain assumptions, limitations, and delimitations. It is assumed that participants will have the computer skills necessary to use the organization intranet and will understand descriptive statistical measures formatted as graphical dials. It is also assumed that participants will answer honestly on survey instruments and in exit interviews.

There are several limitations inherent in this study such as a limited sample size, lack of a control group, and measurement limitations. Organizational constraints limited the number of participants available for recruitment and required that all healthcare executives have access to the dashboard. Confidentiality constraints also prevented reporting the values for the performance measures that were displayed on the dashboard in this research. These limitations contributed to the decision to conduct a descriptive, hypothesis-forming study.

This study is delimited in several ways, including the scope of the measures reported on the dashboard, a small sample of high-level executives, and the organizational setting. The scope of dashboard measures was restricted by the organization to inpatient measures of Community Acquired Pneumonia. These measures are reported to the Joint Commission for Accreditation of Healthcare Organizations (JCAHO, 2002) for accreditation purposes. The detail at which the measurements could be reported was also constrained; measures were reported with respect to system-wide performance and individual hospital performance. Using the dashboard to report performance for intrahospital units and providers

was not allowed by the organization. The organization also limited who could

access the dashboard. Access was restricted to high-level executives in the

organization such as regional CEOs and Quality Improvement Directors. This

study is also delimited by the research setting, which may not be representative of

other health systems. HealthFirst has a robust information infrastructure with an

electronic medical record, a data warehouse, and a widely used organization

intranet.

Definition of Terms

This research uses a number of terms that may not be familiar to the lay

reader. These terms have been defined below:

- **Community Acquired Pneumonia:** Pneumonia that is acquired outside of the hospital setting.
- **Data warehouse:** A collection of data that is extracted from various operational information systems and stored in one location for retrospective analysis.
- **Query tools:** Software designed to help a user connect to a data source and retrieve specific data. This data may be retrieved in a detailed fashion with every record visible, or the data may be aggregated into summary values.
- **Organizational intranet:** Analogous to the Internet with the notable exception of residing within the organization.
- **Performance measures:** These report how well an organization is doing. Measures may be classified as "process measures," that summarize how often a particular process is occurring. Following these processes generally leads to improved outcomes. The dashboard in this research reports six process measures specific to the care of patients with Community Acquired Pneumonia. While some measures may be created and defined within an organization, the dashboard in this research primarily reports measures defined by the Joint Commission for Accreditation of Healthcare Organizations (JCAHO, 2002). High-level definitions and rationales for these measures were adapted from JCAHO materials:
    1. **Oxygenation assessment**: What percent of patients were assessed for oxygenation on admission? The rationale for this process is that

assessment will lead to supplemental oxygen being provided if necessary.

2. **Blood culture:** What percent of patients were provided blood cultures prior to administration of antibiotics? The rationale for this process is that a blood culture may help the provider select a more appropriate antibiotic.

3. **Screening for pneumococcal vaccination**: What percent of patients over 65 were screened for pneumococcal vaccination? The rational for this is that the vaccination may reduce future morbidity and mortality.

4. **Smoking cessation counseling (pediatric/adult):** What percent of patients, or caregivers of pediatric patients, who smoke were counseled about smoking cessation? The rationale for this process is that the hospital setting is seen as an ideal opportunity for counseling and evidence that counseling by a physician may lead to cessation.

5. **Time to antibiotics:** On average, how many minutes does it take from arrival to first administration of antibiotics? The rationale for this process is that prompt administration of antibiotics may lead to better outcomes.

The intranet dashboard used in this research also reported non-JCAHO measures such as the average length of stay for patients, fatality rate, readmission rate, and the average account total charge and payment for a hospitalization. Since these measures are largely impacted by what processes are carried out in patient care they may be referred to as "outcome" measures.

Report-writing tools: Software designed to help format data retrieved via a query. These tools often look like a word-processing package and may contain integrated query tools.

Threaded discussion board: A web page that allows users to post messages. These messages may be questions to other users, reflections, or replies to existing messages. Replies are frequently indented below the original message and are considered a discussion "thread."

Literature Review

Glanz, Lewis, and Rimer (1997, p. 21) define theory as a "set of interrelated concepts, definitions and propositions that presents a systematic view of events or situations that specify relations among variables in order to explain or predict the events of the situations. " The literature will be reviewed in order to provide a framework for understanding how intranet dashboards may support evidence-based medicine. The principal themes that will be addressed are the role of dashboards in organizational learning, how dashboards function with respect to diffusion of innovation and evidence-based medicine, mechanisms in which data warehouses and the organizational intranet can support information sharing, and limitations that may be encountered with intranet dashboards.

Organizational Learning

Building on earlier work by Argyris and Schön (1978), Peter Senge popularized the term "learning organization" in his book *The Fifth Discipline* (1990). Senge maintains that as business becomes more interconnected and complex, learning must occur at all levels of the organization, not merely at the top (p. 4). According to Senge there are five component technologies necessary for creating a learning organization: systems thinking, personal mastery, mental models, shared vision, and team learning.

Systems Thinking

Systems thinking allows for an understanding of how components in a complex system interact with one another to achieve a whole greater than any part. Using this approach provides a macro-perspective and a logical framework for exploring how the components work together in healthcare delivery (Shi & Singh, 1998, p. 24). A systems perspective looks at the entirety of an organization rather than using reductionalistic approaches that consider components to be unrelated forces or having only linear cause-effect relationships. This perspective is particularly fitting for health care organizations where failures may be related to components that do not realize how their actions impact the organization as a whole.

In healthcare these components may range in scale from nursing float teams to quality-improvement directors at geographically separated facilities working within the same system. Lukas et al. (2002) sketch the conceptual model of integrating these components in healthcare as beginning with managers creating structures that allow coordinated processes to be carried out across the system for identified care lines. A similar sentiment, albeit more patient-centered, may be found in an interview conducted by Paul Manus (1995) in which Stephen Shortell remarked:

> Integrated healthcare delivery systems comprise various components that work together in an integrated fashion to provide a continuum of health care to a defined patient population...care coordinated so that patients are not asked the same questions over and over. (p. 24)

Intranet dashboards may provide a system-wide view reflecting the interaction of various components. The same dashboard may also provide for mechanisms that increase the coordination of these components. For example, Rozich and Resar (2002) explored how patient flow can result in "logjams" and "bottlenecks" with resulting delays in treatment, staff attrition, and waste. The researchers developed an intranet dashboard with traffic lights for each hospital unit. The development of this dashboard began with identification of factors that affect care capacities such as staffing, present census, and anticipated turnovers. Working with stakeholders, the researchers then weighted each of these factors and created composite scores. These scores were represented as a color on a traffic light for each nursing unit. As color progressed from yellow or orange, nurses were able to independently stop new admissions to their unit. Results found improved patient flow and increased staff satisfaction.

Consider a manager accessing a dashboard that displays adherence to evidence-based guidelines related to the care of Community Acquired Pneumonia. The hypothetical dashboard initially displays specific process measures for the entire organization. By "drilling" through the top-level display, regional managers can see how their hospital or unit is performing and how this contributes to the overall performance of the organization. Each indicator on the dashboard represents a care process that is associated with improved outcomes, together these processes represent a multivariate model that may result in better outcomes than any one process can bring about by itself. In this sense the dashboard does not represent simple linear cause-and-effect relationships, but the interaction of care

processes in various parts of the organization that together contribute toward the best possible outcomes.

In many cases these processes occur not in one central place, but in various parts of the organization. For example, a patient may be assessed for oxygenation status in the emergency room, counseled for smoking cessation after admission to a hospital floor, and given a pneumococcal vaccination by discharge staff. If staff in each of these work areas can access a central dashboard, they can see how their individual actions contribute to the larger picture. The concurrent use of threaded discussion boards, available within the dashboard, may facilitate communication and relationships between staff in disparate work areas. For healthcare systems that are geographically dispersed and have multiple facilities these benefits may be exponential.

Personal Mastery

Senge (1990, pp. 142-143) uses the term "personal mastery" not in the sense of domination but in the same vein that an artist may excel in their work. Personal mastery necessitates a continual clarification, or *vision*, of what is important as well as an accurate sense of reality. Senge notes that conflict between the vision one holds and the current reality leads to "creative tension"; he goes on to say that the "essence of personal mastery is learning how to generate and sustain creative tension in our lives." Why would an organization care about personal mastery? In many respects personal mastery relates to personal growth.

Organizations that nurture growth gain employees with more commitment, initiative, and responsibility.

How can a dashboard support the discipline of personal mastery? In its most obvious implementation an evidence-based medicine dashboard does not appear closely aligned with the discipline of personal mastery. While a gauge may portray the current reality with one needle and a vision of where that needle should optimally be, the most common use of a dashboard may be more aligned with an organization than with an individual. Nonetheless, by extending the functionality of a dashboard it may be employed by an individual in pursuit of personal mastery. For example, dashboards could present customized views that are specific to the employee with gauges reflecting the performance of not the system, facility, or unit, but of the employee. A gauge such as this could provide a visual representation of the gap between the current reality and the vision of what is desired. Senge (1990, p. 150) sees this gap as the source of creative energy, or tension, for an individual. The challenge with this application is that personal visions are not always quantifiable. Another application in support of personal mastery may be through threaded discussion boards that are integrated into the dashboard. Within this communication framework, employees could theoretically exchange thoughts on their visions and in this manner engender the visions of others.

Mental Models

Mental models are images, assumptions, and stories that we use to help make sense and explain the world around us (Senge, 1990, p. 175). People may become quite fixed in these models and resist challenges to their validity. For example, a manager may believe that it is inappropriate for smoking cessation counseling to occur early in the patient stay. A mental model held by this manager may categorize this process as part of patient education and bundle it with discharge planning. A subordinate employee who sees an innovative approach for offering smoking cessation counseling early in a patient stay may encounter resistance when proposing this to their manager.

Intranet dashboards may challenge mental models as performance measures are displayed in a graphical manner that is difficult to ignore. Managers who previously believed that evidence-based care processes were being judiciously followed might find their mental models challenged as suboptimal measures are clearly displayed in a dashboard format. O'Sullivan (1999) maintains that learning does not occur from benchmarking and the examination of other implementations in other organizations but through internal trial and error followed by reflection. However, a dashboard can provide a place for written reflection in the form of threaded discussion boards. Reflections that are added to a discussion board can persist throughout time and provide a record of trials, errors, and thoughts for the enlightenment of others within the organization.

Shared Vision

A learning organization has a vision that is shared throughout the organization. Senge (1990, p. 206) states, "shared vision is vital for the learning organization because it provides the focus and energy for learning." This vision emerges from personal visions and represents a plan that everyone, not merely top management, can agree on and work together to achieve. Senge (1998) sees the vision as being synonymous with intended results. He points out that many look for a larger purpose, a passion, in their work. However, the common view is not that we are intrinsically motivated but that we go to work for a paycheck. Senge (1998, p. 21) advocates that results be passion oriented such as "contributing to a better world" but acknowledges that this type of exhortation will lead to cynicism in organizations that have consistently thwarted innovation. A dashboard can support innovation by providing an open forum for questioning processes and exchanging ideas. Furthermore, by virtue of embedded data displays a dashboard can actually demonstrate progress toward a vision rather than leaving the vision as an abstract message on company letterhead.

One important concept to convey is that, in theory, dashboards could feed into larger dashboards. For example, one dashboard may represent performance on key processes that lead to better outcomes for patients having a particular disease or injury. A Community Acquired Pneumonia dashboard may display six indicators that reflect evidence-based care processes. A seventh indicator may actually be a composite of the six, reporting how often all of the processes are followed. This value could feed into composite measures for other disease states,

with the final value being reported on a top-level dashboard indicating whether "the best patient care" is truly being provided.

Team Learning

Teams that are aligned in personal visions may rise to new levels of performance (Senge, 1990, p. 234). Bohmer and Edmonson (2001, p. 34) point out that healthcare is typically provided by more than one individual and rests on a knowledge base that is larger than what any single individual can tap. Noting that "Individuals learn naturally, but teams and organizations do not," the authors describe common mental models of learning in healthcare as linear, individual, and monotypic. They illustrate each of these points through traditional processes such as continuing medical education, which focuses on one-way (linear) transfer of information that is commonly related to best practice and guidelines. In this example, learning is focused on the individual and can be characterized as single-loop learning or "monotypic." The authors advocate an alternative model where learning is cyclical by being subjected to reinterpretation. They note that knowledge is gained through dynamic processes such as reflection of observed outcomes, which leads to reinterpretation and refinement of the knowledge base. This dualistic approach is analogous to the double-loop learning proposed by Argyris and Schon (1974). O'Sullivan (1999) sees learning as requiring continual revision based on the most current information from the environment facilitated by both horizontal and vertical communication. These requirements for organizational learning may be supported by an intranet dashboard in that a dashboard provides

information about the environment as well as methods of communication that transcend traditional hierarchal structures.

The use of an intranet dashboard can facilitate team learning. McGovern (2002, p.32) described the intranet as "vital glue" that reinforces corporate values, communication, and objectives in organizations that are physically dispersed. With this in mind, a dashboard does not need to be limited to displaying performance measures. A robust dashboard would also include tools for learning and implementation. Furthermore, communication tools such as threaded discussion boards can serve to link team members within, and between, organizational facilities. These tools ensure that learning is dualistic in nature by allowing for reflection and open questioning of underlying processes.

Diffusion of Innovation as a Component of Learning

Innovations in healthcare are not new. Goes, Friedman, Buffa & Seifert (2000) characterize healthcare as a roller coaster of change over the last 20 years. An intranet dashboard represents a technological innovation with many advantages over traditional manual reporting processes. In these respects, an intranet dashboard has the potential to be adopted by managers throughout the organization as a tool for organizational learning that provides decision support, collaboration with counterparts, and a medium for disseminating guidelines throughout the system.

However, simply implementing a dashboard does not guarantee that the intended audience will utilize the innovation. In his book *The Diffusion of*

Innovations, Everett Rogers (1995, p. 5) defines diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system." Application of this definition leads us to ask how the innovation of an intranet dashboard will be communicated throughout a healthcare system. Moreover, a secondary layer of innovation exists within the dashboard in the form of evidence-based guidelines. The hope is that the graphical representation of evidence-based processes will trigger learning and implementation of guidelines. In this sense the medium is the message, with the dashboard representing a multifaceted diffusion process. The first facet in the process is the dashboard and the second facet the diffusion of the message.

With two elements requiring diffusion it is important to consider what factors impact the speed of diffusion. Rogers (1995) maintains that the speed of adoption for an innovation is largely dependent on five perceived attributes of an innovation: relative advantage, compatibility, complexity, trialibility, and observability. Other factors that contribute to the speed of adoption are the type of innovation decision, the communication channels, the nature of the social system, and the extent of change agents' promotion efforts (pp. 206-208).

Relative Advantage

How does an intranet dashboard represent an improvement over traditional reporting of performance measurements and dissemination of guidelines? From the perspective of the healthcare executive, a number of advantages are readily

apparent: improved data representation, interactivity, accessibility, communication with counterparts, and availability of guidelines for adoption.

Traditional reporting formats often involve reports that contain large amounts of data that are represented in numerical displays or buried in text. Graphical representations, such as histograms and line charts may not be provided. This necessitates that report recipients take the time to "dig out" relevant facts. With reports received in a variety of formats, executives may not be able to glean crucial information that is needed for effective decision-making. Johnson and Frack (2001) found that the dashboard format resulted in increased satisfaction for senior management and board directors at one health system. The dashboard allowed managers and directors to see the status of the organization; "similar to the way a pilot scans cockpit instruments for altitude, heading, speed, location, and alerts for failure of mission critical systems" (p. 42). This graphic representation provides at-a-glance assessment of organizational performance measurements, decreasing the need for executives to "dig out" relevant measures from dense, or poorly designed, information displays.

An intranet dashboard also allows for interactivity of performance measures. Traditional reports are static; they do not allow the recipient to filter or manipulate the information display. However, with an intranet dashboard, the executive can use hyperlinks to alter the query that is executed against the data warehouse. In this sense the information display is more usable. For example, if the dashboard presents system-wide measures and the executive wants to see a particular hospital, the selection of a hyperlink, bearing the hospital name, can

retrieve a new set of values that updates the dashboard display. Similarly, if the default display of the dashboard presents measurements for the latest calendar quarter and the executive wants to see a previous quarter instead, hyperlinks can be selected to tailor the display. While these steps may parallel "digging" information out of a paper report, the desired view can be saved in the form of a bookmark so that the same steps do not have to be repeated on subsequent visits. For executives who desire detailed data displays, automated reporting tools can be leveraged to supplement the dashboard. These tools can be used to post reports to the dashboard depicting data in a variety of formats such as histograms, line charts, and statistical process control charts.

An intranet dashboard also facilitates access to performance measurements. McGlynn et. al (2003) note that a key component for any solution in improving care practices is the routine availability of performance information. By accessing measures in one location on the organization, intranet executives do not have to struggle with finding reports that may be buried in E-mail folders or desk drawers. Traditional reporting processes, regardless of whether a data warehouse is available, require many manual steps in the extraction, aggregation, and delivery of performance measures. An intranet dashboard programmatically linked to a data source can automate the delivery of performance measures. This results in improved timeliness of performance measurements as dependency on human processes for report creation and delivery is removed. Moreover, a dashboard could conceivably allow the user to display any measure they see fit, limited only by the availability of fields and values in the data warehouse. For example, a

generic dashboard might allow an executive to configure gauges that display specific treatment codes and related outcomes, providing that these codes exist within the warehouse. The ramifications of this are that the dashboard becomes, in effect, a high-level query and data-display tool for an executive – providing feedback for previously unreported performance measures.

Dashboards can do more than provide information on performance measures. They can also be used to connect people both within and between organizations. If the dashboard displays performance measures for multiple facilities in a healthcare system, counterparts can identify successes and failures within the organization and share their knowledge. In this manner, quality improvement efforts can become more coordinated across geographically dispersed healthcare systems. In discussing the development of integrated delivery systems, Friedman and Mullins (1995) emphasize that these types of relationships need to be identified and exploited. An intranet dashboard may include tools for communication similar to the way pilots have tools for communication embedded within their instrument panels. Threaded discussion boards can be used to share knowledge and to create relationships. An executive may notice that a peer hospital in the system is doing much better on a particular performance measure. With this awareness a line of communication can be created on the discussion board seeking clarification on how success is being achieved in the other hospital. In addition to linking executives with counterparts via threaded discussion boards, resources can be integrated into the dashboard to make the information actionable. Evidence-based guidelines for adoption may be provided for download and

implementation. Links to professional organizations and literature sources that detail successes may also be provided in an effort to place context and tools for action around the measures.

Rogers (1995, p. 217) notes that preventive innovations suffer from a slow rate of adoption in that the outcome is not readily apparent. An evidence-based medicine dashboard should provide feedback regarding the current reality of adherence to performance measures and support the diffusion and implementation of guidelines to prevent unwanted outcomes. In this sense the dashboard is a preventive innovation; however, if measures are appropriately selected with casually related process and outcome measures, the desired effect is obvious and ideally reinforcing for continued process change.

In addition to displaying performance measures, an intranet dashboard may provide resources for download and implementation. These tools, predominately guidelines and associated order-sets, represent a second facet of diffusion. For example, links could be provided to relevant guidelines from professional organizations. These guidelines represent a relative advantage to providers, as they are evidence-based processes that ensure the best possible outcomes. Without guidelines the provider may have to rely on possibly outdated information learned in medical school, from peers, or by instinct. In addition to providing guidelines, organizational order-sets could also be provided for download. Rather than requiring providers to read through detailed guidelines and write out individual orders for each evidence-based process, order-sets can bundle all relevant evidence-based processes into something akin to a checklist.

Compatibility

If an innovation is not compatible with respect to sociocultural values and beliefs, previously introduced ideas, and client needs for innovation, it may not be adopted (Rogers, 1995, p. 224) Within these three areas the intranet dashboard may be most compatible in meeting the information needs of the healthcare executive. After all, the primary purpose of the dashboard is to provide an improved information delivery system so that executives and managers know when and where to implement evidence-based medicine initiatives. Similarly, the availability of order sets that are diffused from the dashboard, can help meet the information needs of the provider by reducing the number orders that need to be written.

The issue of sociocultural values is more difficult to discern. This is particularly true if the healthcare executive has no clinical background and yet is keeping tabs on clinicians' adherence to evidence-based guidelines via the dashboard. In enlightened organizations this may be a nonissue; however, providers in more conservative organizations may see this as an example of big brother. In addition, the role of threaded discussion boards, particularly the use of anonymous postings, may clash with existing sociocultural values. Hierarchical organizations may not be accustomed to communication mechanisms that allow anonymous messages to be posted by anyone with access to the site. Should the dashboard diffuse from high-level executives to front-line staff, a discussion board could become an anonymous complaint box, providing a forum for discontent and conflict.

Rogers (1995) notes that the name of the innovation is often a factor in the rate of diffusion (p. 236). The term "dashboard" is essentially a word-symbol, evoking a mental image of a car dashboard where critical information is displayed often in the manner of an analogue gauge. It is a fitting term for the type of information feedback healthcare managers may need. However, implementing a graphical dashboard with analogue gauges is currently difficult, if not impossible, using current report-writing packages. Based on a desire for providing high-level information to executives, but lacking tools for implementation, most previously introduced implementations of dashboards in healthcare have been nongraphical with little resemblance to a dashboard other than representing high-level performance values. While the term "dashboard" may contribute to increased diffusion and adoption, previous misuse of the term may serve as a deterrent.

Complexity

Rogers (1995), sees a negative correlation between the complexity of an innovation and its adoption (p. 242). That is, the more difficult it is to understand and use an innovation, the slower people will adopt the new idea. In many respects the purpose of the intranet dashboard is to decrease the complexity around receiving feedback pertaining to evidence-based processes, exchanging ideas, and diffusing guidelines. Foremost, the dashboard metaphor presents high-level numerical measures in a graphical format that is familiar to anyone who has driven a car. This stands in contrast to reports that are in a variety of formats, ranging from frequency tables to histograms to statistical process control charts. Similarly,

the use of order-sets distills a large amount of information into a focused list, thereby decreasing the complexity of following evidence-based guidelines.

It is important to note that not all websites are simple to use. While a graphical dashboard display of performance measures may represent simplicity, the manner in which it is linked to other intranet pages can introduce a tremendous amount of complexity. In addition, order-sets that attempt to function for all patient types may have a large amount of complexity. For example, an order-set for a patient with moderate pneumonia who is admitted for observation may be markedly different from what is needed for a patient admitted to the Intensive Care Unit. Trying to bundle variable situations such as these into one order-set and delineating the conditions with "if-then" clauses can introduce an unwanted level of complexity.

Trialability

While complexity may be negatively associated with adoption, the trialibility of an innovation may be positively associated with adoption (Rogers, 1995, p. 243). From the viewpoint of the healthcare executive, an intranet dashboard provides a large degree of trialability. Users may chose when to visit the dashboard and may experiment with different views and download order-sets through the familiar interface of a web browser. However, this trialability is dependent on the usability of the site – if the dashboard is difficult to find in the midst of other intranet sites attempts to trial it will be diminished. Likewise, if

navigational structures within the dashboard are not well designed, attempts to "try out" the dashboard may not meet with success.

Another limitation to the trialibility of a dashboard are access restrictions placed by the organization. The degree of adherence to evidence-based guidelines may be information that the organization wants to restrict due to possible legal ramifications. Thus, even if a nurse manager wants to try out the dashboard so that she or he can get a better sense of whether order-sets should be downloaded and implemented, access to the dashboard may be restricted. The default web server display for such an access attempt is not comforting: "Error 403 Forbidden."

Observability

Another trait, according to Rogers (1995), that is positively associated with adoption is the observability of an innovation (p. 244). The results of the dashboard should be twofold: first, they should provide an easy-to-understand display of critical information; second, the guidelines and order-sets should be downloaded and implemented, leading to increased adherence of evidence-based processes and improved patient outcomes. Thus, the results are circular and reinforcing in nature as the dashboard functions as a cue to action with accompanying tools for implementation.

Unfortunately, intranet dashboards are not well suited to observability due to the singular nature with which people view information on their computer monitors. For the purposes of protecting patient and organizational information, many healthcare organizations have acted to the best of their ability to ensure that

computer monitors are not readily visible to anyone other than the user. The same issues do not necessarily hold true with the observability of order-sets. Paper order-sets can literally be tacked to a bulletin board, used in provider rounds, and marketed in other manners.

Type of Innovation Decisions

The rate of adoption can also be impacted by how the innovation is presented. Rogers (1995) notes that innovations that are optional and adopted by the individual are more readily adopted than organizational-wide adoption with many players (p. 206). A dashboard may be presented as a voluntary decision-support tool that executives may use to determine when and where to initiate evidence-based medicine initiatives. As guidelines are implemented, the managers may return to the dashboard to assess progress and share learning with counterparts, reflecting an incremental approach to change. This voluntary and incremental approach to organizational change is seen in work by Goes, Friedman, Buffa & Seifert (2000), who create a framework for describing approaches to organizational change in their work "A Turbulent Field: Theory, Research, and Practice on Organizational Change in Health Care." The researchers found that most practitioner-oriented change strategies were voluntary instead of deterministic, classifying this approach to change as "Teleology and Strategic Change" and noting that few empirical studies exist to support performance benefits of this change approach.

Communication Channel

How the innovation is communicated, or marketed, is another attribute that contributes to the rate of adoption of an innovation (Rogers, 1995, p. 207). With respect to the diffusion of guidelines, the dashboard is essentially the communication channel – providing a mechanism for acquiring guidelines and feedback regarding rates of adoption. Within a target audience of authorized users an intranet dashboard can be marketed through other intranet sites, E-mail announcements, and hard-copy printouts distributed to various teams and workgroups. The second mechanism, E-mail announcement, is ideal in that it is "pushed" at the recipient – appearing within his or her workflow. Within the body of the E-mail an embedded image can provide foreshadowing of what the dashboard looks like.

Communication may also be interpersonal in that executives may E-mail counterparts the link to the dashboard with an encouragement to trial it. Web users commonly undertake this E-mail referral. However, referrals such as this can backfire if access to the dashboard has been restricted. The result may be the default web server message "Error 403 Forbidden." For those without access to the dashboard, but still involved in the use of guidelines, frustration may ensue concerning why access is not allowed. Web site administrators can change this message to something less discomforting, such as an indication of why access has been restricted and steps the user can take to gain access.

Change agent promotion efforts

Rates of adoption may be facilitated through the use of change agents (Rogers, 1995, p. 208). "Physician champions" or "executive sponsors" may lend support and leadership. Without visible support form high-level leaders, the diffusion of innovations may begin with momentum, rather than inertia. Accordingly, the distribution of E-mail announcements, newsletters, and other promotion efforts should be considered with respect to how the recipient will view the communication. With the backing of an executive sponsor, visible in the signature of the E-mail and the sender's E-mail address, both communication channel and change agent are intertwined.

Change agents may also play a role in intranet dashboard by actively using the threaded discussion board. If an employee visits the discussion board and finds no content, they may mark it off as wasted effort and not revisit the discussion board at a later date. However, if an employee finds content posted on the discussion board by an executive sponsor, credence may be lent to the discussion board as a viable communication method.

Evidence-Based Medicine

The Institute of Medicine drew attention to medical errors with its report *To Err is Human: Building a Safer Health System* (Kohn, Corrigan, & Donaldson, 2000). This report cited previous studies that estimated as many as 98,000 dying every year from medical errors. The result of this report was a flurry of activity by healthcare organizations as attempts were made to identify and reduce medical

errors. A follow-up report by the Institute of Medicine was entitled *Crossing the Quality Chasm* (2001); this report functioned to describe flaws in the system that resulted in failures to provide quality care. Ten rules for the 21st-Century Health System were delineated in this report:

1. Care based on continuous healing relationships.
2. Care is customized according to patient needs and values.
3. The patient is the source of control.
4. Knowledge is shared and information flows freely.
5. Decision-making is evidence based.
6. Safety as a system property.
7. Transparency is necessary.
8. Needs are anticipated.
9. Waste is continuously decreased.
10. Cooperation among clinicians is a priority. (p. 67)

Intranet dashboards address a number of these goals. Foremost, dashboards can provide executives with evidence regarding whether guidelines are being followed – thus helping to fulfill the fourth rule pertaining to the sharing and free flow of information. The seventh rule, "Transparency," refers to being open with the public about quality measurements. Intranet dashboard may support public reporting initiatives by simply moving the dashboard from an intranet web server to an Internet server. An intranet dashboard also addresses the ninth rule in that as a monitor of quality processes dashboards can help an organization focus on waste. Furthermore, with respect to the last rule, dashboards can increase cooperation among healthcare providers by providing tools for information sharing and collaboration.

Dashboards may function by providing a high-level view of adherence to evidence-based medicine processes, supporting decisions regarding where executives and managers should target evidence-based medicine initiatives. Sim, Sanders & McDonald (2002) analyzed the gaps between evidence and action and identified four major difficulties: (a) obtaining the evidence that is relevant to the clinical action, (b) systematically reviewing the evidence, (c) applying this summary evidence within a specific division context at the point of care, and (d) measuring practice change. It is not clear what role dashboards can play beyond measuring and reporting practice change. Performance measurements may be made actionable by including resources such as guidelines and order-sets for downloading and implementation. Threaded discussion boards may link counterparts and engender knowledge transfer. However, issues associated with obtaining the evidence, systematically reviewing the evidence, and applying it at the point of care are complex and not easily addressed by intranet dashboards.

Information Sharing

Organizations may face difficulty in implementing evidence-based guidelines due to inadequate feedback mechanisms. Neither providers nor managers may know whether evidence-based guidelines are being followed (McGlynn et al., 2003). Integrated clinical information systems greatly facilitate information retrieval, decision support, and documentation at the point-of-care where a provider and a patient interact. However, these systems do not typically provide reports of how well the organization is following evidence-based

guidelines and associated patient outcomes. For example, a provider using an integrated clinical information system should be able to quickly ascertain whether a particular patient was screened for pneumococcal vaccination status on admission to the hospital. In many cases the same system typically will not provide information for a manager about screening rates for a particular hospital, functional unit, or provider. This lack of population level reporting is due in part to the fragmented development of healthcare information systems (Scheese, 1998).

Development of Data Warehouses

The 1960s and 1970s found hospitals investing in large mainframes with a focus on accounting procedures. The technology imperative soon drove other work areas to ad hoc implementations of information technology solutions (Shortliff & Perreault, 2001). Built with different programming languages, data formats, and operating systems, these clinical information systems could not seamlessly exchange clinical information. Early adopters saw the gains to be had if particular software applications could share data, allowing for universal access and decreasing data reentry. The electronic medical record (EMR) became, and continues to be, a symbol of successful information integration for an organization. Rindfleisch (1997) notes that moving toward an EMR system is inevitable due to a desire for timely access to information, decision-support aids, the need for simultaneous access to patient information by multiple providers, and the push toward improved cost effectiveness. A survey of healthcare organizations found that 69% (n=737) of respondents identified sharing comparable patient data among

different sites within a multihospital healthcare delivery system a major factor

driving the need for an EMR system (Medical Records Institute, n.d.). In contrast

to integrated systems that can freely exchange data are nonintegrated systems, also

known as "data graveyards" (Landers, Buckley & Roantree, 2000).

Three labels are commonly used to define these clinical information

systems: "transactional," "operational," and "live." For purposes of simplicity the

term "transactional" will be used in this research. Regardless of the label, these

systems are designed for the same specific function – input and output of

individual records. In some cases, query tools may be used against transactional

systems for extracting records for performance-measurement purposes.

Unfortunately, numerous problems exist with connecting to a live transactional

system. One of the most important reasons to avoid querying a transactional

system is that the selection and retrieval of multiple records uses system resources

and can significantly degrade system performance, potentially disrupting

healthcare operations (Scheese, 1998). Organizations may mitigate this risk by

extracting records during times when transactional systems are not experiencing

high use, such as at night. However, the raw data may be stored in multiple data

structures that have incomprehensible names and incompatible formats. Extracting

meaningful information from these sources is difficult. Furthermore, the data may

reflect only one aspect of the care continuum. Many research questions require

information about processes and outcomes that span the healthcare continuum.

Should an organization endeavor to extract and integrate information from clinical

information systems across the organization, follow-up measurements require that the process be repeated at a similar cost (Johnson, 2001).

In their search for answers, health organizations have followed other industries in creating data warehouses where related data are extracted from disparate systems, transformed into common file formats, and loaded into one common area (usually on a different server) that is more conducive to analysis. Each time the warehouse is loaded, or refreshed, new data from the transactional systems are added and the knowledge base grows. While the focus with transactional systems is to get the data "in," the data warehouse is focused on population-based reporting with a number of dimensions for stratification and analysis (Wyderka, 1999). Bringing organizational data into a single data warehouse, where queries can be run and analytical reports generated, is a primary reason for building a data warehouse (Hagland, 1998; Hoyo-Barbollo & Lees, 2002). The data warehouse "supports informational processing by providing a solid foundation of integrated, corporate wide historical data from which to do management analysis" (Inmon & Hackathorn, 1994, p. 1).

Many of the successes with data repositories in healthcare have centered on analysis of potential adverse drug events. Einbinder and Scully (2002) explored using a clinical data warehouse to estimate the frequency and costs of adverse drug events. Using published criteria they searched for potential adverse drug events, such as looking for someone being given a nephotoxic drug while their creatinine levels were rising. Their queries demonstrated predictive results. Johnson (2001) sees evaluating drug therapy outcomes, tracking drug utilization, and evaluating

performance as a driving force in the need for data repositories. Kaiser has also

exploited their data warehouse to look for effective drugs and prescriptive patterns,

development of preventative guidelines, and implementation of best practices

(Hoyo-Barbollo & Lees, 2002). Other entities are also seeing the benefits of data;

payers are creating repositories with sophisticated analytics for profiling

medication and treatment compliance. For example, Hoyo-Barbollo and Lees

(2002) performed a case study of the Detroit Medical Center where data resided in

disparate systems, leaving decision-makers unable to see the whole continuum of

care. Implementation of the data warehouse led to positive, qualitative outcomes

and conclusions that the data warehouse benefits included a competitive

advantage, increased productivity of decision-makers, integration of isolated

systems, and immediate information delivery.

Intranet Used for Tapping Warehouses

Data warehouses may hold a tremendous amount of data indicative of

organizational processes. This data can be used to support evidence-based

medicine initiatives. However, much of this data may remain untapped due to

inefficiencies in traditional report-delivery mechanisms, leaving healthcare

leadership with plentiful data but scant information (Hagland, 1998). Traditional

reporting mechanisms often rely on workers who are skilled at using query tools

and report-writing packages. These workers extract related records from data

warehouses using query tools, format the results with report-writing packages, and

then deliver a final report using methods ranging from hard-copy printouts to

posting reports on the organizational intranet. What is interesting in these processes is that a much more direct process may be overlooked. The organizational intranet can be linked directly to the data warehouse. Instead of an employee manually creating a report and posting a copy on the intranet, the same logic can be built into an intranet page that automatically updates itself as the underlying data changes. Furthermore, the intranet page can be much more interactive than a static report. Should the executive wish to change the date range represented in the report, she or he can modify a few settings on the intranet page and instantly see the results. In this sense the intranet page becomes a high-level query tool that the executive can use.

Organizations are increasingly using intranet web pages for document exchange and communication (Landers, Buckley & Roantree, 2000). Put simply, intranets are essentially an internal collection of websites within the organizational network. Users can access information relevant to their own work area or other parts of the organization, or they can choose to seamlessly visit "outside" websites on the Internet. In most respects an organizational intranet is analogous to the Internet, with the notable exception of residing within the organization (Austin & Boxerman, 1998, p. 129). As query and report technology becomes more sophisticated, it becomes web based (Gillespie, 2002). Intranets become ideal places to display dashboards (Johnson & Frack, 2001).

Successful uses of intranets have found exploitation of information delivery mechanisms and collaborative communication tools across the network. For the national immunization survey the intranet was an essential component,

serving as the project's information center and increasing productivity by allowing bureaucratic hierarchies to be bypassed (Dennis et al., 1998). Kesner (2003) created a web portal for sharing knowledge and collaboration for the information services division at a geographically dispersed university. The portal contained customer survey feedback data, documents, tools, and biographical data so people could identify local experts. Also available were discussion, team rooms and links to other intranet sites. No more than three clicks separated content form the entrance. Kesner reported using "Push" information delivery principles in providing E-mail notification whenever documents within the site change. To promote the site, mouse pads with the web address were distributed. The end results found improved staff communication and improved collaboration across the project and service-delivery teams.

Limitations of Intranet Dashboards as Feedback Systems

Intranet dashboards have a number of advantages over traditional reporting processes such as at-a-glance graphical information displays, automated updating, and tools for collaboration and guideline implementation. Nonetheless, limitations still remain and should be addressed with any dashboard implementation. Some issues to pay attention to include indicator choice, data quality, information design, and web usability.

Indicator Choice

Just as a good researcher examines the validity and reliability of the variables used in a study, the selection of indicators on a dashboard should be approached with care. It is possible for an organization to focus on the wrong quality indicators, building systems that mislead on a large scale (Wyatt, 1999). When intended to provide support for strategic management dashboards and reporting systems may be largely focused on financial indicators, an approach that Weber (2001) describes as myopic. Inamdar, Kaplan & Bower (2002) found that performance measurements common in the 1990s, such as Joint Commission Measures, were narrow in scope and failed to address the whole story, as measures reflecting cause and effect were missing.

To counter the organizational tendency to focus on one narrow area, Kaplan and Norton (1992) proposed a solution in the form of a "Balanced Scorecard" that purposefully focuses on four linked perspectives: financial, customer perspective, internal perspective, and learning and growth perspective. These perspectives provide a multivariate view of strategic management, capturing critical determinants that would have been overlooked if the viewpoint were solely financial in nature.

While there is a necessity to provide breadth in measurement, there is also a danger of measuring too many variables or the wrong ones. Inamdar, Kaplan & Bower (2002) interviewed executives from nine provider organizations implementing the Balanced Scorecard. They concluded that Balanced Scorecards allowed "executives to keep the clutter out." The authors also noted that in many

cases there was a tendency toward "indicator creep" as people who were trying for program visibility sought to add their measures. Coakley and Fiegener (1995) encountered similar findings, noting that managers may frame performance data so as to create more positive impressions with upper management.

Issues of selection bias in the choices of indicators may occur when the indicators themselves are used for performance measurement. Jennings and Stagger (1999) examined the role of summarized performance measurements that are released to the public in the form of "report cards." The authors point out that there is a negative connotation of report cards aligned more with judgment and punishment than with learning. Jennings and Stagger (1999) advocate a more ecological approach with three components of quality being presented comprised of structure, process, and outcomes. A dashboard designed with these criteria would report not only process and outcome measures, but also an indication of what structures are in place. These structures could range from the percentage of hospitals having order-sets integrated into electronic medical records to the percentage of employees with access to the dashboard.

The indicators presented on an evidence-based dashboard are often more prescribed than those developed for a comprehensive dashboard supporting that supports broad strategic-management efforts. As the definitions of these indicators and the rationale for their measurement are thoroughly documented in accompanying guidelines, they may be less prone to selection bias. Nonetheless, many organizations will also want to include outcome measures so that they can demonstrate that following evidence-based processes can lead to improvement.

Regardless of which measures are chosen, one way a dashboard can address concerns around measurement validity is by creating a special section of the dashboard for documentation related to measurement selection, data quality, and a forum for questions and answers. These resources will not only save the dashboard coordinator time from repetitively answering the same question, but can also provide a stimulus for questions and ideas that may lead to improved measures.

Jennings and Stagger (1999) note that analysts may extract erroneous values without understanding the assumptions placed on the data they are extracting and the measures they are creating. This may be an unconscious error or a more systemic issue related to selection bias. For example, a measurement for how often allergies are updated may be grossly misrepresented. To represent how often an allergy update occurs the number of updates should be divided by the number of admissions. However, including patients who had an update done on a prior visit I the numerator would inflate this measure as the more often patients encounter the system, the greater the chance that their allergies will be assessed at least once. This is a simple example of measurement error; however, once the error is identified managers and employees who have performance evaluations tied to the measure such as this may resist change efforts. It is important to also note that this measure does not detail the full story. Just because an allergy check is completed on admission does not mean that the information is later utilized. Reporting how often the allergy record is consulted prior to medication administration and updated after an allergic reaction would provide additional

information, as would reporting training rates related to identification of allergic reactions, etc.

Data Quality

Not only must the indicators be carefully selected, they must also be accurate. Organizations that have invested large amounts of money and time in sophisticated reporting mechanisms can be hindered by poor data. Problems can arise at multiple points in the measurement process—e.g., during data entry, extraction, transformation, and loading into the data warehouse; and during the query and measurement calculation phase. A survey of health information managers found that only 16% used comprehensive automated quality checks of data (Lorence, Spink & Jameson, 2002).

With the increasing use of electronic medical records providers are being challenged with entering clinical information, including diagnostic codes, directly into the clinical information system. This stands in contrast with traditional coding processes where a highly trained coder reviews medical records before determining a diagnostic or treatment category. Lorence and Inrahim (2003) examined this online process, noting that it is more efficient than traditional processes but that it also relies on whether a comprehensive knowledge base of diagnostic codes and classification schemes is held by the provider. However, many providers have received little or no training in coding and classification schemes. The authors looked at how often health information managers agreed with diagnostic codes selected by providers. They surveyed a cross-section of

16,000 accredited record managers across a range of treatment settings in the U.S., and found that 19% of respondents reported that more than 5% of patient encounters resulted in disagreement between the coder and the physician. The researchers also stratified results on a number of variables and found significant differences between coding in areas, with an average of 5.5% disagreement, to less densely populated locales where disagreement was found 4.5% of the time. Higher rates of disagreement were also found in high-volume facilities and in differing levels of per member, per month managed-care expenditures.

In addition to the inconsistent entry of diagnostic codes, upon which many performance measures rely, data quality can be impacted by poor controls and validation checks on data entry fields. For example, date fields may be stored in a free text field with no control constraining how the date may be entered. The result may be a wide range of incompatible date values that are impossible to aggregate. To ward against this, source data from disparate information systems needs to be continually assessed for quality as it is extracted from source systems, transformed, and loaded into the data warehouse. At each of these stages there is potential for introducing error. Basic data-screening procedures can identify aberrant values and provide flags for where fixes are needed in source systems or in the warehouse loading process. This also holds true for the query and measurement calculation phase.

Steps can be taken within an intranet dashboard to improve the quality of measurement data. All data should be subjected to frequency and outlier analysis with attention to missing values. Errors may need to be brought to the attention of

the data warehouse managers and frontline staff who are entering data. All steps of the measurement process, beginning with data entry and ending with the creation of measures, should be thoroughly documented and posted in a resource area of the dashboard. This process ensures that data-quality issues are addressed during the development stage and accessible to the audience. Similar to issues related to indicator choice, questions and responses related to data quality may be provided within the dashboard to provide a ready reference for the audience and developer alike.

Information Design

According to Jennings and Stagger (1999), the basis of performance measurement is changing data into information for decision support. The critical question to ask, based on this premise, is how best to present data as information? Wyatt (1999) says that Marshall McLuhan "perhaps overstated his point when he claimed that the medium is the message," but adds that in developing evidence-based content, we also need to develop evidence-based formats (p. 1502). One such empirical study was conducted by Elting, Martin, Cantor & Rubenstein, (1999). These authors looked at how the same data, when displayed in different formats, can lead to different conclusions by physician investigators. The researchers presented data related to interim measurements collected during a clinical trial. Subjects were asked whether they thought the trial should be stopped based on available data. The data was presented in three different formats: tables, stacked bar charts, and icons. By presenting the same data in these different

formats, the researchers found significant differences regarding when subjects thought the trials should be stopped. The icon format led to the most accurate decisions. It should be noted that this research utilized a very small sample size and a mixed-model design, including repeated measures, which could have led to measurement reactivity and maturation.

Edward Tufte explored numerous issues related to information design in his 1990 book *Envisioning Information*. Tufte points out that much of the world is multivariate and examines how this be produced on the "flatland" of paper (p. 12). One approach, suggested by Tufte (p. 23), is using "small multiples" where the same information design is repeated for all images, allowing users to apply the decoding method learned from the first symbol to all. This approach is apparent in many dashboard designs as variants of the analogue gauge are used to represent different measures such as the speedometer and the tachometer. Another approach is "micro-macro readings" (pp. 36-51) where both detailed and aggregate information is presented together. Tufte (p. 43) uses the Vietnam veterans memorial in Washington, D.C., to illustrate an example of this principal. From a distance, all the names on the wall blur together to present a sense of magnitude while up close one can read individual names

Tufte (1990, p. 50) is also concerned about "data density," or how much data is presented (or not) on a single unit of space:

> Visual displays rich with data are not only an appropriate and
> proper complement to human capabilities, but also such designs
> are frequently optimal. If the visual task is contrast, comparison,
> and choice – as so often it is – then the more relevant
> information within the eyespan, the better. Vacant, low-density
> displays, the dreaded posterization of data spread over pages

and pages, require viewers to rely on visual memory – a weak skill – to make a contrast, a comparison, a choice.

Using dense data displays on a dashboard is counterintuitive as the objective is to provide a simple, high-level view of aggregate measures. However, there may be times when more detail is needed. The answer may be to provide extension to the dials in the form of optional data displays. When activated, these displays – whether histograms, line charts, or stem-and-leaf charts – are juxtaposed next to the dials, providing both micro and macro views, as well as a sufficient amount of data density for those with the need for clarification.

Similar to providing micro- and macroviews of information, simple and technical versions of data displays may be provided, particularly when a dashboard serves a dual role as an external transparency site and an internal quality-improvement support tool. Barr et al. (2002) examined public reporting of hospital patient satisfaction in Rhode Island and found formative testing to be critical in achieving a good design. The researchers used cognitive interviews for assessing responses to content, structure, and language. Important findings were that measurement information should be at footer of reports and that two versions of the report needed to be created, one public and one technical.

Web Usability

Information must not only be designed well, it must also be usable. Efforts to logically format performance measures, offer guidelines for download and tools for collaboration may be fruitless if the website they are placed in is not usable.

Many people have encountered web sites that are rich in content but hindered by poor design.

In his book *Designing Web Usability*, Nielson (2000) proposes an engineering approach to web design with every choice open for empirical testing (p. 11). Some of the principles Nielson advocates for designing usable website include minimizing navigational elements on pages, appropriate content and link writing, minimizing download times, designing for multiple platforms, and separating design from content.

Many website pages are dominated by navigation elements, frequently in the form of horizontal or vertical bars containing links to other areas within the site. In his research, Nielson (2000) found many web pages where less than 20% of page space was devoted to content (p. 19). Two approaches can remedy this: (a) minimize the navigation structures, and (b) design pages that expand to work with the full width of the end-users' monitor resolution. Older monitors and video cards only allow for images 640 pixels wide. To ensure that users with these displays do not have to scroll horizontally to access content, many designers create web pages with fixed widths of less than 640 pixels. The result is a great deal of wasted space for users who have monitors that are set to display more than 640 pixels in width. One solution is to use relative widths in the page design, specifying that the page can expand to fill 100% of the browser window, thereby becoming a "liquid" page that expands or contracts to fill the browser window as it is resized. Minimizing navigation elements and focusing on content is similar to

Edward Tufte's (1990, p. 34) call for adding information to increase relevance and for reducing "chart junk" that can detract from the true data.

One tendency is for people to author web content as they do in the paper-based world. However, people tend to scan web pages, so Nielson (2000, p.111) recommends starting complex pages with a conclusion and using bulleted lists. Another problem is that designers often override the default display of links. Nielson advocates for maintaining the standard link colors, not because they are the best from a human factors perspective, but because they are what people are familiar with. Links should be informative and not represented by abstract phrases such as "click here" that carry no information and imply the use of a mouse (p. 60.)

Most users on the web have been frustrated at some point by pages that are slow to load. Nielson (2000, p. 160) states, "The Web is an attention economy where the ultimate currency is the user's time" and recommends minimum download times of less than 10 seconds. This necessitates minimizing graphics on a site. However, multiple instances of the same graphic can be used without impacting download times, as the graphic only needs to be used once and is then cached on the local device. Another approach to limiting file sizes is to optimize graphic files. In many cases image files have a high resolution that cannot be displayed on conventional computer monitors. Judicious scaling, cropping, and digital resampling can dramatically decrease the size of image files. Large file sizes do not generally have as much negative effect on the organizational intranet where users have fast network connections. However, workers who telecommute

may access the organizational intranet via a dial-up connection, so it still pays to ensure that pages download efficiently.

One challenge with web usability is the diversity of proprietary web browsers and operating systems. Each of these, and interactions between the two, can impact how a web page is displayed. To this end, web development requires careful testing using a variety of software, hardware, and connection methods. However, an organizational intranet represents a certain advantage, as standards may be in place specifying which software and hardware should be used. This can greatly simplify development – though care needs to be taken if internal sites will someday be made accessible via the Internet.

Perhaps one of the most difficult concepts for developers to grasp is the need for separating design from content. Simply put, directions for how to display content should be separate from the content, rather than interwoven with the content. For example, many web pages have hidden code that tells the browser to display a chunk of text with a particular font. If this is done throughout a large site and a decision is made to change the font, every page may need to be opened and edited. However, a better approach is to separate design specifications from the content and place these specifications in a style sheet. Every time the browser loads a content page the browser can look at the linked style sheet to see how paragraphs, headings, and other page elements should be displayed. Not only does this facilitate design updates and ensure a visual continuity, but other style sheets can be employed to render the same content in manners more appropriate to

specific display devices such as cell phones and screen readers for people with disabilities (Nielson, 2000, p. 38).

How can one ensure that a website is usable? There is no single measure for usability, and thus no simple answer to this question. Clark et al. (2003) note that there is little objectively verifiable evidence with regard to website quality or performance. Common measures based on web server log files can be erroneous: "If assessment focuses on the wrong items or is conducted incorrectly, it will lead to distortions within the organization's values system" (p. 51). These measures may include page hits, impressions, visits, viewing time, unique visitors, ease of navigation, download time, or graphic coherence. However, hits could be inflated by accidental visits that don't progress pass entrance pages. Misdirected outside links, typographical mistakes as someone types in the name of a popular and similarly named site, and software agents that index sites for search engines may also contribute to inflated hit counts. Similarly, while viewing time in a retail store may be positively correlated with spending, this is not always the case in a web site. Viewing time it could be due to longer load times, excesses of text, navigation difficulties, and the possibility that people are multitasking. Perhaps the best measure for assessing web usability is to employ focus groups with members from the target audience. Observing, and interviewing, audience members while they navigate through a web site can provide valuable qualitative and quantitative information concerning web usability - particularly in the early stages of website development.

Concluding Thoughts

A common adage in management is "you manage what you measure." This saying holds true in the turbulent world of healthcare management, where adherence to evidence-based guidelines may be less than optimal. Measurement and efficient feedback techniques are needed to determine where guidelines are being followed and where there is room for improvement. Traditional measurement and reporting techniques are resource intensive and may not meet the information needs of the recipients. Reports may arrive after the fact, in a variety of formats that are difficult to decipher, and fail to link stakeholders with one another and with the tools they need for improvement.

An intranet dashboard provides an innovative solution to many of these problems. Linked to a data warehouse, a dashboard can automatically update itself, bypassing the delays associated with report creation and delivery. Principles of information design and web usability can provide an intuitive and interactive dashboard that presents both high-level measures and detailed data displays in the familiar graphical metaphor of a vehicle dashboard. By including tools for communication with geographically dispersed counterparts and resources for downloading that help with guideline implementation, the dashboard can go far beyond simply displaying performance measures; stimulating and supporting organizational learning with respect to the diffusion and adoption of evidence-based guidelines.

The next step is to test whether a dashboard truly represents an improved feedback system. By weighing the evidence, healthcare organizations will be able

to make an informed choice with regard to implementing their own dashboards in support of evidence-based guideline initiatives.

Methods

For the logical presentation of the methods portion of this study, the overall research design will first be described. This will be followed by a description of the subjects and sampling, measurement instruments, procedures and protocols, and will conclude with a description of analytical techniques.

Overall Design

This descriptive study utilized a convenience sample of healthcare executives from a medium-sized health system in the Pacific Northwest. Prior to subject recruitment the dashboard was designed and implemented. Full details regarding dashboard development may be found in Appendix A. Following dashboard development, participants from five different facilities within the healthcare system were administered a web-based survey assessing coordination and cooperation with respect to Community Acquired Pneumonia, demographic characteristics, satisfaction with receiving outcome reports, and willingness to participate in exit interviews. Over the course 3 three months, participants were able to visit an intranet dashboard. Visits to the dashboard were recorded in a web server log file. Participants received an E-mail update with a link to the dashboard during each month of the study. Following the 3-month intervention period, the survey was re-administered. Because so little is known about this area, semistructured, qualitative exit interviews were conducted to create a rich source of data related to receiving outcomes reports, barriers to communicating and

collaborating with other facilities, and reactions to the design and usability of the dashboard.

Subjects and Sampling

The reference population for this research was healthcare executives and managers having the ability to impact care processes at regional or system-wide levels. The accessible population consisted of executives at HealthFirst working either for a region or for the corporate office. Inclusion criteria were membership on an executive or membership on a quality-improvement team at either the hospital or the corporate level. Membership lists were derived from four different sources: team intranet sites, an intranet-based human-resources directory of employees, and the membership properties of team E-mail distribution lists. In several cases, these data sources produced conflicting information about whether a person was a member of a particular group, or about their title. These conflicts were resolved by phone calls to administrative assistants. The Director of Outcomes Research reviewed this preliminary list and determined that a number of people no longer worked for the organization or were improperly categorized. The resulting list contained 43 executives from throughout the organization. Job titles typically reflected quality-improvement roles or positions related to involvement in patient outcomes.

Given that no previous literature or data could provide a reasonable estimate of effect size, a medium effect size was anticipated. A medium effect size is "conceived as large enough to be visible to the naked eye, so that one would be

aware of the change in the course of the normal observation" (Portney & Watkins, 2000, p. 706). A minimum sample size was estimated to be 34, using a two-tailed paired t test with a medium effect size, (d=.50 α =.05, power = .80).

Convenience sampling was used to recruit research participants. Following approval from the institutional review board, an E-mail distribution list was requested from network services. Distribution lists function by allowing an E-mail to be sent to a single address, the E-mail server then forwards the E-mail to all members of the distribution list. A request was also made to "blind" the membership of the distribution list so recipients could not examine the membership properties. This helped to ensure the confidentiality of potential participants and facilitated sending the recruitment E-mail.

A senior vice president acted as an executive sponsor for this research project, sending the recruitment E-mail using the address of a blinded E-mail distribution list. The body of the E-mail included a brief introduction from the executive sponsor, followed by an E-mail solicitation from this author with an accompanying link to the web-based survey. Three months later a very similar E-mail was sent to all research participants requesting completion of a follow-up survey. Full text for these recruitment E-mails may be found in Appendix B.

Sheehan and McMillan (1999) noted that the saliency of paper-based surveys was positively correlated with response rates. Recipients were expected to find this study salient due to a number of factors: an introduction by an executive sponsor, the fact that pneumonia ranks in the top five most common diagnoses in the healthcare organization, and a system-wide operational plan that specified

Community Acquired Pneumonia as an evidence-based guideline initiative. While a web-based survey may decrease response rates and contribute to selection bias due to technological and access barriers, this was not expected to be the case in this study. All participants in the study regularly use the same web-based survey tool for organizational initiatives, time tracking, and payroll information. A 3-week window was left open for receiving survey responses. One-week after E-mail recruitment, the administrative assistants of nonrespondents were contacted and asked to place a copy of the E-mail on respective calendars.

Measurement Instruments

Two measurement instruments were used in this research. The first was a web-based survey that elicited information about subject demographics and experiences with coordination and cooperation around Community Acquired Pneumonia. This survey was administered twice: before the participants ever saw the dashboard (baseline) and again after 3-months' exposure to the dashboard (follow-up). The second measurement instrument was a web server log file that recorded every visit to the dashboard throughout the 3-month intervention period.

Survey Instrument

Subscales from the Network Integration Instrument were adapted to measure trends in coordination and cooperation with respect to Community Acquired Pneumonia. Lukas et al. (2002) found that valid and reliable indicators

could be obtained to measure the progress of system integration in the Veteran

Affairs healthcare system. Originally published in 1999, the Network Integration

Instrument has a Flesch-Kincaid Grade Level of 11.4 and uses a closed-question

format. Administration time for the full survey approximates 20 minutes or less.

The survey has been administered five times by the Veteran Affairs Management

Decision and Research Center to sample sizes over 800 (Lukas & Valley, 1999).

This instrument was adapted by selecting four specific subscales most pertinent to

the current research setting. Each of these subscales reflected aspects of

coordination and cooperation that the dashboard was thought to facilitate, such as

increased sharing of project results, relationships with counterparts, benchmarking,

and increasing the potential for future coordination:

- **Quality-improvement efforts:** involves sharing of results from projects across the system, having opportunities for participation in activities such as committees and task forces, and the existence of teams with multifacility representation.
- **Staff cooperation:** involves relationships with counterparts in other facilities: knowing whom to call for assistance, willingness of others to help, similarity in goals and standards, efficiency and effectiveness of data and ideas across the system.
- **Service cooperation:** involves problem solving, benchmarking their performance across facilities, and coordination of administrative and support efforts across the system.
- **Overall coordination and integration:** involves overall measurement of past, current, and future coordination and integration.

Five subscales from the Network Integration Survey were not used in this

research: leadership, clinical coordination, alignment, shared vision, single

standard of care, and manager alignment. Many of the survey items in these

subscales were very specific to the Veteran Affairs healthcare network and could

not easily be adapted without jeopardizing their psychometric properties. In other

cases the questions were very global in nature, far beyond the reach of what the

intranet dashboard could affect during the 3-month intervention period. For

example, one survey item from the single standard-of-care subscale posited, "The

pharmaceuticals available at this facility are virtually the same as those available at

other facilities across this Network."

Each of the four subscales that were chosen had between three and seven

survey items. The first three subscales employed a 7-point Likert scale. An

example item with the numerical value associated with a response is represented

below:

Sharing data and ideas about Community Acquired Pneumonia from this region to
another region is an efficient and effective process.

- O   1. Never or almost never
- O   2. Rarely
- O   3. Sometimes
- O   4. About half the time
- O   5. Often
- O   6. Usually
- O   7. Always or almost always

The fourth subscale, "Overall Integration and Coordination," differed in that it

used a 5-point scale, (0=Poor, 1=Fair, 2=Good, 3=Very Good, 4=Excellent).

Previous use of the Network Integration Survey has found high reliability

for group comparisons and strong convergent/discriminant validity among these

dimensions (Lukas et al., 2002). Cronbach's alpha reflects the internal consistency

of a scale and is calculated by looking at the correlation among the scale items and the correlation between items and a summed score. In the social sciences, a value above .80 is an indicator of internal consistency. If values are low, the individual items may be measuring different traits, and if they are too high, they may represent redundancy (Portney & Watkins, 2000, p. 577). Cronbach's alpha measurements for the five subscales that were adopted from Network Integration Survey were reported to range from .71 to .87 (Lukas & Valley, 1999)

As this instrument was originally developed for use within the Veterans Affairs System, it was modified so that the vernacular more closely matched HealthFirst. For example, "Network" was replaced with "HealthFirst." In some cases, questions were made specific to Community Acquired Pneumonia. One survey item was added to the survey instrument to elicit satisfaction with receiving Community Acquired Pneumonia reports on a 7-point Likert scale. Questions were also added to the pretest survey eliciting demographic characteristics, and to the posttest asking for qualitative responses regarding useful features of the dashboard. These questions were added to the end of the survey so as to minimize changes to the psychometric properties of the Network Integration Instrument.

The final collection of survey items were converted to a web-based survey using a custom survey-building tool that was developed prior to this study by the web services team at HealthFirst. This development tool was entirely web based and allowed survey authors to create questions, designate response options and types, and retrieve data from a back-end database. Radio buttons were used for response options instead of check boxes to prevent participants from selecting

multiple responses for a single survey item. Completing surveys in this manner was familiar to the research participant, as the same survey interface was frequently used for organizational health surveys, ad hoc surveys administered by various areas in the organization, and for human resource functions such as payroll entry. Several executives and data analysts who were not part of the pilot study helped pilot test the survey, ensuring a minimum of face validity and usability. The entire survey instrument may be found in Appendix C.

Web Server Log File

To examine whether the intranet dashboard was actually visited, measurements were collected from a web server log file that provided a line item detail of visits to the intranet site. The web server was configured so that every visit resulted in the recording of the visitor's network username, referral source, file accessed, and visit date and time. The web server recorded this information as comma-separated values in a text file. Rozie-Hristovski, Hristovski, and Todorovski (2002) examined web server log files to describe users' information-seeking behavior on a medical library website and found that such analysis can provide detailed information on how the website is used. Analyzing trends in log files can indicate how visitors enter a site, paths that visitors take through a website, areas where server errors occur, and to some extent - duration of visit.

One difficulty with tracking visitor behavior is establishing the fact that two visits on different days belong to the same person. Internet Protocol (IP) addresses are often stored in log files and may be employed for tracking repeat visits. However, IP addresses are not always stable over time. For example, if a

person uses a different computer to access the site, their IP address will not follow them. Furthermore, many Internet providers assign "dynamic" versus "static" IP addresses – meaning that with every new connection to the Internet, a new IP address is assigned. One solution for tracking visitor behavior between visits is using "cookies," which commonly refer to a small text file that the web server stores on the visitor's computer. This text file is accessed by the web server on subsequent visits and helps to establish that the visitor is the same person (Stout, 1997, p. 80). Unfortunately, cookies have some of the same problems as IP addresses insomuch as being computer specific. Furthermore, cookies have a reputation among the public of threatening the privacy of web users. Stout advocates the use of registered usernames as a method for tracking visitors over time (1997, p. 75). Each time the user visits the website they must log in, thus identifying themselves across subsequent visits. This approach was adapted in the sense that all users of the organizational intranet had to sign on to their computer using their network identification name. The intranet dashboard was preconfigured to allow any of these "authorized users" access to the intranet dashboard. The result found network identification names automatically recorded in the web server log file.

Procedures and Protocols

This research study required several steps, beginning with approval from two institutional review boards and followed by dashboard development, recruitment of research participants, administration of a baseline survey

instrument, exposure to an outcomes dashboard, monthly E-mail updates, a second

administration of the survey instrument, and qualitative exit interviews. The

chronology of these steps taken in 2003 is represented below in a bulleted list and

followed by an in-depth discussion of each step.

Figure 3.8 Research Milestones, 2003

- **January:** Applications for expedited review made to Institutional Review Board at HealthFirst and Oregon State University.
- **February:** Dashboard development and testing
- **March:** Recruitment, survey administration, link to dashboard provided.
- **April:** First E-mail update, site visits logged.
- **May:** Second E-mail update, site visits logged.
- **June:** Third E-mail update, site visits logged.
- **June – July:** Follow-up survey administration and exit interviews.
- **July – October:** Data analysis and report writing.

Recruitment and Baseline Survey

Following approval from the IRB, an E-mail distribution list was created

containing the E-mail addresses for the 43 executives in the accessible population.

Properties of this distribution list were configured so that only the researcher could

see who was a member of the list. The executive sponsor sent the recruitment E-

mail to this distribution list. This E-mail contained a brief introduction to the

researcher, a request for help in evaluating an intranet dashboard, and a link to the

web-based survey.

Participants who followed the link to the survey found themselves on an

intranet page containing a brief welcome statement with an inline link to the

informed consent document. At the top of the online survey a distinct notice

alerted users that completing the survey was not anonymous but that individual results would be kept confidential by the researcher. Below this introduction were the survey questions related to coordination and cooperation, demographics, satisfaction with receiving outcome reports, and availability to participate in exit interviews.

A button labeled "submit" was located at the bottom of the page. When the participants clicked on this the survey contents were transferred into a secure database. This transfer also included a time stamp and a recording of the participant's network identification. This data transfer was nearly instantaneous to the participant and was followed with a new page containing a brief statement of thanks and a link to the intranet dashboard. These steps, from E-mail recruitment to first visit to the dashboard, are illustrated below in Figure 3.1.
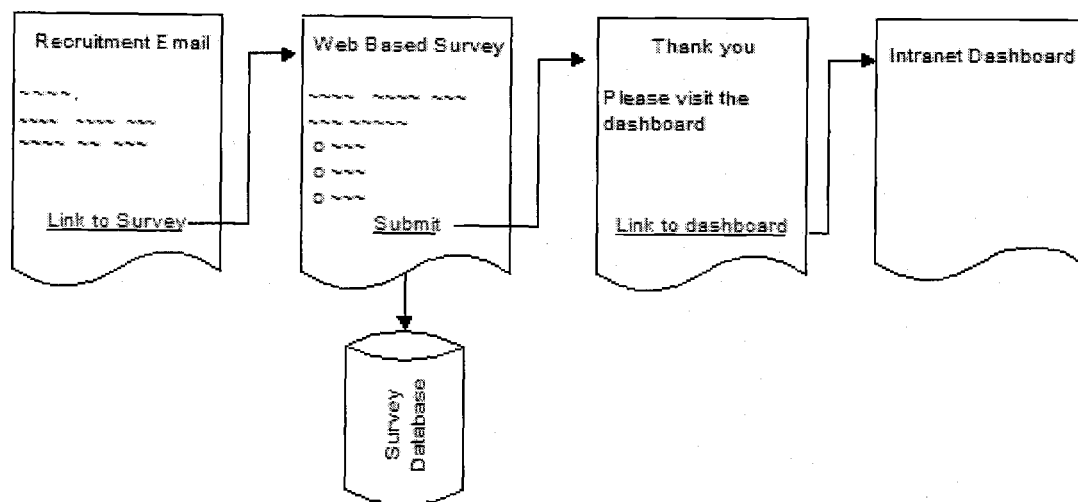
Figure 3.1 Steps leading from recruitment E-mail to Intranet Dashboard.

A 3-week response period was allowed for completion of the surveys. During this time, the survey database was checked periodically for new responses through a secure web interface provided by the web services team. Participants who did not complete a survey after the first week were identified and their administrative assistants were contacted with a request to put the E-mail on their supervisor's calendar.

Monthly E-mail Updates

The intranet dashboard used in this research not only delivered the information in a centralized, accessible location but also utilized "push" principles by sending E-mail updates containing a link back to the main site (Choo, 1998, p. 166). All executives who had access to the intranet dashboard received monthly E-mails notifying them of site updates or changes with a prominent link to the site. Each update included several statements contrasting different outcome measurements. For example, the first E-mail compared how many times a popular movie would need to be watched with the median length of stay for a patient with Community Acquired Pneumonia. The third E-mail estimated how many airplane flights could be filled with patients who had not been screened for pneumococcal vaccination. Full text for these updates can be found in Appendix D.

Follow-Up Surveys

After 3 months of exposure to the dashboard and monthly E-mail updates, the participants who had completed the baseline survey received an E-mail request to complete a follow-up survey. Participants were told that completion of the exit survey would result in a gift certificate for a free beverage at a local coffee shop. This survey replicated the same questions from the baseline; however, stable demographic questions were excluded.

Exit surveys were collected for 3 weeks. Participants who did not complete a survey after the first week were identified and their administrative assistants were contacted with a request to put the E-mail on their supervisor's calendar. Following the data collection phase, participants were sent gift certificates to a local coffee shop along with a note of thanks.

Exit Interview

Participants were asked during baseline and follow-up surveys if they would be willing to participate in qualitative exit interviews. Eight participants consented and were contacted after completion of the follow-up survey by phone or E-mail so that an interview date could be scheduled.

Over the course of 3 weeks in late June and early July 2003, eight executives were interviewed by phone or in person, using semistructured, qualitative interview questions. Participants were asked questions about experiences with receiving reports of patient outcomes, barriers they saw with respect to systems integration, and reflections on the design and usability of the intranet dashboard. Interviews were audiotaped, transcribed verbatim and sent to

participants for review and consent for use. When interviews were conducted over the phone a device was used for bridging the cord between the telephone and the handset cord. This provided for a line connection to the microphone input jack on a cassette recorder. Transcripts were imported into winMAX 98 pro for qualitative coding purposes. Full transcripts for these interviews can be found in Appendix E.

Data Analysis

Three types of data were obtained from this research. Paired survey scores were obtained from administering the survey twice. Over the course of the intervention, visits to the intranet site were recorded in a web server log file. And a third source of data was found in the interview transcripts.

Survey Data

Following the completion of the surveys, an intranet "Survey" site maintained by the HealthFirst Web Services Department was visited. The survey results were exported as comma-separated values to a secure network drive. These files were opened in Microsoft Excel 2000 and visually examined for data integrity. All survey variables in the second file had "2" added to the variable name to denote the fact that it was the posttest measure. All network usernames were replaced with an arbitrary code. A master list was created on paper, linking the network username with the code should it be later needed. This list was kept under double lock and key.

Baseline and follow-up survey responses were then imported into SPSS for descriptive analysis. The first survey contained 29 responses and the second 23 responses. Survey responses were originally imported as text values and were recoded into numerical values. This started with a value of 1 assigned for the first response item of "Never or Almost Never" and progressed by an increment of 1 for each response through 7 for "Always or Almost Always." One survey question needed to be reverse-coded, as it had a negative question stem. An outer join was created between the pretest file and the posttest file, based on the common key field, and a new data set created containing all 29 pretest responses and paired responses from the posttest survey for 23 subjects. Before the data were considered usable, descriptive statistics were run on all variables to look for potential data inconsistencies.

A number of factors led to the decision to conduct a descriptive study of these survey responses rather than an inferential study. The two chief factors were a limited sample size and the lack of a control group. Furthermore, the data were abnormally distributed for many items and could not be assumed to be on the interval scale. Most of the survey items used seven response options ranging from "Never" to "Always"; with these limited categories there was a lack of precision in subjective survey responses (Portney & Watkins, 2000, p. 485). Another problem was the lack of a control group and use of a convenience sample; even if statistical significance were found in survey results it would be difficult to argue that these changes were a result of the intervention. These conditions led to a post hoc decision to describe trends in the survey data. Paired survey responses were

dichotomized into Low Agreement and High Agreement categories. The Low Agreement category contained the following survey responses: "Never or almost never," "Rarely," "Sometimes," and "About half the time." The High Agreement category contained the following survey items: "Often," "Usually," and "Always or almost always." Percentages of responses indicating High Agreement were reported for each baseline and follow-up survey item. Frequencies for all survey response options may be found in Appendix F.

Web Server Analysis

Web server analysis was conducted first by importing the delimited log file into a Microsoft Access 2000 Professional database. While there are a number of software packages available that are dedicated for web server log file analysis, these were not employed due to their cost and a desire for ad hoc analysis. Entries from nonresearch participants were removed from the server log file, as were entries that occurred after administration of the follow-up survey for each participant. Following some data manipulation to adjust for the web server using Greenwich Mean Time, data were imported into SPSS where visits were analyzed with descriptive statistics for most commonly accessed files, time of access, and common pathways through the intranet site.

Qualitative Exit Interviews

Semi-structured qualitative exit interviews provided the third source of data. Interview sessions were transcribed into ASCII text files and then imported into winMAX 98 pro, a qualitative coding software package. Grounded theory was used as a theoretical orientation for interpreting the data and generating theory. Originally presented by Glaser and Strauss in *The Discovery of Grounded Theory* (1967), Strauss notes that with this approach "coding is grounded in data on the page as well as on the conjunctive experiential data, including the knowledge of technical literature which the analyst brings into the inquiry" (1987, p. 29). According to Denzin & Lincoln, " the major difference between grounded theory and other approaches to qualitative research approaches is its emphasis upon theory development" (1998, p. 160).

Transcripts were read and initially subjected to open coding with an eye toward the conditions, strategies, interactions, and consequences that were apparent in the data. Four guidelines proposed by Strauss were followed in this open coding process (1987, p. 30-32). The first guideline was to ask the data what category or emerging theory it represents and to constantly compare the process and the outcome. The second guideline was to minutely analyze the data on a line-by-line basis so as to achieve conceptual density and saturation versus an overview approach of quickly skimming the data to generate categories. The third guideline was to frequently pause coding to create theoretical memos, these were attached to passages and reflected themes and relationships that reached across individual categories. The fourth and final guideline was to allow themes related to

demographic characteristic emerge from the data if they were warranted, and not to immediately cease upon them because they are available and familiar.

As additional interviews were read, codes were sometimes discarded and merged until the codes became "saturated and is placed in relationship to other codes, including its relation to the core category or categories" (Strauss, 1987, p. 32). Questions had been pre-determined prior to the interview sessions, so to some extent this research involved anticipatory data reduction (Denzin & Lincoln, 1998, p. 173; Miles & Huberman, 1994, p.10). These pre-determined questions provided broad areas for exploration. As categories emerged in each area, individual categories were subjected to intense coding, also known referred to as "axial coding" (Strauss, 1987 p.32), to examine themes and relationships of core categories. Following axial coding, and with the identification of core categories, interview data were subjected to selective coding where conditions, consequences, and interactions were looked for in relationship to the core categories (Strauss, 1987, p.33).

Results

This research led to both qualitative and quantitative findings. For the logical

presentation of this chapter, results will be presented in the order of the five broad

research questions outlined in Chapter I:

1. What trends may be evident related to coordination and cooperation after introduction of the dashboard?
2. Will executives actually use the intranet dashboard?
3. What perceptions will executives have related to the design and usability of the dashboard?
4. What barriers will executives report with respect to coordinating and cooperating with counterparts within the healthcare system?
5. What perceptions will executives report with respect to receiving outcome reports?

Response Rates

In early March 2003, 43 participants were targeted for recruitment via E-

mail solicitations sent via a physician executive champion. Twenty-nine

participants consented and completed baseline surveys, representing a response

rate of 67.4%. One subject was unable to access the online survey and returned a

paper-based survey. Three E-mails were received from executives reporting that

they did not feel they could provide relevant feedback because they had so little to

do with the content area. One participant E-mailed and said she got distracted

while filling out the survey and did it a second time and that only the results from

the latter survey should be used. Another participant E-mailed and said the link in

the E-mail would not open up the intranet site with the survey. This participant

opted to complete a paper-based survey, which was hand-delivered. Later in the

study the same participant reported computer problems with some aspects of the

dashboard and the problem was tracked down to an incomplete browser upgrade. Participants who did not complete a survey after the first week were identified and their administrative assistants were contacted with a request to put the E-mail on their supervisor's electronic calendar.

Three months following completion of the pretest surveys, participants were asked via E-mail to participate in a follow-up survey. Twenty-three participants completed the follow-up survey, representing a retention rate of 79.3%. Unpaired Likert scores were excluded from descriptive analysis so as to minimize confounding due to intersubject differences.

Sample Demographics

A total of 23 paired surveys were obtained. The majority of these participants were female, white, and in the 46-55 age group. Demographic characteristics may be found below in Table 4.1. The sample was highly educated, with 91% reporting 4 years of college or more. A large proportion of the sample reported having some type of clinical training, with the two most common categories listed as nursing and medicine. Four participants indicated clinical training but did not specify the type. The majority of these respondents indicated that they were no longer practicing, or practiced minimally. Four participants reported that they were active in clinical practice. Job titles typically reflected quality-improvement roles or positions related to involvement in patient outcomes, ranging from Regional Quality Improvement Facilitator to Regional Chief Executive Officer. Twenty-two participants reported being "Comfortable" or

"Very Comfortable" with computers; one subject reported being "Very

Uncomfortable" with computers.

Table 4.1 Demographic characteristics for 23 participants who took both baseline and follow up surveys

	n (%)
Female participants	15 (65%)
Caucasian	21 (91%)
46-55 years old	16 (69%)
Four years of college or more	21 (91%)
Some clinical training	19 (83%)
Medicine	5 (22%)
Nursing	6 (26%)
"Comfortable" or "Very Comfortable" with computers	22 (96%)

Demographic characteristics for the six participants who did not complete

the follow-up survey were examined and may be found below in Table 4.2.

Overall, these participants were very similar to the larger sample of participants

who completed the follow-up, with the majority being female, white, highly

educated, and having had some clinical training. Four reported being "Very

Comfortable" with computers, and the remaining two reported being

"Comfortable."

Table 4.2 Demographic characteristics for 6 participants who took only the baseline survey

	n (%)
Female participants	4 (66.6%)
Caucasian	5 (83.3%)
46-55 years old	4 (66.6%)
Four years of college or more	5 (83.3%)
Some clinical training	5 (83.3%)
Medicine	2 (33.3%)
Nursing	1 (16.6%)
"Comfortable" or "Very Comfortable" with computers	6 (100%)

Participants were asked on both baseline and follow-up surveys if they would be willing to participate in qualitative exit interviews. Out of the eight who consented, five took place in person and three occurred over the phone. Demographic characteristics (Table 4.3) for these "interviewees" were similar to the rest of the sample; the interviewees were predominately white, 46-55 years old, highly educated, had clinical training, and were at least "comfortable" with computers. Notable differences were a slight change in the sex ratio with slightly less than half of the interviewees reporting to be female. Also, a greater proportion indicated clinical training in medicine, and all of these participants reported that they were currently practicing. Five of the interviewees completed both surveys and three completed only the baseline.

Table 4.3 Demographic characteristics for 8 interview participants

	n (%)
Female participants	3 (37.5%)
Caucasian	8 (100.0%)
46-55 years old	6 (75.0%)
Four years of college or more	8 (100.0%)
Some clinical training	8 (100.0%)
Medicine	5 (62.5%)
Nursing	1 (12.5%)
"Comfortable" or "Very Comfortable" with computers	8 (100%)

Research Question 1: What trends may be evident related to coordination and cooperation after introduction of the dashboard?

Twenty-three participants answered both the baseline survey and the follow-up survey. Participants were asked questions that reflected positive characteristics of sharing and collaboration across a healthcare system on both surveys. The majority of the survey items were rated on a 7-point Likert scale ranging from "Never or almost never" to "Always or almost always." These response options with numerical equivalents are represented below:

1. Never or almost never
2. Rarely
3. Sometimes
4. About half the time
5. Often
6. Usually
7. Always or almost always

For analytical purposes, responses were dichotomized into "Low Agreement" and "High Agreement," with responses ranging from 1-4 falling in the first category and responses ranging from 5-6 falling in the second. The percentage of "High Agreement" was looked at across both survey conditions and is represented below in Table 4.4 for each 7-point Likert survey item. Survey items are presented in this table according to the order of greatest increase in High Agreement between baseline and follow-up.

Overall, eleven of the 17 survey items showed positive increases in agreement to statements that reflected positive aspects of coordination and cooperation. No change was seen on four survey items, and one item showed a decrease. Most survey items were answered on baseline and follow-up by between 20 and 23 participants.

The largest increase in agreement was in response to the following statement: "Clinical support staff and services for Community Acquired Pneumonia seem well coordinated across regions." Fourteen paired responses were obtained for this question; the baseline survey found no responses in the High Agreement category; however, twelve (85.7%) participants indicated High Agreement on the follow-up test. The second greatest shift in agreement was found in response to whether improvement/action teams around Community Acquired Pneumonia involved multiple regions. Out of 19 total paired responses, only 3 (15.8%) indicated High Agreement at baseline while 13 (68.4%) reported High Agreement at follow-up. Positive shifts with changes of at least 20 percentage points were found on 8 other survey items.

Four survey questions elicited predominately High Agreement responses at both baseline and follow up: "When it comes to cooperation among regions, there is a lot of talk but not much action or support; Staff in other regions are willing to help when I contact them with a question or request; I have opportunities to participate in organization-wide activities (committees, task forces, conferences); and Staff in other regions cooperate when I need their assistance." It is important to note that the first survey item mentioned here, pertaining to cooperation, has a negative question stem. This survey item was reverse-coded before analysis so that High Agreement meant that when it comes to cooperation among regions there was a lot of action and support.

At both baseline and follow-up, 12 out of 23 participants (52.2%) said that they interact with staff from other regions. The same response proportions were also found with a survey question that asked whether participants, when they needed a consult, could find people with the right expertise in other.

One survey item found a decrease in the proportion of agreement across survey conditions: "In my region we are encouraged to benchmark our performance against data from other HealthFirst regions." Out of the 21 participants who answered this question, 12 (57.1%) indicated high agreement on baseline and 9 (42.9%) indicated high agreement on follow-up.

Table 4.4 Percentages of "High Agreement" using paired survey responses

Survey Question	Paired n	High Agreement* Baseline n (%)	Follow up n (%)
Clinical support staff and services for community-acquired pneumonia seem well coordinated across regions.	14	0 (0%)	12 (85.7%)
Improvement/action teams on Community Acquired Pneumonia issues involve multiple regions	19	3 (15.8%)	13 (68.4%)
Results of Community Acquired Pneumonia projects done at other regions are shared with me.	21	3 (14.3)%	13 (61.9%)
Sharing data and ideas about Community Acquired Pneumonia from this region to another region is an efficient and effective process.	18	7 (38.9%)	15 (83.3%)
How satisfied are you with receiving reports about CAP in your region?	19	9 (47.4%)	17 (89.5%)
When I contact staff in another region, I feel that I am dealing with someone who has the same goals and standards that I do.	20	14 (70%)	19 (95.0%)
When we discover a "fix" to a problem in our region, we have a mechanism for informing other similar services across HealthFirst regions.	20	4 (20.0%)	9 (45.0%)
In my region we have access to the data we need in order to benchmark our performance against data from other HealthFirst regions.	21	11 (52.4%)	16 (76.2%)
Administrative services are appropriately integrated to achieve cost-effective patient care.	15	4 (26.7%)	7 (46.7%)
When employees attempt to work on a quality problem involving more than one region others are supportive and provide resources.	21	14 (66.7%)	18 (85.7%)
When it comes to cooperation among regions, there is a lot of talk but not much action or support (reverse coded).	22	14 (63.6%)	15 (68.2)
Staff in other regions are willing to help when I contact them with a question or request.	20	19 (95%)	20 (100%)
I interact with staff from other regions	23	12 (52.2%)	12 (52.2%)
If I need a consult, I know where to find people with the right expertise in other regions.	23	12 (52.2%)	12 (52.2%)
I have opportunities to participate in organization wide activities (committees, task forces, conferences).	23	18 (78.4%)	18 (78.4%)
Staff in other regions cooperate when I need their assistance.	19	18 (94.7%)	18 (94.7%)
In my region we are encouraged to benchmark our performance against data from other HealthFirst regions.	21	12 (57.1%)	9 (42.9%)

Note: "High Agreement" indicates a response of 5, 6, or 7 on a seven point Likert scale with: 1 = Never or almost never, 2 = Rarely, 3 =Sometimes, 4 = About half the time, 5 = Often, 6 = Usually, and 7 = Always or almost always.

Three questions asked about overall integration and coordination between the regions. These three survey questions used a 5-point Likert scale ranging from "Poor" to "Excellent." These response options are listed below:

1. Poor
2. Fair
3. Good
4. Very Good
5. Excellent

Responses were dichotomized into two categories: "Poor," "Fair," and "Good" were placed into one category, and responses of "Very Good" and "Excellent" were placed in another category. Frequencies and percentages were calculated for each category and are presented below in Table 4.5 in order of greatest change between baseline and follow-up survey conditions. Frequencies for all response options can be found in Appendix D. Examination of the dichotomized data found the greatest increase in response to the following statement: "Currently the overall level of integration and coordination among the regions is..." At baseline only one person out of 20 (5%) gave a high response; however, on follow-up, seven (35%) gave a high response. At both baseline and follow-up a majority of the participants reported that "A year from now I expect the overall level of integration and coordination among the regions to be..." either "Very Good" or "Excellent." Out of 19 participants who answered this question, 14 (73.7%) indicated a high response at baseline and 17 (89.5%) indicated a high response on follow-up. When participants were asked about the overall level of

integration and coordination with respect to Community Acquired Pneumonia 3 months prior to the time of the survey, only one respondent out of 20 provided a rating of "Very Good" or "Excellent." On follow-up, no respondents provided a response of "Very Good" or "Excellent."

Table 4.5 Percentages of "Very Good" and "Excellent" using paired survey responses

Survey Question	Paired n	"Very Good" or "Excellent"* Baseline n (%)	Follow up n (%)
Currently the overall level of integration and coordination among the regions for Community-Acquired Pneumonia is....	20	1 (5.0%)	7 (35.0%)
A year from now I expect the overall level of integration and coordination among the regions for Community Acquired Pneumonia will be...	19	14 (73.7%)	17 (89.5%)
Three months ago the overall level of integration and coordination among regions concerning Community Acquired Pneumonia was...	20	1 (5.0%)	0 (0.0%)

Note: "Very Good" or "Excellent" indicates a response of 4 or 5 on a seven point Likert scale with: 1 Poor, 2 = Fair, 3=Good, 4 = Very Good, 5 = Excellent.

Research Question 2: Will executives actually use the intranet dashboard?

Each visit to the dashboard resulted in a notation in a web server log file. Following completion of the follow-up survey, the web server log file was analyzed for visits and trends. Eighteen out of the 29 participants who consented to be in the study visited the dashboard during the intervention period. Three of these visitors did not complete a follow-up survey. Conversely, no record was found in the web server log file for eight of the 23 participants who contributed both

baseline and follow-up survey responses. The dashboard users were predominately female, with only four of the 18 being male. Fourteen indicated having had some type of clinical training, such as medicine or nursing, but only three indicated they were still practicing their clinical profession. There were no discernable differences in the demographics for participants who did not visit the dashboard. Among the 18 who did visit, there was a total of 35 user sessions with 9 participants visiting the dashboard only once; several two, three, or four times; and with one participant who visited five times. In total, there were 379 page views across these 35 sessions. The majority of these page views occurred within 3 days of each of the monthly updates; 260 (70.5%) of all the page views occurred during these periods.

One participant loaded only one page view during a single session, while another looked at 50. Examination of referral sources to the dashboard provided details for only two user sessions. One session was started immediately after a participant submitted the baseline survey. Another session was started after a participant followed a link from another HealthFirst intranet site.

Table 4.6 indicates that after the Entrance and Home pages, the three most frequently viewed pages were Core Measures, More Measures, and Tools. In general, bar charts were more frequently selected than other types of information displays. The confidentiality statement was viewed once.

Table 4.6 Twenty-five most frequently viewed pages

		Frequency	Valid Percent	Cumulative Percent
Valid	Entrance	56	14.8	14.8
	Home	54	14.2	29.0
	Core Measures	48	12.7	41.7
	More Measures	25	6.6	48.3
	Tools	20	5.3	53.6
	C1. Oxygenation: Bar Chart	11	2.9	56.5
	FAQ/Contact	11	2.9	59.4
	C4b. Adult Smoking: Bar Chart	10	2.6	62.0
	C5. Time to Antibiotics: Bar Chart	10	2.6	64.6
	C3. Pneumococcal: Bar Chart	9	2.4	67.0
	C2. Blood Culture: Bar Chart	9	2.4	69.4
	Time to Antibiotics Benchmarks	9	2.4	71.8
	C1. Oxygenation: Data Tables	8	2.1	73.9
	C2. Blood Culture Benchmarks	8	2.1	76.0
	C1. Oxygenation: Line Chart	7	1.8	77.8
	C4a. Pediatric Smoking Benchmarks	7	1.8	79.7
	Adult Smoking Benchmarks	7	1.8	81.5
	Admitting Diagnosis	7	1.8	83.4
	C3. Pneumococcal: Line Chart	6	1.6	85.0
	C1.Oxygenation Benchmarks	6	1.6	86.5
	C3. Pneumococcal Benchmarks	6	1.6	88.1
	C4a. Pediatric Smoking: Bar Chart	5	1.3	89.4
	Primary Diagnosis	5	1.3	90.8
	ATS Guidelines	4	1.1	91.8
	Crosswalk	3	.8	92.6

Research Question 3: What perceptions will executives have related to the design and usability of the dashboard?

Four sources of data provided qualitative information about perceptions of the dashboard design and usability. The first source of feedback about the dashboard was the discussion board within the site. Numerous comments were also received when executives received their monthly E-mail update. Several replied to the monthly E-mail update, sending a comment about the dashboard to this author. A third source of qualitative data came from two questions on the follow-up survey that asked what participants thought of the dashboard and suggestions they might have for improving it. The fourth source of information about the design and usability of the site was derived from semistructured qualitative exit interviews with eight executives.

Discussion Board Feedback

The discussion board was accessed through a button on the dashboard entitled "Discuss These Measures." Following this link resulted in a pop-up window with a threaded discussion board. Two different participants posted two messages during the intervention period. The participants did not elect to use anonymous options. The first message asked for box and whisker plots, while the second posting reflected positive comments. Both postings are reproduced below:

- *This site is so cool. I think the data tabs are very interesting. The Max, Min, and Aver are useful. I thing box and whickers [whisker??] plots by month would be a wonderful addition. Easy to understand show median, middle 50 percentile, and extreme outliners. What do you think?*
- *This is looking better each month. Thank you for the hard work and diligence in populating the data.*

E-Mail Feedback

Each month, a "Monthly Update" was sent to the participants. Eleven participants responded during the intervention period with short messages indicating positive responses. Two responses contained suggestions for change. No negative responses were received via E-mail:

- *Wow! What a great tool and website. Nice job.*
- *Cool.*
- *This is a fantastic site. You've done a great job.*
- *Thanks, it is really an impressive site.*
- *Thanks for all your hard work! The site is GREAT!!*
- *This is looking really good.*
- *I cannot tell you how much I love this site. It is one of the best-designed sites on [Intranet]. Thanks for putting a little fun in this project!*
- *You did a really nice job on the WEB site*
- *This is GREAT!!!!! What a way to make a point! Sooooo creative!!!*
- *Too funny!!*
- *This is really neat!!! Thanks.*
- *There is a definite advantage to having the dials reflect a specific quarter. Does one of the bells or whistles include changing the color of the bar graphs in CAP 1 and CAP 5 to match the other measures?*
- *If I may make a suggestion for down the road.... would there be a way to add a drop down box for each region for the data values? I can see that over time the list will become very long...*

Survey Feedback

During the follow-up survey, participants were asked what the most useful feature of the dashboard was and how they would improve or change the dashboard. Sixteen participants responded to the first question; two themes were apparent with the first concerning the ability to draw comparisons. In total, five participants alluded to comparing measures both across time, to external benchmarks, and to other regions within the system. The second theme concerned the design of the dashboard, with four subjects referencing the dashboard metaphor. The original comments are below:

Comparison Themes

- Comparative views and most importantly, having an e-mail notice to tell me that the dataset was recently updated.
- The Core Measures data compared with prior quarters and benchmark
- All regions are there for comparison
- Comparative info from the other regions
- Provides a benchmark with comparison to other regions.

Design Theme

- *The dials*
- *The dashboard*
- *Visual appeal and ease of interpreting data; knowing in an instant what the status was easy to use graphics of the data*
- *Clear, well defined presentation of data*
- *Comprehensive data, easily accessed*
- *Consolidation of data*

Uncategorized Responses

- *Integration of outcome measures with guidelines*
- *Antibiotic time*
- *Our own data.*
- *Seeing the status of the region and the system on the core measures*

When asked, "How would you improve, or otherwise change, the CAP Measures Site?" two responses indicated that access to the site should be extended to counterparts in other regions or medical staff. These responses were categorized in a "Wider Audience Theme." Eight responses addressed design or usability, including one detailed response that suggested replacing "Primary Diagnosis" with "Principal Diagnosis" and also suggested linking measure descriptions directly to the dials. One participant asked for provider-level information, and another reported that the dashboard was a little "busy" and asked for information trending over time. Two different participants requested that reports be E-mailed to them. One participant reported that delivery by E-mail would be preferable. Three responses contained no clear suggestions for change or improvement. These comments are reproduced below:

Wider Audience Theme

- *Would like to share some of the information with my counterparts in the other regions*
- *Make it generally available to med staff providers*

Design and Usability Theme

- *Here are a couple of minor suggestions; Replace the terminology of "primary" diagnosis to "principle" because that's the standard terminology and definition. Also would suggest seeing if there were a way to link the measure definitions from the dial area (maybe add a link to the measure PDF when clicking on the measure description). That way it's easier for someone who may not be familiar with the measures to get to the definitions easier than looking in the FAQs to see what's included/excluded, etc.*
- *Individual physician information for feedback*
- *Make it simpler to view --it's a little "busy." Add information on trending over time?*

- *I would like the reports to come to me via email rather than seeking them out because CAP is only a small part of the clinical focus I work on and it would keep the most current data in my consciousness.*
- *Have the physicians receive e-mail notice that the dataset is updated.*
- *I can't think of any improvements needed at this time*
- *It is excellent*
- *No improvements - its a great site!*

Exit Interview Feedback

When asked for their thoughts on the design and usability of the Community Acquired Pneumonia Measures site, four themes emerged: acceptance of graphical dashboard format, need for secondary needle to indicate direction of change, the monthly E-mail as a trigger to action, and a desire for access by a wider audience. Each of these themes is described in detail below and is supported by quotations from participants. An italicized numerical range, enclosed in parenthesis, follows each quotation; this range indicates where on the individual transcript the quotation may be found.

One recurrent theme throughout this research study was positive acceptance of the graphical format of the dashboard. Feedback around this theme was received via E-mail, on survey responses, and also during qualitative interviewing. Terry said, "I think the dials are great. Everybody I have talked to thinks the dials are great." Jeff interacted with the dials during a phone interview while commenting:

> Let me just click a couple of these things. This is so so cool. It would be nice if one could always know that a 100 is the best place to be. These are percents, but it would be nice to know what you are shooting for because that is the beauty of metaphor. I like it, it is engaging. It's not a table [laughs].

John, a data analyst and quality facilitator remarked, "I have talked to a few docs and they are more inclined to like the speedometer. I like it.... I think for most people the visual part helps a lot."

During the second month of the research study, user feedback indicated a need to see change over time on the main dial. Secondary needles were added to the dials to reflect the previous measurement. The secondary needle was distinguished as a faded needle with luminescence set at 20%. This secondary needle was mentioned several times during the interviews as a valuable feature and served to indicate that a single needle did not provide an adequate amount of information. People seemed to want to see the current measure, the previous measure, and (as Jeff indicated) the target. At the same time, participants did not want to be overwhelmed or have a "cluttered" display.

Several interview participants saw the monthly E-mails as a useful feature, George reported: "I like the prompt. I would not otherwise go to the site because I wouldn't think about it unless someone prompted me. It is easy because it is one click onto the link and I am there." A similar sentiment was voiced by John, "The really, truly, most important thing for me is when you E-mail me and say it is updated and I know I can go look at the latest results." These responses were supported by web server analysis, which showed that the majority of visits occurred in the 3 days after the monthly E-mail updates were sent.

Several interview participants indicated that they felt a wider audience should see the dashboard. John said, "Actually, I wish that all docs and administration could get access to it and be notified when they are live and

updated. I think that is the way it is going to make improvement." Andy reflected a similar sentiment, referencing the executive team: "because when I look at this I think…boy, it would be kind of neat to have worked out a reasonable quality dashboard like this and to present it to the executive team; I am sure they would love to have it."

Research Question 4: What barriers will executives report with respect to coordinating and cooperating with counterparts within the healthcare system?

Qualitative coding found two dominant themes in the perspectives of healthcare executives regarding barriers to network integration. Foremost was a concern about lack of standardization. The second theme to emerge concerned the need for face-to-face interaction with peers in other regions. Several participants voiced concern about the lack of common vocabulary and definitions. With little central oversight or coordination in outcomes, measurement regions developed their own custom measurements. While the measurements may have similar names, the underlying operational definitions and calculations frequently differed across regions, leading to confusion and a distrust of cross-regional reports. Mike noted, "What you need is standardization at the data level so that you can tell that region A is really better or worse then the region B one. So we just have a lot of work to continue moving forward in that direction." Jeff added to this by saying:

...when you really try to use data to make a decision, comparative data across the system, it is a complete waste of time. Now, some clinical data we worked out through the [Leadership Team] over the past couple years are actually apples to apples. But whenever you try to use administrative data the data definitions are different, the coding is different.

Also evident was a need for more face-to-face interaction with counterparts in other regions, George voiced a need to have team analyzing and pushing information out to decision makers:

We have operated under the assumption that if we just give them the information they are going to change.... to me that is where I see the role of a CAP team, or a diabetes team, is to take that information at a regional level, to analyze that, and then to push out to people who make decisions operationally and improvement side...

Research Question 5: What perceptions will executives report with respect to receiving outcome reports?

Coding revealed five themes that characterize experiences with health outcomes reports: organizational progress, suboptimal report delivery, use of reports for environmental scanning, the need for informational design, and a desire for information at the unit or provider level.

The first pattern to emerge was a sense that the organization had made significant progress but still had ground to cover. Mike reported, "We've come a long way compared to when I started 10 years ago. This stuff is possible; then it was impossible. Now we are getting to a point where our reports and information are pretty good but I still think we have a long ways to go." Cindy noted, "We've

taken so many giant steps over the last three years or so that it is just wonderful."

Comments indicating that ground still needed to be covered followed virtually

every comment about progress.

Several participants reported receiving few outcomes reports and difficulty

with accessing existing web-based outcome reports. George flatly stated, "I don't

think we see nearly enough. That is the bottom line." Tom articulated a similar

viewpoint:

> We don't have enough data. It is not that we have too much. We
> can guess we know some of our problem areas; we can know that
> without data. But clearly when you don't have data you can't be
> sure of some of your problem areas. We are no different from the
> rest of the world.

Participants identified four main types of system-wide outcomes reports:

diabetes reports related to a cross-regional registry project, corporate clinical

quality indicators which were connected to an employee success-sharing program,

Community Acquired Pneumonia reports related to this project, and JCAHO Core

Measure Reports delivered quarterly from a vendor. All report categories relied on

the intranet as a report-delivery mechanism.

The diabetes report site had two aspects to it, the first was an exception

report where users could set query criteria via drop-down boxes and text-input

boxes. Date ranges and providers could be specified, and patients with clinical

measurements below a certain level were identified. This was lauded by three

participants as a feature that allowed them to quickly find the information needed.

The other part of the site was a quarterly population-level report posted as a Power

Presentation. One respondent noted that this format was less than satisfying, as the information was not interactive.

The corporate quality indicators site was another intranet-based site identified as a source of cross-regional reports. This site was refreshed quarterly and contained several process and outcome measurements ranging from percentage of heart attack patients receiving aspirin to cesarean section rates. An annual "success sharing" program was linked to these measures. John felt that these reports were limited:

> These are pushed down to each region for focused comparison. The indicators will show you some information but for me to think that I would run a business upon this information, I don't think there is enough drill-down on these indicators.

John thought that the delivery mechanism could be improved by sending recipients an E-mail update: "I think that people need to see that like boom on their computer. You need to open this and see the indicators. Otherwise, I don't think they pay attention to them until it is time for the annual review."

Participants also identified JCAHO core measure reports delivered from the vendor responsible for passing data onto JCAHO. Cindy referred to these reports: "As a member of the quality council here, we get the information that comes out of our JCAHO reports. So we have a regular quarterly report to the whole council on where we stand with regard to those based on feedback from the vendor." Further dialogue found that the council typically had to wait an entire quarter before receiving the report from the vendor. This wait appeared to frustrate

Cindy, but she saw no need for monthly reporting unless there was physician-level information.

John, a quality facilitator and data analyst, felt that the format and length of these reports were a deterrent, noting that some reports were 20-50 pages long. In addition to the length of reports, difficulty was voiced regarding finding necessary reports, this is evident in a statement from Lucy:

> I just have to periodically go out there and look. It is not always easy to do. The one bit of information that I need and I don't know how to get is the state hospital comparative data. It is the financial data and all the reporting to the state hospital association. Here is a certain path you have to take and I can't find my way through it.

Reports were commonly seen as tools for environmental scanning. The need for informational design was commonly voiced; leaving these two themes interrelated. The three most common terms used in describing ideal reports were "at a glance," "trending," and "drilling." Participants indicated that reports were used to identify trouble areas – particularly through the use of statistical process control charts, but that information needed to be presented at a very high level and provide a capability for them to "drill" to submeasures, thus requiring interactivity within the report. Mike voiced a this need for high level representation and interactivity:

> I get probably 70 emails everyday and lots of voicemails, those emails can range from everything from one or two liners to comprehensive stuff [emphasizes last two words] so there is a real need for the critical information we need to do our jobs effectively and to change behavior things like that. To have information presented at the highest level very very visually so that you can quickly observe a lot of information and see those things I have mentioned, trends, really good really bad and then when you see something to drill down. Very effective. We are just not there.

Jeff also mentioned needing to have data formatted at a high level, noting, "...if data have to be dug out, or if they are particularly late, they become fairly useless. So the format of the data, the fit into the workflow, and the decision flow is the real challenge."

Several participants felt that reports should provide measurements stratified at a lower level than region; George referenced a health system that had provided reports to providers showing their performance in scattergram where all other providers were anonymous:

> They just basically gave it to the docs and told them which letter they were. It was a very powerful tool for improvement because these guys down at the bottom really wanted to know who these guys were at the top, what they were doing that they had better outcomes.

Discussion

Highlights of this study found substantial changes on a number of survey items. These findings suggest that the intranet dashboard helped participants in different HealthFirst regions share information and ideas about Community Acquired Pneumonia. However, the effect of the dashboard may be called into question given that web server log file analysis indicated limited use by the research sample. Qualitative analysis of semistructured exit interviews found experiences of suboptimal report delivery, a desire for standard definitions across regions, and positive responses to the graphical dashboard design. The following discussion will explore possible explanations for these findings as well as unexpected findings. This will be followed by a discussion of strengths and weaknesses in the study design before concluding with implications and specific recommendations for further research.

Research Question 1: What trends may be evident related to coordination and cooperation after introduction of the dashboard?

Analysis of paired survey data suggests that after exposure to the dashboard there was greater cooperation and communication across the regions with respect to sharing data and ideas related Community Acquired Pneumonia. More than half of the survey items, which asked about agreement with positive characteristics of well-integrated health care systems, indicated substantial increases from baseline to follow-up. No change was seen on four survey items,

and one item saw a decrease. Each of these items will now be discussed in detail with respect to possible explanations and implications.

Clinical support staff and services seem well coordinated

Examination of paired survey data found the largest increase in agreement to be in response to the following statement: "Clinical support staff and services for Community Acquired Pneumonia seem well coordinated across regions." While no participants reported High Agreement with this statement at baseline, more than three quarters of the participants indicated High Agreement at follow-up testing.

One possible explanation for this finding is that there was no formal cross-regional coordination for Community Acquired Pneumonia prior to the introduction of the dashboard. Participants may have seen the dashboard and monthly E-mail updates as a service that helped to coordinate cross-regional efforts. This finding is important given that increased coordination between disparate regions in a healthcare system may lead to enhanced efficiency in quality-improvement initiatives.

Quality-improvement/action teams involve multiple regions

The second item with substantial changes across survey conditions was the perception that improvement/action teams involve multiple regions. Possible explanations for this change may have been the absence of any formal cross-

regional action team at baseline followed by the perception that involvement in the intervention was an improvement/action team activity. While there was no formal "list" of which executives had access to the dashboard, participants could have examined address properties of the monthly E-mail update and discerned who the other recipients were. Another explanation could have been the listing of a corporate Quality Improvement Facilitator on the FAQ/Contact page. In general, corporate employees at HealthFirst work only on cross-regional projects. Participants may have seen this person's name on the dashboard and concluded that a formal cross-regional quality-improvement team was in existence. During the course of this research a small, cross regional, action team did meet to discuss how the system could improve Community Acquired Pneumonia outcomes. It is unclear how many research participants were aware of this cross-regional team.

One qualitative-interview participant felt that it is important that site visitors have an implicit understanding of who else had access to the site and an indication of whether visits were concurrent. This is a feature of some Internet discussion boards; however, this feature was unavailable within the discussion board software available on the HealthFirst intranet. Knowing that another person within the organization was visiting the dashboard at the same time could facilitate chatting, or other synchronous communication such as talking on the telephone. This feature would no doubt need to be balanced with privacy issues – perhaps through user controls that allow the visitor a choice regarding whether their visitation is obvious to others.

Results of Community Acquired Pneumonia projects done at other regions are shared with me

This survey item elicited the third largest increase from baseline to follow-up. The most obvious explanation of this finding is that the dashboard served one of its primary purposes: displaying cross-regional performance measures. This is important because awareness of how another region is doing may provide a reference point and contribute toward organizational learning. For example, one region may notice that another is doing much better on a particular process measure and initiate a line of dialogue with counterparts to determine why a measure in one region is different from another regions.

It is important to note that the intervention did not necessarily report the results of specific projects; rather, measures were reported only at the facility level. In other words, a region might have multiple quality-improvement projects underway; however, the dashboard data displays would only report the overall regional performance measures and not measures stratified by particular project. Specific projects—for example, on a geriatric medical unit in a regional facility— were not identified in the dashboard model or monthly E-mail updates. The a priori expectation was that participants would use the threaded discussion board to exchange information on regional projects and otherwise collaborate. However, qualitative evaluation found only two postings on the discussion board, neither reflective of regional projects. When subjects were asked about the discussion board, most felt that using discussion boards was too unfamiliar or "new." This author was involved in several E-mail dialogues concerning cross-regional

projects; however, suggestions to move the dialogue to the discussion board to benefit a wider audience were unsuccessful. One feature of the discussion board that was not employed was a "subscription service." Had this feature been activated by either the participant, or by the researcher, each posting to the discussion board would have automatically been forwarded, or "pushed", by E-mail to research participants. In retrospect, it would have been valuable to enable this option so that participants could be more aware of content posted on the discussion board.

The need to have a formal method for communicating region-specific projects was voiced by at least one participant, who suggested in passing that having another button leading to regional action plans would be very helpful in promoting organizational "spread." This suggestion was posed to several other participants and who responded with agreement that it would be a useful feature. Another participant thought there should be a monthly newsletter that highlighted successful projects in specific regions. The utility of including action plans was made apparent to this researcher during semistructured exit interviews when one participant reported, "What I am really hoping is that we end up with databases of stories and databases of resources so that we know who to connect to."

Sharing data and ideas effective and straight forward

At baseline 7 out of 18 participants (38.9%) reported High Agreement with a survey item stating that sharing data and ideas about Community Acquired

Pneumonia from one region to another was an efficient and effective process.

Follow-up testing found that 83.3% of the 18 participants reported High

Agreement. This finding suggests that the dashboard may provide an efficient and

usable mechanism for sharing data and ideas across the region. Principle features

of the dashboard were graphical dials and detailed data displays that allowed one

to view measures from across the regions. The discussion board may have also

been seen as an effective mechanism for sharing ideas. This finding is important,

given that one region may have successes that could benefit others; without a

formal mechanism for sharing these ideas, regions may not benefit from each

other's successes.

Satisfaction with reports

Healthcare executives receive performance measurement reports through a

variety of modes such as intranet, E-mail, fax, mail, and word of mouth. It was not

clear a priori whether providing performance measurements on an intranet

dashboard would result in increased satisfaction or simply add to the relative chaos

of report delivery.

Participants indicated substantial increases in satisfaction with receiving

reports about Community Acquired Pneumonia across survey conditions. The

most straightforward explanation of this finding is that the dashboard represented

an improved report-delivery mechanism compared to traditional reports. This may

be due to the dashboard format meeting the report needs of the participants; the

dials may have functioned as a satisfying method for relaying performance

measures. Other explanations for this change could be the relative absence of cross-regional reports prior to the intervention and the crude effect brought about by receiving reports of any sort. Yet another possibility is that participants received local reports from regional analysts. However, triangulation with qualitative follow-up survey responses, unsolicited E-mails, and exit interviews did indicate appreciable satisfaction with the dashboard. Qualitative data found that executives voiced dislike with having to "dig out" information from traditional reports. They also expressed a desire for interactive reports that allowed them to "drill" through the measures, essentially stratifying the data display by another variable. To counter this known frustration with "digging out" data, the dashboard was designed with a graphical display of high-level performance measures. The existence of a "Drill Menu" allowed the visitor to stratify the dashboard by region and by time. Both of these features may have contributed to increased satisfaction with receiving outcome reports.

Same goals and standards

At baseline, 14 out of 20 participants (70%) indicated High Agreement with a statement indicating that when they contacted someone in another region they felt they were dealing with someone with the same goals and standards. On follow-up, all but one of these participants (95%) indicated High Agreement with this statement. One explanation for this change may be that the dashboard, by virtue of delineating several performance measures, served to create standard goals and standards. It is important to note that in no place did the dashboard report

explicit goals. Throughout the course of the intervention, senior management indicated that goals, or "targets," were still in the formative stage. Had these goals been clarified, the graphical design of the dashboard could have been modified to illustrate what the goal was for each measure. However, participants may have viewed this survey item in a more general fashion, seeing the performance measures on the dashboard as care standards and improving each of the performance measures as a goal. It is important to note that this survey item, despite demonstrating a significant amount of change, already had a substantial amount of High Agreement (70%) at baseline. This may reflect the general wording of the survey item (Community Acquired Pneumonia was not specified) and pre-existing shared views regarding improving outcomes. HealthFirst is a mission driven organization. Pre-existing shared views may stem from the mission statement and core values which focus on improved outcomes.

One theme in the qualitative interviews, with regard to barriers in systems integration, was a lack of common definitions. This theme contrasts with high baseline and follow-up levels in response to the following statement: "When I contact staff in another region, I feel that I am dealing with someone who has the same goals and standards that I do." Reactions to this survey item may have been biased by "goals" preceding "standards," resulting in "goals" taking on more importance in the participant interpretation of the survey item.

Mechanism for sharing fixes

One of the hopes for the dashboard was that it would allow regions to communicate successes with each other, especially by way of the discussion board. Messages posted in the discussion board would persist for the foreseeable future, providing feedback to the other interested region and with additional regions at a later date should their needs change.

At baseline, only 4 out of 20 participants (20%) reported High Agreement regarding whether there was a mechanism for sharing a "fix" with other regions. At follow-up, 9 of these 20 participants (45%) reported High Agreement with this statement. While these numbers represent a substantial shift across survey conditions, less than half of the participants indicated High Agreement at follow-up. One explanation for these findings is that the discussion board was not widely seen as a utility for communicating fixes. During semistructured qualitative exit interviews, several participants indicated that the discussion board approach was too unfamiliar, or that participants may not have posted content to the discussion board for fear of looking "stupid." Another explanation is simply that the discussion board was not as accessible as the other features of the dashboard. Most areas of the dashboard, such as "Core Measures" and "Tools," were available on the main navigation bar, which resembled the tabs on a set of folders. However, the button leading to the discussion board was much smaller and suspended from the main page header. Participants may have not recognized that this feature was available in the discussion board.

Access to data

Substantial increases in agreement were also seen across survey conditions in response to the following statement: "In my region we have access to the data we need in order to benchmark our performance against data from other HealthFirst regions." At baseline, 11 out of 21 (52.4%) of the participants indicated High Agreement, while at follow-up, 16 participants (76.2%) reported High Agreement. Presenting comparative measures from across the regions was a central feature of the dashboard. The default view of the Core Measures page presented a "System View" in the form of dials that represented aggregate measures using data from all of the regions. Visitors could then use the "Drill Menu" to explore measures for individual regions. The detailed data-display buttons below each dial represented another approach visitors could use to display comparative measures for each region. These data displays used clustered histograms, multiple-line charts, and numerical cross-tabulated tables to illustrate the performance of each of the regions relative to the other regions.

This measure is notable in that it was relatively high at baseline, with slightly more than half of the participants indicating High Agreement. One explanation for this could be the fact that the question was not made specific to Community Acquired Pneumonia. Many of the participants in this research study had access to an intranet site that reported comparative information for a number of performance measures. It could not be discerned how many of these participants were aware of this other intranet site; however, it could have been the basis for High Agreement for some participants.

Administrative services are integrated to achieve cost effective care

The last of the 7-point Likert scale survey items to show substantial

increases across both survey conditions concerned whether participants felt that

administrative services were integrated to achieve cost effective care. Fifteen

paired responses were obtained for this survey item: at baseline only four

participants (26.7%) indicated High Agreement, while seven (46.7%) reported

High Agreement at follow-up. While there was a substantial increase across the

survey conditions, at both baseline and follow-up less than half of the 15

participants indicated High Agreement with this statement. Furthermore, this

survey item had the lowest number of paired responses. One possible explanation

for the small number of paired responses is the difficulty participants may have

had in interpreting the survey item; in general, this survey item was more abstract

than other survey items. While charge information was posted on the dashboard

under the "More Measures" page, cost information was not available for posting.

In short, the dashboard did not report a measure of administrative integration

linked to cost of care. Without this information, participants would not have had a

data-driven basis for responding to this survey item. Furthermore, this question

was not made specific to Community Acquired Pneumonia or to whether

integration was within, or between, regions.

Other regions are supportive and provide resources

At both baseline and follow-up, participants indicated that other regions

were supportive and provided resources when quality improvement projects

spanned multiple regions. Twenty-one participants answered this survey item across both survey conditions. At baseline, 14 (66.7%) of the participants reported High Agreement, and at follow-up, 4 additional participants (85.7%) reported High Agreement. Possible explanations for these results are that participants in different regions have had past experiences with other regions that were supportive in nature. While the dashboard had a discussion board, which could be used to communicate support and point others toward resources, this feature was relatively unused.

Lots of talk but not much action

Only one survey item had a negative question stem: "When it comes to cooperation among regions, there is a lot of talk but not much action or support." For analytical purposes this question was reverse-coded so that a higher score indicated High Agreement with the idea that there was action and support when it came to cooperation among the regions. This survey item, which had 22 paired responses, found relatively High Agreement across both survey conditions. At baseline, 14 (63.6%) of the participants reported High Agreement, and at follow-up, one additional participant reported High Agreement (68.2%). The most likely explanation for these findings is that participants do see "follow-through" with projects that involve cooperation among the regions.

Staff in other regions are willing to help

The greatest levels of High Agreement, at both baseline and follow-up, were found in response to: "Staff in other regions are willing to help when I contact them with a question or request." Twenty participants provided paired responses and out of these, all but one (95%) reported High Agreement with this survey item. At follow-up, all of the 20 participants indicated High Agreement. One explanation for this finding is that staffs are genuinely willing to help. Another explanation is that these results are confounded by a ceiling effect brought about by an inappropriate measurement scale.

Interaction with staff from other regions

At both baseline and follow-up, 12 out of 23 participants (52.2%) said that they interact with staff from other regions. The principle mode of interaction on the dashboard was by means of the threaded discussion board. As this feature was relatively unused, it stands to reason that interaction levels did not increase. Even if a large number of the participants were using the discussion board for exchanging support and ideas, it is unclear whether this would be considered as interaction with staff from other regions. The fact that almost half of the participants reported not interacting with staff from other regions suggests that there are either few mechanisms for linking staff together for interaction, or that staff do not see a need to interact with counterparts outside of their region.

Nowhere to find consult in other region

Virtually the same response frequencies as "I interact with staff from other regions" were seen with respect to whether participants reported knowing where to find a consult in another region. Out of twenty-three paired responses, twelve (52.2%) reported High Agreement at both baseline and follow-up. This finding could support why almost half of the participants reported that they did not interact with staff from other regions. How could one interact if they did not know whom to contact? This finding also relates to at least one participant who voiced an interest in a site that reports stories and ideas, not merely performance measures. This finding also supports the idea that one feature that might be advantageous to add to the dashboard would be a membership list.

The existence of informal networks and an intranet human resources directory with title and contact information may also facilitate finding a consult. The intranet dashboard did not provide a list or profile of users. This was avoided due to concerns about protection of human subjects. Knowing the other users of the intranet dashboard was voiced by one participant in a qualitative exit interview as a valuable facet of other groupware applications. This public membership list could have different implications. On the one hand, it could engender community, communication, and a sort of collective accountability. On the other hand, it could represent power imbalances and inhibit communication. How many people want to post a message that will be read, and perhaps misconstrued, by senior management?

Opportunities to participate in organization wide activities

At both baseline and follow-up, 18 out of 23 participants (78.4%) indicated

High Agreement with having opportunities to participate in organization-wide

activities such as committees, task forces, and conferences. This lack of change

may have been due to ceiling effects. One possible explanation for this response

level may be the pervasiveness and availability of cross-regional activities. It

should be noted that the wording of this question was not made specific to

Community Acquired Pneumonia, as other questions were; doing so may have

reduced ceiling effects and lent precision to the question. Responses may also

reflect a loose definition of "opportunity" and "conference." Standard office

telephones have multiline conference-call features representing available

opportunities for conferencing with colleagues in other regions.

Staff in other regions cooperate when assistance is needed

The majority of participants providing paired survey responses reported

High Agreement with respect to whether staff in other regions cooperated when

assistance was needed. Out of 19 paired responses, 18 (94.7%) reported High

Agreement with this survey item across both survey conditions. This survey item

was very similar to another survey item that also saw considerable High

Agreement across both survey conditions: "Staff in other regions are willing to

help when I contact them with a question or request."

The high pretest levels could be due to existing networks providing

opportunities for staff cooperation. HealthFirst invests considerable effort and

support for cross-regional interactions, whether through video conferencing or in face-to-face interactions in the form of "summits" and "retreats."

Encouraged to benchmark

The only survey item to show a decrease in High Agreement was the following: "In my region we are encouraged to benchmark our performance against data from other HealthFirst regions." Twenty-one participants provided paired responses to this survey item. At baseline, 12 of these participants (57.1%) reported High Agreement, while only 9 (42.9%) reported High Agreement. One explanation for this could be that the "Benchmarks" button on each gauge led to national measures and not to regional measures. Another explanation is that during the course of the intervention, senior management did not identify specific benchmarks to be added to the dashboard. For example, the highest performer for one measure could have been identified and this could have been indicated on each region's respective dial. With this approach, one glance would show the regional performance on a dial and a benchmark reflecting the best region performance with that particular measure.

Overall integration and coordination

When asked to rate current levels of integration and coordination, participants reported substantial increases on follow-up. This survey question asked participants to provide responses on a 5-point Likert scale ranging from

"Poor" to "Excellent." Twenty participants provided paired responses to the following statement: "Currently the overall level of integration and coordination among the regions for Community-Acquired Pneumonia is...." Only one (5%) of these participants reported "Very Good" or "Excellent" at baseline, while seven (35%) reported "Very Good" or "Excellent" on follow-up. This suggests that the dashboard may contribute to overall integration and coordination; however, it also suggests that a majority of the participants still do not see high levels of integration and coordination.

Overall level of integration and coordination after one year

At both baseline and follow-up, a majority of the 19 participants who provided paired responses felt that after one year, coordination would be at least "Very Good." Possible explanations for this are pre-existing expectations of work to be done, as the recruitment letter specified that HealthFirst was tackling Community Acquired Pneumonia as an evidence-based medicine initiative.

It is interesting to compare this finding with the previous survey item that asked about current levels of integration and coordination – only 35% of the twenty participants who provided paired responses answered that it was "Very Good" or "Excellent" at follow-up. However, when asked how it would be in one year, 89.5%, or 17 of the 19 paired responses, reported it would be very good or excellent.

Overall integration and coordination three months ago

Twenty-one participants provided paired responses to a survey item asking about the overall integration and coordination 3 months prior to the time of the survey taking. At both survey conditions this was rated very low, with only one participant indicating it was "Very Good" or "Excellent" at baseline and no participants indicating it was "Very Good" or "Excellent" at follow-up. Considering the intervention was only 3 months in length, the question most accurately reflects baseline conditions. While this was useful information, more careful adaptation of the instrument might have resulted in a more sensitive question. One thing that is interesting to note is that when participants were asked about current coordination during the baseline survey, only 1 out of the 20 participants indicated it was "Very Good" or "Excellent." This finding suggests that there was not a considerable increase in overall coordination and integration in the 3 months prior to the baseline survey and the introduction of the dashboard.

Research Question 2: Will executives actually use the intranet dashboard?

The second research question concerned whether executives would actually use the dashboard. Web server log files were examined to help answer this question; results found only 18 out of the 29 participants visited the dashboard. This is important given that dashboards take considerable resources to develop, and the lack of use may indicate a low amount of utility. Furthermore, the dashboard was the main intervention in this research, and with little use by

research participants it becomes difficult to say that trends found in survey data are related to the dashboard. One possible explanation may be a variant of the carryover effect. Anecdotal evidence suggests that some research participants printed various pages from the dashboard and shared them during informal discussion and at executive meetings. While it is gratifying to see this type of carryover effect, these reports also support the finding that the confidentiality agreement was only viewed once, as it expressively warns against printing and sharing content found within the site.

The three most frequently viewed pages were Core Measures, More Measures, and Tools, respectively; this may be due to the order of their links on the navigation toolbar. A more rigorous study with larger sample sizes might present this in alternative sequences for different treatment groups. In addition to the limited traffic at the intranet dashboard, the discussion board saw little use in terms of posting messages and replies. Log files were not available for the discussion board, so no measure for how often participants accessed the discussion board was available. Over the course of the study only two messages were posted: one asking for box-and-whisker plots to be added and the other voicing positive feedback concerning the site. This was a disappointment, as it was hoped that the discussion board would see more use, specifically with freely flowing, threaded dialogues discussing measures and strategies for improvement.

Gordon (1998) was also faced with findings of low use and high acceptance; Gordon surmised that participant reactions of approval were with respect to the ongoing development of his dashboard project. This could very well

be the case in this research. Another explanation is that the observation period for this research was too limited and that more time is needed for people to become aware of the dashboard and to make it part of their work flow.

Low use could have been due to inadequate placement of the links to the discussion board. If log server files were available, it would be possible to examine frequency of access. The limited number of postings may have more to do with relative unfamiliarity with discussion boards and the tendency for most visitors to browse rather than post. With less than 70 users having access to the dashboard, including nonresearch participants, there may not have been enough of a "critical mass" to spark dialogue on the discussion board. Another reason why the dashboard saw such low use may be related to the poor match between the measures and the information needs of the research participants. Had the participants been able to design their own measures, they may have seen more utility in the dashboard. Conversely, if the participants had been front-line staff, rather than executives, they may have had a closer connection to the measures and used the dashboard more frequently.

One interview participant noted the utility of knowing the identity of other members of the "community" and how this could facilitate collaboration and communication. In short, providing profiles of users of the site, and even real-time reports of concurrent visitation, might serve to provoke communication and collaboration.

Research Question 3: What perceptions will executives have related to the design and usability of the dashboard?

Throughout the intervention period, there were many positive responses to the dashboard. Some of these positive responses were spoken or E-mailed directly to the researcher. Others were secondary reports relayed through informal relationships. Reports were received from throughout HealthFirst, including from top management. Anecdotal reports arrived of the dashboard being discussed in various meetings – indicating spread and adoption. When asked for their thoughts on the design of the dashboard, four themes emerged: positive responses to the graphical dashboard format, the need for a secondary needle to indicate direction of change, the monthly E-mail as a trigger to action, and a desire for access by a wider audience.

The positive responses to the dashboard format overwhelmingly related to the familiarity of the gauges, which looked like car speedometers. Additional feedback strongly supported the need for a secondary needle to indicate a previous measure and a desire for some other visible representations of comparative measures, or benchmarks. Participants did not seem to mind that a needle did not represent the sixth measure, average minutes to antibiotics. Interview participants saw the monthly E-mail update as useful; and it is notable that at no point did anyone request removal from the E-mail distribution list.

Research Question 4: What barriers will executives report with respect to coordinating and cooperating with counterparts within the healthcare system?

One barrier to regions coordinating and cooperating with one another was a lack of common definitions. The issue of trying to compare apples to oranges was familiar to many and emerged in the several interviews. This issue was not perceived with regard to the performance measures on the dashboard, probably because the definitions came from a third source and, prior to this research study, a great deal of cross-regional work went into defining data sources that matched JCAHO definitions.

Another thing to consider is that the most prominent measures on the dashboard were process measures, which were practices that need to be done regardless of patient characteristics. These measures did not need to be statistically adjusted to compensate for different age differences or for other characteristics that might confound results.

Interview participants also felt that having face-to-face interactions was a barrier to communicating and cooperating with one another. This underscores the idea that it is not enough to simply provide the information and expect a change. Rather, opportunities for in-person interaction are needed and cannot be entirely supplanted by electronic interaction.

Research Question 5: What perceptions will executives report with respect to receiving outcome reports?

In general, there was a consistent theme regarding the quality of outcome reports being suboptimal. Reports were widely used for environmental scanning purposes; however, there was a sense of not enough integration of financial and clinical information, or provider-level reports. While a few participants voiced having enough data, many indicated that they did not have enough information at hand. Virtually all participants uttered frustration on some level with difficulties in accessing needed data, either because it was buried in a 20-page report or difficult to locate on the organizational intranet. Progress was another theme related to receiving outcome reports, with a strong sense of the organization making significant strides in providing feedback.

This feedback is important in designing future dashboards. One reason for the relatively low use of the intranet dashboard may have been due to difficulty in locating the dashboard on the organizational intranet. Efforts to have a link added to the HealthFirst intranet homepage were not supported by the web services department due to competing demands. While efforts were successful in having the dashboard listed on other organizational intranet pages, it was unclear how often research participants accessed these pages. Only one visitation in the web server log file indicated that the referral source was from another organizational intranet site. It was clear, both from quantitative and qualitative data, that the E-mail updates were successful at stimulating visits to the dashboard.

Unexpected Findings

Several factors, spanning technological and cultural dimensions, prevented the dashboard from providing near-real-time quality measures. The testing phase during dashboard development revealed that data would not be available for use until at least 45 days had passed, as medical record coders needed time to determine final diagnostic codes. This represented a major introduction in reporting lag over the anticipated one-day lag. Yet another delay was introduced when quality checks found that regional staff were changing Core Measure data extracts on the JCAHO vendor website. The result was another 2 weeks of reporting lag as each region reviewed and edited records. This finding also resulted in a change in anticipated data flows with source data being acquired from the vendor rather than direct from the organization data warehouse. These two unexpected findings resulted in a feedback lag of approximately 2 months. While this lag was less than the JCAHO vendor quarterly report, which had a lag of 3 to 6 months, it still represented a considerable delay in delivery information into the hands of decision makers.

It was initially hoped that the survey instrument would provide a rich source of quantitative data that could be analyzed with inferential statistics. However, post-hoc examination of survey data found that responses on several survey items were skewed. Furthermore, it could not be established that the response options were on the interval measurement scale. Last, many survey items from the original survey instrument were modified to match the vernacular of HealthFirst and to make some questions specific to Community Acquired

Pneumonia. These changes may have impacted the psychometric properties of the original survey instrument. These findings, coupled with the lack of a control group and a limited sample size, contributed to the post-hoc decision to conduct a descriptive study.

Another unexpected finding was participant feedback concerning a secondary needle to indicate the value of the previous measure. It was possible to create these secondary needles; however, this introduced another manual step in what was hoped to be a purely automated dashboard. One approach to automating these dials would be to specify the white background of the dial as a transparent part of the image. The table cell holding this image could then have its background image set to display an image corresponding to the previous value.

Limitations

Perhaps the most notable limitations in this research were the lack of a control group, the use of a convenience sample, and a limited sample size. These constraints limit the ability to determine the true effect of the dashboard and to generalize results to other settings. Potential threats to internal validity in this study include carryover effects due to the same survey being administered with only 3 months' duration. Two historical threats were the first outbreak of Severe Acute Respiratory Syndrome (SARS) in North America occurring during this intervention and also the convening of a small cross-regional meeting discussing how to improve outcomes related to Community Acquired Pneumonia. Media reports related to SARS could have heightened awareness around respiratory

illnesses and contributed to changes that were observed on several survey items. While total membership cross-regional team of this team was quite small, with approximately 10 members, and only one meeting occurred during the research period, knowledge of the existence of this team could have influenced survey and interview responses. Another threat to interpreting the results from paired survey scores may be use of monthly E-mail updates. These updates contained information about Community Acquired Pneumonia; it's possible that the content of these E-mails impacted how participants answered questions on the follow-up survey.

Organizational constraints also limited this research by restricting what variables could be used for outcome measures. The goal of the dashboard was to provide decision support for healthcare executives and to facilitate the diffusion of evidence based guidelines and order sets. However, it was not possible to measure how often providers utilized order sets. Furthermore, due to potential legal ramifications, the organization did not allow the performance measures to be used as dependent variables in this research.

This research was also limited with respect to the length of the intervention. With only 3 months between baseline and follow-up measurements, it is possible that the time span was too short for the dashboard to fully diffuse throughout the research sample. One factor affecting the rate of diffusion is observability (Rogers, 1995, p. 244). Unfortunately, intranet dashboards are not well suited to observability due to the singular nature with which people view information on their computer monitors.

Additional time should have been spent with the design and systems analysis phase during the dashboard development phase of this research; doing so would have revealed problems with the data flow and the necessity to include a secondary needle. Issues with data quality and organizational structures resulted in a dashboard that did not have near real time data. This limitation may have contributed to fewer visits to the dashboard by research participants. Another limitation was that the dashboard was very limited in focus, featuring measures specific to one disease process. While some complementary measures were also integrated, such as financial data and patient satisfaction, these did not have the same visibility as the gauges that displayed JCAHO Core Measures.

Another limitation in this research is that the dashboard focused on measures that were primarily reported as percentages. Using analogue gauges worked well for these measures as there was a defined range beginning with 0% and ending with 100%. However, this approach may not generalize well to other measures that are not represented as percentages. For example, the performance measure "average minutes to antibiotics" was not displayed with a graphical gauge. Furthermore, the measures were limited to the facility level, which may have been too general for some participants. For example, if the measures could have been specific to individual hospital units or providers, participants may have found more utility in the dashboard. Likewise, the use of convenience sampling and the executive status of research participants presented a limitation to this research. Had a larger sample size been available, with participants ranging from providers to unit managers, this research may have produced different results.

This intervention was also heavily reliant on information technology; implementation in a setting lacking a digital information infrastructure may not work. Furthermore, executives need to have access to a network-enabled computer and the time to view an intranet site. For small or underfunded healthcare systems, these constraints may be considerable obstacles.

Future Research

Analysis of paired survey data suggests that use of the dashboard facilitates cooperation and coordination between facilities in a geographically dispersed healthcare system. A more rigorous research design, using larger sample sizes with random selection and assignment is needed to explore whether these findings are the result of the dashboard, or the result of confounding variables. Future research should also examine how to improve the dashboard so that it includes action plans and progress notes related to regional projects, rather than relying on the existence of the discussion board as a communication medium. Research should also examine the role of E-mail notification of discussion board activity. This type of approach may engender increased use of a discussion board. Several participants mentioned wanting to know whom else was visiting the site. To this end, integrating biographic sketches and an indication of whether another executive is concurrently visiting the site may be helpful. Kesner (2003) created a web portal for sharing knowledge and collaboration for the information services division at a geographically dispersed university. The portal contained customer survey feedback data, documents, tools, and biographical data so people could identify

experts within the organization. Findings such as this, combined with the graphical design of the dashboard, may contribute toward increased utility for healthcare executives.

Further development is needed to create the programming code necessary to support a secondary needle that portrays a previous time period. For measures that are not easily reported in percentages, intuitive gauges need to be created. Researchers may also want to explore the effect of a dashboard that allows the executive the ability to create their own dashboard display. For example, if an executive was interested in the mortality rate of a specific patient population – a dashboard that allows the executive to define this measure and see it graphically depicted on a dashboard may provide more utility to the executive.

Another area that needs to be researched is how non-executives can utilize a dashboard. In many ways this research assumed a "trickle-down" effect, with executives noticing that improvements need to be made in their facility and indirectly initiating quality improvement initiatives. If employees from all walks of life in the organization can access the dashboard and view results that are specific to their work area, the dashboard might yield different results.

Conclusions

This research resulted in a number of important discoveries and avenues for further research. Highlights include qualitative data in support of the graphical design of the dashboard and quantitative data that suggest the dashboard contributes to increased communication and cooperation between executives in

geographically dispersed healthcare facilities. These findings are balanced with difficulties in automating the dashboard and examination of the web server log file, which indicated that the dashboard saw very little use.

It is clear from qualitative observations that dashboards may serve a valuable function in a world where healthcare executives need high-level feedback about the status of mission critical indicators. This research resulted in the design of a dashboard whose basic design and functionality can be adopted by other healthcare organizations. However, before other healthcare organizations implement a dashboard such as this, careful attention needs to be paid to organizational culture and structures that may be at odds with project goals. For example, if the healthcare organization restricts the detail at which data can be displayed on the dashboard, and if access is limited to only a small group of executives, the full potential of the dashboard may not be realized and it may see little use. In addition, the importance of E-mail notifications and reminders should not be understated. It is not enough to build an intranet site and expect that executives will make it part of their daily routine.

Organizations also need to carefully examine the quality of their data. A dashboard that uses questionable data may actually be counter-productive, leading to inaccurate decisions and possible distrust of the dashboard. Furthermore, if the quality of the data is questionable it may not be possible to automatically update the dashboard, as the data will need to be quality checked prior to any updates.

With an awareness of these issues, healthcare organizations may consider implementing their own dashboards. In the months following the end of the data

collection phase in this research, it has been gratifying to see the dashboard

concept diffuse throughout HealthFirst. One dashboard has been implemented in

support of the evidence based care of patients with diabetes. HealthFirst has also

created a dashboard with a broad range of quality measures as part of a

transparency initiative. This transparency dashboard is currently accessible to all

employees on the organizational intranet, next year it will be released for public

use on the HealthFirst Internet site. With further evaluation and refinement,

dashboards such as these may contribute toward a goal that spans the healthcare

continuum…improved decision support and ultimately, improved patient

outcomes.

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Appendices

Appendix A. Design and Development of Intranet Dashboard

Development of the dashboard was guided by the system development lifecycle with activities focused on six areas: Analysis, Design, Programming, Testing, Implementation, and Maintenance (Laudon & Laudon, 2000). During the analytical phase organizational constraints, available tools and resources, and information flows were identified. Design involved creation of mock data displays using graphical dials as well as conventional approaches such as high-level numerical values in tabulated grids and histograms. These prototypes were presented to an expert panel before a final design was solidified. Programming involved a variety of high-level languages for building interactivity into the dashboard and for automating data flows. The testing phase dealt with usability tests and examination of data quality; once this phase was complete the executive sponsor sent an E-mail announcing the site and requesting that executives participate in the research study.

Systems Analysis

The systems analysis phase of the software-development life cycle involves identifying organizational constraints, available tools and resources, and information flows. Certain constraints were communicated via executive management; others were a factor of time and resources. For example, the JCAHO Community Acquired Pneumonia Core Measures were required by executive management to be the predominant measures on the site. Access to the site had to be restricted to executive management, and the term "Dashboard" could not be

used, as it was felt the term had been misused too often within the organization. No funds were available for purchasing commercial solutions or new development environments that might facilitate the creation and implementation of a dashboard. Furthermore, future resources could not be anticipated, so mechanisms for updating the measures had to be as automatic as possible.

An inventory of available tools and resources followed the identification of pre-existing constraints. At hand was the organizational data warehouse containing approximately 6 million records representing inpatient and outpatient hospital visits across five facilities in three states. Within this data warehouse were reports of visits by patients with Community Acquired Pneumonia; summary values from these patients had to be reported on the intranet dashboard. Also at hand was a Microsoft Access database named "Core Measures" This database presented significant savings in development time, as it contained 48 prebuilt queries that extracted records from the data warehouse and manipulated them until they met JCAHO submission requirements. This database ran automatically once a month and generated a comma-delimited file for each region to upload to the JCAHO vendor.

HealthFirst had several query tools and report packages that were available for reporting purposes, such as Microsoft Access, Statit, Crystal Reports, and SPSS. All of these tools had the ability to be scheduled to automatically connect to a data source and perform some degree of data extraction and formatting, followed by posting of the content in HTML format. Also available was Macromedia's

Fireworks, a vector graphics package optimized for creating web based images and page designs.

As a means of handling the information flow, beginning with record extraction from the data warehouse and ending with populating the CAP dashboard, CAP queries could be isolated from all of the Core Measures queries and replicated in another database called "CAP Measures." Here, they could be scheduled to run more frequently and modified to bring in additional information from the data warehouse to support ad hoc measures such as length of stay and readmission rates. Start-up preferences in this database specified a particular form to display. When loaded, this form executed a series of programming commands that resulted in the execution of sequential queries against the data warehouse. This process could be automated by using the Windows 2000 Professional Scheduler to open the database at a reoccurring point in time, thereby creating a refreshed dataset. This dataset was then available for use by third-party query tools and report-writing packages. All tools could be scheduled to run nightly following the data-warehouse refresh, creating a near-real-time dashboard.

The organizational intranet server was available for use and security mechanisms in place for restricting access to specific content. Static pages could be posted and edited with Microsoft FrontPage, which was the organization standard for web editing. For intranet and Internet applications, all employees used the same version of Microsoft Internet Explorer, reducing issues related to cross-browser functionality. Various sites on the intranet used programming on the web server to dynamically query a database and display results on a web page;

however, it was determined that employees who were not on the web services could not store programs on the web server, as doing so could introduce security and performance issues. However, desktop computers in the organization had the capability of running programs and serving web pages on the intranet. An unused desktop computer could be utilized as a web server for the dashboard. One issue that needed to be dealt with was an organization policy that no identifiable patient information be kept on a desktop computer. This issue was solved with a new database called "Cap Clean" that would periodically retrieve summary tables from the CAP Measures database. Last, this web server could be run in a password-protected mode behind double-door lock and key. This resulted in a total of four data sources. A graphical representation of this reporting mechanism may be found below in Figure A.1.
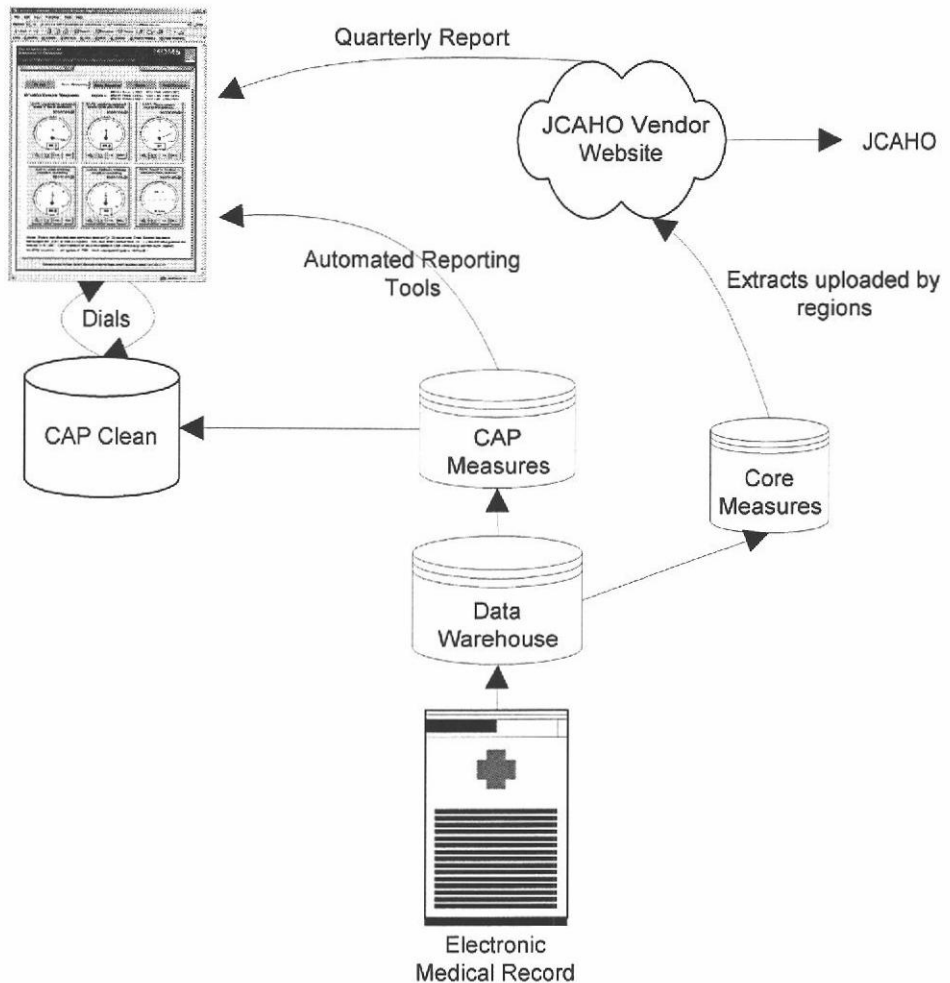
Figure A.1 Data sources for populating the intranet dashboard

Systems Design

The systems analysis phase determined what constraints were present, what

resources existed, and mapped how tables of summary CAP data could be

provided for query tools and report writers. No constraints had been placed on the

default view of the measures. Design involved creation of mock data displays

using graphical dials and conventional approaches such as high-level numerical

values in tabulated grids and histograms. To ensure expert face validity, a panel of 14 expert users reviewed the prototypes. These experts had extensive experience with displaying information to executives. In addition, participants who were not in the reference population and who indicated difficulty with understanding outcomes reports were purposely sought out for feedback in the early dashboard-design phases. Feedback found overwhelming support for a graphical dial display.

The outcome of the design and prototyping phase was a site using a dashboard and tabbed-folder metaphor, which has been demonstrated to be an effective navigation method (Kesner, 2003). This tabbed navigation approach represents a form of progressive disclosure, with each tab providing a reference to location and indicating what lies within. Every content area has the same header and navigation interface as shown below in Figure A.2. This header functions to identify the site and included an organization logo to increase familiarity (Carpenter, 2002). An EKG motif was used on the header to set the context of healthcare and a link trail made for orienting the user as to location on the organizational intranet.
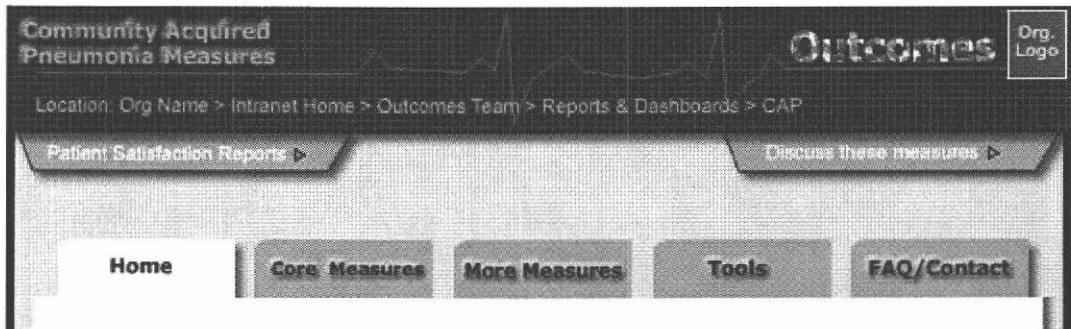
Figure A.2 Header and tabbed navigation bar

As some users would be accessing the site from devices with low screen resolutions, the main template design was limited to 600 pixels in width. This ensured that users with lower screen resolutions would not have to scroll horizontally to access content.

The CAP dashboard consisted of five content areas, or "tabs." A single "Entrance" page required visitors to indicate agreement with a security statement. Following agreement with this statement, visitors found themselves on the "Home" page; the purpose of this page was to provide a purpose statement and a log of site changes and updates. At this point, visitors were presented with an expanded navigation bar offering a full range of choices to all content areas: Core Measures, More Measures, Tools, FAQ/Contact. Links are also provided to a Patient Satisfaction report library and to a threaded discussion board. The name and function of each of these content areas are briefly described below in Figure A.3.
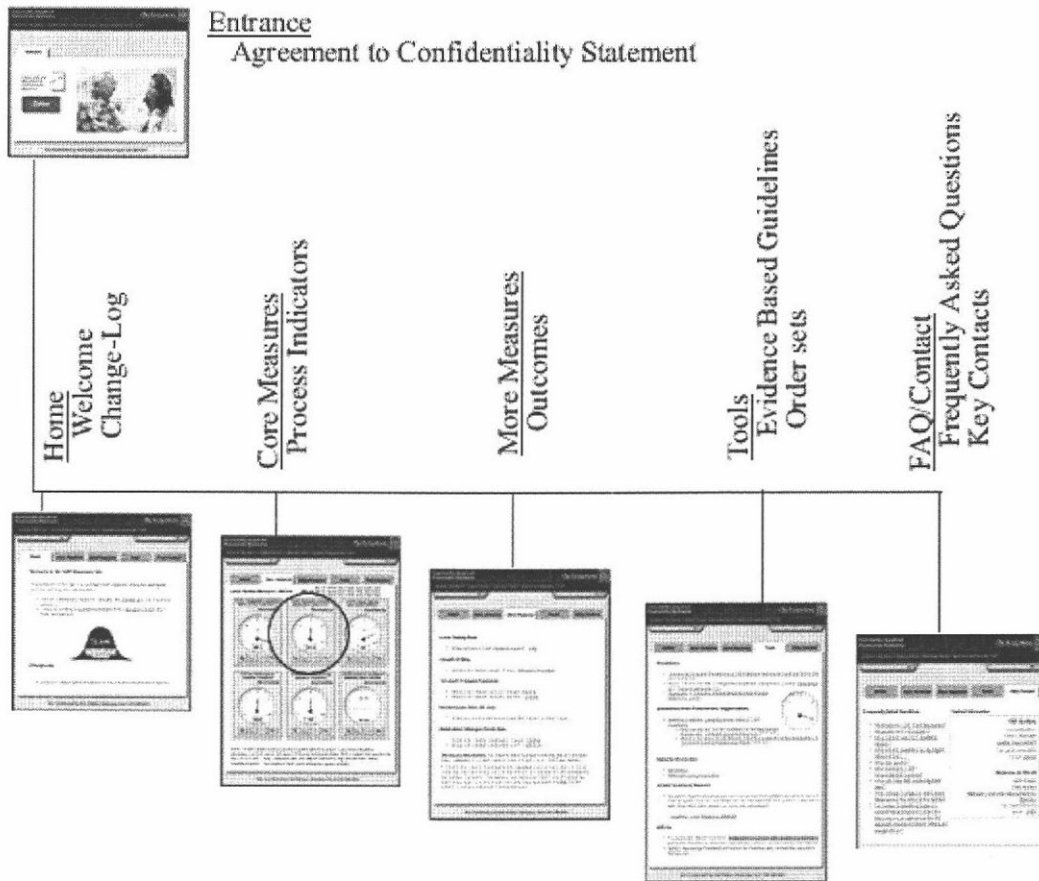
Figure A.3 High level view of intranet dashboard

Entrance Page

The CAP site was designed with a single "Entrance" page (Figure A.4)
requiring agreement with a confidentiality statement. The confidentiality statement
provided an overview of proper handling techniques and warned against
unauthorized disclosures. Also present on the Entrance page was an image
depicting a caregiving scene between a nurse and an elderly patient. Members of
the web services team provided this image for internal use; as consent for extra-
organizational use could not be obtained, the image was obscured using a graphics

filter. All intranet users were allowed access to the Entrance page, but file permissions restructured further access to authorized visitors exclusively. Agreement with the confidentiality statement led visitors to the "Home" page. A notable design difference between the "Entrance" and "Home" pages was a much more comprehensive navigation bar providing links to all content areas.
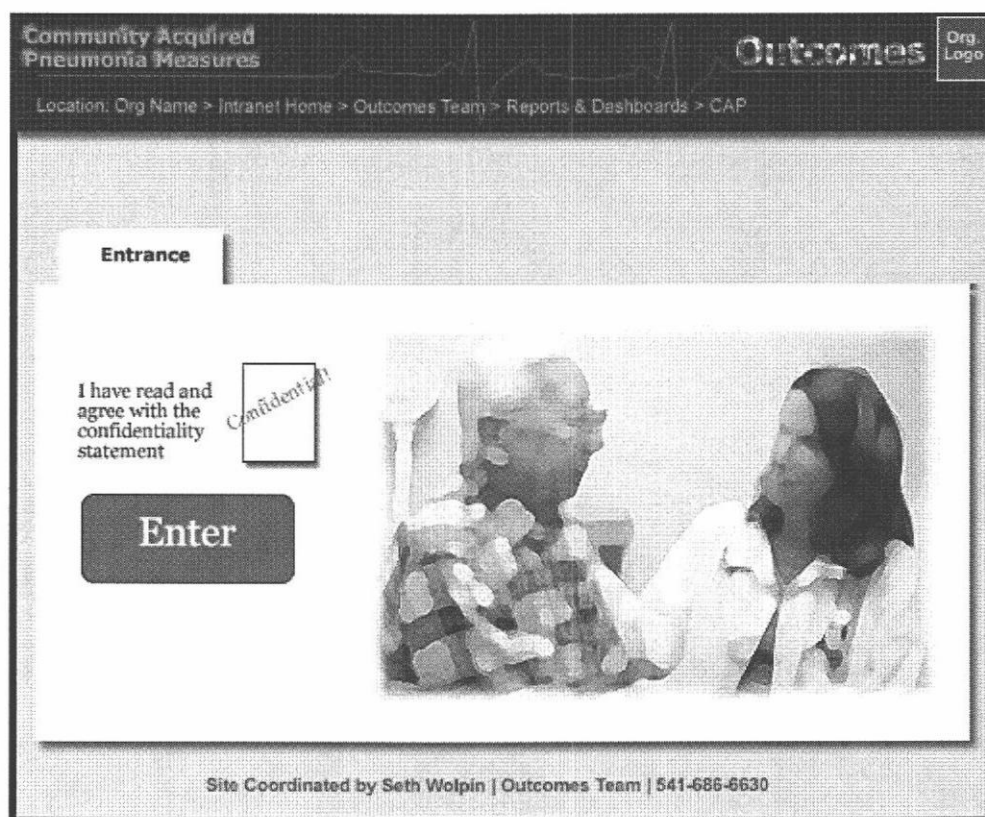
Figure A.4 Entrance page

Home

The purpose of this page, presented below in Figure A.5, was to provide a brief welcome statement, a link to support information, and a list of updates and changes made to the site. Below the welcome statement was a bell-shaped curve

with the acronym for the Outcomes team masking a collage of team members. Across the base of the bell curve was the team motto: "Working with you to transform data into knowledge." Further below was "change log," organized as a bulleted list detailing updates and modifications made to the site.

In addition to providing a welcome and a brief update of recent changes, the home page also existed as a methodological tactic to prevent website metrics being confounded by default views. That is, if the Entrance page led users directly to the Core Measures page, instead of a neutral page, it would be impossible to determine with web analytics what preference was given to Core Measures.
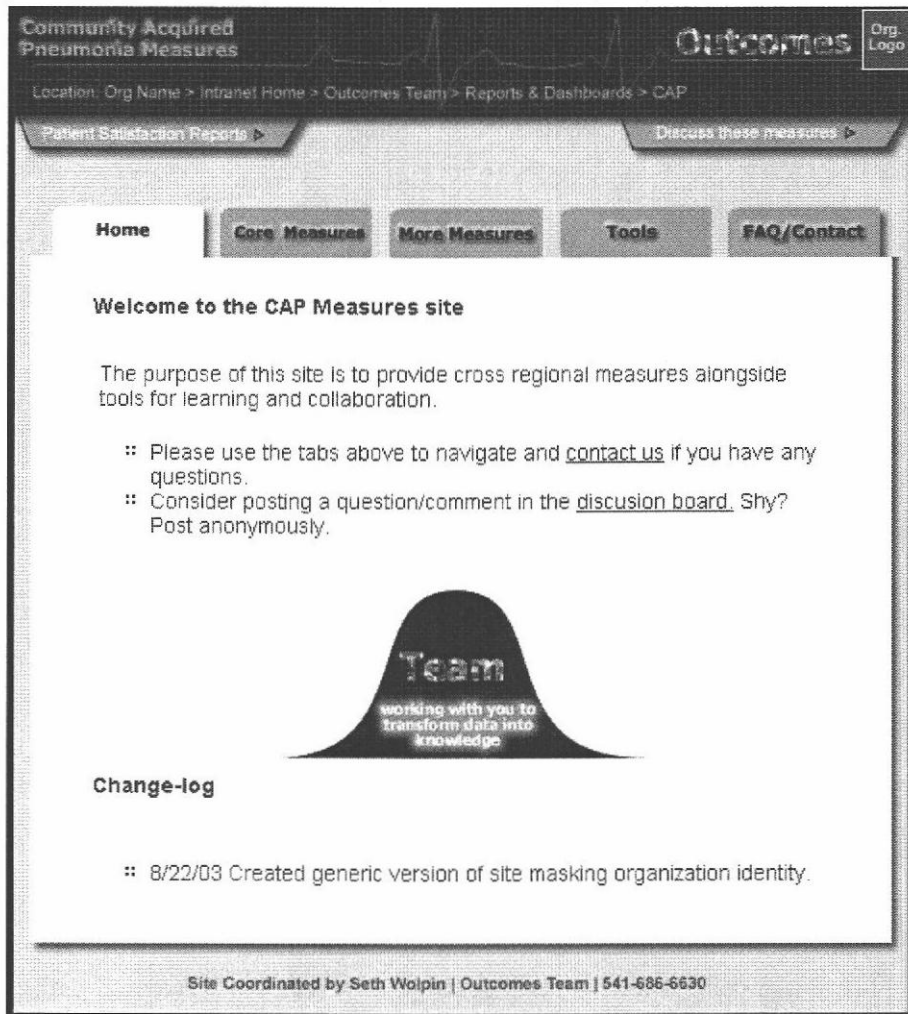
Figure A.5 Home page

Core Measures

This page presented six graphical gauges reminiscent of a speedometer, with each reporting the latest available CAP Core measures. A screen shot of this page is provided in Figure A.6. The numerical value on each dial, and its corresponding needle placement, was to be determined by selected values stored in a local database having only summary values. A blend of high-level programming

languages allowed the same page to display different dials for different regions and time period based on what the visitor wanted to see. Below each dial a series of buttons led to an additional four levels of detailed information in differing formats: Bar Charts, Statistical Process Control Charts, Frequency Tables, and Miscellaneous Output. A variety of software tools were used to automatically publish this content on the dashboard.
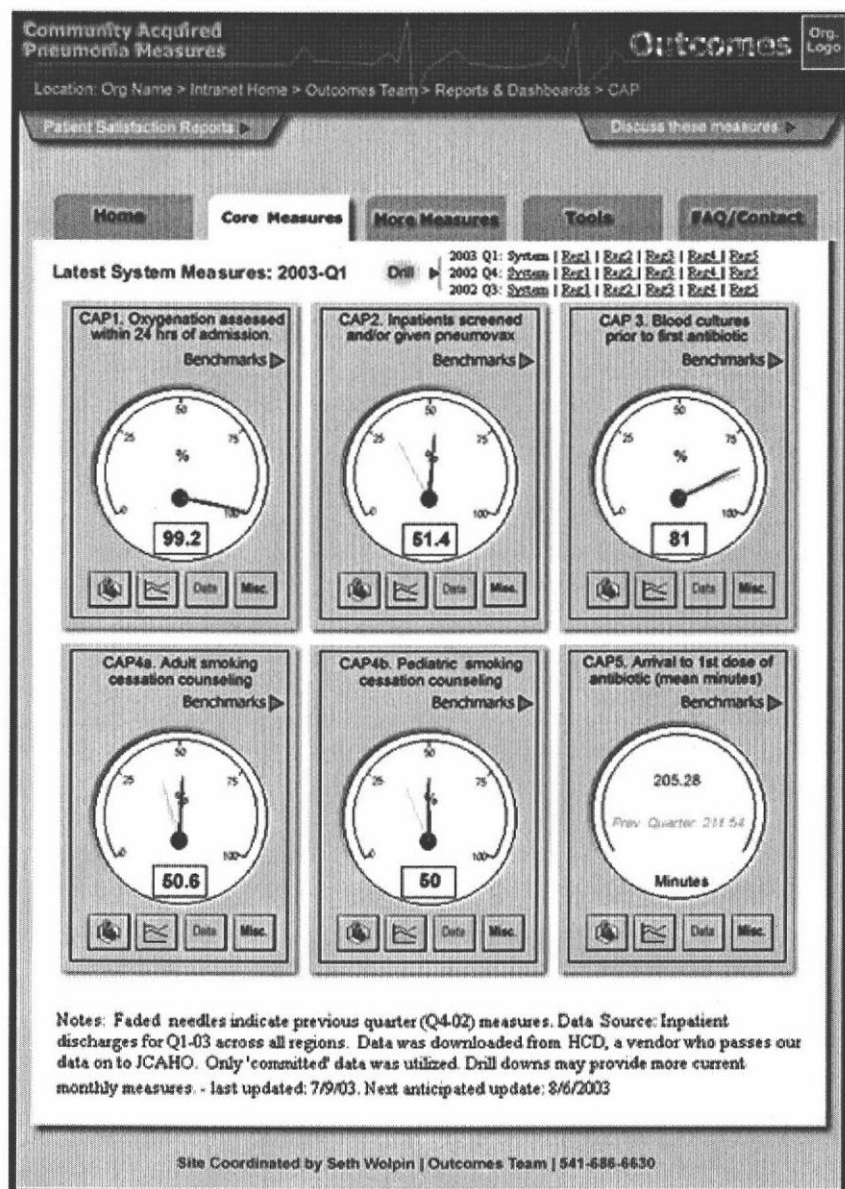
Figure A.6 Core Measures

More Measures

This page was used to display outcome results of ad hoc queries and measures identified by quality leaders such as Length of Stay, Mortality Rate, 30-day Readmission Rate, Account Total Charges. This page is represented below in Figure A.7. A prominent link on this page solicited requests for having new measures posted there. Separate requests were met for Top Ten Principal Diagnoses, Medications Costs, Septicemia Rates, and Antibiotic Use. Measures were displayed following a question stem that was then hyperlinked to a new window displaying the measure stratified by time and facility. This detailed output was created using SPSS syntax files that ran against the CAP Final SPSS dataset. Output was scheduled using the SPSS Production Facility and Windows Scheduler.
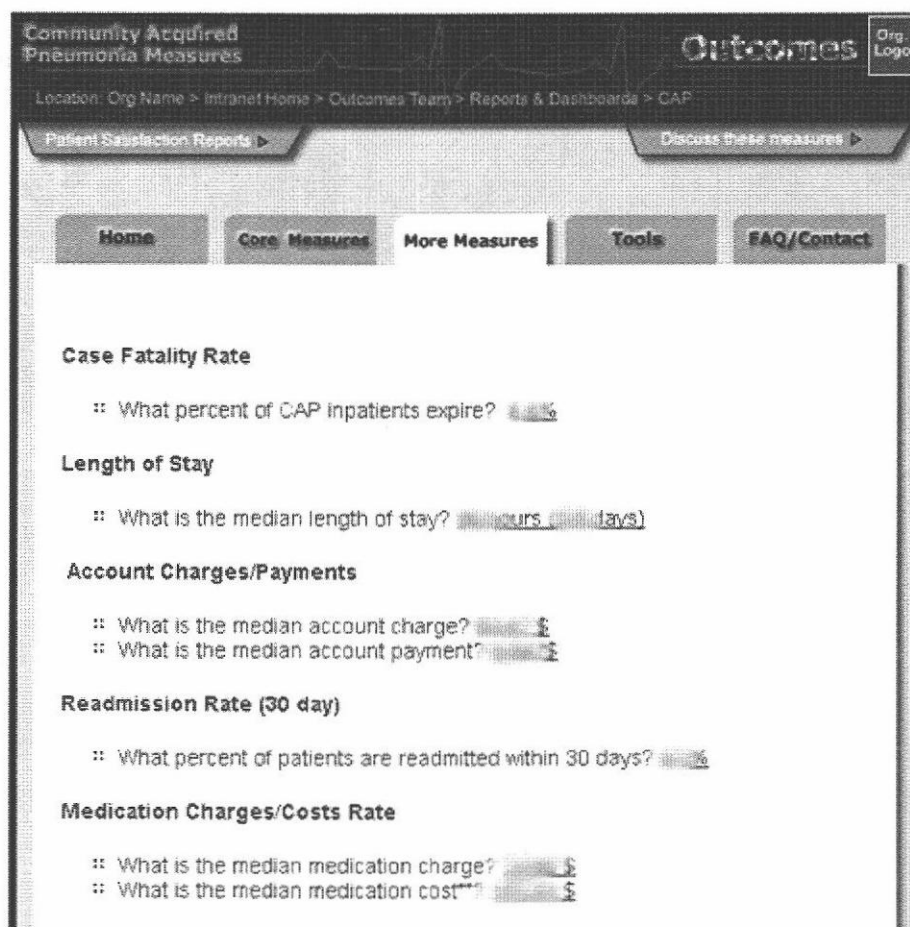
Figure A.7 More Measures

Tools Page

The first part of the Tools page, as seen in Figure A.8, contained links to a standard HealthFirst "order set" that regions could download, print, and make available to providers. Developed according to evidence based guidelines by a cross-regional team, this order set essentially grouped necessary medical orders for the care of CAP onto a single document akin to a flow sheet. As some regions already developed their own order sets, a "cross-walk document" was provided that noted the similarities and differences between regional order sets and the of regional order. Further below were links to CAP guidelines on the Intranet, general

overviews of CAP, online academic articles related to CAP, and JCAHO quarterly reports.

Figure A.8 Tools page

FAQ/Contact

This page, represented below in Figure A.9, functioned to answer frequently occurring questions. These were culled from other reporting sites and answered questions about purpose, refresh rates, data and measure definitions. This page also contained contact information for an expert quality improvement facilitator on the Continuous Improvement Team and contact information for this researcher, the 'Site Coordinator".

Figure A.9 FAQ/Contact page

Patient Satisfaction and Discussion Board

Two buttons descending from the header provided links to a patient satisfaction report library and to a discussion board. The patient satisfaction report library was hosted on another site. Satisfaction reports were not available specific to CAP definitions, however a link to the entrance page for more general patient satisfaction reports was made available. This site also included organizational health reports compiled from routine employee satisfaction surveys.

The discussion board button led to a threaded discussion board. Messages posted here persisted and visitors could choose to simply browse, leave a reply, or start a new topic. Visitors could also post questions and comments anonymously, well as revisit their posts and delete them at will and include attachments for others to view.

Systems Programming

A variety of graphic design techniques, web formatting, and high level languages were used in the creation and automation of this intranet dashboard. A general overview of these approaches is described below.

Prototypes and final designs were created using Macromedia Fireworks, a vector graphics program containing tools for bitmapped and vector graphics. Additional features that were exploited in this software were image optimization, HTML export, and basic animation options.

A full-page design, measuring 600 pixels in width was created. Image components were saved on different layers within Fireworks for juxtaposition

effects and easier image editing. The resulting designs required image slicing as some areas were better optimized in different graphic formats and because some page components required image-swapping capabilities.

Many computer images are stored at very high resolutions, which are not seen on monitors due to resolution limits imposed by computer monitors (Powsner & Tufte, 1994). As some members might be accessing the intranet via remote access dial-up and virtual private network connections the file size for each image was evaluated for need, size, and quality with respect to resolution. In general, highly detailed images such as bitmapped photographs images were exported in JPG format while images containing solid colors were exported as GIF files allowing for a 20% image loss and adaptive 256 color palette to conserve overall file sizes.

In addition to the creation of optimized image slices, Fireworks MX was also used to create a file with the HTML tags necessary to reassemble the image slices. This HTML file was then re-used to create primary content pages within the site. Each page contained the same header, background, and footer. Differences were found in page titles, versions of the navigation bar (each having a different tab raised reflecting content location) and in the main content area.

The dial was also designed is a vector graphic object intended for slicing and export. It is important to note that 101 image slices were created so that needles for every whole number value between 0 and 100% could be used. Accomplishing this manually would have been difficult to do, as each needle position would need to be manually rotated prior to the creation of individual

image slices. An animation technique called tweening was used to automatically create 101 image files. To accomplish this the vector graphic object representing the dial needle was converted to a symbol. Instances of this symbol were then placed pointing to 0% and 100%. A tweening command was executed and results were distributed to 101 frames. All frames were then exported in one step as separate image slices.

An externally linked Cascading Style Sheet controlled the presentation of textual content. This sheet specified font styles and background colors for links, allowing for site-wide formatting changes to be made from one file, it also served to increase accessibility as visitors could choose to use their own style sheet, providing more tailored settings for the formatting of content.

A JavaScript function was inserted into the header of each page. When called, this function specified the width and height for opening window. In general, links that pointed to supplemental information within the site called this JavaScript function. The purpose of this was to provide concurrent views of main content and supplemental content such as the clustered bar charts and statistical process control charts. This juxtaposed display of dense data alongside a graphic representation of an aggregate value provides for both micro and macro readings (Tufte, 1990, p .39).

The programming phase for automating the dials involved writing pseudo code for the retrieval of specific values in the database and the image substitution to portray the correct needle position for the analogue dial. This code was implemented using server side scripting, a method that allows the server to

communicate with the database and generate HTML to the browser (Corning,

Elfanbaum, & Melnick, 1997, p. 115).

Server-side scripting code was added to the HTML on the CAP Core

Measures page. This is loosely represented below in Figure A.10. Following the

activation of a link (A) hidden parameters in the suffix of the link were used to

extract specific records from the CAP Clean database (B). In assembling the dial,

an image slice corresponding to the rounded value for the measure was inserted

(C), the numerical value was also reported in a text box below the main dial (D).

Figure A.10 Steps for updating dials

The code used for automating the dials is represented below. To make the code more readable, all HTML has been removed. When fully implemented this code includes HTML for specifying the layout and placement of various image slices and page element.

```
<%

' -------------------Error Trapping -------------------------
If Err.Number <> 0 Then Response.Write Err.Description

' ------------------Declaring Variables----------------------------
Dim rs
Dim strQuery
Dim adoCon
Dim oConnection
Dim qrstrRegion
Dim qrstrQrterYear
Region = Request.querystring("qrstrRegion")
QrterYear = Request.querystring("qrstrQrterYear")

' ----------------Connecting to the Database----------------------------
Set oConnection = Server.CreateObject("ADODB.Connection" )
oConnection.Open "Provider=Microsoft.Jet.OLEDB.4.0;" & _
"Data Source=C:\Inetpub\wwwroot\cap\misc\CapClean.mdb;" & _
"User Id=admin;Password=;"

' ----------------------Building Query String-----------------------------
strQuery = "SELECT * FROM tblAggregatemeasures where region = '" &(Region)& "' and
QrterYear = '" &(QrterYear)& "'"

' ----------------------Executing the Query-----------------------------
Set rs = oConnection.Execute( strQuery )

' ----------------------Displaying View Name------------------------------
Response.Write "<div align='Left'><bCurrent View:</b> " & rs("Region") & " :: "
Response.Write rs("QrterYear") & "</div>"

'-------------------------Displaying needle image slice------------------------
Response.Write "<img src=needles/"& Round(RS("cap1"))&".gif><br>"

'-------------------------Displaying numerical value----------------------
Response.Write rs("cap1")

'-------------Close the connection object ----------
RS.Close
Set RS = Nothing
oConnection.Close
Set oConnection = Nothing

%>
```

One issue that came to light was that the sixth measure was not represented as a percentage, but as average minutes to antibiotics. Due to time and resource constraints, a decision was made to replace the dial with text reading "Please See Numerical Value Below." Further below this numerical value were specific buttons with each leading to more detailed data display. The content for each of these areas was created using a different tool and high level scripting. The Bar Chart button invoked the JavaScript pop-up function, which then displayed a web page with a large clustered bar chart for a particular measure. Crystal Reports was used for retrieving, formatting, and posting bar charts. A third party tool was used for scheduling this action and having content be posted on the web server in HTML format following each refresh of CAP Measures.

The Statistical Process Control Charts were created with Statit, which was the HealthFirst standard for creating SPC charts. Syntax was saved as macro files, specifying database connection strings to summary tables in the CAP Measures Database. The macros also contained query strings, and html output destination. Macros were scheduled to run following the CAP Measures database update using the Windows Scheduler utility on the Researchers desktop computer.

The data button led to a display of numerator and denominator counts for the process measure, stratified by region and month. Row percents were used displayed. This content was generated with the same type of server side scripting as detailed in the Core Measures dials with the notable difference that there was no image substitution.

Miscellaneous output fell under the fourth button. This was output generated using SPSS. Following a refresh of the CAP Measures Database, a scheduled SPSS Production Facility task named "UpdateCAPFinal", scheduled using the Windows Scheduler, triggered a SPSS syntax file on a network drive. This syntax contained a database connection string to the CAP Measures database. It also included an SQL statement, and a series of data manipulation steps that acted to recode the data for analysis. The final step in this syntax file saved the working dataset as a SPSS data file called "CAP Final". Syntax files were then created that opened this dataset and created descriptive and inferential output for specific performance measures. Production Facility tasks were created that referenced each of these syntax files and specified a specific directory on the web site for output in HTML format.

The last area of the site to include programming was the discussion board. The design and programming for the discussion board was created prior to this research by the HealthFirst web services team. Using server side scripting and a secure back-end database, this application featured a web-browser interface where discussion board administrators could perform basic tasks such as setting security and display properties. Security was set to restrict access to research participants and other authorized users. Discussion board administrators could also "subscribe" members so that anytime something was posted to the discussion board an E-mail copy of the message, along with a link to the discussion board, would be sent to the subscriber. This option was not enabled, leaving the subscription decision in the hands of the visitor.

the subscriber. This option was not enabled, leaving the subscription decision in the hands of the visitor.

Testing & Implementation

Both formative and summative testing was conducted to ensure that programming and usability were optimum (Barr, et al 2002). All queries were quality checked by two data analysts for face validity. Measures were quality checked by comparing output between multiple query tools. Proxies for the research participants were observed using the dashboard and probed concerning usability. This researcher methodically activated every hyperlink looking for errors in logical linking and links that resulted in file not found errors. Web server log files were also examined during this testing phase for potential errors.

It was initially hoped that the database underlying the dashboard could be scheduled to run immediately after the data warehouse refresh. As this latter refresh was moving from a weekly to nightly task, the dashboard would reflect near-real time measures. However, during testing it was determined that patient visits were not fully coded for admitting and primary diagnosis for up to forty-five days after the visit end date. This time period was needed for coders to review medical records and receive clarification from providers before determining a final code for reimbursement purposes. These codes, necessarily for determining inclusion in the CAP JCAHO dataset were not transferred to the data warehouse until finalized by the coding department. This resulted in the introduction of a 45-day reporting lag.

A second unexpected finding concerned the quality and completeness of the data. It was discovered that regional staff were editing Core Measure extracts on the vendor website, replacing data elements that were missing in the extract due to accounts not being fully coded at the time of the extract. When regions felt comfortable with their data, as seen through the vendor website, they "committed" the data which authorized the vendor to pass the data on to JCAHO. If the dashboard was populated using the same query designs that created the core measure extracts, the aggregate measures would differ from the JCAHO report because the latter reflected changes made by regions on the vendor website. Rather than have a dashboard report contradictory measures a decision was made to populate the dashboard using committed data from the vendor website. This represented an additional two-week delay as regions took time to review records and replace missing data, bringing the lag up to 60 days. A feature on the vendor site allowed committed data to be downloaded as a comma delimited file. This was done through an encrypted connection. The CAP Measures database was then modified to pull the data from this Excel file rather than the directly from the data warehouse. A variety of data problems were found within the file, such as the loss of leading zeros and concatenation of medical record numbers and medical account numbers into a single field. Parsing queries were used to separate these into unique values. Missing account numbers were replaced by joining to the visit table in the data warehouse by medical record number and discharge date. Additional queries brought in supplemental information from the data warehouse,

such as account charges and financial class information. This revised data flow for

populating the intranet dashboard is represented below in Figure A.11.
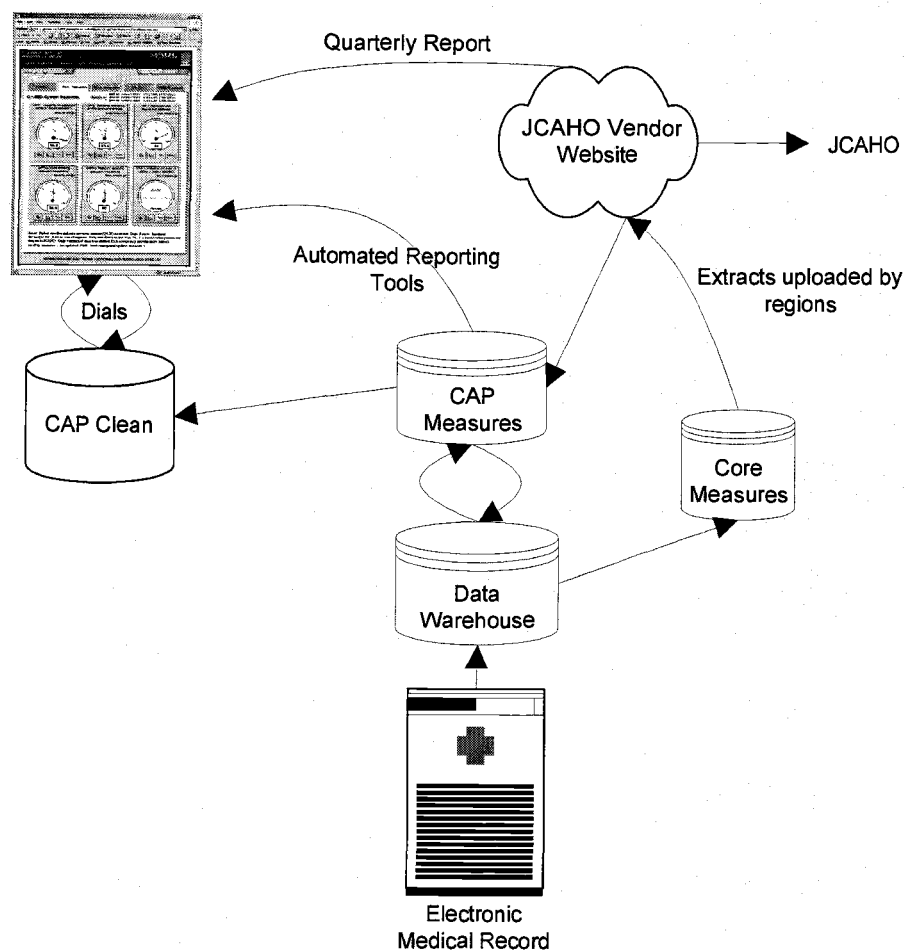
Figure A.11 Revised data sources for populating the intranet dashboard

Under optimal conditions the committed data could be manually

downloaded and the CAP measures site updated in 2 hours, the majority of this

time was consumed by queries acquiring supplemental information from the data

warehouse. These queries, and other updates, were largely automated by macros so

the majority of these two hours were available for other work.

Erratic data committal meant that portraying the system wide measures, by month, on the Core Measure page could not reliably occur. It was decided to portray these measures quarterly and to provide a "drill menu" for exploration of monthly measures for regions that had committed their monthly data for that time period. Feedback arrived at this juncture from a variety of sources, requesting a secondary needle on the dials to reflect the measure from the previous quarter. As these dials were being updated quarterly, and the current programming conventions would require one hundred times one hundred image slices to reflect every needle permutation, a decision was made to create the dials with secondary needles manually once a quarter.

Conversion and Maintenance

As no site existed previously, participants were made aware of the site through recruitment E-mails, links from various intranet sites, and monthly E-mail updates. Maintenance of the site was assured through automating as many of the update parts as possible. Four hours were set aside per month to monitor and quality check this task.

To examine whether the intranet dashboard was actually visited and whether the site was functioning correctly measurements were collected from a web server log file. Properties of the web server, Microsoft Internet Information Services, were configured so that an "extended log file" was maintained that recorded network username, time of access, and errors in server functions.

Appendix B. Invitation to Participate in Study

Baseline Invitation

To: *[Blinded email distribution list]*
Subject: CAP information survey

Seth Wolpin, a systems data analyst, is a doctoral candidate at Oregon State University, and is working at *[organization name]* as a clinical data analyst. He is evaluating our new CAP (Community Acquired Pneumonia) Measures Site as part of his dissertation. Seth has posted a survey on *[intranet name]*; this survey should take less than 20 minutes to complete and will help both Seth and *[organization name]*. Please consider taking a few minutes to complete this survey. It can be accessed at: *[intranet link]* An introductory email from Seth follows below.

[name], MD
Senior Vice President
Clinical and Operational Improvement
[organization name and contact info]

Greetings,

I am pleased to announce that the Community Acquired Pneumonia (CAP) Measures Site is now available on crosslinks. This site reports on key CAP indicators across the *[organization name]* system and includes tools for collaboration and learning.

I would like to ask for your participation in a research project evaluating the usefulness of intranet sites as a reporting mechanism for health outcomes information. To participate, you will be asked to complete a brief survey, after which you will have access to the CAP site as you like. Every month you will receive a CAP report by email with a link to the dashboard. After three months I ask you to complete a follow-up survey and an exit interview. Individual responses and activity at the dashboard will be kept strictly confidential.

Your feedback is critical to design improved information delivery mechanisms that create real value. The link below will lead you to a website detailing your rights as a research participant and the survey. Once you complete the survey you will receive a link to the CAP site. You may also complete the survey by telephone, please contact me if you are interested in this option. Participation in this study is voluntary; if you would like to access the site without being a study participant please contact me so that access can be granted. If you have any questions, at any time, please do not hesitate to contact me.
CAP Survey: *[intranet link]*

Thanks for your time,
-Seth

Seth Wolpin
Data Analyst, *[organization name and contact info]*

Follow-up Invitation

To: *[Participants who took pre-test]*
Subject: CAP information survey

Greetings,

Several months ago I wrote and asked for your participation in a research study evaluating a Community Acquired Pneumonia (CAP) dashboard.

I would like to ask for your participation in completing a second survey. Participants who complete the second survey will receive a gift certificate/token for 1 free beverage at a local coffee shop. Comparing the responses from the first survey and this follow-up survey will help evaluate the effectiveness of dashboards as reporting tools. Even if you rarely visited the CAP dashboard your feedback is valued.

The link below will lead you to a website with the exit survey. If you would rather complete this survey over the telephone please contact me. If you have any questions, at any time, please do not hesitate to contact me. Thank you for your participation in this study.

CAP Dashboard Survey: [intranet address inserted here]
Sincerely,

Seth

[Contact info inserted here]

Appendix C. Survey Instrument

Survey Description
The majority of these questions have been adapted with permission from the VA Network Integration Instrument. Completing this survey will help evaluate how health outcome measures are reported.

Individual results are kept confidential.
This survey is not anonymous.

Directions
Please read the following questions and select the one answer that best describes your experience. All responses are optional. Your responses will also be kept confidential as stated in the *[hyperlink]* informed consent document. If you have any questions please contact Seth Wolpin *[phone number and E-mail]*

Some of the questions ask about conditions in *[organization]* regions. Please answer these questions based on your experience even if your contacts have involved only one or two regions outside your own. Contact with all or even most regions is not required in order for your experiences to be useful in this context.

Click in the circle next to the best choice for the question. Use the scroll bar on the right to move down the page. When finished, click the OK button located at the bottom of the survey.

1. How satisfied are you with receiving reports about CAP in your region?

- O Never or almost never
- O Rarely
- O Sometimes
- O About half the time
- O Often
- O Usually
- O Always or almost always

2. Staff in other regions cooperate when I need their assistance.

- O Never or almost never
- O Rarely
- O Sometimes
- O About half the time
- O Often
- O Usually
- O Always or almost always

3. When I contact staff in another region, I feel that I am dealing with someone who has the same goals and standards that I do.

- ○   Never or almost never
- ○   Rarely
- ○   Sometimes
- ○   About half the time
- ○   Often
- ○   Usually
- ○   Always or almost always

4. Staff in other regions are willing to help when I contact them with a question or request.

- ○   Never or almost never
- ○   Rarely
- ○   Sometimes
- ○   About half the time
- ○   Often
- ○   Usually
- ○   Always or almost always

5. I interact with staff from other regions.

- ○   Never or almost never
- ○   Rarely
- ○   Sometimes
- ○   About half the time
- ○   Often
- ○   Usually
- ○   Always or almost always

6. If I need a consult, I know where to find people with the right expertise in other regions.

- ○   Never or almost never
- ○   Rarely
- ○   Sometimes
- ○   About half the time
- ○   Often
- ○   Usually
- ○   Always or almost always

7. Sharing data and ideas about Community Acquired Pneumonia from this region to another region is an efficient and effective process.

O   Never or almost never
O   Rarely
O   Sometimes
O   About half the time
O   Often
O   Usually
O   Always or almost always

8. In my region we have access to the data we need in order to benchmark our performance against data from other HealthFirst regions.

O   Never or almost never
O   Rarely
O   Sometimes
O   About half the time
O   Often
O   Usually
O   Always or almost always

9. When we discover a "fix" to a problem in our region, we have a mechanism for informing other similar services across HealthFirst regions.

O   Never or almost never
O   Rarely
O   Sometimes
O   About half the time
O   Often
O   Usually
O   Always or almost always

10. When employees attempt to work on a quality problem involving more than one region others are supportive and provide resources.

O   Never or almost never
O   Rarely
O   Sometimes
O   About half the time
O   Often
O   Usually
O   Always or almost always

11. In my region we are encouraged to benchmark our performance against data from other HealthFirst regions.

○   Never or almost never
○   Rarely
○   Sometimes
○   About half the time
○   Often
○   Usually
○   Always or almost always

12. When it comes to cooperation among regions, there is a lot of talk but not much action or support.

○   Never or almost never
○   Rarely
○   Sometimes
○   About half the time
○   Often
○   Usually
○   Always or almost always

13. Clinical support staff and services for community-acquired pneumonia seem well coordinated across regions.

○   Never or almost never
○   Rarely
○   Sometimes
○   About half the time
○   Often
○   Usually
○   Always or almost always

14. Administrative services are appropriately integrated to achieve cost-effective patient care.

○   Never or almost never
○   Rarely
○   Sometimes
○   About half the time
○   Often
○   Usually
○   Always or almost always

15. Results of Community Acquired Pneumonia projects done at other regions are shared with me.

○ Never or almost never
○ Rarely
○ Sometimes
○ About half the time
○ Often
○ Usually
○ Always or almost always

16. I have opportunities to participate in organization wide activities (committees, task forces, conferences).

○ Never or almost never
○ Rarely
○ Sometimes
○ About half the time
○ Often
○ Usually
○ Always or almost always

18. Improvement/action teams on Community Acquired Pneumonia issues involve multiple regions

○ Never or almost never
○ Rarely
○ Sometimes
○ About half the time
○ Often
○ Usually
○ Always or almost always

19. Three months ago the overall level of integration and coordination among regions concerning Community Acquired Pneumonia was...

○ Poor
○ Fair
○ Good
○ Very Good
○ Excellent

20. Currently the overall level of integration and coordination among the regions for Community-Acquired Pneumonia is....

○ Poor
○ Fair
○ Good

○ Very Good
○ Excellent

21. A year from now I expect the overall level of integration and coordination among the regions for Community Acquired Pneumonia will be...

○ Poor
○ Fair
○ Good
○ Very Good
○ Excellent

22. What is the highest grade or year of school you completed?

○ Never attended school or only attended kindergarten
○ Grades 1 through 8 (Elementary)
○ Grades 9 through 11 (Some high school)
○ Grade 12 or GED (High school graduate)
○ College 1 year to 3 years (Some college or technical school)
○ College 4 years or more (College graduate)

23. Please indicate your sex

○ Female
○ Male

24. Please indicate your age

○ 25 or younger
○ 26-35
○ 36-45
○ 46-55
○ 56-65
○ 66-75
○ 76 or older

25. Which one of these groups best represents your race?

○ White
○ Black or African American
○ Asian
○ Native Hawaiian or Other Pacific Islander
○ American Indian, Alaska Native
○ Other [specify]

O Don't know/Not sure
O Refused

26. Have you had any clinical training (eg pharmacy, nursing, medicine

O yes (indicate type and if currently practicing) *[free text field]*
O no

27. Please rate your comfort with computers

O very uncomfortable
O uncomfortable
O comfortable
O very comfortable

28. Would you like to be contacted about taking part in a confidential interview concerning your CAP experiences? The interview would take between 15 and 30 minutes and would be conducted over the phone or in face-to-face meetings.

O Yes
O No

29. What was the most useful feature of the CAP Measures Site? *[follow-up only]*
[free text field]

30. How would you improve, or otherwise change, the CAP Measures Site?
[follow-up only]
[free text field]

Appendix D. Monthly E-mail Updates

April Update

-----Original Message-----
From: Wolpin, Seth
Sent: Tuesday, April 22, 2003 12:28 PM
To: DL:CORP-CAP Measures Site
Subject:CAP Measures Site Update

This information is confidential, please do not forward.

Did you know that for Community Acquired Pneumonia patients at [organization]...

...Region 4 and Region 5 have assessed 100% of CAP patients for oxygenation status so far...
...the median length of stay is the same as watching the movie Chicago 47.3 times...
...Only 1 out of 3 patients is being screened for pneumococccal vaccination....

To learn more about Community Acquired Pneumonia, visit the HealthFirst CAP Measures Intranet Site (a screenshot is below):
http://w004878/measures/cap/
[embedded screenshot of dashboard]

May Update

-----Original Message-----
From: Wolpin, Seth
Sent: Wednesday, May 14, 2003 1:20 PM
To: DL:CORP-CAP Measures Site
Subject: CAP Measures Site Update - May, 2003

This email contains confidential information - please do not print or forward.

The average CAP patient at HealthFirst is 74 years old (median).
Faded needles have been added to dials to indicate previous quarter measures.
A crosswalk of regional CAP guidelines has been posted in the 'Tools' Section.
Data from Jan. and Feb. is available for 3/5 regions - use the drill down buttons
for details.
For more information visit the HealthFirst CAP Measures Site:
http://w004878/measures/cap/

[embedded screenshot of dials]

Appendix E. Interview Transcripts

Interview 1. "Mike"

Note: the first few lines of the interview transcript have been removed to protect participant confidentiality.

6: * What is your life like in terms of reports of patient outcomes?
7:
8: It may be useful to for you to see how I use it. I think how I use it is probably going to be
9: pretty similar to most of the really senior leadership in the organization, people like
10: executive team members, and that is I will look at the reports, specifically looking for
11: whether or not we are making good progress, what the trends are, where the problem
12: areas are. Unlike somebody who may be in a director level role or something like that;
13: their interest is specifically going to be 'do I have a problem in the area I am responsible
14: for and if I do what do I have to do about that?' I don't obviously have much
15: responsibility to do that other than kind of indirectly. So the way I use it, and I think the
16: way a lot of the executive team uses it is to look at it, see where we are doing well, see
17: what the trends are, see what the particular problem areas are. And then, depending on
18: the situation, the way I most commonly use it after that is once I've seen those things is I
19: will go to the executive team or the regional executive teams I will use that information
20: and try to help guide decisions and point out where their problem areas are and things
21: like that because then it is really up to them. So that is kind of the level of which I use it,
22: it is more to kind of inform me about those trends.
23:
24: So then when it gets to the specific reports. You know I think that our organization has
25: done really really well. We've come a long way compared to when I started 10 years ago
26: – this stuff is possible – then it was impossible. Now we are getting to a point where our
27: reports and information are pretty good but I still think we have a long ways to go. I think
28: that, and when I say we have a long ways to go I am talking about for people at my
29: level…well really at any level but certainly at my level, how you present the information
30: really starts to become key because we are very busy, we do get bombarded with
31: information all the time and so if you are going to meet the needs you need to spend a fair
32: amount of time getting into the design of reports so that it is quickly possibly to see the
33: things I just described. Where are we doing well, what are the problem areas, what are
34: the trends? You really need to think through how to do that in quick, efficient, useful
35: way…so I think we still have progress ways to go before people like me can just sit down
36: and a series of reports and get a quick idea of where I need to focus in on.
37:
38: Then I think the other area I think we need to improve on is that once we see an area ..
39: 'Gee that's…I need more information about that, it should be fairly simple on a
40: dashboard just click on it (makes drill sound) drill down which of course gets to an area I
41: think you guys are already getting into…. Developing cubes things like that so that it is
42: pretty seamless and effortless for us to kind of drill down and see if we can kind of see
43: the cause of this particular situation and this outlier and how worried do I have to be
44: about it and what kind of action do I have to take. So, as a qualified answer I think we
45: have done really well, we are way ahead of an awfully lot of organizations but we still
46: have a ways to go and you see that because the dashboard with quotes around it there is
47: still a problem because there is so much there. [emphasizes last three words]. I've been
48: helping the Database Team Director design one for Region As' CEO. There's just too
49: many links….there's just too many…there's just…[fading off] We're not very good yet
50: at presenting the data.
51:
52:

53: * You mentioned being bombarded with information. I have a mental map of being in
54: * your shoes and having information come in…faxes…lots of emails…journal
55: * articles…kind of in a chaotic fashion…different formats…feedback lags.
56:
57: Very much…so which kind of gets to the whole information presentation problem. It has
58: gotten to the point where, well the stack is pretty small now, but my snail mail…if people
59: mail me something like that, unless they FedEx, they have a problem because as busy I
60: am and as much as I travel and as digital as my life has become, the snail mail pikes up in
61: stacks and if people send me a report on a piece of paper it can be 6 weeks before I see it.
62:
63: I am very electronic, very efficient. There is a reason for that, it is much more efficient to
64: deal with information that comes to me by email. Just much much more efficient for me
65: to click on that, open up a report, see what is going on, quickly scan and decide if I don't
66: need it I delete it so digital is unquestionably the future. Faxes and other mail in paper
67: form is not very effective.
68:
69: * What do you think would help?
70:
71: I think there is a real art to presenting this information and for people at our level who are
72: getting deluged all the time. [searches for book on information display and one by
73: Edward Tufte] I get probably 70 emails everyday and lots of voicemails, those emails
74: can range from everything from one or two liners to comprehensive stuff [emphasizes
75: last two words] so there is a real need for the critical information we need to do our jobs
76: effectively and to change behavior things like that. To have information presented at the
77: highest level very very visually so that you can quickly observe a lot of information and
78: see those things I have mentioned, trends, really good really bad and then when you see
79: something to drill down. Very effective. We are just not there.
80:
81: * If you were gone for vacation for two weeks and came back what kinds of things
82: would you look at?
83:
84: Well it basically boils down to clinical reports cause that is why I am in this business –
85: people think I work in computers, but computers are [inaudible] why I went into this was
86: to improve the quality and safety of care and computers are an effective way to do that.
87: So I always look for that information and I look for financial information and I look for
88: emails that are any particular problem that I have to be aware of… things like personal
89: issues…but the key things that I need to do my job .
90:
91: * Are the clinical information reports you are looking at JCAHO core measure or are
92: they more like LOS for the top five procedures?
93:
94: I don't look much at the LOS anymore, I used to do that, for me it is much focused on
95: clinical quality safety things – how well are we doing, how well are we treating our
96: patients with MI-s…how are we doing with all those other parameters. LOS has gotten to
97: the point where there are other people who manage it just fine, we are doing pretty well
98: by and large.
99:
100: * And are you finding most of those reports on the corporate clinical quality
101: * indicators site? Are you finding that you need to go different places?
102:
103: The most common place I go is there and that is a nice site…but again, it has the
104: problems I mentioned it has too many clicks and then if I see something I really want to
105: drill down on you can't do it. I get frustrated because I can't do that.
106:
107: * By building this site where the regions could see each other's information and with
108: having a discussion board I was really hoping to see some collaboration and

109: integration in QI efforts and knowledge and information sharing among the regions.
110:
111: You and I both, that's my vision.
112:
113: * What barriers do you think exist now, and what can be done to improve systems
114: integration?
115:
116: Well I think the two biggest barriers are standardization and culture. In terms of
117: standardization the biggest challenges are when you try to integrate the information
118: requires the people are using similar definitions and recording the information the same
119: way and all this kind of stuff. It is another one of those areas where PH has made a lot of
120: progress but we still have a longs ways to go to really improve our ability to pull
121: information together in a meaningful way.
122:
123: I am a little less worried about process standardization, I should explain that – if people
124: in region A develop a process that they think is better for treating CAP and can show that
125: to region B – that is fine. But what you need is standardization at the data element level
126: so you compare apples to apples so you can tell that region A is really better or worse
127: then the region B one. So we just have a lot of work to continue moving forward in that
128: direction.
129:
130: And the other one is cultural and again we have made a lot of progress in helping the
131: regions understand that the diabetics in Region A are really no different from the
132: diabetics in region B. I can't tell you the number of meetings over the years I have been
133: to where people would get up and somehow want to argue 'our diabetics or our
134: community acquired pneumonias are different. I would sit there and and politely, well I
135: would think different things then I would say. I was a little more harsh in my thinking but
136: what I would say is "No…I don't think so, they aren't".
137:
138: I think we are getting far enough along and people are starting to realize they aren't –
139: they may be Eskimo in Region A and White Anglo Protestant ASP in Region Y but
140: diabetics are largely diabetics, there are cultural issues but they are largely the same
141: disease process so you are constantly fighting the issue that somehow people think they
142: are unique.
143:
144: But compared to most organizations we are way way ahead of that. Particularly on the
145: technical side, we are not as far along on the quality side. But on the technical side we
146: have made enormous progress. Now we can implement a brand new system or go for a
147: major version upgrade in our EMR and it is almost a non-event. It didn't use to be like
148: that because it would take a year and a half of haggling over issues to achieve consensus
149: and now it is much much easier. We need to get to the same point in quality. People
150: really do understand that there is value in standardizing information and there is value in
151: collaborating on solutions to achieve quality.
152:
153: It is not only true in our organization, if you want a grandiose vision… I think we should
154: be able to have a master data warehouse for the entire United States so you can kind of
155: see how things are going and drill down from there.
156:
157: We're going to have to balance the privacy...the bigger the database the easier it is to
158: manage that. If you have a database with States X,Y, and Z and get enough patients in
159: there it is very difficult to identify. Our organization is a little harder because if you did a
160: search on and select out the smallest region it is a lot easier to figure out who they are.
161:
162: * What is your take on integrating financial and outcomes information? How often do
163: you see them integrated together in a balanced score card fashion?
164:

165: I think it is really useful. In my perfect role - you talked about if I leave on vacation for
166: two weeks and I come back...in my perfect world I would like to have a link emailed to
167: me saying "Here's your updated reports" Click on the link, up pops the dashboard with
168: all the relevant information whether it is financial or clinical and quickly see the trends
169: and drill away from there down into the information you want to drill into.
170:
171: * Which might include financial information, length of stay, which might not be so
172: important for you, but also cost per case.
173:
174: I shouldn't say that stuff is not important to me. If there are problems then I have to dig
175: into it and start working with the regions to figure what is wrong but we don't have as
176: many problems...I could get all consumed if I wanted to look at everything. I've done
177: that in my life. Three years ago I had to take a three-month sabbatical because I was just
178: so burned out, had to take some time off. I had to learn that I have to focus my attention
179: where I think there is the greatest value. Five years ago the greatest need for me to focus
180: all of my attention was on the EMR and getting all of these systems completed. Now it is
181: much more important to me to focus on quality and outcomes and patient safety because I
182: think that is where I think in the next five years our organization needs to make the most
183: progress.
184:
185: * Can I show you a screen shot of the dashboard?   I'm curious what are your
186: * thoughts are on using gauges?
187:
188: I like it because it is an effective way to get at what I was talking about earlier because it
189: is the king of thing that someone like me can quickly scan and once you get used to the
190: faded, the red and the green and all that kind of stuff...once you get used to it you it you
191: can quickly see where you need to go pay attention and from there if there is an area
192: where you need to pay particular attention you can drill down. I see a dashboard it might
193: be on a two different pages but one would be key quality indicators, it might be four or
194: five tabs. Another one would be key financial parameters; I mean it is all right there
195: [emphasizes last three words]. I mean this is exactly what I am talking about, in fact I
196: really like this...this is something I should talk about for Region As' CEO's dashboard
197: because right now it is too many links.
198:
199: I can tell you, having been a member of the executive team for almost a decade now that
200: this kind of thing will really race their motor. It will take a little time for them to get used
201: to the scheme.
202:
203: * It doesn't work too well for certain measures and for the region gauges right now I
204: * am not able to get secondary needles on the gauges. If there weren't a secondary
205: * needle can you think of anyway to show a trend? I could maybe put a hash mark
206: * here...
207:
208: What we are doing here, this is just a nice example of the next iteration of how we
209: improve the presentation of data in our organization. In a perfect world you would have
210: the needle. In a little less perfect, but far better you would just have a number and a box
211: here so the exec would quickly get used to seeing where it is and then looking at the
212: number. So we will figure this out as we go along and I think any of those will work.
213:
214: What I would like to see us do is... I have learned in this game that just like everything
215: you have to prioritize. One of the key things to do high on the priority list is you have to
216: satisfy your main decision makers because when it comes time to giving the resources
217: you need to go into the future, if you have groups like the executive team happy with
218: what is going on... you know when I go to present the budge they say "I remember...we
219: need more of that" It is not that other people are not important, they are extremely
220: important but you kind of move down the priority list like that with the key decision

221: makers.
222:
223: So this is a long wind up to say that what I would like to see us do is design things like
224: this starting first with understanding the needs of people like the executive team and key
225: people in the regions that are not on the executive team but make a lot of decisions on
226: this what they need and then king of move down the priority list of end users.
227:
228: Because when I look at this I think "Boy, it would be kind of neat to have worked out a
229: reasonable quality dashboard like this and to present it to the executive team, I am sure
230: they would love to have it.
231:
232: And this one doesn't bother me [points at CAP 6, not represented as a dial] because it is
233: just a given that there are some, there is not going to be one tool that is going to work, or
234: one way of doing that is going to work. We will have to figure out, hopefully there won't
235: be a dozen. But we'll probably end up with somewhere like three ways that people are
236: going to have to learn the data is presented depending on what type of data it is and
237: getting comfortable with that.
238:
239: * I am exploring human factors literature, human interface design...
240:
241: Which is exactly what I think you need to do, which is why I was trying to find that book
242: by Tufte, because I do think we can learn from...and I think airlines are a great example
243: because those guys have obviously have, since they fly those things everyday, have found
244: it useful the way all that information is presented and it is not all that different...I don't
245: think. A lot of the same principals can be pulled across. Good stuff.
246:
247: *Thanks for your time

Interview 2. "Tom"

Note: the first 13 lines of the interview transcript have been removed to protect participant confidentiality.

14: * What is your life in terms of receiving patient reports?
15:
16: We don't have nearly enough data. We don't have a database in the ICU for example. We
17: have cardiovascular services databases that are well maintained and there are people
18: whose jobs to do that. The biggest problem is the data in [emphasis last two words] part.
19: Not the getting time for data out – though that is a problem. So would I love to have
20: access to more data analysts? Yes. But more than that I want somebody – some system –
21: for inputting data in. For capturing the front end. Because clearly if you don't have data
22: in the front end, I don't care how good your analysts are you can't get it out the other
23: end. So I think one of the deficiencies of our system is we are going to capture ICU data
24: just like we capture…we are going to have to capture all kinds of data about hospitals just
25: like capture cardiovascular services data and as far as I am concerned the earlier we can
26: do it…two things: We are just going to be ahead of the curve but two: we're going to
27: have to do this. We need some sophistication. We need to look good but we also need to
28: be good. Both substance and what the world thinks of you. There are people who don't
29: have good PR and don't look good but they probably are and there is the other way
30: around. But we need to both look good and be good. And hopefully it is the same thing. It
31: is not just fluff.
32:
33: Ten years ago if you generated any data for insurance companies you looked good. It
34: could be absolute [expletive]. But insurance companies and even the government didn't
35: have the sophistication to know [expletive] from stuff that is important. I think we are
36: developing that. JCAHO is just coming up with core measures for ICU stuff. One of them
37: is ventilator-associated pneumonia. We are actually in really good shape for that. We still
38: haven't captured that data but we spend a fair amount of time looking at almost all of the
39: stuff they have decided are important things to look. I also think that historically we have
40: shared almost no good data between different aspects of the corporation. We've had very
41: few corporate wide things. We may have financially. It may be the CEO's of these
42: hospitals and systems have talked to each other. But in terms of have the clinicians shared
43: data? Someone in Region C could spend a ton of time doing a good project that is just
44: great – we'd never hear about it. The same thing could be in Region A or E or whatever.
45: Or we could come up with stuff and to be honest I didn't know people shared all that data
46: on the HealthFirst website. None of our order sets or anything are even on the website.
47: Region C at least has got them all on the HealthFirst website. Here is the little hospital of
48: the group that probably has the best organization.. Some of that is probably [names
49: physician] And some of that is probably the person in my role is a HealthFirst employee
50: where they are not in Region A and they are not in Region B. Yes we are paid something
51: but we don't work for the HealthFirst.
52:
53: * I have a perception of being a healthcare leader and being bombarded with so much
54: * information in so many different….
55:
56: We don't have enough data. It is not that we have too much. We can guess…we know
57: some of our problem areas, we can know that without data. But clearly when you don't
58: have data you can't be sure of some of your problem areas. We are no different from the
59: rest of the world. Sometimes when something gets looked at we are surprised too. We
60: developed comfort zone, we develop whatever – it's the way we've done it. Damn!
61: We've got a big infection rate here or something else.
62:

63: I think system wide efforts where we focus on things that are important clinically. It
64: doesn't hurt that we get brownie points from somebody for this. If you can pick things
65: where there is agreement in the field. Where there are some best practices and to write
66: out standardization of care under most circumstances and then to track it...I think that
67: helps. You don't have to do a million of these. But I think if we try to do a few of these
68: things over time, like Community Acquired Pneumonia. There are a lot of ways to do it.
69: The way that has been done is interesting. It doesn't take an extraordinary amount of time
70: to have somebody take a day out of their schedule to go to Region A or B or C to
71: occasionally have a meeting. You have to try not to overdo it and have hundreds of
72: people because it is too expensive – but I think this is one step in the right direction.
73:
74:
75: * Do you think it is possible to have this kind of systems integration around CAP
76: * without face-to-face meetings?
77:
78: Yes I do. I think sometimes the more you think you have to get a group of people excited
79: about something the more face-to-face meetings are important. There may be certain
80: issues that people are already excited about. And I don't know how often that is going to
81: happen. You can imagine the situation that – just everyone is kind of pumped about – and
82: the less you need that sort of sense of working together. The more you do this and the
83: more you have successes the less you actually have to meet together. I think in the
84: beginning it is probably more important. If you get a group of people that is used to
85: working together, they know each other, they know it is important and they are kind of
86: pumped – I think you can do some follow-ups by v-tel or whatever.
87:
88: * What are your thoughts on the CAP measures site?
89:
90: Can I just make one scientific comment? At least in pulmonary literature people are
91: questioning again – and many big time people – are questioning whether we should ever
92: do blood cultures in community acquired pneumonia. And that is the only thing
93: controversial in this. There are lots of good people that think they are absolutely
94: worthless. There is a couple cost benefit analyses showing no benefit whatsoever..
95: Nothing else in this whole thing is controversial except this...knowing it is an enormous
96: waste of money. I still think the best way to do these things are is you need a physician, I
97: hate the word champion, but a physician champion and I don't like the quality
98: improvement lingo so to speak but you need someone who quote owns it on an
99: administrative side. It can be an administrative nurse. But I think you need a team to get
100: together on a regular basis to review this stuff. It is fine if that review of your data and the
101: system wide data – it is fine if someone prints it off a web site. But there needs to be a
102: group whose job it is to monitor this. I think if it doesn't happen - the 'hold your gains'
103: stuff doesn't happen. At some point, it could be every six months or a year when
104: everything is really humming. Amongst that review would be 'is there anything we want
105: to change?' In that formal review for example...certain things you can do everywhere but
106: if our resistance...we might want to change antibiotics here that you don't change in
107: Region A because the antibiogram has really changed. There might be different
108: resistance patterns in different communities.
109:
110: I think for these things to really work there needs to be formal review locally and it has to
111: be someone's job to do that. In general that group should include at least one physician,
112: at least one nurse, and probably...in most cases someone from pharmacy, you know who
113: could say 'Well what does this cost for the change?'
114:
115: * There is account total charge information on the site, but not cost measures....
116:
117: But even that helps. What Region B CEO and HealthFirst CEO clearly wants is 'how
118: much does this cost us?' I should know this but I don't – I don't know exactly what was

119: in the final stuff but what was going to save money in ours was automatic pharmacy
120: switches to PO medicine because every PO medicine, doesn't matter how expensive it is,
121: it is so much cheaper than virtually any IV medicine just in terms of how much does it
122: cost the institution to give this. The other plus is clearly if you are put on PO medicines
123: and you only have pneumonia – many times you may go home a day early. You're
124: probably not going to go home two or three days early but you got switched to oral
125: medicines yesterday at 6 by pharmacist and your doc comes in and says "Hey, you're on
126: PO medicines, you are walking around…why don't you go home today?
127:
128: * Do you think the group should be receiving regular reports about time to PO switch
129: * or what percent of patients have been switched? Or is that something, like you said,
130: * that periodically, every 6 months or every 3 months a group would come together to
131: * review that?
132:
133: I'm not sure what is the best way to do that. I just have the sense that if you don't have
134: formal time to do this it just drifts away. I think there has to be an expectation that
135: minimally maybe you meet quarterly and the first year and every 6 months to a year after
136: that.
137:
138: * How can I generate reports that are the right information, the right format, the
139: * right person…
140:
141: As a clinician, whether I like it or not, yes my administrators I perceive as caring about
142: quality in the overall sense. But I think they are more likely to be willing to spend money
143: on this if we can show we have saved money on this and helped the quality. So I want to
144: not only do it but I want to prove it. So if we do this project and we can show that we've
145: saved a 1000$ per patient on average I would like to prove that and I would like to be
146: able to bring it to administration to say "We're doing better stuff and we are saving you
147: money"
148:
149: We've sent a bunch of people to System X historically. And frankly, I can't tell you
150: about Region A or C, but I think we've wasted a lot of money. The physicians we sent to
151: System X we spent at least fifty thousand apiece educating them and we haven't had
152: expectations of those people. From my perspective that is dumb. If you are going to
153: invest heavily in people you need to expect something in return for that. It is not just
154: some general thing that 'we've educated you so we are going to get benefit from you.' I
155: would like to be able to show to my administrators that when we work on these projects
156: we are making things better and saving you money. So it makes sense for you to invest in
157: the next project. And probably not just the next one but more of these. We are not just
158: playing with ourselves. This is one of the short-term futures in medicine. Cause I think it
159: is. There are a lot of things in medicine that are someone's newest trend. I don't think this
160: is a trend. It is something we need to do for the foreseeable future and we should be
161: doing it. I mean medicine is way behind everyone else, except maybe the government.
162: And part of that is because particularly physicians, we were trained to be lone rangers and
163: if you just look at the personality of our training it is not in general to work in groups, it
164: is to be isolated people. Everybody hears about it all the time…it is like herding cats. In
165: every generalization there are some falsehoods but there are some truths to it too.
166:
167: * How do you see the role of reporting in consolidating some of these practices? For
168: * example, if I gave you a report with and your time to PO switch with yourself as a
169: * known dot and everyone else is anonymized. Are you going to have some cognitive
170: * dissonance and think "Gee, I'm"-
171:
172: -Ten years ago the CEO gave physicians a lot of financial data. There was a lot of buzz
173: going on about how much you spend on X. If you just tell a physician 'you spend more
174: money than X' – everyone says they have adverse selection. But if you tell me that I

175: spend much more money on x-rays and you spend more on labs…that data is useful. You
176: have to kind of cut through this a little and be more specific. I think that has profound
177: effects on people's behavior. People don't want to be viewed as an outlier. I think you
178: have to have somewhat specific information for it to be useful. It is not just that you
179: spend more money on pneumonia. The data that says you have people on IV antibiotics is
180: useful. That probably won't happen if you have standardized orders or standardized
181: switches to PO. It probably is an adverse selection if there are standardized orders. If
182: there are standardized orders and you do more critical care than I you may in fact have
183: sicker patients so if there are standard orders for the pharmacy to automatically switch
184: and they don't, there is usually reason for it
185:
186: * You mentioned at one point wanting to be able to demonstrate the efficacy of
187: * instituting these guidelines. How would you demonstrate that? Would you have an
188: * analyst? Would you put in a request? What is the ideal way?
189:
190: The ideal way is you are automatically on a team that would use this [indicates
191: dashboard] and that your expectations are clear and that you have to do some prep time
192: before that meeting and it could potentially be things that you want to come up with or
193: that the team – and the analyst is a part of – 'hey we are not sure about this – would you
194: [the analyst] go back and look at this'. But I think optimally when you create a team like
195: this part of the team is a good data analyst. And there are pre-set expectation of what we
196: are going to look at and sometimes when you come up with something you have to drill
197: down and say 'well, we've got this funny stuff that we hadn't expected, can we go back
198: and look at this and see if we can make any sense of it.
199:
200: I want to be real clear in terms of science. Most of the time we are a small enough
201: institution. Yes we could come up with stuff. It is more likely to be published in a quality
202: improvement journal than a pulmonary journal or whatever…but in general we can't
203: decidem, and we shouldn't be trying to decide what is the best treatment of pneumonia.
204: Those are national – there is a lot of research – millions of dollars need to go into what is
205: the best treatment for pneumonia. Hundreds of millions go into what is the best treatment
206: for an MI or pulmonary embolism. Drug companies are spending hundreds of millions to
207: prove their 2b3a drug is better than somebody else's. And so I think it is ok to refine
208: things and someone's job to review data on this. Typically that is a physician's job and
209: say 'is there anymore good, backed, national data?' I don't think in general we are trying
210: to create. We are trying to find out when there is national agreement and do something.
211: We may tweak things a little. Our job is not to say "Should aspirin be given for an MI?"
212: Our job as docs, pharmacists, and team members is to say 'Has the national agreement
213: evolved?' So at least once a year look at the national data and say "are we where the rest
214: of the country is?'
215:
216: If you did this for thirty years, and you were a good doc, there is no question that
217: probably a few times you could prove something scientifically. But not much. When you
218: look at System X [outside system] and the millions of dollars they put into this they
219: probably got 15 or 20 guys trying to get their PhD's.
220:
221: * When you say "the money they put into this" , what is "this"?
222:
223: Mostly quality improvement efforts. What is the best way to treat something?
224:
225: Within the ICU there is the issue of data not getting in. Let's say the data does get in
226: and you are gone for two weeks vacation and you get back. What would you want to
227: see and how would you want to see that in terms of measures or reports?
228:
229: Just as an aside. We are looking at demo'ing a database system which is the society for
230: critical care database which is what Region C has, but Region A is like us…they don't

231: have anything. First and foremost we may as different members of this overall morass
232: decide that we have separate problems. We may have a problem with ventilator-
233: associated pneumonia that Region C does not have. And some of it may be patient
234: selection, some of it may be something that we're doing wrong or they are doing right. I
235: think whatever we want to study…that's part of the stuff…and I don't know that it has to
236: be looked at every couple weeks. [emphasizes last sentence]. I think it would depend on
237: the thing whether it is quarterly or monthly. I would like to know what my risk adjusted
238: mortality is. I would like to know what my ventilator hours are not my ventilator days.
239: You could make a fairly big intervention that might cut ventilator hours by six or eight
240: hours and we have no way for measuring that. We are basically measuring when people
241: are on ventilators at midnight. We could save a fortune, make patients happier, but we
242: could never pull it off with anything that we have.
243:
244: * Would you like to know that everyday or just before and after a process change?
245:
246: Well both, I have no idea what I compare to national data or hospitals my size. I think it
247: is particularly important. The reason you would like to have some general data on your
248: hospital, your unit, your whatever is because I think you will notice some things need
249: improvement that may be different across the system. Most of what I have chosen as
250: quality improvement issues is that 1) when there is a change that people seem to agree on
251: nationally. Just like community-acquired pneumonia. There is a lot of agreement with the
252: ideas IDSA and the American Thoracic Society in recent years that really wasn't there
253: ten years ago. There are things in critical care that clearly saves money and saves lives.
254: So when someone comes up with a really important study and you see this sort of. It is
255: just reaching out to grab you. There are just certain things you know you ought to
256: implement.
257:
258: But we are like everyone else. If you look at our nursing staff compared to – I trained in
259: San Diego. My average ICU nurse in San Diego was 25 or 26 years old. The average ICU
260: nurse here is 50- and has worked here 20-30 years. It doesn't mean people can't change.
261: But nursing in particular is more inherently conservative than any part of the system. So
262: when you try to change something it sort of changes for a while and then it seems to go
263: right back to where it was before. And some of it is because people are pretty
264: comfortable with the ways that they have done things for years. And actually I think the
265: biggest challenge in this system is to get nursing not to undo all the changes that we do. It
266: isn't that I think that nurses are bad. I think we have a wonderful nursing staff, in some
267: ways the best staff I have ever seen. But it is like you have the most conservative
268: Republicans you ever saw that don't want things to change. I think the challenge
269: psychologically is 'How do you get nurses to be involved in this process?' Because if this
270: is perceived as something that comes down from top. From Nursing Administration, that
271: is the top…same as it comes from me…they will find ways to undo it. Ten years ago the
272: physicians would have been the problem. They would have figured out ways to undo this.
273: Now it is – not that there aren't physicians who won't want to do this – but in general
274: physicians have bought off on standardizing care in most situations. The most
275: conservative sector of hospital population by far is nursing. My major challenge is how
276: do I get nurses excited and involved in some of these changes.
277:
278: * Do you think something like the CAP dashboard would help?
279:
280: It does. Is that [indicating hard-copy screenshot] the kind of thing you can hang on the
281: wall someplace where nurses hang out? Yep…it is, and do I think that helps? Yep, it
282: does.
283:
284: * What do you think about being able to see at a glance how the other regions are
285: doing?
286:

287: Healthy competition is ok for this. We can do that. Again, I think there is a sense that we
288: have to experiment and see what will work. But do I think some of this on a regular basis
289: on a regular basis to the appropriate groups will help? I do. In general Community
290: Acquired Pneumonia on purpose – we have different approaches to this in different
291: systems. Region C's approach is sort of one size fits all. I have on purpose not tried - Our
292: order set did not include ICU and HIV care. On purpose because my goal for writing this
293: was to mostly cover 80 –85% of things and I think too often in these if you try to cover
294: everything it gets too complicated. At least my experience has been - the more you can
295: simplify things the better. You don't have to worry about covering 100%. Boy, if you
296: could cover 85% of people we would be happy. It is the other 15% that are very
297: complicated. They require 50% of the order changes, for somewhere between 5 and 15%
298: of the patients. Is that workable? And the other thing is, frankly, in general I don't want
299: the average family doctor managing a critically ill pneumonia patient in the intensive care
300: unit who has sophisticated order changes. I want a sub specialist in that…whether
301: infectious disease or pulmonary. I don't care as much if they follow a strict pattern
302: because those are the people you end up deviated from the pattern anyway.
303:
304: * What barriers do you see on getting all the different regions to cooperate on
305: something like this?
306:
307: I think the biggest barrier is that I don't think it has been a priority for the systems before
308: and we haven't done it. I don't know that most people in our systems think of us as a
309: system. Yes – they know they are part of HealthFirst but do most people here really feel
310: related to Region C or Region A? The answer is no. Because we haven't had much
311: interaction and we don't feel much like a family. Now, it might feel that way in Bellevue,
312: but it doesn't feel much that way in most places. We've actually interacted with Alaska
313: most. Our little cousin up north. We sent a bunch of physicians back and forth and some
314: administrators. But I don't think most people feel very related to our two other reasonable
315: size system hospitals. I think what helps is just doing it. But that requires a commitment
316: from our CEOs and the guys [at Headquarters]. I think the more you work with people
317: and the more you feel related. It is sort of a self-fulfilling prophecy. The way you change
318: it is just to make it happen. To create relationships that are fruitful.
319:
320: My equivalent guy in Region C is great. I think he understands some systems stuff more
321: than a lot of docs. His nursing colleague who I think is director of the ER and the ICU I
322: also think he is terrific. I'm not trying to be obnoxious but I think he is better than anyone
323: in Region A or Region B. He is just a very incisive thinker. It doesn't a lot of people like
324: that to affect an entire system.
325:
326: One of the things I used to say about pulmonary medicine. If I worked at the University
327: of Washington, and it would probably be true at Oregon Health Sciences Center in
328: Portland. It is hard not to keep up on stuff. We had 30 attendings in pulmonary medicine
329: and another 30 or 35 fellows all working on research all doing presentations every week.
330: I don't mean every physician is doing one every week but there is probably 2 or 3 keep-
331: up-to-date things every week. And frankly just being there you kind of absorb what the
332: state of the art is different areas. It is real different in private practice. It doesn't mean
333: that we don't go to national meetings. But you actually have to work on staying at the
334: cutting edge. One of the reasons I lecture a fair amount is because it is one of the things
335: that really keeps you sharp. You make sure you have read all of the data on something
336: that is up to date last month and I think it makes you feel good about yourself
337: professionally. Having these kinds of networks for people like me helps keep one sharp.
338: And you would like us to keep sharp on quality improvement efforts just like we stay
339: sharp on interstitial lung disease or blood clots or whatever. The more we have good
340: networks within HealthFirst, I think in some ways the smarter we are going to be.
341:
342: You know I like [names SVP for Clinical and Operational Improvement] and I think that

343: [names Director of Systems Continuous Improvement] is a great gal who I really only
344: met once but I was impressed with her. I think that they should be higher profile than
345: they are right now in HealthFirst. I think the average doc in Region B. has no idea who
346: those people are because we haven't been affected by them very much. I would like to
347: see their profile come up a couple of notches. I tried to get the two of them interested in
348: some ICU stuff last time I was down there. Again, what are they interested on the
349: HealthFirst executive committee? Yes – they are interested in quality and I don't think
350: that is b.s., they are really interested in quality and community service. But they are also
351: interested in 'Boy if you can do better and spend less money' that looks good too. And
352: that is not inappropriate; I think good administrators should have those interests. And to
353: be honest, there have been those that say it is always better quality when you save money
354: and I don't believe that. I think there are times when you have to spend money to have
355: good quality and I think most people in the field think that too. I think we ought to be
356: looking carefully when there are times when there is data that you can save money and
357: improve quality and clinical care is an unbelievable percentage of total healthcare
358: expenditures and I don't think we have looked carefully enough at how we can both
359: improve quality and save dollars. Having said that I think you got to put a few dollars up
360: front to do that and some of that is data analyst dollars, some of that is just plain
361: allocating the time that people need to do this because it does take time and I think
362: historically. We in Region B, this is not the system because I can't speak for Region C or
363: A, we did a bunch of quality improvement projects, RPIs, we improved medical records,
364: we improved the flow of people coming out of something or other. But we haven't done
365: many what I call clinical quality improvement. It has been ponderously slow from a
366: clinician's standpoint. Now, you need to know our psychology as a doctor and you
367: probably appreciate this…but we want things done yesterday and I understand that you
368: can't. But it is still been frustrating from a clinical standpoint, from my perspective, until
369: now…both as an institution and as a system I think we have under-invested in clinical
370: quality improvement and I do think it will have a good effect to the bottom line, in
371: addition to the bottom line of good quality it will profoundly affect the bottom line of
372: how much money we spend. I think we have under invested in that. I think we need more
373: data analysts for example. I don't think we have enough people to do the job that we are
374: going to need to do in the next five years. We may need twice as many, three times as
375: many. I don't know that – I would leave that to the data analysts and the administrative
376: people.
377:
378: * Thanks for your time.

Interview 3. "Lucy"

Note: the first 5 lines of the interview transcript have been removed to protect participant confidentiality.

6: * Can you tell me a little about what your life is like in terms of receiving reports of
7: *health outcomes?
8:
9: I will tell you that I am just learning what I need and don't need. What I am finding is
10: that I don't have the information. And I don't know that until I stumble on it or somebody
11: asks me something and they are expecting me to know it. Even though I have data
12: analysts that work for me, and I know what it is that they do, mostly around supporting
13: data requests from the medical staff. Ad-hoc, routine reports around their indicators, that
14: sort of thing.
15:
16: There is lots of data activity in other departments that I don't know anything about. I
17: don't need to know necessarily all the detail of it but what is important is that I know who
18: is doing what. Just recently the Director of the Database Team, [names three people on
19: the Application Services Team] have formed a group locally....to bring together key
20: people in the hospital to find out who is doing what?
21:
22: It is not just my struggle but it is a struggle for a lot of other people. But one of the things
23: that is becoming more and more clear to me. Last week we have just completed the third
24: survey that I have been responsible for in the past twelve months. Two Joint Commision
25: surveys and a Department of Health Licensing Survey. And in each of those surveys it
26: was my responsibility to know who was doing what. Where...how they were using
27: information and I don't always know. [emphasizes last four words] . For me.... it creates
28: kind of a dilemma because this department, in the past, has not been able to respond to
29: everybody's data requests. So what they ended up doing is creating their own data
30: analysts in their departments. Their issue...my issue that I bring to this Information
31: management Steering Committee is...how do we know these people know what they are
32: doing? They have built these rudimentary data collection systems that may or may have
33: work and may or may not be giving them useful information. If they are using the
34: information at all. I asked the question about a year ago, my boss and one thing led to
35: another and this team has formed for the purpose of all of us identifying who is doing
36: what. So there is lots of stuff, and I know this is a very broad answer to your question.
37: But at a high level my needs are around having awareness of what data people need and
38: use in their work every day. At a high level. So that way we can kind of monitor...is this
39: information that people are trying to compile, is it strategically effective? Does it get us
40: where we need to go? Or are they stuck in something that really doesn't matter [stresses
41: last three words]. There are lots of reasons for me needing to know. Just as [names
42: Outcomes Team Director] needs to know who is doing what... It is kind of that same
43: thing. So I stumble across information.
44:
45: * So the issue is you need reports about what reports are being done?
46:
47: Right.
48:
49: * What about standard reports you get?
50:
51: The reports that I get are the surveys, the satisfaction surveys, the corporate indicators,
52: core measures, ORYX. That bulk. The only one that I am really aware of...that I get a
53: trigger that says "This information is current" is CAP data from you. I couldn't tell you
54: that I get that from anyone else. I do know that I get it from you. I just have to

55: periodically go out and look. It is not always easy to do. The one bit of information that I
56: need that I don't know how to get is the state hospital comparative data. It is the financial
57: data and all the reporting to the state hospital association. There is a certain path you have
58: to take and I can't find my way through it.
59:
60: I know I need it because my boss needs it. And he can get it through other avenues. But
61: when he is asking me for it, I always have to say "I don't know how to get it…I can't get
62: there to get there. [Laughs nervously]
63:
64: So it is information like that. Then there is experience information like that. Then there is
65: very specific information like that and again it drills down to department specific access
66: and we've been trying to correct that. And Cardiac services have all of their databases –
67: NRMI and everything. And they have several others. We don't have access to any of
68: them. The NIST database from the CDC, the infection control nurse has access to that but
69: we don't. And she is not a data analyst.
70:
71: * Do you get regular reports off of those?
72:
73: No. Nothing. We don't get anything. She also doesn't have all the tools cause it is an old
74: DOS based program. We've called the CDC and they are upgrading to a web-based
75: program but they are not there yet. So we are trying to purchase this link – software so
76: we can use the information more. Cause the nurses are not data analysts, they don't
77: know. So there are lots of things, particularly around patient safety issues or outcomes
78: that we need more and more. And in fact this area is the real area where I see our need
79: continue to grow and our ability to delivery it more and more important in the next year
80: in particular. If I see any growth in my department that is the area.
81:
82: *What do you think the right format and frequency of those reports should be?
83:
84: In order for us to have real effective outcomes quarterly data is useless. Because you
85: collect it quarterly and then it takes a month to six weeks to analyze the data to get a
86: report.
87:
88: The most useful information, if we have to do it retrospectively, is monthly data. We
89: need to get as close as we can to the events. The best scenario is that we have real time
90: data. That is the best scenario. At the end of each day we know how many people have
91: deep sternal wound infections. We know that. We have that information. Right now, not
92: without a lot of effort, we can get that information. But it is usually not without a lot of
93: effort. Even just tracking a change in patient status. I think there are lots of things that we
94: could do at a higher level we could kind of see 'do we have a problem' and right now we
95: haven't developed a process to pull it out.
96:
97: Like the mortality rates for all of the diagnosis, I guess it would have to be 45 days
98: old because of coding closeout. But you could know the current mortality of all the
99: inpatients last week because the data mart is refreshed every night.
100:
101: That kind of information is really important and I know I don't have access to that
102: information.
103:
104: * If you did, how would want to get those reports? How do you envision the format?
105: The delivery?
106:
107: I am going to share something with you. It is going to sound convoluted and stupid.
108: Several years ago I was working with person W on the diabetes registry
109: report. When we started using it up here, the docs in the community had different needs
110: than the people who created that structure.

111:

112: I worked really hard with [information access specialist] and Xour physician champion
113: in the community, and [Director of the Database Team] and [Director of Outcomes
114: Team] – a whole bunch of other people to make sure that whatever they needed that
115: would make their management of the patient in the office easy…that they could get it
116: through that tool. Such a great tool. That the docs could access it from their offices, just
117: put in the parameters of what they were looking for and it would pop down a list of the
118: patients they need to pay attention to. That simple kind of tool is ultimately where we
119: need to be. Where the patient care directors, the executives, whoever it is, could simply
120: go in and pick the area they are interested in. Put in some dates or whatever. And we
121: could see it.
122:

123: * Would you also see something like that as profiling providers?
124:

125: Yes. In my mind what would be really useful, I am using that as an example, but what
126: went into that was just an incredible amount of work building those queries, making sure
127: the extract and everything that they needed was there to make that happen. But once we
128: got it to the place where it just happened automatically, it was great. People really began
129: to use it. So in the same sense, making the information display – the user piece – as
130: simple as possible. Simple for the uninitiated. The unsophisticated. That is where we
131: need to go. And I am talking about a lot of work. I have grand visions [laughs]. But if you
132: could imagine if [names supervisor] has a question about how many people died in the
133: hospital this week, he could just go to this simple tool. Put in what we'd
134: already determined and was already built – he already knew it. Just went in and selected
135: it and put in the data, his information came up. Ultimately that is when we get to the
136: place where information in useful.
137:

138: You know, generating volumes of reports is not very useful. What is useful is that we
139: have access to that information retrospectively. Because a lot of times we need to go back
140: and do a comparative study or something. So to be able to pull that information out when
141: we needed it. But most of the time the information that most people will need is that high
142: level summary information. They are not going to need a list of every patient and with
143: every diagnosis. But what they are going to need is 'how many people on my unit have
144: infections?' How many people were admitted today?
145:

146: * Accessed from one place within an intuitive navigation structure?
147:

148: Look at this! [indicates hard-copy report on desk] I get all kinds of stuff and I am in the
149: middle of something and I get something else and I have to keep track of that and set it
150: right here. Just another stack of paper doesn't do anybody any good. If we could get it
151: online in a simple display that at a high level some information – that is fantastic. And if
152: we can ever get to that place we will be a high performing organization. But we are not
153: even to the place where we even know how to ask the right questions. So – I know I am
154: asking for the sky.
155:

156: One of the first things that I saw was the Diabetes Registry Exception Report Site you
157: mentioned. I thought, why aren't data analysts building these? The response I got was
158: that we are not database or web developers and that is for them to build. But they may not
159: know the needs as well so there is some silo-ing effect.
160:

161: I would say the biggest problem I have right now is this silo-ing effect. We identify a
162: need, and we have a vision of how it is useful to us but we can't get there
163: because…well…no…we can't do that because these people over here have to do that but
164: then we never get it done. You know I've hired a database guy and now it has created
165: problems in the whole organization. [laughs]
166:

167: I think it is good to create problems because what we are doing is that we couldn't get a
168: response that worked for us. To be able to say that the only way we can make anything
169: happen is if I can go around and build support, region to region, and then if everybody
170: agrees we might be able to stick it in the list and maybe in the next couple years we can
171: do it...that doesn't work. When our information needs are growing. I mean they are
172: exploding. They are not just growing, they are exploding. We have to have a way to
173: deliver what we need to deliver even if I am making everybody nervous. I don't really
174: care. The fact that we've exposed some issues and person V [names database developer
175: she hired who is outside database team] activity has kind of created some dilemmas.
176: Great. Good. Now lets talk about it. I am not opposed to going around existing structures
177: because they don't serve me well. Unfortunately we spend a lot of resources doing that.
178:
179: What barriers do you see with regard to integration across the regions? Are you
180: aware of what QI departments in the other regions are doing? Their successes,
181: failures, shared learning's, and spread?
182:
183: Well it is getting better because we have the Quality Improvement Leadership Team.
184: That is helping. But no we don't really have much of an opportunity because when that
185: group does come together we don't have a lot of time to explore with each other 'what
186: are you doing', 'what are you guys worried about this week?' We don't really have that
187: opportunity to do that. The structure that is beginning to form in my head, I had a
188: conversation with Director of the Database Team] and I took [database
189: analyst/developer she hired who is outside database team] with me, is that what I need is
190: a [Outcomes Team] person and a [Database Team] person. And that they work for me,
191: but they are linked to the Outcomes and Database teams. That way, the work that they get
192: done goes through the right channels and everything but I have my own resources to
193: make it happen. So that is kind of what I am working on. There has to be more
194: alignment...I believe my department...the data analysts...need to be more aligned with
195: the systems analysts. Well connected. I just believe that the expertise that exists on the
196: Outcomes and Database teams needs to be regional.
197:
198: * What are your thoughts on the design of the CAP Measures Site?
199:
200: The dashboard was easy to use and provided great information. What I really like, what
201: was most useful was that you sent me a notice when it was updated. And I could just go
202: and look at that and I really like that.
203:
204: * What do you think about the factoids in the email? Fluff? Deep six them?
205:
206: For someone who is more involved in-patient care that might be helpful.
207:
208: * Just the link? 'It's been updated and here's the link'?
209:
210: Yeah. For me that was real useful.
211:
212: * Thanks for your time

Interview 4. "Jeff"

Note: the first 16 lines of the interview transcript have been removed to protect participant confidentiality.

17: * Could you describe what your life is like in terms of receiving patient outcomes
18: reports?
19:
20: In HealthFirst? I get a lot of reports, I am the executive lead on [grant], I have two
21: analysts who work full time. Creating reports for the clinics as well as for the grant
22: project. We have to report back to the grant administrator every month. So we have all
23: kinds of reports. Basically reporting on the promises we made to the patients at the
24: beginning. The thing that I wouldn't exactly call reports is that we built this systems
25: dynamics model of diabetes and congestive heart failure at the community level. Huge
26: amounts of data had to be obtained and turned into information over a period of about a
27: year. As far as looking at daily, or any kind of quality reports, I'm not in the clinical area.
28: You know the head of the Patient Care Division and the Chief Medical Officer should be
29: more interested in operational quality data, although I am always interested in the getting
30: data into the hands of people who will make a difference as opposed to having it for
31: reports.
32:
33: * The reports you currently get, are they in the right format, the right....
34:
35: Well, I think the cubes are going in the right direction that's for sure. Are you familiar
36: with those. Do you play with those?
37:
38: * The Proclarity cubes?
39:
40: yeah, I know [CEO] has been trying to get datasets for individual managers and
41: employees so that they know what they need to be doing. I sort of help lead the
42: development of the competency database. So those things all should wrap together
43: shortly so that every person knows what their job is, who can give them help, and
44: delivering them fairly near real time data so that they know what they are doing.
45:
46: * With the datamart being refreshed near real-time is possible for a lot of measures...
47:
48: Actually I wasn't aware that we had switched to daily. The last time I had heard it was
49: every weekend. Daily now? That is great. I knew we were going there I just didn't know
50: the date. Seems like you are right, seems like it was the first of June or something.
51:
52: For most management data that is really good. For some of the things like, one of the
53: things that is going on up here that is really useful is data three times a day on the
54: hospital census where beds are filling up. Not having to move patients around three
55: times. Get them in the right place.
56:
57: * Are you feeling over/under whelmed with reports? Or the opposite; lacking critical
58: reports and not getting enough?
59:
60: I think for people in operations there is a natural sort of cycle to when you need data and
61: my guess is that if you format the data correctly and present it correctly you wouldn't
62: overwhelm people. But if data have to be dug out, or if they are particularly late they
63: become fairly useless. So the format of the data, the fit into the workflow and the
64: decision flow is the real challenge. I get monthly financial reports, about 20 pages, that I
65: seldom look at. I think people who are good at that have learned to scan and pick up the

66: ten lines out of all that they want so they don't actually feel the pain. I think some of the
67: reports I still get, you actually have to abstract the data physically by looking at a long
68: report.
69:
70: * Do you see financial information integrated with health outcomes data?
71:
72: The stuff I get on the executive team does not have clinical data in it, they are not
73: integrated at all. There is this place out on [intranet] where they are starting to put clinical
74: data and other data. I don't know, two months ago at the *****Health Executive Team
75: meeting instead of paying attention I was playing around on that website. It looked pretty
76: cool.
77:
78: * You mentioned [intranet] and cubes. What role do you see the intranet playing in
79: reporting and delivering outcomes measurements?
80:
81: It is absolutely critical. We shouldn't be pushing a lot of paper around. I think the other
82: point, and I am sort of ahead of the curve here, I think that healthcare requires the
83: collaboration of a lot of people who think they are competitors. So the Internet and the
84: intranet are both going to be critical for data reporting. One of the cool examples is that
85: we had a team a couple years ago to move the discharge distribution to the left, earlier in
86: the day, so it at least coincided with the admission distribution. And one of the things that
87: was needed was the workflow between the hospitals and the nursing homes to work. It
88: was on a Thursday we identified that problem and by Saturday we built a secure website
89: that allowed every nursing home in the county to let us know, but not each other know,
90: what their bed status was. What the preference for the room was, like it had to be a male
91: or female.. On our end we set it up so we could look at the patients chart while they were
92: evaluating whether to take them because up until that point we had printed out an
93: electronic medical report and faxed it to them so that they could decide whether to accept
94: them or not. So by doing those, things which were essentially a reporting function, we
95: dramatically shortened the hassle and the time in getting nursing homes to make a
96: decision on accepting a patient. So that is an example of using the Intra, or Internet.
97:
98: * What about sharing information across the system? Do you see much of regions
99: sharing information with another region?
100:
101: I'm going to go a little offhand here ok? I don't think the key value in sharing information
102: across regions is in data. I think it is a lot more in lessons learning, problem solving, sort
103: of communities of learning kind of approach. And then the data is needed. I should just
104: tell you that the experiences we've had...I should just speak for myself...when you really
105: try to use data to make decision, comparative data across the system, it is a complete
106: waste of time. Now, some clinical data we worked out through the
107: [Leadership Team] over the past couple years are actually apples to apples. But whenever
108: you try to use administrative data the data definitions are different, the coding is different.
109: I remember one particularly insightful day when the executive team sat down for three or
110: four hours going though reports comparing us to other areas. We were looking forward to
111: it. 'Boy, we're really different from them, better or worse'. Then you would start looking
112: into what the numbers actually came from and each and every case that day there was no
113: conclusion one could come to because the data definitions are different. So I think
114: comparative clinical data are really compelling and help motivate people to change. But
115: as you must know, data reports never tell you what to do, they just point you in a
116: direction. What I am really hoping is that we end up with databases of stories and
117: databases of resources so that we know who to connect to. If I had my way everyone
118: would have groove, everyone would have weblogs. And we'd have a fairly open
119: document management system where you could have discussion threads and drop
120: documents into it.
121:

122: * I put a discussion board within the site, I think only two people ever posted
123: anything. I had hoped to see a community born, people sharing ideas.
124:
125: I have given this a lot of thought. I think if you want to have people communicating, they
126: actually have to know each other. They don't have to have ever met, but there has to be a
127: persona. No one is ever going to consistently put messages into the void. You got to
128: know who you are talking to. For me, that means you actually have to create, using
129: weblogs, a persona. I have to be able to know who you are. Something about you. Your
130: job description, what you are working on, what you care about. As soon as I can get that
131: anytime that I want and I know who is asking for it and whether I should trust you,
132: whether I care. You have to be human. Then you will see it go up exponentially. I am
133: involved in a growing community in the world, not in *****Health. And it really works
134: well. But you know ****Health at some point needs to, at some point decide whether it
135: wants to be predominantly hierarchal and tightly controlled or whether it wants to be
136: organic and innovative. A tough decision.
137:
138: * As far as systems integration, with the regions becoming more integrated with
139: * approaches to any disease state, other than dissimilar definitions, what other
140: * barriers do you see?
141:
142: I don't see any insurmountable barriers. I think clinicians want to learn from each other. I
143: think we are strongly motivated by a healthy competitive desire, not to have someone
144: else taking better care of patients than we do. I think it is the kind of stuff I was talking
145: about, why don't people just sent you chat messages? It is an issue of creating the culture.
146: It isjust send chat messages? It is not mechanical; people actually have to know each
147: other to some level. People have to travel; they don't need all the teams. But you need
148: somebody who can represent the other team. This is still a very human enterprise and
149: data systems don't replace that. So the only barriers I really see are ones of focus, which
150: things are we going to do? And then a circuit rider like the Senior VP of Clinical and
151: Operational Improvement. Someone who can go between the regions and sort of say,
152: 'this is what they're doing and this is what we're doing and couldn't we do this?
153:
154: * You mentioned chat tools, Netmeeting has a chat feature but it does not alert you
155: * when you have a message.
156:
157: Get Groove. Groove is amazing. It does that and everything else. Virtually everything
158: you have seen on peer-to-peer computing. What it allows you to do is have web pages
159: and documents and discussions, threaded discussions that are private. Just who ever has
160: been invited and every object in there creates its own internal url so you can reference
161: things back and forth. You can also do voice over IP. And you can do shared excels, tools
162: for project management, more stuff than you can shake a stick at. But the main thing it
163: has is context. In other words, it lets you keep things in a space. Each space is named –
164: when you get in there if you want to be invited to a really exciting space let me know and
165: I will invite you to a space called *****. Smartest guy on earth on knowledge
166: management, a guy by the name of *****, which we have no right to have a guy like him
167: participating, but he does.
168:
169: * Do you see Groove as being helpful in terms of systems integration?
170:
171: It is spreading like wildfire – that is the answer – it speaks for itself. Before I get off
172: groove let me tell you two things. To actually have really useful knowledge management,
173: everyone is comfortable with Groove. Groove is private. You get it, you love it. Private is
174: not the solution to very many problems. So the trick in groove is to get people.... we
175: have to create spaces for them to take things once they are permissible and put them out
176: in the public domain. The threesome for me is weblogs, something like web crossing for
177: discussion threads and document management, which are both open, and then a private

178: space. You don't want to make a fool of yourself in public too often. The nice thing about
179: groove though is that it keeps everything in context. Web crossing can do that to some
180: extent.
181:
182: * Can you just flip a switch and make private things public?
183:
184: You can, it is a pretty gross switch. If you look at my weblog today...I did that yesterday
185: just to see how it worked. It took every single discussion item and splashed it out on the
186: web. I could get rid of all of them but not the last. [laughs]
187:
188: What we need is one where you have discussion thread by discussion thread and you
189: could press a button. I don't mind that, I'm sure this will be solved, if I could point it to a
190: category as opposed to my homepage. I don't know if you know about radio, you can
191: have a bunch of categories. Publishing static web pages, when you are publishing you say
192: 'this goes to my homepage, but also send it to a web page called knowledge management.
193: So there is this other weblog that only has postings around knowledge management.
194: Some of which I have on my homepage, some of which are not. If I can ever get this
195: Groove tool to point to a category, then I am not concerned about dumping all that stuff
196: on my homepage.
197:
198: * What are you thoughts on the design of the CAP site?
199:
200: You know, I think it has to be playful or no one is going to play. I actually really like
201: those things. Not that they are always the easiest way to present the data but they are
202: interesting.
203:
204: * What do you think about being able to see who else is on the site at the same time?
205:
206: Well, in Groove I can't tell you how useful it is to know who is visiting at the same time.
207: Groove just says here they are. And that means you can start a discussion and all kinds of
208: other things. I think if what you want are people to learn together they need to know they
209: are there. When you get time to go look in Groove you might look at the development
210: stuff. There are a lot of people building apps inside Groove because it is 192 bit
211: encrypted. It is a nice package because it is so secure.
212:
213: What is the little sort of shadow thing on these dials?
214:
215: * It is a faded needle indicating the previous quarter measure
216:
217: Ah – shows you which way it is going. Are the benchmarks the same things as goals?
218:
219: * No, they are comparative measures. Not targets or goals per se.
220:
221: Let me just click a couple of these things. This is so so cool. It would be nice if one could
222: always no that a 100 is the best place to be. These are percents, but it would be nice to
223: know what you are shooting for because that is the beauty of metaphor. I like it, it is
224: engaging. It's not a table [laughs] The size of the print is a little hard to read but then I
225: am 50, you know so I wouldn't worry about that too much. Might be nice if there was a
226: button on here, people get the idea of changing the size. [changes font size within
227: browser] It changed but it didn't change the titles, they must be some kind of pic file.
228:
229: * Ideally it would be text
230: Yeah – but nothing is more annoying than having the text overwrite the graphic.
231:
232: * Last question, why not use email? Would reports delivered by email be effective in
233: your eyes?

234:

235: I think there is a revolution against email. No one will say this to you. Email now is more
236: of a burden than a help. Some people can't live with out it. People in operations who use
237: it for communication to get work done every day have no choice. But I am more into the
238: creating things kind of deal and I have lots of support so I don't read email. I will before
239: a meeting if I have to. The average exec in America gets, if you believe the statistics, 2
240: hours of email a day, well that is insane. That is not two hours of value. Two hours to
241: read and manage it –

242:

243: * A third of the day – a quarter…

244:

245: A third, I think you are right to begin with. Maybe more than that because once you
246: figure out the time for the meetings you are in you may have just wiped out the entire
247: discretionary time. I'm not sure the average executive has two hours in a day to get work
248: done. That is where I may an aberration of the concept of the sparse radial network. I
249: have to make sure that the few people I am connected to everyone I care about so that I
250: can ignore everybody but them. I mean in day-to-day operations, I don't mean ignore
251: them really. But I actually see a time, and I don't know if ****Health will ever get there,
252: when much much information will get put out there permanently in weblogs and threaded
253: discussions for everyone to see and these RSS feeds – basically a subscription deal with
254: XML. People will learn to describe to things they want to hear and go look at them on
255: their own and not have all this stuff pile up unread. I think there is a fair amount of
256: discussion out there on the web. No one has quite figured out what the solution is. But I
257: can tell you where I am connected with news feeds, it is just amazingly useful. Every
258: other day or so I will go and read, or at least scan, everything that I have subscribed to.
259: But I have determined who I am subscribing too.

260:

261: * Changed the signal to noise to ratio…

262:

263: Exactly, but Groove helps. Send me something in Groove and I will read it right away,
264: send it in email and it will never get read. Anyone who wants to get a hold of me can
265: contact my X [administrative assistant]. My cell phone is on every single email I send.

266:

267: * Thanks for your time

Interview 5. "Cindy"

Note: the first 11 lines of the interview transcript have been removed to protect participant confidentiality.

12: * Could you tell me a little bit about what your life is like for in terms of receiving
13: health outcomes reports?
14:
15: The one I have been most involved in is Diabetes because I am on the cross regional and
16: I used to be the team leader for Region D team but handed that off to our diabetic
17: educator here. I am one of the two people here who spend most of the most time relating
18: to physicians around diabetic measures and around quality improvement of chronic
19: diabetic care so initially, and I can't remember how long ago, but probably about two
20: years ago, maybe three years, what I was doing to give physician about their diabetic care
21: was I would do panel queries in the live EMR and get information that way. I usually
22: spent...I thought it was a miracle at the time actually. It was just a miracle to be able to
23: provide them with feedback about how many of their patients had HBA1C in the last year
24: and so on. I would usually spend between half a day and a day to put together enough
25: information to give feedback to all the docs and I wasn't really giving them much
26: feedback about the values, just whether they had had the test or not.
27:
28: * How often was that? Quarterly? Monthly?
29:
30: Well it was not very often [laughs] because at the time I had probably ten primary
31: providers and I would come in on Saturdays so I could use several different computers so
32: that I could get panel queries started and just run through each doc on the same panel
33: query. So I just moved from one computer to the next and do the round again because
34: there is a kind of central core here admin, clinic, admin; so I accessed a whole bunch of
35: computers real close. That's how I did it. Then I would put it all in an excel sheet, figure
36: out the percentages. It was laborious but very exciting because there was no way to do
37: that before. So it was very cool but if I didn't take a Saturday or Sunday it didn't happen.
38: So it wasn't happening to often, maybe once a quarter at best.
39:
40: * How is it happening now?
41:
42: Now I get all that information on [intranet].
43:
44: * Part of the intranet diabetic site you can enter certain parameters, hit submit, and
45: generate a list on the fly. ...
46:
47: That is the one I use the most. That is the exception report it is called. So I can just put in
48: a physician name and say 'ok what I want...'. Now that doesn't get everything but I can
49: just look in there for any given physician find out which ones of his patients have not had
50: or are out of whack with some measure. Then I can move it real easy into excel, sort it,
51: give it to the doc.
52:
53: * So the intranet has helped...
54:
55: Yes, it has helped a whole lot. Now what I am waiting for is the Healthcare Improvement
56: Division to do all the figuring out what is important to the docs, sorting and sending it to
57: them without having to go through me. That would be great. We've taken so many giant
58: steps over the last three years or so that it is just wonderful.
59:
60: * What about other reports of other disease states, practice variation. Do you get

61: regular reports?

62:

63: No. Well…that is not true. As a member of the quality council here we get the

64: information that comes out of our JCAHO reports. So we have a regular quarterly report

65: to the whole council on where we stand with regard to those based on feedback from our

66: vendor.

67:

68: * Is that timely enough? The quarterly reports? Is monthly preferable?

69:

70: I think it is quarterly but it is pretty delayed.

71:

72: * I think it is a little lag after the quarter closes.

73:

74: I think it is quite [emphasized] a little lag. A whole quarter or something.

75:

76: * In the ideal world how frequently, or current or fresh does this information need to

77: be?

78:

79: Quarterly is really fine actually. If we can't get good individual physician feedback.

80: Because then really all we can do with the quarterly report is say "OK…we are messing

81: up here. We are not doing a whole lot of smoking cessation counseling. But I can't

82: feedback to any individual physician easily.

83:

84: * Other than physician level detail what else do you think is missing in these quarterly

85: reports?

86:

87: You are asking for my fantasy life [laughs]. In my fantasy life when I see that we have

88: some exceptions. That we are really not doing well. It would be great if I had an easy way

89: to understand why. [emphasizes last word] What are the delays about? Did the order not

90: get written? Did the order get written but not carried out? Where along the process did it

91: screw up? That however is going to be very involved. When we decide to focus on

92: something we get that by going out just by going out and doing individual chart review

93: because there really isn't any other way that I know of.

94:

95: * What about sharing information across the whole system? Do you ever get

96: information about how another region is doing on the same measure? How does that

97: work?

98:

99: We do in diabetes. Well it is always nice to know you are doing great…compared

100: [laughs]. There are four things, sort of, when you are thinking about how well you are

101: doing that I tend to look at. One is 'Well gosh how do I compare to perfect? How do I

102: compare to some kind of national benchmark? How do I compare to what I was doing

103: before? How do I compare to other regions?' So it would be nice to look at all of those.

104:

105: * What kind of barriers do you see to the different regions working together on key

106: issues?

107:

108: The biggest barrier over the last couple of years has been the difference in

109: implementation of provider tools. Because you develop a process that works for different

110: things you put together out of the [EMR] and outpatient [EMR]. But if other people aren't up

111: on it, or they haven't been up long enough to have enough history in there to give them

112: really good information then it is hard for them to benefit. We've had the EMR for six

113: years so we have lots of history in there and lots of time to develop processes around it.

114: So when we went to these cross-regional meetings and shared how we were doing things

115: it was dissonant because other regions didn't have access to the same stuff we did. I think

116: now, as we move forward, I am getting calls from people in other regions to talk about

117: how we are doing this or something else. It just seems more relevant now because we all
118: have the same tools.
119:
120: * You've been through those hoops with the tools and now they are going through
121: * them?
122:
123: I think that is a lot of it, because I can remember way back in the very beginning I was
124: very enthusiastic about sharing what we were doing. Nobody was very interested, at least
125: that is how it seems.
126:
127: * In the last three months have you looked at changing processes or systems to
128: * improve health outcomes associated with CAP?
129:
130:
131: Oh yes. Well it is real clear that we need to do something about smoking cessation
132: counseling. We are not doing very well with that. We've had a lively discussion in our
133: local group about how to do that with differences of opinion. We still don't have that
134: resolved. We've also spent a lot of time looking at the graphs of time to first antibiotic
135: and we are going to work on that. Mostly in the ER because that is where most of the
136: pneumonias come in. Our plan is not to let them leave the emergency room until they
137: have had their first dose of antibiotic.
138:
139: * What alerted you to these two measures? Was it already known that 'Gee we need
140: * to better on these two'. Or was it Vendor Quarterly reports or seeing it on the CAP
141: * site or a different reason?
142:
143: It was the Vendor site and the CAP site.
144:
145: * What are your thoughts on the design on the CAP site using dials?
146:
147: I think the dials are great. Everybody I have talked to here think the dials are great. I
148: really like the addition of the faint pointer of the last quarter's information. That is really
149: nice too. How you have the bright red pointer over the faded pointer.
150:
151: * I send out an email once a month that has a link to the site just so people don't
152: forget about.
153:
154: That is great. That is wonderful that you do that.
155:
156: What about the factoids in the email? Are they fluffy, worth keeping in there?
157:
158: They are fun [laughing]. I think you should leave them. I like them but I read Harper's.
159:
160: * This doesn't have anything like exception reporting like the diabetes site does. Do you
161: * see something like that as something useful to add in here?
162:
163: The really valuable thing about exception reporting is you can get.... diabetes is a little
164: bit different in the sense these are people we have ongoing care of we need to pull them
165: out and do something with.
166:
167: * What about having provider specific reports?
168:
169: That would be great. That would be really nice.
170:
171: * Thanks a lot for your time
173: It is a great site really, I like it a lot.

Interview 6. "George"

Note: the first 40 lines of the interview transcript have been removed to protect participant confidentiality.

41: * What is your life like in terms of receiving health outcomes reports? Are you getting
42: * too many? Not enough? Wanting information? Flooded by emails?
43:
44: I'm certainly not flooded by emails. You know – I guess we are talking internally...the
45: patients we are taking care of in our community and within our medical group. I don't
46: think we see nearly enough. That is the bottom line. Where we do see – where I think we
47: have adequate information I think is around diabetes. I think we have been able to
48: provide some outcomes data with some fairly high integrity around that. That has taken
49: years to do. In part some of the simplest barriers, or simplest questions have been
50: extremely difficult to answer. Number one is who is a diabetic? How do actually put
51: someone on a list and call them a diabetic and make sure you have a list that you can then
52: query from to give you accurate information? That has been a big challenge and I have
53: sort of lived through those processes through the years.
54:
55: The second piece is the simple question...what is our denominator? If we got a group of
56: diabetics well...what is the percentage of diabetics within the larger population that we
57: take care of - even knowing who the patients are who we have some responsibility for
58: providing care for is a very difficult thing for us to even be able to get our hands or arms
59: around.
60:
61: Those have been pretty basic things that have really created challenges for us. Those
62: kinds of questions are reasons why maybe we haven't been able to get as much outcome
63: data out there.
64:
65: * Because the questions are so tricky to answer? Everyone has a different response as
66: * to who is a diabetic? Coming to a standard agreement?
67:
68: I think that is part of it, some standardization and agreements around definitions. We
69: have also tried to use the electronic medical records system but it also has limitations.
70: There are processes that occur where people get taken off the list or they get put on the
71: list. The simple thing of death. People die and do we have a good process for making sure
72: that person is removed from the denominator when we look at outcome measures. Or that
73: they get removed from the list and not included with all the other diabetics. It is
74: something that is fairly simple. Yet on the other hand it disrupts the data. When there is
75: not good data, us providers out there won't look at it. Unless we are certain that it has
76: integrity. So – to come back to your question – we still have some work to do.
77:
78: * Are you getting those reports regularly? Are they pushed at you by email...?
79:
80: That's whole another question. How do you disseminate that information? Currently it is
81: located at a site, a secured site, where you have to go look at a PowerPoint presentation
82: basically. It is not really user friendly from a clinician's perspective. The ideal would for
83: me to site in a room with a patient, or to sit at the medical record and I am able to bring it
84: up on screen and I can drill down directly to my numbers and I can tell that person, if
85: they are a diabetic, 'you know with 80% of my diabetics I am able to achieve less than
86: seven and I think that I can do that for you as well.' Because these are the numbers from
87: my practice. Having that kind of direct availability of information that has a direct
88: influence on the way I practice is where I think we need to be and we are a long ways

89: from that.

90:

91: * Outside the point of care environment you can't get to a report specific to a patient?

92:

93: I can but it would take some training and most docs would say 'this is too much hassle

94: and so most docs would just ask their manager to get that information and bring it to me

95: in paper. So it does not really meet that criteria of having the right information at the right

96: time on the right patient. So there is a lot of work to be done.

97:

98: * Do you ever receive regular reports about any other disease states, kind of

99: * population level reports?

100:

101: Other than what you have just been providing – other than CAP. Within our

102: organization? We've started looking at the pneumovax. We've been doing that at the

103: Senior Health and Wellness Center for some time. The Senior Health and Wellness

104: Center data that we have generated on our own out there has been a little bit different

105: than the rest of the region because we have the ******** Study we've also been

106: collecting data on satisfaction and clinical outcomes specific to our clinic. So I probably

107: receive more outcome information than anybody else in the region as a result of that.

108:

109: As a result of having some funding for an analyst to provide reports? You don't

110: have an internal analyst here who you can turn to and say 'can you generate a

111: report on this or that?'

112:

113: No. But our manager at the Senior Health and Wellness Center wrote some of the

114: findings software for provider tools. She was an analyst before she became our

115: manager…so we are able to get more information out of that system than most. We've

116: also been able to get reports that are non-clinical reports but operational reports using

117: proclarity software looking at cubes on the outpatient EMR.

118:

119: * When you say operational reports are you referring to census and…

120:

121: Yeah – appointment times, people that are no shows. How many open slots we are not

122: filling, by operational I mean these are tools that allow us to operate more efficiently.

123:

124: * Do you want to see that information integrated with clinical outcomes information?

125:

126: Absolutely, that is the future.

127:

128: * Currently you don't see financial, clinical outcomes, and operational so you can

129: * connect the dots?

130:

131: Hopefully with the datamart we will allow us to look at cost data and drill down

132: specifically to diabetic patients so that we will know if Dr. X has the best outcomes and

133: this is how much it is costing and his panel per good outcome we get an idea then what

134: the cost is and we can begin to generate some improvement.

135:

136:

137: * What barriers do you see with regard to sharing information across the different

138: * regions?

139:

140: That is a very interesting question because it came up this past year where one of the

141: regions wanted to see our outcomes at the Senior Center so they could compare their own

142: outcomes.

143:

144: On the one hand I want to be transparent within our organization and to share information

145: so that other folks can sort of see and have some benchmarks within our organization. On
146: the hand I am a little bit reluctant without a formalized process to look at that. And the
147: reason for that is, as I recall, I gave out my response to the request. Most of it has to do
148: with the intent of knowing what the information is and what they are going to do with it.
149: On the one hand using information to make one group look better than another – then the
150: intent is not healthy. If the intent is to look at best practice and to strive to best practice
151: and use that information to get a workgroup to move forward in improving their
152: processes, I think that is a whole different subject. I can see that.
153:
154: The problem is that it needs to be very clear upfront and there needs to be a process in
155: place that everybody has agreed too. And one of the concerns I had was that there was
156: sort of a sense that one group wanted to prove to everyone else that they are doing a
157: whole lot better. And I think that is not a healthy thing. One of the things you can do –
158: and I know they did this at System X. Is to take data and blind it. Show all the data and
159: blind it and put letters next to it. Show all the departments that are doing the same thing,
160: indicate where they are in terms of the other like departments that are doing work. I think
161: that is effective. If they see that department X is doing way better than they are. Then to
162: have discussions about how to unblind that so that those people can get together and try
163: to understand what they are doing that is better than everybody else.
164:
165: * Do you think the same kind of thing can be used with physicians?
166:
167: Yes - I think that is how System X used it, was by physicians. They took a whole group
168: of urologists and looked at prostate surgery complications. A huge range. They just
169: basically gave it to the docs and told them which letter they were. It was a very powerful
170: tool for improvement because these guys down at the bottom really wanted to know who
171: these guys were at the top, what they were doing that they had better outcomes.
172:
173: * It is interesting because if nothing was blinded, the up-cry that would ensue…
174:
175: Chaos.
176:
177: * In the CAP site the regions could see who the other regions were.
178:
179: I wonder how much of that needs to be blinded unless down at the physician, or practice
180: level, and I think that is a whole discussion that needs to be had.
181:
182: * What are your thoughts on this kind of design for the CAP site, for delivering this
183: * type of health information along with an email letting you know it has been updated
184: * and providing a link to the site?
185:
186: I like the prompt. I would not otherwise go to the site because I wouldn't think about it
187: unless someone prompted me. It is easy because it is one click onto the link and I am
188: there and I am in front of the dashboard when I do one click. So I highly recommend it
189: being one or two clicks away.
190:
191: I like the format of the website because it connects the data with the guidelines and with
192: other resources all in one site and in fact I would like to copy it for our geriatric stuff
193: which will be our next conversation.
194:
195: In terms of the dials and that format. It's ok – I might prefer seeing it in a graphic format.
196:
197: * Histograms?
198:
199: I'm not as enthused by histograms – I actually like SPC charting might be one way,
200: because then it lets me know whether a change is statistically significant or whether we

201: should really pay attention to it or not. Otherwise I don't really know that – whether it is
202: better or worse. What is the standard deviation that would indicate that we ought to pay
203: attention. I think you will find that everyone is going to have their own sort of visual that
204: means more to them – I'm not sure if we need to accommodate everyone's needs. I am
205: fine with the dials. But I like the graphic graph.
206:
207: * Under the dials are four buttons. One will lead you to SPC charts.
208:
209: Oh...it does?
210:
211: * The main dials do have a secondary needle that is slightly faded to indicate the
212: * previous quarter measure.
213:
214: I was just going to mention that can be deceiving because if you see a trend in two or
215: three months it is consistently going down, I wouldn't know that.
216:
217: * What if it has been measured for each of six months, so now you have six needles,
218: * the oldest one is the most faint and the newest one the most current so it is almost
219: * like a motion trail?
220:
221: Yeah....I would try to keep it simple. I think you put too many needles. You put too
222: many boxes there [laughs] just give me the raw numbers and let me look at them.
223:
224: The other possibility is...I don't recall are the raw numbers on there?
225:
226: * Yes, it says 96.5 and the needle is pointing to that.
227:
228: So there might be a little box with the previous number. You know the dial doesn't give
229: me an accurate number, just a general idea.
230:
231: * Any other thoughts how a dashboard could be done differently, better?
232:
233: You know I think you address it there but I am not sure how. It is the internal
234: benchmarking – It is hard to show that in a dial.
235:
236: * What would be a benchmark for you?
237:
238: A benchmarks to me may be the target, or it is the best practice and that is where we need
239: to go. But I tend to see benchmarks as what everyone else is doing. It may not be the best
240: – it is sort of like treatment of hypertension in the country – only about 29% are
241: adequately treated we think we are probably about **% so we are better but it is not
242: worth [expletive] but it is a benchmark. I think probably not going overboard – I would
243: pick one or two.
244:
245: * What do you think about the frequency of reporting these kinds of information?
246: * Reported monthly? Quarterly?
247:
248: I would think that sort of high level information that is produced at this site be quarterly.
249: If you are looking at trying to change behavior and you are using it as a process
250: improvement tool, then I think you need to have more frequent data that is accessible and
251: maybe push that. If you are trying to reduce HbA1Cs in your diabetic population you
252: might want to push that out in a monthly but if you are looking at a system wide
253: dashboard like this then quarterly is probably fine. We haven't really had that discussion
254: either about what kinds of data do we need. We tend to shot gun everything and put them
255: all in the same line.
256:

257: * In the last three months have you implemented anything new around CAP that
258: * weren't already in place?
259:
260: I haven't personally – but you know we need to pull in our nurse practitioners – we run a
261: collaborative nursing practice as part of our service line. We have four geriatric nurse
262: practitioners that are in the nursing homes. One of their projects last year was to
263: standardize and bring in the pneumonia protocols into the nursing homes. They've used
264: some of the same criteria that we have been using in the hospital that is specifically for
265: the nursing home. That might be a project you want to bring into the CAP folks. I
266: mentioned it to X [Senior VP for Clinical and Operational Improvement] because it is
267: sort of the next step but we have already done it here; hopefully you won't need to go re-
268: invent the wheel. But not many people know that these guys are doing it. I don't know of
269: anyplace else in the organization that is doing the kind of work that they are doing either.
270:
271: * But the CAP reporting was not a trigger for that?
272:
273: No it wasn't. They started that last year, probably about a year ago, they realized that
274: they needed to standardize how they were treating pneumonia in the nursing homes.
275:
276: So I can't really think that this has changed anything. You know it is hard to change
277: anything unless it specifically comes down to the practice site of the physician. For
278: example, I don't know if you have data specific to the Senior Health and Wellness Center
279: and to the three docs who have their practices here. I can't imagine going through an
280: improvement project unless there is specific data
281:
282: * One of my hopes were regional requests for the medical record numbers for
283: * tracking purposes.
284:
285: You bring up an excellent point. I think one of the places where we have dropped the
286: ball. We have operated under the assumption that if we just give them the information
287: they are going to change. I think people look at the information and they see that they are
288: not doing that well and they think about what the work is involved for trying to do
289: something different and we have so many other things going on that it just becomes
290: information only. Making that connection from data that shows where we can be
291: improving to actually implementing something that has an effect on that I think we have
292: fallen way short. So, to me, that is where I see the role of a CAP team, or a diabetes team,
293: is to take that information at a regional level, to analyze that, and then to push out to
294: people who make decisions operationally and improvement wise. To say 'ok, this is what
295: is going on…our pneumovax rates are way below everybody else's. We've got to come
296: up with a process that improves pneumovax rates.' That they take some responsibility
297: and there is some support around process improvement. Just providing the information is
298: not going to make it work. We've tried it and it doesn't work. We've tried it with
299: individual physicians and it doesn't work. It is only in situations where there is follow-up
300: support, and support for doing process change – the only time that I have seen change
301: actually happens. I think it is a big learning lesson for the Diabetes Wellness Project over
302: the last three years. It has been very technically oriented toward that electronic data and
303: providing, getting that data, getting the registry started and producing reports.
304: Well…we've produced all these reports but we haven't really seen the kind of
305: improvements that we thought we would see. So now they are kind of going in a different
306: direction and looking at 'now, how do we apply these reports to the actual clinic
307: processes that happening at the clinic level, in the office with the doc and how can we
308: support that?'
309:
310: * So having a group of people who are provided with supporting information?
311:
312: Yes, for example, Person X here…who has been sort of assigned by HealthFirst medical

313: group to be the diabetes lead person. She is a nurse who takes that information and goes
314: to the individual practitioner or practice and says 'ok, here are the numbers. Here is
315: where you are at with this. These are the people that we need to get them in for their
316: diabetes exam and to lower their HgA1Cs. How are we going to do that? What I can do
317: to help support your reception and your nurse and you in order to get them? I have some
318: processes already in place that work, worked at other practices, we can apply it here and
319: just make it happen.'
320:
321: So, those are the kinds of things that have to be done. That is a lot of work. That is where
322: the rubber hits the road.
323:
324: * She needs to understand the data and the process and -
325:
326: -then translate it. I think you find the same thing in CAP.
327:
328: * One other thing on the site was the discussion board – I had hoped to see some
329: * discussion – especially across the regions. It was really unused. It has an anonymous
330: * feature because some people might be shy about posting questions-
331:
332: They don't want to look stupid [laughs] I wouldn't throw it out. I think it is a matter of
333: there is sort of a threshold in the number of participants. Once you reach that threshold in
334: the number of people interested in using the site they are more likely to post questions in
335: the watercooler. Also habit is part of it. You have providers who are not electronically
336: savvy. Some of the newer docs are. The majority of us baby boomers did not grow up
337: communicating electronically so even having chat rooms and that kind of thing. So the
338: modus of communications is to pick up the phone and call the pulmonologist and ask
339: them about a particular question. Probably the most I see, I get these all the time, is
340: someone through email because they know me personally and they know they don't have
341: to post their question which could potentially make them look stupid – they can just post
342: it to me and I can put a quick answer back. So you might think about, rather than a water-
343: cooler, an 'ask an expert' kind of approach. But the question is whether people would use
344: it. You have to have people frequenting the site and going there a lot. If it is password
345: protected, you gotta go a couple, three clicks away.
346:
347: * What do you think of a CAP site like a CAP dashboard, a mega dashboard if you
348: * will, where you can explore core measures and other measures? Or is better to have
349: * each thing be a distinct thing?
350:
351: My idea is that we should bring it as close to the micro system as possible. When I talk
352: about the micro system I mean the small units in which we are providing care, or practice
353: where we are providing care. Bring it down to the doc. In fact, bring it in to the room
354: with the patient. On the EMR screen where I have the patient up I should be able to
355: choose a site that says "CAP" and I can go to that site and it will give me everything I
356: need to take care of that patient and it will tell me how we are doing or how I am doing.
357:
358: * As an organization and then down to the provider?
359:
360: At the provider level it ought to be the other way around. The first click ought to not be
361: the organization level, but that individual physician. We kind of thought drill from the big
362: picture down to the individual unit. Well the doc, the office, could care less how the
363: region is doing. So you might start with the individual physician so that when you are
364: logged on, it automatically knows who is logged on, and they can bring that up. That has
365: been one of my questions because it ought to be right in front of them how they are
366: doing. And it ought to be one click away in terms of the guidelines for treating
367: pneumonia.
368:

369: I think that having a list of those things that are common and produce 80% of our energy,
370: a few dozen or so, that are beneficial for the doc in the office in the room. You should
371: have CAP, a diabetes site, geriatrics is what I would like to see so that when you are there
372: you can access the dementia workup, and this will tell you how to do a dementia workup,
373: this tells you how to treat urinary incontinence, tells you how to treat geriatric depression
374: – these are all the tools that we use…- they are here. You can kind of look at them, print
375: them up, and you will have it there so you can fill it out with the patient in the room.
376: Bringing that to the device in the room with a patient is where I think we need to be.
377:
378: You might want to set up with the provider 'this is what I want to see, this is what is
379: important to me, work with them individually so that there is some customization to the
380: reports.
381:
382: * Thanks for your time.

Interview 7. "Robin"

Note: the first 16 lines of the interview transcript have been removed to protect participant confidentiality.

17: * What is you life like in receiving reports of patient outcomes? Are you flooded with
18: reports? Lacking information often?
19:
20: I feel like I am – I would say in the range not enough, just about right or too much...I
21: would have to say just about right. I am fortunate that the data analysts are in our division
22: and part of my team. We've created processes and we meet weekly. If there are things out
23: there that could be done differently or better we talk about that. In that weekly team that
24: we have we've included one of the coding specialists, we've included one of the medical
25: staff – office. Medical staff office staff – because they are such an integral part of getting
26: the physicians the report that they need – the indicator reports , those sort of things. And
27: not only that, but I feel very supported by the reports I get from finance.
28:
29: * How do you get those reports from finance, are they emailed? What format?
30:
31: Emails. Mostly excel.
32:
33: * How often do the analysts send indicator reports? Monthly? Quarterly?
34:
35: Monthly
36:
37: * And your sense is that is timely enough?
38:
39: Yes –
40:
41: * What about sending those daily, or weekly?
42:
43: I think it would be too often.
44:
45: * Do you ever see the financial reports and the clinical reports integrated together?
46:
47: No
48:
49: * Do you think that is something that needs to be done or best understood and left
50: separate?
51:
52: I think that in other organizations I have been in there has been integration and it has
53: been very helpful. What that would like for this organization, because I came from the
54: for-profit world I'm not sure in the not-for profit setting...I haven't thought that through.
55: I'm not sure what that would look like. Those are helpful. For example, one thing that we
56: are doing -we have human resource staffing effectiveness indicators and we're looking at
57: correlation coefficients between things like nursing hours per patient day and the amount
58: of falls that we have in our facility. That is very valuable though we are just beginning to
59: learn what that means and what that looks like and understanding what actions things like
60: that would take. That would be an example of combining some of the things that are most
61: often thought of as financial with some of the care practices and outcomes that kind of
62: impact that. That would be an example of some of the things we are doing off the top of
63: my head.
64:

65: * It sounds like having an analyst nearby is helpful in the organizations.
66:
67: Very
68:
69: * Have you used any of the Proclarity cubes? They allow you to drill through the web.
70: * They allow you to explore different datasets graphically.
71:
72: I haven't. The only thing reason I haven't – I would have to be candid and say that with
73: the different things on my plate...Joint Commission will probably be with us in August
74: and getting ready for Joint Commission, because I am also kind of the person who
75: coordinates the activities around. We have functional teams that are ongoing teams. We
76: don't just get ready for Joint Commission, we do have an ongoing readiness program.
77: The second thing, as far as time, some of the people I just mentioned who report to
78: me...we've had vacancies over time in a couple of those key areas. Long story short. - it
79: is mostly time that I haven't used proclarity.
80:
81: * What about integration with other regions? Do you work often with people who are
82: * in your role in other regions?
83:
84: Yes I do.
85:
86: * What kinds of barriers do you see with regions working together, sharing successes?
87:
88: I think part of what I see is a lack of consistent definitions for like indicators. I see that
89: we don't use a lot of like indicators. Take for example our medical staff. If you were to
90: compare our medical staff indicators to Region B's indicators...there is not a lot of
91: similarity. In fact we've had this conversation in our counterpart group for quality
92: leaders. Shouldn't we be looking at similar things so that we have something to
93: benchmark against? And that is the third thing I would like to see enhanced, the
94: benchmarking capability. Not only in our system. But to be able to tap into more and
95: different benchmarking information.
96:
97: * [Tape recording ends – content below represents notes taken during interview]
98:
99:
100: * What did you like about the dashboard?
101:
102: I liked the dials. You need to have something for the visitor.
103:
104: * You mentioned trending - the dials do not do that well
105:
106: I that that is ok - people need to a point in time.
107:
108: * Did you notice the smaller buttons below each dial leading to a spc charts and line
109: * charts?
110:
111: Yes I saw those
112:
113: * There was also a discussion board but it was relatively unused - any thoughts on
114: * why?
115:
116: Just a matter of not having time
117:
118: Did you change and processes in the last 3 months related to CAP?
119:
120: Yes we did –

121:
122: Was that triggered by the CAP reports?
123:
124: -Yes

Interview 8. "John"

Note: the first 14 lines of the interview transcript have been removed to protect participant confidentiality.

15: Is it your sense that managers get the information they need or are wanting?
16:
17: Usually not. After the fact they made up a questionnaire and collected the data and
18: handed it over to me and ask for an analysis or report; once a report is returned to them,
19: it is at that point that they realize that they asked the wrong questions or in the wrong
20: way.
21:
22: Do you think managers are overwhelmed or under whelmed with reports?
23:
24: I think.that is a good one. I think they get a lot of reports but I don't think they expect
25: the results to be as detailed as they thought. I don't think they pay as much attention to
26: the detail. They have a hard time interpreting anything, as they told me this morning,
27: above a six-grade level.
28:
29: What do you think would help with that?
30:
31: I think they just need to sit down and look. I gave them a report this morning. I split the
32: details into four levels. The first level was a summary sheet which described various
33: comparisons of nursing hours and patient falls. It showed overall little or no relationship,
34: perhaps unit X has a fair relationship. That analysis uses correlation coefficients and
35: regression graphs. The next level is more of an epidemiology type of analysis and report.
36: One page: description, time frame, data sources, units participating, analysis
37: methodology, findings and limitations. That level is way over their heads. Then I provide
38: a breakdown of the data by nursing units in a table: including correlation coefficients, r-
39: squared values, total nursing hours, mean nursing hours per month, falls per month. And
40: this is a simple table but a little over their heads too, which surprised me. Lastly, I
41: provided them with regression graphs for each unit. Totally incomprehensible. I tried to
42: give them four levels so that whoever is interested in this can dig into it and see what the
43: results were. Bottom line is: I don't think that they concentrate enough and look over
44: these reports that we prepare for them.
45:
46: Is it just a matter of concentration in a sense? They could interpret and understand if they
47: had the time and desire?
48:
49: Yeah. But I'm not sure they have the skills and knowledge base and I am kind of
50: questioning that now.
51:
52: Do you deliver lots of routine reports like that?
53:
54: These are more ad-hoc or quarterly. This nursing audit is a quarterly report. I do many
55: ad-hoc reports. For example: I did a medical staff survey. They have an annual meeting.
56: They came up with four things they wanted to change in the medical staff so they asked
57: me to make a survey for the medical staff. Those guys, you can give them as much as you
58: want and they read it and pay attention to it. So they have some different knowledge base
59: and skill level and interest.
60:
61: Are those reports more or less complex than what you just talked about giving nurse
62: managers?
63:

64: Same. They might have some chi-squares in them if I compared a couple different groups
65: or responses over time. Nothing they don't really see in their own literature.
66:
67: You used to work as a quality facilitator?
68:
69: Yes.
70:
71: When you worked in that role did you feel over/under whelmed with the number of
72: reports you received?
73:
74: No, because the way I do the facilitating is like someone doing a six-sigma facilitating
75: where I facilitate, I set the agenda, do the minutes for the team, keep them on time. But I
76: also do the data collection and analysis and report writing and summary statements.
77:
78: So you generate your own reports?
79:
80: Yeah I do it myself so those folks only have to come, listen, recommend, move on, do
81: something with the data.
82:
83: What about in your facility as a whole, are healthcare leaders receiving information
84: they need or is it, as you said earlier, that they are receiving it but not interpreting
85: it?
86:
87: That is interesting because I was reading an article in a quality management journal this
88: morning and the subject examined balanced scorecards and use of those by executive
89: team members. Take HealthFirst where there are corporate indicators. These are
90: pushed down to each different region for focused comparison. The indicators will show
91: you some information but for me to think that I would run a business based upon this
92: information, I don't think there is enough drill-down to these indicators.
93:
94: You would drill down to explore what factors are contributing to that overall
95: measure.
96:
97: Yeah - you try to find any causative agents, maybe the things that would assist, more or
98: less, in the business sense. One example that I've seen them following here is the volume
99: of MRI's and CT's done. They follow that monthly in a simple individual control chart.
100: The MRI chart showed a process that was not Out-of-Control. But I further sub-grouped
101: the data for them and their eyes dropped because they see that the business dropped off
102: over the last year to the tune of over 500 MRIs a month, that's like 50 thousand dollars a
103: month and they didn't have a clear idea that was going on. So the next drill down is why
104: are they losing that business. They had to do some marketing to try to recover the
105: business, so it might be recovering slightly but not yet.
106:
107: What about the way that CQI indicators are provided? The mechanism of delivery?
108: Does leadership at your facility know how to find them?
109:
110: I think that can be improved, and has been. The way you provide refreshed data when
111: you send me email that the indicators have been updated. I think that these people need to
112: see that like boom.on their computer. You need to open this and see the indicators.
113: Otherwise I don't think they pay attention to them until it is time for the annual review.
114: And then there appears an indicator related to their bonus money and then they pay
115: attention.
116:
117: How often do you see balanced scorecard reporting?
118:
119: I personally see it because I make up the board report here, quarterly.

120:

121: You see financial information integrated with clinical information?

122:

123: Yeah - because I happen to be in that position. As far as other people doing that - I don't

124: think most management even knows about its existence.

125:

126: Do you regularly see reports that cover all the regions?

127:

128: The only ones I see are the ones you send me.

129:

130: The CAP Measures?

131:

132: Yeah - and the corporate quality indicators, like the ones we follow for aspirin and

133: customer satisfaction..

134:

135: What are your experiences with different regions working with other regions? Work

136: teams that span regions? Work teams in one region that are aware of another?

137:

138: I would say about 10% collaboration. When I snoop around and look at the other

139: websites of teams rarely do I see that they cross-pollinate each other.

140:

141: I am not sure if it is a territorial thing or fear-factor. Perhaps time availability. It might be

142: all of these things. Maybe the main reason is the corporation fosters more competition

143: than collaboration. I've been here a year and a half and this is my impression. Very much

144: competitive rather than collaborative.

145:

146: Do you think it is harmful to display measures side by side?

147:

148: No. Not at all. I've done that for like ten years before I came to this system. It gives you

149: some kind of benchmark to go against. In this corporation the VP levels and above start

150: sweating and getting competitive, 'we don't want to look so bad.' I thought the object

151: was to use it as a benchmark, improve at your own rate. They don't have that concept.

152:

153: What about the design of the CAP dashboard?

154:

155: It's getting better all the time. I enjoy it. The really, truly, most important thing for me is

156: when you email me and say it is updated and I know I can go look at the latest results.

157:

158: What if I just put the results in a word document and just emailed that to everyone?

159:

160: Being the kind of person I am, it works for me. But I have talked to a few docs and they

161: are more visually inclined to like the speedometer. I like it. Doesn't matter to me as long

162: as I know when it is there and I can go look. I think for most people the visual part helps

163: a lot.

164:

165: Do you think it would be preferable to see six little SPC charts instead of dials at a

166: glance, you click on it and it magnifies? The dials don't indicate trends very well.

167:

168: Yeah - but for most people I think they really like it. That is as much as they need to

169: know statistically or analytically.

170:

171: Did you realize that below each dial there are four little buttons and one leads to a SPC

172: chart.

173:

174: Yeah - I knew that.

175:

176: Can you think of anyway it could be improved or changed?
177:
178: I'm happy with the progress that has been made. And like I said I like the notification. I
179: think a tickler system for notification is worthwhile. Actually, I wish that all docs and
180: administration could get access to it and be notified when they are live and updated. I
181: think that is the way it is going to make improvement.
182:
183: What do you think the update frequency is necessary for QI?
184:
185: Monthly.
186:
187:
188: There is a discussion board where you can post ideas, collaborative kind of ideas.
189:
190: I think just because it is new it will take a while to catch on. I clicked on it because there
191: were a couple things there.
192:
193: Do you think down the road people might post ideas or questions directed toward
194: other regions or is there too much of an atmosphere of 'I don't want to look stupid'
195:
196: I just think it is so new and the meetings are so new, we are having these teleconferences
197: to go over things; I think it is a matter of time.
198:
199: A lot of these measures are reported in a quarterly report from HDS, embedded in a
200: pdf document. Do you think it is worth the time and effort needed to recalculate the
201: measures and display them monthly on a site like this?
202:
203: I don't think they will look at those. It is the volume. Some of those reports are 20-50
204: pages, it is just too much.
205:
206: What if you put a set of hyperlinks at the beginning of the pdf report?
207:
208: So you could just jump to a specific measure. That would be great.
209:
210: In the last three months have you been on any active work teams that are looking at
211: changing CAP processes.
212:
213: I have been to a couple of the meetings - we're just getting started. We looked at the
214: protocol and that [names physician champion] and we've run some data. It is kind of
215: interesting. I don't think it is the measurement that is problematic. Some of the problems
216: was one physician whose been leading pneumonia work here and is doing a great job,
217: took the Infectious Disease Society protocol and Chest Medicine protocol for pneumonia
218: and said 'we'll adopt this'. But the ED folks said 'you didn't include us' and so they had
219: this little tough debate and bad feelings for a little bit. So I think that is probably the
220: hardest thing on this protocol.
221:
222: Getting everyone's buy-in?
223:
224: Yeah - getting the right people there, having them participate.

Appendix F. Frequency Tables for Paired Survey Results

1. How satisfied are you with receiving reports about CAP in your region?

Baseline

		Frequency	Valid Percent	Cumulative Percent
Valid	Never or almost never	4	21.1	21.1
	Sometimes	5	26.3	47.4
	About half the time	1	5.3	52.6
	Often	5	26.3	78.9
	Usually	2	10.5	89.5
	Always or almost Always	2	10.5	100.0
	Total	19	100.0	

Follow up

		Frequency	Valid Percent	Cumulative Percent
Valid	Rarely	1	5.3	5.3
	About half the time	1	5.3	10.5
	Often	2	10.5	21.1
	Usually	9	47.4	68.4
	Always or almost Always	6	31.6	100.0
	Total	19	100.0	

2. Staff in other regions cooperate when I need their assistance.

Baseline

		Frequency	Valid Percent	Cumulative Percent
Valid	Never or almost never	1	5.3	5.3
	Often	8	42.1	47.4
	Usually	4	21.1	68.4
	Always or almost Always	6	31.6	100.0
	Total	19	100.0	

Follow up

		Frequency	Valid Percent	Cumulative Percent
Valid	Sometimes	1	5.3	5.3
	Often	5	26.3	31.6
	Usually	5	26.3	57.9
	Always or almost Always	8	42.1	100.0
	Total	19	100.0	

3. When I contact staff in another region, I feel that I am dealing with someone who has the same goals and standards that I do.

Baseline

		Frequency	Valid Percent	Cumulative Percent
Valid	Never or almost never	1	5.0	5.0
	Sometimes	4	20.0	25.0
	About half the time	1	5.0	30.0
	Often	5	25.0	55.0
	Usually	5	25.0	80.0
	Always or almost Always	4	20.0	100.0
	Total	20	100.0	

Follow up

		Frequency	Valid Percent	Cumulative Percent
Valid	Sometimes	1	5.0	5.0
	Often	7	35.0	40.0
	Usually	6	30.0	70.0
	Always or almost Always	6	30.0	100.0
	Total	20	100.0	

4. Staff in other regions are willing to help when I contact them with a question or request.

Baseline

		Frequency	Valid Percent	Cumulative Percent
Valid	Never or almost never	1	5.0	5.0
	Often	5	25.0	30.0
	Usually	7	35.0	65.0
	Always or almost Always	7	35.0	100.0
	Total	20	100.0	

Follow up

		Frequency	Valid Percent	Cumulative Percent
Valid	Often	7	35.0	35.0
	Usually	3	15.0	50.0
	Always or almost Always	10	50.0	100.0
	Total	20	100.0	

5. I interact with staff from other regions.

Baseline

		Frequency	Valid Percent	Cumulative Percent
Valid	Never or almost never	1	4.3	4.3
	Rarely	2	8.7	13.0
	Sometimes	6	26.1	39.1
	About half the time	2	8.7	47.8
	Often	6	26.1	73.9
	Always or almost Always	6	26.1	100.0
	Total	23	100.0	

Follow up

		Frequency	Valid Percent	Cumulative Percent
Valid	Rarely	1	4.3	4.3
	Sometimes	8	34.8	39.1
	About half the time	2	8.7	47.8
	Often	7	30.4	78.3
	Usually	3	13.0	91.3
	Always or almost Always	2	8.7	100.0
	Total	23	100.0	

6. If I need a consult, I know where to find people with the right expertise in other regions.

Baseline

		Frequency	Valid Percent	Cumulative Percent
Valid	Never or almost never	2	8.7	8.7
	Rarely	3	13.0	21.7
	Sometimes	5	21.7	43.5
	About half the time	1	4.3	47.8
	Often	6	26.1	73.9
	Usually	2	8.7	82.6
	Always or almost Always	4	17.4	100.0
	Total	23	100.0	

Follow up

		Frequency	Valid Percent	Cumulative Percent
Valid	Never or almost never	1	4.3	4.3
	Sometimes	5	21.7	26.1
	About half the time	5	21.7	47.8
	Often	5	21.7	69.6
	Usually	7	30.4	100.0
	Total	23	100.0	

7. Sharing data and ideas about Community Acquired Pneumonia from this region to another region is an efficient and effective process.

Baseline

		Frequency	Valid Percent	Cumulative Percent
Valid	Never or almost never	2	11.1	11.1
	Rarely	1	5.6	16.7
	Sometimes	8	44.4	61.1
	Often	1	5.6	66.7
	Usually	3	16.7	83.3
	Always or almost Always	3	16.7	100.0
	Total	18	100.0	

Follow up

		Frequency	Valid Percent	Cumulative Percent
Valid	Sometimes	1	5.6	5.6
	About half the time	2	11.1	16.7
	Often	5	27.8	44.4
	Usually	5	27.8	72.2
	Always or almost Always	5	27.8	100.0
	Total	18	100.0	

8. In my region we have access to the data we need in order to benchmark our performance against data from other HealthFirst regions.

Baseline

		Frequency	Valid Percent	Cumulative Percent
Valid	Never or almost never	2	9.5	9.5
	Rarely	2	9.5	19.0
	Sometimes	4	19.0	38.1
	About half the time	2	9.5	47.6
	Often	3	14.3	61.9
	Usually	7	33.3	95.2
	Always or almost Always	1	4.8	100.0
	Total	21	100.0	

Follow up

		Frequency	Valid Percent	Cumulative Percent
Valid	Sometimes	5	23.8	23.8
	Often	5	23.8	47.6
	Usually	6	28.6	76.2
	Always or almost Always	5	23.8	100.0
	Total	21	100.0	

9. When we discover a "fix" to a problem in our region, we have a mechanism for informing other similar services across HealthFirst regions.

Baseline

		Frequency	Valid Percent	Cumulative Percent
Valid	Never or almost never	3	15.0	15.0
	Rarely	2	10.0	25.0
	Sometimes	9	45.0	70.0
	About half the time	2	10.0	80.0
	Often	1	5.0	85.0
	Usually	1	5.0	90.0
	Always or almost Always	2	10.0	100.0
	Total	20	100.0	

Follow up

		Frequency	Valid Percent	Cumulative Percent
Valid	Rarely	2	10.0	10.0
	Sometimes	6	30.0	40.0
	About half the time	3	15.0	55.0
	Often	2	10.0	65.0
	Usually	4	20.0	85.0
	Always or almost Always	3	15.0	100.0
	Total	20	100.0	

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10. When employees attempt to work on a quality problem involving more than one region others are supportive and provide resources.

Baseline

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Rarely	1	4.8	4.8	4.8
	Sometimes	4	19.0	19.0	23.8
	About half the time	2	9.5	9.5	33.3
	Often	5	23.8	23.8	57.1
	Usually	8	38.1	38.1	95.2
	Always or almost Always	1	4.8	4.8	100.0
	Total	21	100.0	100.0	

Follow up

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Sometimes	3	14.3	14.3	14.3
	Often	9	42.9	42.9	57.1
	Usually	6	28.6	28.6	85.7
	Always or almost Always	3	14.3	14.3	100.0
	Total	21	100.0	100.0	

11. In my region we are encouraged to benchmark our performance against data from other HealthFirst regions.

Baseline

		Frequency	Valid Percent	Cumulative Percent
Valid	Never or almost never	1	4.8	4.8
	Rarely	2	9.5	14.3
	Sometimes	6	28.6	42.9
	Often	6	28.6	71.4
	Usually	2	9.5	81.0
	Always or almost Always	4	19.0	100.0
	Total	21	100.0	

Follow up

		Frequency	Valid Percent	Cumulative Percent
Valid	Rarely	2	9.5	9.5
	Sometimes	5	23.8	33.3
	About half the time	5	23.8	57.1
	Often	2	9.5	66.7
	Usually	3	14.3	81.0
	Always or almost Always	4	19.0	100.0
	Total	21	100.0	

12. When it comes to cooperation among regions, there is a lot of talk but not much action or support (item reverse coded below).

Baseline

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	1	4.5	4.5	4.5
	2.00	2	9.1	9.1	13.6
	3.00	3	13.6	13.6	27.3
	4.00	2	9.1	9.1	36.4
	5.00	9	40.9	40.9	77.3
	6.00	3	13.6	13.6	90.9
	7.00	2	9.1	9.1	100.0
	Total	22	100.0	100.0	

Follow up

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.00	2	9.1	9.1	9.1
	3.00	3	13.6	13.6	22.7
	4.00	2	9.1	9.1	31.8
	5.00	5	22.7	22.7	54.5
	6.00	8	36.4	36.4	90.9
	7.00	2	9.1	9.1	100.0
	Total	22	100.0	100.0	

13. Clinical support staff and services for community-acquired pneumonia seem well coordinated across regions.

Baseline

		Frequency	Valid Percent	Cumulative Percent
Valid	Never or almost never	4	28.6	28.6
	Rarely	2	14.3	42.9
	Sometimes	6	42.9	85.7
	About half the time	2	14.3	100.0
	Total	14	100.0	

Follow up

		Frequency	Valid Percent	Cumulative Percent
Valid	Rarely	1	7.1	7.1
	Sometimes	1	7.1	14.3
	Often	4	28.6	42.9
	Usually	6	42.9	85.7
	Always or almost Always	2	14.3	100.0
	Total	14	100.0	

14. Administrative services are appropriately integrated to achieve cost-effective patient care.

Baseline

		Frequency	Valid Percent	Cumulative Percent
Valid	Rarely	1	6.7	6.7
	Sometimes	10	66.7	73.3
	Often	1	6.7	80.0
	Usually	1	6.7	86.7
	Always or almost Always	2	13.3	100.0
	Total	15	100.0	

Follow up

		Frequency	Valid Percent	Cumulative Percent
Valid	Rarely	2	13.3	13.3
	Sometimes	3	20.0	33.3
	About half the time	3	20.0	53.3
	Often	3	20.0	73.3
	Usually	3	20.0	93.3
	Always or almost Always	1	6.7	100.0
	Total	15	100.0	

16. Results of Community Acquired Pneumonia projects done at other regions are shared with me.

Baseline

		Frequency	Valid Percent	Cumulative Percent
Valid	Never or almost never	5	23.8	23.8
	Rarely	6	28.6	52.4
	Sometimes	6	28.6	81.0
	About half the time	1	4.8	85.7
	Often	1	4.8	90.5
	Always or almost Always	2	9.5	100.0
	Total	21	100.0	

Follow up

		Frequency	Valid Percent	Cumulative Percent
Valid	Rarely	3	14.3	14.3
	Sometimes	4	19.0	33.3
	About half the time	1	4.8	38.1
	Often	5	23.8	61.9
	Usually	4	19.0	81.0
	Always or almost Always	4	19.0	100.0
	Total	21	100.0	

17. I have opportunities to participate in organization wide activities (committees, task forces, conferences).

Baseline

		Frequency	Valid Percent	Cumulative Percent
Valid	Rarely	2	8.7	8.7
	Sometimes	2	8.7	17.4
	About half the time	1	4.3	21.7
	Often	5	21.7	43.5
	Usually	7	30.4	73.9
	Always or almost Always	6	26.1	100.0
	Total	23	100.0	

Follow up

		Frequency	Valid Percent	Cumulative Percent
Valid	Rarely	1	4.3	4.3
	Sometimes	2	8.7	13.0
	About half the time	2	8.7	21.7
	Often	5	21.7	43.5
	Usually	7	30.4	73.9
	Always or almost Always	6	26.1	100.0
	Total	23	100.0	

18. Improvement/action teams on Community Acquired Pneumonia issues involve multiple regions

Baseline

		Frequency	Valid Percent	Cumulative Percent
Valid	Never or almost never	3	15.8	15.8
	Rarely	6	31.6	47.4
	Sometimes	6	31.6	78.9
	About half the time	1	5.3	84.2
	Often	1	5.3	89.5
	Usually	2	10.5	100.0
	Total	19	100.0	

Follow up

		Frequency	Valid Percent	Cumulative Percent
Valid	Sometimes	6	31.6	31.6
	Often	4	21.1	52.6
	Usually	6	31.6	84.2
	Always or almost Always	3	15.8	100.0
	Total	19	100.0	

19. Three months ago the overall level of integration and coordination among regions concerning Community Acquired Pneumonia was...

Baseline

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Poor	13	65.0	65.0	65.0
	Fair	5	25.0	25.0	90.0
	Good	1	5.0	5.0	95.0
	Excellent	1	5.0	5.0	100.0
	Total	20	100.0	100.0	

Follow up

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Poor	8	40.0	40.0	40.0
	Fair	8	40.0	40.0	80.0
	Good	4	20.0	20.0	100.0
	Total	20	100.0	100.0	

20. Currently the overall level of integration and coordination among the regions for Community-Acquired Pneumonia is....

Baseline

		Frequency	Valid Percent	Cumulative Percent
Valid	Poor	6	30.0	30.0
	Fair	9	45.0	75.0
	Good	4	20.0	95.0
	Excellent	1	5.0	100.0
	Total	20	100.0	

Follow up

		Frequency	Valid Percent	Cumulative Percent
Valid	Fair	4	20.0	20.0
	Good	9	45.0	65.0
	Very Good	6	30.0	95.0
	Excellent	1	5.0	100.0
	Total	20	100.0	

21. A year from now I expect the overall level of integration and coordination among the regions for Community Acquired Pneumonia will be...

Baseline

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Good	5	26.3	26.3	26.3
	Very Good	8	42.1	42.1	68.4
	Excellent	6	31.6	31.6	100.0
	Total	19	100.0	100.0	

Follow up

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Good	2	10.5	10.5	10.5
	Very Good	10	52.6	52.6	63.2
	Excellent	7	36.8	36.8	100.0
	Total	19	100.0	100.0	