

Management Reporting on the Web

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Executive Summary

Driven by easy-to-use World Wide Web technology and new information integration concepts with a proven track record in business and industry, online management reporting is becoming an important strategy for improving operational performance in healthcare organizations. In this report, we provide an overview of these new information management concepts and describe our experience in planning and executing an enterprise-wide, Web-enabled management-reporting initiative at SI-member Cedars-Sinai Health System in Los Angeles. We also discuss organizational strategies essential for developing and sustaining Web-enabled reporting services for healthcare managers.

In this ultimate month of the Y2K problem, healthcare managers find it more challenging than ever to keep their long-range strategic information management initiatives on track. While Y2K remedies continue to absorb necessary attention and resources, 'this too, shall pass' and fundamental information-management problems will continue to face today's healthcare organizations. One such problem is the need for an efficient management-reporting capability: the ability to generate timely, accurate, intelligible and easily distributed information that provides administrators and physicians with a clear picture of how their organization is performing.

To address this issue, more and more organizations are marrying the information-distribution technologies of the Internet with a new set of data-management concepts. The Internet (or private intranets) and Web browsers (such as Netscape and Explorer) are rapidly becoming de facto healthcare communication standards that enable electronic distribution of reports right to the desktop. Data-management concepts—Data Warehouse (DW), Data Mart (DM) and Clinical Data Repository (CDR)—provide practical organizational principles that can help healthcare managers refine reports they rely on for running their business activities and clinical practices.

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At Cedars-Sinai Health System (CSHS), a not-for-profit 875-bed teaching hospital and healthcare network in metropolitan Los Angeles, we are exploring these concepts while developing an intranet-based management-reporting capability. We offer here an overview of these ideas, along with a description of our institutional experience, as a point of departure for organizations contemplating a similar strategy.

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Correction:

Last month's report, *Planning and Implementing an Electronic Medical Record in an Ambulatory Setting*, was co-authored by Jennifer Oakes, a fourth-year medical student at the University of Pennsylvania Medical School.



Models for data management

Healthcare decision-makers are turning to data-management models that have proven their worth in other businesses and industries. While the critical piece of institutional intelligence may vary—from a community hospital's what-if scenario for a new business association to an integrated delivery network's utilization "dashboard" for a tertiary service—healthcare organizations are discovering the value of combining well-designed data models with user-friendly Web "front ends." We begin by briefly examining these new data-management models and their potential uses in healthcare organizations.

The data warehouse

Data Warehousing addresses the long-standing problem of integrating and analyzing strategic information distributed throughout the enterprise in incompatible and heterogeneous data stores. DW content is extracted from multiple operational data sources, organized by business and care-process subject areas—patient visit, budget, physician, patient accounting, medical records, payroll—and typically summarized for analysts and other users. Unlike information systems designed for recording and monitoring daily business activities, the DW rarely deals with real-time data. Instead, updating of the DW relies on "batch" processing conducted according to business demands and data availability. Updating patient-accounting data, for example, may occur weekly, while budget-data updating may happen after each month's close of books. Typically, the DW contains several years of historical data to facilitate trending and forecasting.

Development of a DW requires a long-term institutional commitment, clearly articulated goals and careful planning. Some organizations mistakenly try to build an "enterprise" DW that integrates all possible subject areas in a single project-development cycle. These efforts can take two to three years during which business requirements and IT would have changed. A more productive approach: build the DW in manageable increments, a few subject areas at a time, while working with users to meet high-priority requirements in an iterative manner.

The data mart

A subset of the complete DW, the DM contains data for a single subject area such as payroll, patient accounting or materials management. Like the DW, the DM aims at efficient retrieval of historical data that is regularly updated using batch procedures. The good news for smaller health-

care organizations is that off-the-shelf DM software applications are becoming available for accounting, finance, materials management, payroll and human resources.

Well-defined in scope, the DM is often a good first step for an organization seeking to improve its management capabilities because it offers a predictable improvement in management reporting while avoiding the risks associated with more comprehensive data integration efforts. However, because the DM development cycle is a relatively short six-to-nine months, organizations can be seduced into constructing a slew of DMs that lack cohesion with the larger strategic goal of data warehousing. Such a piecemeal approach may lead to inconsistent data structures and redundant or incompatible data stores that are difficult to integrate later.

The clinical data repository

The Clinical Data Repository (CDR) offers a comprehensive, patient-centered approach to information integration, potentially combining data from many sources throughout the enterprise, including inpatient, outpatient and emergency department clinical information systems as well as ancillary admission/discharge/transfer, laboratory and pharmacy "feeder" systems. Patient accounting and patient-related materials-management data may also become important components of the CDR.

CDRs support the strategies of healthcare organizations seeking to improve quality and lower costs by integrating patient-care information previously isolated in separate systems. CDRs make it possible, for example, to protect pharmacy orders using alerts and prompts linked to patient histories, or to compare outcomes of different patient-management strategies. CDRs also provide patient data both in realtime—for improving clinical decision making—as well as "longitudinally" for observing long-term trends and conducting clinical research. Because of the complexity and security issues associated with patient data, it makes sense to develop CDRs using an incremental and/or iterative approach.

Marshaling resources for online reporting

The models described above provide organizing principles for developing an integrated information infrastructure supporting Web-enabled management reporting. At CSHS, our information integration efforts to date have focused on achieving the first-phase deployment of our DW. We have also developed our CDR logical model based on an analysis of our patient-care business processes. Further efforts are underway in evaluating and deploying new operational systems incorporating DM features for finance, payroll and other enterprise-wide business activities. In addition to developing appropriate data sources, however, implementing online management reporting requires strong executive leadership, participation of stakeholders throughout the organization and establishment of new working relationships among report users, data owner/analysts and IT specialists.

Healthcare decision-makers are turning to proven data-management models from business and industry.

The Data Mart is a good first step for an organization seeking to improve its management capabilities.

A multidisciplinary team is essential to ensure that all necessary skills and perspectives are represented, including those of senior administrators, resource and outcomes managers, information technologists, data analysts and representatives of business and clinical user groups. If the organization lacks specific expertise, outside consultants can help in analyzing and documenting business and patient-care processes, evaluating candidate information system components and developing buy-versus-build recommendations.

The following section describes our progress at CSHS in planning for online management reporting, assessing the needs of prospective users, developing data sources, generating online management reports using Web-enabled reporting tools and delivering online reports to CSHS business managers and clinical administrators through our Intranet Management Reports Web Site.

The CSHS Reporting Initiative

Planning and organization

Because of projected improvements in timeliness, quality and usability of CSHS management reports, senior management endorsed the goal of publishing 90% of management reports online by the end of 1998. With the data-warehousing effort well underway in March, it was time to launch the initiative. We established a task force that included people from medical records, finance, IS, resource management and First Consulting Group under the joint chairmanship of the senior VP of medical affairs, chief financial officer and chief information officer.

CSHS senior executive management received regular reports from the group, which was divided into five smaller groups responsible for overseeing and executing specific project components covering the entire first-iteration development cycle for the project, from initial requirements assessment through design, deployment, user support and quality management.

Information needs assessment

Users initially selected to receive online management reports included CSHS senior executives, VPs, service-line directors, clinical department chairs and data analysts responsible for supplementary information analysis. The task force assessed management reporting needs through user focus groups, which helped identify the most important information items in terms of reporting feasibility during the initiative's first phase. Based on this evaluation, the group developed a set of essential and achievable reporting capabilities and designed sample versions of online reports. The entire online report team evaluated which online reports would be submitted to CSHS senior management for approval. Senior executive management also approved the lists of recipients for specific categories of online reports.

Deploying online management reports requires a strong and consistent commitment by executive leadership.

A multidisciplinary team is essential.

Data warehousing and reporting tools

The first iteration of the DW incorporated data from three main legacy data sources—admissions/discharge/transfer, patient accounting, and medical records coding and abstracting. While these data sources provided a substantial portion of user information requests at CSHS, several requested reports required data identified as strategically important but not currently available in the DW. To incorporate these external data sources, the online-reports team worked with the "owners" of the non-warehoused information to develop interim data sources and to prepare for data integration in the next phase.

Successful deployment of the DW—for both "standard" online management reporting and the more sophisticated ad-hoc reporting required by data analysts—also required the evaluation of Web-based front-end reporting tools. To accommodate the range of requirements found throughout our relatively large healthcare system, we deployed both Web-based and "client" report-generating and analysis software. Typically, data analysts query the DW and analyze results using a Web browser with "plug-in" software or a PC-installed client application for the most powerful analysis. Users of standard online reports access them via our Management Reports Web Site using a "plain-vanilla" browser. Standard online reports are generated, formatted and posted to the Web using the reporting software's automated scheduling features.

User access via the Web

We designed the Management Reports Web Site to offer convenient and secure access to online management reports through the CSHS Intranet. The site provides user-based security and filtering features for report selection and viewing, displaying available report names and dates when a report category is selected as shown in Fig. 1. Clicking the adjacent "i" dot provides contact information for the analyst who authored the report. Supplementary pages list all available online reports and a complete report-production schedule. A list of Frequently Asked Questions (FAQs) assists users in resolving problems they may encounter, and a User Feedback Form is available to facilitate return of questions or comments by e-mail to the Web-site administrator.

Figure 1
User's Web Page
for Selecting and
Viewing Reports



To ease the transition to online data analysis, in-house classes can be conducted as needed.

While barriers to entry are falling, new information technology infrastructure and organizational change overhead may still be required.

User training and support

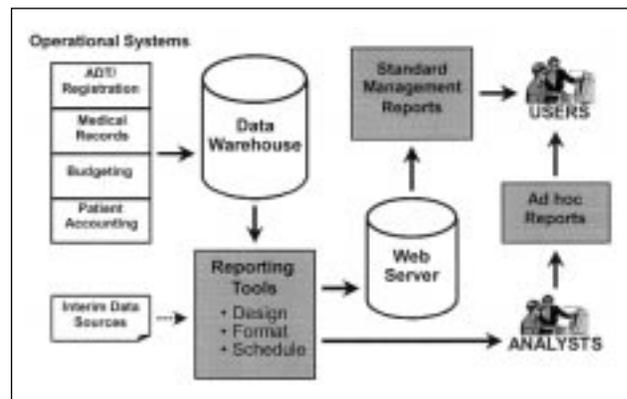
In addition to the support services provided through the Web site, training programs have been developed for CSHS data analysts. These individuals provide information analysis beyond that provided in standard online reports, create ad hoc reports using the DW that were previously generated in legacy systems and develop more comprehensive data syntheses using newly integrated information sources. To ease the transition to online data analysis, in-house classes demonstrating the features of online reporting tools and the content and structure of the DW are held on an as-needed basis. We are also designing a formal certification program for analysts and other users to maintain the special skills required to use these online resources.

Data quality management

As a complement to the training and certification program, the online-reporting team plans to implement an overall "product management" approach to strategic enterprise information quality with assistance from the CSHS department of resource and outcomes management. Additional data—quality metrics-completeness, accuracy, and reliability of source data; overall fidelity of DW data compared to source data; timeliness of online report preparation; and user satisfaction—will supplement monitoring of the data-transformation processes involved in populating the DW.

We rolled out the first iteration of the Management Reports Web Page to CSHS users in January 1999. About 1,000 Web-enabled reports—covering user-requested information in finance, payroll, provider activity, institutional performance, service utilization and other categories—have gone out to 150 online users. While adding 350 reports a month, we're expanding the user base and report-generating capacity to include CSHS managers and decommissioning paper-based versions. The overall information flow in the first iteration of CSHS online management reporting is illustrated in Fig. 2.

Figure 2
CSHS Online
Management Reporting
Information Flow



Considering online reporting

The proliferation of Web-enabled off-the shelf software packages and the availability of free, user-friendly Web browsers may make the move to online reporting look relatively easy. While the barriers to entry are falling, a substantial amount of new IT infrastructure and change manage-

ment may still be required. At CSHS, our online reporting initiative has been successful partly because a "critical mass" of technology infrastructure and information management skills had already been achieved through a multi-year IT-development effort. Smaller organizations may find they need to beef up their internal knowledge and technology resources or that the DM solutions previously mentioned offer lower-cost and more immediately achievable results.

Whatever an organization's size, it should review the following checklist of required capabilities before undertaking an online management reporting initiative:

- Infrastructure—a private local or wide-area intranet and/or secure communication via the Internet; desktop PCs and Web server
- Security—provisions for controlling and administering network access and online reports viewing
- Data Sources—a Data Warehouse, Data Mart and/or Clinical Data Repository—the foundations for online management reporting
- Reporting Tools—Web-enabled applications or stand-alone reporting software approved by users and appropriate for the information management tasks at hand
- Web Expertise—Web designers and Web-savvy data analysts experienced in creating and distributing reports using this new electronic publication medium
- User/Stakeholder Participation—buy-in from report users, content generators and heads of report-contributing departments
- Senior Executive Endorsement—leadership promoting enterprise-wide attention, participation, and follow-through
- Ongoing User Support—assistance for online report users; training for data analysts
- Ongoing Service Improvement—responsive approach to requests for additional reports and Web-site enhancements; iterative improvements in online reporting capabilities

While the above requirements will vary depending on the organization, our experience suggests that firm and lasting commitment in each of these areas is essential to achieve information management improvement and lasting organizational change.

Conclusion and Recommendations

With the maturation of Web technology and the development of comprehensive information management architectures, online management reporting for healthcare organizations is coming of age. Web-enabled reporting solutions exist for healthcare organizations regardless of size and are available from vendors as DM features for off-the-shelf software applications, through dedicated Web-enabled reporting software products linked to existing databases or as custom-developed capabilities within full-scale enterprise information integration programs. Like others, we at CSHS view these IT advances as today's best pathway to the complex reporting capabilities required for resource management, health-plan

Well-designed reporting systems are a key step in "closing the performance feedback loop" for clinicians and administrators.

management, disease management and demand management as well as for analyzing and understanding the cost and quality dimensions of healthcare delivery.

Web-enabled reporting has its own quality dimensions and attention to online reporting as a strategic service to the organization is essential to ensure that online reports progress beyond mere emulation of previous paper-based versions. Beyond the generically appealing notions of "paperless reporting" and "on-demand access," developing an online management reporting capability offers managers the opportunity to re-think the parameters their organization uses to measure healthcare quality and service delivery.

Eleanor Latimer, an expert on process redesign in First Consulting Group's Dallas office (972-869-9977), offers the following recommendations:

In planning enhancements to management reporting via the Web, it is important to:

1. Have strong executive leadership. With vision and perseverance, strong executive leadership can keep the complex process of enhancing management reporting via the Web on track and focused.
2. Involve all the stakeholders. Using a cross-functional team to plan, design, deploy and evaluate the online management reporting projects ensures that a full spectrum of views will be incorporated. It assists in gaining buy-in—a key success factor.
3. Remember, it's an iterative process. Moving management reports online is a complex project that may derail if the project team tries to accomplish too much, too soon.
4. During initial planning sessions look for "quick wins" that are feasible and have a major impact. These early wins give credibility to the premise that benefits are within reach when tackling thorny challenges. They also provide learning-curve benefits as the participants begin functioning as a team.
5. Keep the end goal always in focus. During initial information gathering, the primary reason for initialing an online management reporting system should be identified. By having that goal foremost in everyone's mind, the team can concentrate on executing those tasks required and not wander off on side objectives.

By informing users about relevant and actionable organizational performance parameters, well-designed reporting systems offer a key step in "closing the performance feedback loop" for both clinicians and administrators. In the hands of knowledgeable managers, we believe these new information technologies will become important vehicles for strategic information—coordinating action, aligning decision-making and improving our abilities to deliver the best possible operational performance and the highest quality patient care.

