

Clinical intelligence for the healthcare enterprise



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Clinical intelligence addresses the complexity of healthcare today by pulling disparate data together and making it available to users when they need it.

Executive summary

Today's healthcare environment is characterized by escalating costs, growing patient sophistication, burgeoning regulatory requirements, ongoing mergers and acquisitions, ever-increasing data volumes, and rapidly evolving technology. In this dynamic environment, healthcare enterprises seek to differentiate themselves by providing superlative quality of care. Perhaps the most valuable asset at their disposal in this quest—and one that is largely untapped—is the enormous volume of data that typically resides in siloed legacy systems.

The ability to integrate all of this data for purposes of analysis and actionable knowledge defines the emerging technical arena of clinical intelligence. Leveraging years of experience in the broader business community with extensive data warehousing and business intelligence initiatives, the healthcare industry now stands on the brink of an exciting new era in which lower costs and higher quality of care can exist side by side. No longer is it necessary to manually select data from the different (and often proprietary) silos in order to create the documentation that the business requires.

HP, a technology leader with a worldwide reputation for excellent quality and a full spectrum of innovative products, solutions, and services, now offers a powerful, cost-effective clinical intelligence solution. The solution is easy to implement and nondisruptive to existing processes and infrastructures. It quickly enables healthcare providers to start benefiting from “right time” data—data in any format, from any part of the enterprise that is accessible to clinicians and decision makers exactly when and where they need it.

Industry concerns

With the help of candid focus group input, HP has identified many areas of interest and concern to healthcare executives. These areas include traditional reporting, quality reporting, dashboards, ad hoc queries, business analysis, outcomes analysis and research, robust post-care analytics, retrospective analysis, and support data for grant writing.

Traditional reporting

Historically, each departmental system has had its own reporting parameters, with a lack of standards and consistency. A major challenge for healthcare providers, therefore, is managing reports—and collecting the data for those reports—that come from different departments (often numbering in the hundreds, and in many different formats: Microsoft® Access 2000, plain text, Crystal Reports, standalone financial reporting systems, and others.) Despite the obvious advantage of being able to look across the enterprise and aggregate all this data, providers typically lack the necessary budget to retroactively re-index the reports and insert them into a single database.

As a simple example, consider the hospital that wants to pull together a comprehensive patient record for audit purposes or a potential legal action. In many cases, the necessary data resides in the clinical information system, the financial system, the lab and pharmacy systems, and, sometimes, even in paper records. Therefore, in order to assemble what, on the surface, would be a straightforward patient record takes several people anywhere from two to eight hours. When you multiply that out over a year and assume you are only pulling a couple of patient records a day, you have spent in a conservative calculation 18 days annually on just pulling a few patient records.

Quality and pay-for-performance reporting

Today, recognition and pay-for-performance initiatives are driving quality improvements in clinical healthcare. Data required to support these initiatives includes interventions provided, clinical outcomes, diagnosis, length of stay, timeliness of services, types of services, effectiveness, and more. All of this data can be analyzed in order to effect clinical, business, strategic, operational, and educational improvement. Quality improvement can lead to cost savings or enhanced patient care within the healthcare organization, recognition as a center of excellence or a leading national hospital, and even monetary compensation from organizations such as the Centers for Medicare and Medicaid Services (CMS).

Dashboards

Dashboards or scorecards, fed in real time from a clinical intelligence data warehouse, show, on a routine basis, where the enterprise stands on measures that are being tracked. For example, what percentage of your physicians is ordering a hemoglobin A1c test on every diabetes patient over age 55 before they are discharged? How timely is your reporting? How quickly are you turning around your discharge summaries? The dashboard provides healthcare executives—CEOs, CFOs, CIOs, CMOs, and a growing number of chief medical informatics officers (CMIOs)—with the immediate and often graphical status of key indicators.

Every hospital is unique in terms of its focus areas. One might be a stroke center of excellence, while another might specialize in diabetes. The dashboard can be configured to track specific areas, or it might be set up to provide a cross-sectional view of the entire enterprise—or both.

Ad hoc queries

As the name suggests, ad hoc queries are “one-off” requests for data that are sparked by some immediate need for information. Because they must be rebuilt every time, the ad hoc queries currently represent an expensive and time-consuming process for the healthcare enterprise. At the same time, this capability is essential for providing critical information to clinicians, decision makers, researchers, and general areas within the hospital.

As healthcare enterprises begin to aggregate their data in one place, they are coming to realize that they can ask questions that they have never asked before. They can easily analyze patient population trends and patterns, and give clinicians accurate timelines of each patient’s illness, care, and outcome. This new level of knowledge and insight can then drive across-the-board changes to improve overall quality of care.

Business analysis

In business analysis, the healthcare decision maker may wish to manipulate parameters and rerun the data, or generate a report that cross-references the cost of delivering a particular service in a particular demographic to a particular patient population. Whatever the business question, it is essential to realize that today’s healthcare organizations are being evaluated not only on the quality and effectiveness of their treatment, but also on waste and unnecessary cost. By effectively leveraging enterprise-wide data on labor expenditures, supply utilization, procedures, medications prescribed, and other costs associated with patient care, healthcare professionals can identify and correct wasteful practices and unnecessary expenditures. These changes benefit the bottom line and can also be used to differentiate the healthcare organization from its competition.

Outcomes analysis and research

Outcomes analysis involves looking at what the patient was admitted for, the treatment received by the patient, and the condition of the patient—or the class of patient—at the time of discharge. This type of analysis is often performed longitudinally, in order to assess the long-term effect of treatment on patients and to better understand how one institution's outcomes compare to other institutions or published reports. The results of this analysis are used to make decisions that drive improved patient outcomes.

Post-care or retrospective analytics

Post-care and retrospective analytics both look to the past as a way of amassing knowledge concerning a protocol, disease, treatment, the use of a particular drug, and so on. For example, a health group may wish to compare two different drugs used to treat a disease over the past year in order to assess differences in patient outcomes, treatment cost, whether or not the patients needed hospitalization, and so on.

The results of such studies allow health groups to enhance patient care quality, ensure that appropriate drugs are prescribed, improve treatment protocols, and reduce overall costs. In one recent retrospective study, researchers examined two drugs used to treat depression. They found that the average 12-month prescription cost for the first drug was approximately US\$100 less than the second, while hospitalization and therapy costs for the two groups were essentially the same. With this kind of knowledge, health groups can make informed decisions about managing their businesses and treating patients, thereby helping to improve the quality of the care they provide and reduce their costs.

Support data for research, clinical studies, and grants

Healthcare enterprises are active participants in research projects, clinical studies, and clinical trials. In fact, these projects often help healthcare organizations achieve goals in clinical excellence and distinguish themselves both nationally and in their local communities. In order to support these projects, clinicians and researchers are always looking for patterns and trends in clinical data that bolster clinical and research hypotheses, validate the value and feasibility of a study, prioritize studies, and narrow research topics. Once identified, this data can be used to target specific studies, research, and trials. The same data makes it faster and easier for clinicians to submit abstracts, papers, and funding requests.

Public health alerts

In the United States, the Centers for Disease Control and Prevention (CDC) and the Department of Homeland Security are very interested in the ability to alert the appropriate people in real time to any kind of medical trends, whether they signal potential epidemics (such as avian flu) or bioterrorism. Clearly, the ability of healthcare organizations to participate in such activity, whether as members of a regional health information organization (RHIO) or as a part of a Homeland Security initiative, is greatly facilitated by their use of an enterprise data warehouse and clinical intelligence.

Industry drivers

A number of industry drivers are fueling market interest in clinical intelligence systems. These drivers include improving quality of care, reducing medical errors, patient satisfaction, pay-for-performance reporting, cost reduction, evidence-based medicine, and compliance.

Improving quality of care

Improving quality of care is an overall umbrella concept that includes reducing medical errors, driving toward more consistently positive outcomes, and enhancing patient satisfaction. All of the pay-for-performance and quality initiatives (e.g., the Joint Commission on Accreditation of Healthcare Organizations [JCAHO] and the Leapfrog Group for Patient Safety) tie back to this concept. As an example, improvements in composite quality scores in the first year of one initiative ranged from 87 to 91 percent for heart attack patients, and 69 to 79 percent for community-acquired pneumonia.

Improving quality of care leads to lower hospital costs and shorter hospital stays. It also gives the institution a better standing in the community, resulting in greatly enhanced patient attraction. Balanced, aggregated data that reflects current reality across the enterprise—in other words, clinical intelligence—is essential in identifying trends and understanding how well a hospital, doctor, or clinic is performing compared to their peers. Furthermore, analyzing results in training hospitals for use in future care could improve overall quality in the healthcare system.

Reducing medical errors

According to the Commonwealth Fund (2002), one in five Americans report that they or a family member have experienced a medical error. Medical errors rank as the eighth-leading cause of death in the United States—higher than motor vehicle accidents, breast cancer, or AIDS (Agency for Healthcare Research and Quality, 2002). A study by two prestigious teaching hospitals revealed that nearly 2 percent of hospital admissions experience a preventable medication error, resulting in an average increase in hospital costs of US\$4,700 per admission. Extrapolating these findings to all U.S. hospitals, preventable medication errors cost the economy approximately US\$2 billion each year (Institute of Medicine, 1999), not to mention the rise in liability insurance rates and the incalculable cost of human suffering.

Adverse drug reactions (ADRs) take an even higher toll. According to a 1998 meta-analysis of prospective studies conducted by Lazarou, Pomeranz, and Corey, ADRs are the fourth-leading cause of death in the United States and the single largest source of malpractice payouts. They cause close to 2 million hospitalizations and more than 100,000 fatalities annually.

Implementing software that tracks, monitors, and cross-checks patients is one way to reduce medical errors and ADRs. Another approach involves real-time decision support implementation of best practices and protocols. For example, data analysis might reveal more nosocomial infections in one clinic than in another, prompting immediate remedial training on compliance with required protocols.

Patient satisfaction

With statistics on medical error rates and adverse drug reactions appearing frequently in the media, and with leading publications providing annual rankings of the best hospitals in the country, patients today are more sophisticated than ever when it comes to assessing the quality of their medical treatment. Patient satisfaction is absolutely essential to maintaining and growing a competitive position in the healthcare industry.

Because patients can decide who will provide their healthcare, the ability of a healthcare organization to organize data about the institution and position itself positively in the marketplace is critical. Many organizations choose to publish their credentials, along with the numbers and success rates of their high-profit services to recruit more patients. Aggregating and leveraging their own data, while simultaneously capturing publicly available data about their competitors, can enable them to differentiate themselves more effectively.

Pay-for-performance reporting

Many initiatives in the marketplace aim to ensure accurate capture and documentation of patient treatments, outcomes analysis, educational followup, how frequently a patient with a particular type of disease is readmitted for the same problem, and the like. These include the Institute for Healthcare Improvement (IHI) and programs initiated by JCAHO, Leapfrog, and CMS.

The ability to monitor these quality measures on a real-time basis makes it possible to prepare timely reports, and it may also make providers eligible for reduced liability insurance, lower annual costs, and higher reimbursement based on the quality of care provided. Modern Healthcare (November 2005) noted that the

CMS was poised to “write out bonus checks for a total of \$8.85 million to 123 top-performing hospitals in a groundbreaking pay-for-performance demonstration project.”

Aggregated and readily available data also supports successful accreditation inspections and regulatory visits. In fact, CMS recently implemented a pay-for-quality initiative with its Medicare Physician Group Practice Demonstration in 10 large physician group practice organizations. This project will run for three to five years and reimburse participants for improvements in quality if, during the demonstration period, they enhance care and document quality measures for diabetes, CHF, CHD, and specific preventative care.

Healthcare is a complex field. This is due in part to constant changes in reimbursement schedules and documentation requirements, as well as the continual evolution of new treatments, drugs, and procedures. The ability to keep track of all related data in a flexible manner makes it possible to update reports quickly and easily.

Cost reduction

Many elements combine to drive the upward spiral in healthcare costs. Malpractice lawsuits represent a major factor; not only do healthcare enterprises have to pay out huge settlements, but they also face increases in their liability insurance premiums. A changing patient population is also key: There are more people in the world, the population is aging and living longer, and more patients than ever before are seeking medical care. The expense of drug development and clinical trials is yet another factor, while healthcare fraud costs Americans more than US\$50 billion annually.

With effective analysis of aggregated data, healthcare enterprises can improve quality by reducing medical errors while simultaneously improving workflow efficiency and the way services are delivered. By reducing the number of people performing the same task, they can help eliminate costs associated with redundancy. The ability to track varying practice patterns and financial models across different organizations makes it possible to remove cost from the system by standardizing supplies and procedures. Cost reduction can also be realized at the system management level: Various software packages make it possible to monitor system use and user patterns, as well as track compliance with service level agreement contracts between departments. Finally, access to data that supports clinical trials and assists in quickly identifying trial participants can help speed new drugs to market, reducing the cost of drug development.

Healthcare enterprises around the world face the urgent need to reduce costs, whether they are part of a private or a government- or state-run health system. They all seek to turn their data into actionable knowledge so they can improve quality and cut expenses.

Evidence-based medicine

Evidence-based medicine makes it possible to track success rates against best practices. Performing regular followups on discharged patients to assess the effectiveness of treatment leads to ongoing process improvement. Building a body of evidence on every single procedure helps increase quality outcomes, improve patient satisfaction and attraction, and support negotiations with payers for better rates.

Prescribing medication or providing treatment based on longitudinal evidence goes hand in hand with closing the loop on medical care. Physicians who have access to a data store of information about a particular disease, together with evidence on the success of various treatments, are able to improve medicine at the point of care in real time.

Compliance

Compliance cuts across many different areas of the healthcare enterprise. It includes compliance with best practices, regulatory requirements, contracted quality, and service level agreements. Ready access to integrated, up-to-date data across the enterprise greatly facilitates the ability to track and monitor compliance issues.

Providers contract for specific levels of care and quality with both managed care organizations and employers. For example, a healthcare enterprise might agree with Kaiser, Aetna, Cigna, or UnitedHealthcare that each employee will be offered generic drugs as a first option. Using clinical intelligence, the provider can then track the percentage of patients that accept the generic versus the brand name drug and calculate the resulting cost savings.

Compliance with changing regulatory requirements is an ongoing challenge in the healthcare industry. Hospitals must be able to document that all medications are distributed only by a registered nurse or LPN, and never by a nurse's aid, an orderly, or a family member. They must document that proper protocol (e.g., a minimum of one minute scrub time) is followed every time a patient dressing is changed. The ability to provide this documentation, critical in the event of an audit, depends on access to complete and current data.

The areas of security and privacy have as much to do with policies and procedures as with systems and built-in user authentication. It is essential that healthcare workers have appropriate restrictions on the data they can view. Security issues exist at system, system management, and user levels. Security measures need to be tracked and audited, and they must be discoverable.

Clinical intelligence

Data from disparate databases

Every department in a healthcare enterprise, both for on-demand reporting and to conform with best practices, collects data in a variety of different formats. At the time of patient discharge, the institution is faced with a vast amount of information from multiple departments that has been gathered on patients during their stay. The question is: What do you do with that data? Regulatory requirements mandate that providers keep this data for a long time, and in many different formats.

As data capture methodologies, devices, modalities, and instruments begin to capture the data in electronic form, providers suddenly have the ability to extract new value from it. They can parse, depersonalize, analyze, index, store, and retrieve it quickly. The power to use extract, transform, load (ETL) or other analytical tools to aggregate the data reveals many new opportunities to save money and enhance quality of care. Without these tools, constructing ad hoc reports on data from disparate locations can take several days.

The concept of clinical intelligence includes an end-to-end process from analysis to delivery. It fosters a repeatable approach to dealing with data that is available today, as well as beginning to look at setting standards for data capture and storage for the future. Even small organizations that do not collect a significant amount of data will discover the need for robust clinical intelligence capabilities when they start adding business objects, images, and dictation in voice waves. They will need to become more sophisticated about the tools they use.

Data available at the right time

Pulling disparate data together to create an enterprise view—as opposed to maintaining data in silos—makes the data available to more end users at the right time. One term that is current in the industry is “think speed,” meaning that the data is available as fast as clinicians think they need it.

Today, clinicians and analysts often spend more time gathering data for analysis than they do actually analyzing the data. They have to go to each of the silos, determine which silos contain the information they want, and reconcile the data if two silos have the same information, before they can even start to derive any meaning from the data. A clinical intelligence system provides access to that data across the enterprise, so more people have the ability to get at the data and ask questions of it. This significantly reduces the amount of time spent by IT staff, analysts, and clinicians preparing the data for queries and analysis—and it reduces the wait time for critical reports by orders of magnitude.

Simplified support and reporting

With the right tools, and with data aggregated into an enterprise view, end users can be more proactive in querying the database and getting the information they need. They no longer need to go to IT or some other group to request specific reports and data. Clinical intelligence takes tremendous cost and complexity out of the reporting process and enables the healthcare enterprise to enhance its valuable resources.

IT steps up

Traditional enterprise data warehouse solutions

Several leading healthcare organizations, including Intermountain Health Care (IHC), make excellent use of traditional enterprise data warehouse solutions. IHC's Clinical Data Repository (CDR) represents the transactional system that feeds the data warehouse, where data is cleansed, transformed, and aggregated for analytics. The CDR connects facilities and enables access to clinical data transactions (patient visit documentation, medications, problems lists, etc.) across the enterprise. It also feeds a data warehouse designed for reporting capability, research, and knowledge discovery.

As reported in *Healthcare Technology*, Volume 3, IHC's primary care initiatives include measures programs in diabetes, asthma, depression, pneumonia, and congestive heart failure. Within the Diabetes Care Management System, IHC extracts a registry of more than 25,000 diabetes patients from the data warehouse and follows

diabetes longitudinal care measures, including cholesterol, hemoglobin A1c (HgbA1c), and urinary microalbumin screening. Every primary care provider in the organization receives a quarterly report on how well their patients are doing with regard to these measures over time, as well as a comparison to their colleagues' performance. The four years between 1998 and 2002 saw improvements of 25 percent in some of these measures. IHC plans to expand the program yearly and increase clinician access to real-time, clinically focused data.

Innovations in the enterprise data warehouse

Like everything else in the IT world, the enterprise data warehouse market is moving toward simpler, more cost-effective solutions that deliver excellent performance and solid return on investment. Of particular interest is the idea of a preconfigured, low-cost, operator-free product that can process enormous amounts of data to help uncover valuable information patterns and relationships—virtually on demand—to make critical clinical decisions.

Healthcare enterprises would clearly benefit from a fully prepackaged, integrated product that includes processors, storage, relational database management system (DBMS) software, data model, and data services software, with dedicated services available to support clinical intelligence solutions. Having all hardware and system software fully configured, integrated, and pre-tuned for data warehousing on arrival would translate into fast implementation for this highly scalable solution.

Why HP?

Leading IT company

In today's competitive healthcare marketplace, customers want to do business with a company that can support their needs over the long term. They want a company with leading-edge products, solutions, and services, plus the financial strength and stability needed for a true strategic partnership.

With US\$86 billion in revenue for fiscal year 2005, HP is one of the strongest IT companies in the world today. As a Fortune 11 company, it has operations in 178 countries and occupies a leadership position in virtually every market, customer segment, and region. HP's flagship NonStop server—and the recently introduced Integrity NonStop server, based on the industry-standard Intel® Itanium® 2 processor—is the leading choice for business-critical enterprise solutions in financial services, communications, healthcare, and emerging markets.

Full range of products, solutions, and services

HP delivers the most reliable, available, and scalable products and solutions in the healthcare industry.

Trusted database

The HP NonStop SQL database can scale online to support tens or hundreds of terabytes of healthcare data, with industry-leading data integrity and no need to change the application.

Robust, scalable platform

Whether the HP clinical intelligence solution runs on a NonStop server, an Integrity NonStop server, or another platform that leverages the NonStop SQL database, you can be assured of a robust, scalable platform to handle your critical data aggregation and analysis needs.

Conclusion

R. Krohn, president of HealthSense Inc., delivered an accurate diagnosis when he observed that “the healthcare industry is awash in data and is unsurpassed in its preoccupation with gathering, storing, processing, analyzing, and distributing information. But healthcare data is notoriously fragmented and often incomplete, making analysis and knowledge distillation from such sources an ongoing challenge.”

The prescription comes from Dr. Joseph Traube, CMIO at Scripps Health: “Scripps is committed to providing the highest-quality healthcare for our patients. Instant access to a complete set of relevant information at the point of clinical decision making is the key to achieving this goal.” HP and Scripps have joined forces to develop a clinical intelligence system, called the Enterprise Data Warehouse, to help Scripps improve patient care and safety within its hospitals and clinics.

Today's healthcare industry is highly complex and multidimensional. With rising costs, constant regulatory changes, and ever-increasing competition, providers look to the wealth of data in their legacy systems as the key to their future success. Marrying legacy data sources into a single enterprise view—having all the data in one place, with the ability to report on it consistently—enables providers to save money while maintaining or improving quality.

HP is prepared to work with healthcare enterprises anywhere along the clinical intelligence spectrum, from preliminary assessment to implementation of a fully operational data warehouse. To help manage the explosion of data that most healthcare institutions are experiencing, HP has created a standalone back-end service, consisting of a scalable hardware and software combination of disks and CPUs matched to the volume of the business.

This extremely cost-effective solution can be implemented quickly, with no disruption to existing infrastructure or processes, and will start returning value to the enterprise immediately. It enables real-time analytics without affecting operational system performance, and it is flexible enough to fit the unique needs of any healthcare enterprise and adapt to changing requirements.

Writing for *Healthcare Technology*, Cullen and Wilson note that a hallmark of clinical intelligence "is that there is often the unanticipated result of finding answers to questions that we didn't even know enough to ask," sometimes referred to as *knowledge discovery*.

For identification and easy retrieval of the right data at the right time—for the next step in achieving true knowledge discovery in the healthcare system—HP's clinical intelligence solution delivers superior performance at a very reasonable price point.

For more information

www.hp.com/go/nonstop

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4AA0-5854ENW, May 2006

