



## Identifying Data Reporting Needs

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A primary goal of collecting high quality clinical data is to produce reports that are relevant for clinicians and users of the database. There are many factors, both internal and external to the health care setting, that drive cardiac database reporting. The purpose of this paper is to present and discuss how database structures dictate the kinds of reports that can be generated, how to identify reporting needs in an institution, and to provide some examples of how this process has been implemented in the cardiac program at Seton Medical Center.

**The cardiac database structure.** Although numerous internal and external factors drive the development of reports, the structure and content of the database determine to a great extent what kinds of reports can be generated. The cardiac database used at the San Francisco Heart Institute at Seton Medical Center (HeartBase, SIR Americas Inc., Chicago, Illinois) is a case structured, multi-level relational format

that organizes patient information from the level of the patient through individual coronary artery disease segments that are treated (Figure 1). Patient data are organized in a format similar to a medical chart. Multiple hospitalizations can be stored for each patient. Within those hospitalizations, information from multiple visits to the catheterization laboratory or surgical operating room can be stored. Within those visits to the catheterization laboratory or operating room, information on individual vessels and segments treated, with the equipment used to treat them, can be stored. Each report written from the database accesses different levels of the database structure. Although report writing is dependent upon the existence of a data element in the database, the structure of the database can have a significant impact on which reports can be written from the database. Consider a request for a report of post-catheterization laboratory complications in which the requestor wanted to track complications following every visit to the catheterization laboratory during a single hospitalization. Although post-laboratory complications may be collected in the database, it would be impossible to obtain a report on this for patients who had multiple visits to the cath lab if the structure of the database did not allow for independent entry of complications following each visit. It is often structural issues such as this that make it difficult or impossible to write a specific report from the database.

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The database must also have a mechanism to query the data. Most databases have an SQL (Structured Query Language) interface or a 4GL (Fourth Generation Language) for database query. The multi-level structure of HeartBase can be accessed and manipulated with either SQL or a 4GL language called PQL. These tools facilitate the process of pulling logical pieces of information out of the database and configuring this into a format that can provide a direct report or a file that can be exported to a statistical, graphics or spreadsheet software package. The availability of these tools facilitates the kind of report writing that can be done from the database.

**Internal reporting requirements.** Perhaps one of the strongest drivers of the development of reporting at our institution has been internal reporting requirements. The types of internal data reporting needs fall into 3 broad categories: 1) quality improvement projects; 2) physician profiling; and 3) technology and therapeutic evaluation. Each of these categories requires access to different levels of the database. Examples of quality improvement projects include length of stay analyses, tracking peripheral complications after catheterization procedures, and the use of anticoagulation with coronary stenting. An example of a length of stay analysis is an ongoing report looking at length of stay for female patients from 1994 through 1997, comparing Medicare versus non-Medicare insurance coverage (Figure 2). This report accessed the demographic and hospital levels of the database to merge information together, showing that length of stay has decreased for all women over the years, but a difference continues to persist between Medicare and non-Medicare patients. The analysis of peripheral complications accesses not only demographic and hospital information, but also the procedure and complication levels of the database (see Figure 3). This multi-level report, which was generated on a regular basis, showed that peripheral complications dramatically increased in 1994 both in patients receiving drug therapy (anticoagulants and antiplatelets) and those who were not. This led to a quality improvement study that resulted in an enhanced education program for nurses who were holding groins for bleeding after procedures. A dramatic increase in peripheral complications was also seen in 1996, which was most prominent in patients receiving drug therapy (e.g., ReoPro). This was mainly occurring in ReoPro patients, and weight-adjusted heparin dosing and decrease in the use of coumadin led to decreased complications in 1997. The third example of internal reporting demonstrates how a report accessing very detailed levels of the database showed that patients who received stents with no coumadin achieved shorter lengths of stay with no increase in abrupt closure (Figure 4).

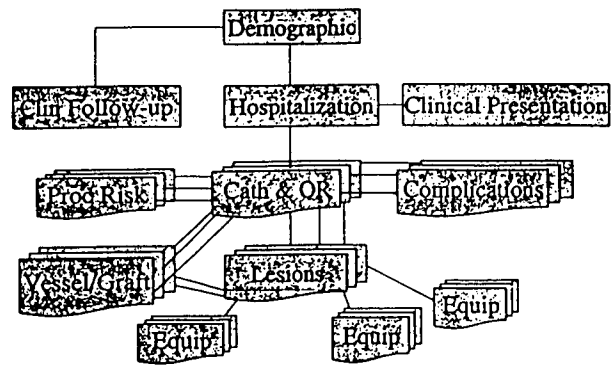


Figure 1. Levels of cardiac data.

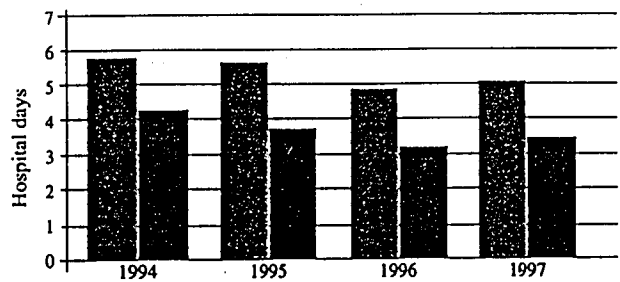


Figure 2. Hospital stay — Medicare.

■ = Medicare ■ = Non-Medicare

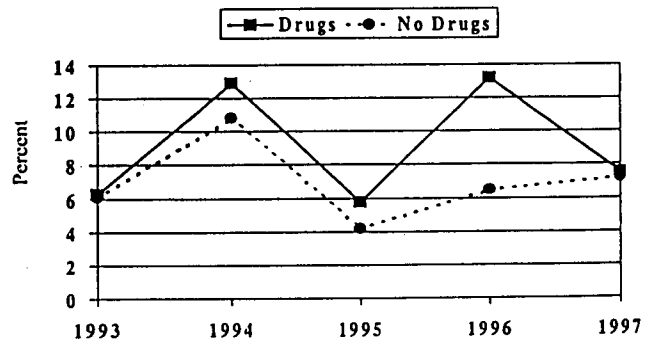


Figure 3. Peripheral complications.

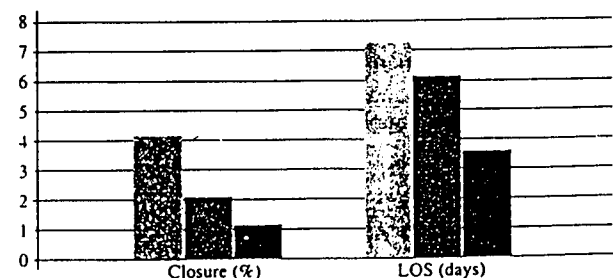


Figure 4. Anticoagulation and stents.

■ = Historical Cont ■ = Stent-Coum ■ = Stent-No Coum

Physician profiling is another internal reporting need that has been a driver in the development of reporting from the database. We have developed profiles for invasive cardiologists, non-invasive cardiologists and cardiac surgeons. Information included in these profiles covers a wide variety of clinical outcomes, utilizations and financial information and represents access of multiple levels of the database. The profile for invasive cardiologists includes the number of cases performed in the catheterization laboratory, acuity of the procedures, success, raw and adjusted mortality, complications, length of stay, and catheterization laboratory costs and total hospital costs (See Table 1). The profile for the non-invasive cardiologists includes number of patients, length of stay, blood utilization, mortality and costs for non-surgical and surgical patients managed by each physician (See Table 2). The profile for cardiac surgeons includes number of surgical cases performed, type of surgery, length of stay, raw and adjusted mortality, complications and hospital costs (See Table 3).

The third area that drives the development of internal reporting is technology evaluation. Technological and pharmaceutical developments have progressed rapidly during the last 5 years. Although large scale clinical trials have provided important information about the safety and efficacy of many of

these technologies, the application and integration of these advances into standard clinical practice requires the collection and evaluation of local cardiac data. The rising costs of new technologies and drugs has made it imperative that local institutions monitor the use of these advances. In addition, a focus on out-of-hospital outcomes is becoming increasingly important in these evaluations. A report that is generated on a regular basis at our medical center tracks the utilization and cost of catheter-based interventional devices used in combination with the IIb/IIIa glycoprotein receptor blockers. The use of this combination, although more expensive in-hospital if ReoPro is used during a bailout stent procedure (Figure 5), appears to have great clinical benefit in late outcome, especially where ReoPro is used in the setting of a bail-out stent procedure (Figure 6).

**External reporting requirements.** There are a number of organizations that interact with hospitals and health care professionals on a daily basis and shape the external reporting needs of the organization. Among the most prominent are local payors that provide managed care services. These contracts often dictate the kind of financial and clinical information that is required for maintaining these contracts on plan members. Other initiatives involve

Table 1. Profile form for invasive cardiologists.

1997 Statistics for Seton Medical Center			
Case Status	N	Procedural Success	LOS
Elective	_____	_____ %	_____
Urgent	_____	_____ %	_____
Emergent	_____	_____ %	_____
Total	_____	_____ %	_____
	N of Procedures	Devices/Lesion	
Balloon Only	_____	_____	
Primary Stent	_____	_____	
Rotablator	_____	_____	
Directional Atherectomy	_____	_____	
Salvage Stent	_____	_____	
Other or Combination	_____	_____	
Overall Mortality _____ %		Emergent CABG _____ %	
Repeat of Lesion < 72 hours _____ %		Needing Blood _____ %	
Stroke _____ %		New Q-wave Infarction _____ %	
Peripheral Complications _____ %		Event-Free Procedure _____ %	
Seton Volume 1997: _____	Hospital Length of Stay (days): _____		
Total Hospital Cost: _____	Total Direct Cost: _____		
Seton 1997 Mortality: _____ %	Expected: _____ %	Adjusted: _____ %	
Dr. _____ Mortality: _____ %	Expected: _____ %	Adjusted: _____ %	
Total Cases in Database (1990-1997): _____			
Total Database Mortality (1990-1997): _____ %    Expected: _____ %    Adjusted: _____ %			

national insurers such as Aetna and Blue Cross. Another important external driver of reporting needs is the Joint Commission on Accreditation of Hospitals Organization (JCAHO). JCAHO regularly publishes indicators that require hospitals to produce selected reports when they are surveyed for accreditation. In addition, JCAHO has instituted the ORYX project, which requires hospitals to collect and report quality indicators through vendors that are certified for those specific indicators. State and national organizations are also beginning to require specific outcomes to be tracked for patients. The HCFA Demonstration Expansion Project will require that detailed clinical data be provided on a regular basis for Medicare patients who have catheterization laboratory interventions or cardiac surgery at a standard price. Admission into this demonstration project and continued involvement is contingent on the government evaluating these outcomes. Many states have begun projects that require reporting of data on cardiac patients. The California CABG Mortality Reporting Project represents the combination of a state agency (OSHPD) and a business coalition called the Pacific Business Group on Health. This consortium is working to provide risk-adjusted mortality and outcomes for patients undergoing coronary artery bypass graft surgery at California hospitals. Professional organizations of cardiac specialists such as the American College of Cardiology (ACC) and Society

for Thoracic Surgeons (STS) have defined basic data sets, which guide the collection and subsequent reporting of outcomes.

**Locating data within the institution.** For reports that need to be adequately addressed on an on-going basis, it is imperative to find reliable and valid sources for that data in the organization. In most hospitals, it is typical that data related to cardiac patients is collected in different places in the institution, often with different coding and definitions applied by non-clinical coders. In some cases, systems are used that are isolated and not able to connect with any of the standard hospital information systems. The only way to adequately meet reporting needs is through the formation of multi-disciplinary information management teams. Data on cardiac patients is managed at our institution through the efforts of 3 primary teams: 1) the Hospital Information Management team; 2) the Cardiac Data Monitoring and Usage Committee; and 3) the Cardiovascular Task Force. Each team has a unique purpose and membership, although all are multi-disciplinary groups by definition.

The purpose of the Information Management Team is to provide oversight for the general information needs of the hospital. This committee focuses on system integration issues and is one of the committees that participates heavily in fulfilling JCAHO requirements. The team is composed of information

Table 2. Profile for non-invasive cardiologists.

1997 Statistics for Seton Medical Center

Non-surgical Patients	<u>N</u>	<u>LOS</u>	<u>Mortality</u>	<u>Cost</u>
CHF	_____	_____	_____	\$ _____
Acute MI	_____	_____	_____	\$ _____
Chest pain (R/O MI)	_____	_____	_____	\$ _____
Major Arrhythmias	_____	_____	_____	\$ _____
Other Cardiac Conditions	_____	_____	_____	\$ _____
Overall	_____	_____	_____	\$ _____
Surgical Patients	<u>N</u>	<u>LOS</u>	<u>Mortality</u>	<u>Cost</u>
Primary CABG	_____	_____	_____	\$ _____
Primary Valve	_____	_____	_____	\$ _____
CABG + Valve	_____	_____	_____	\$ _____
Reoperations	_____	_____	_____	\$ _____
Other Cardiac Surgery	_____	_____	_____	\$ _____
Overall	_____	_____	_____	\$ _____
Utilization	<u>% Needing Blood</u>	<u>Units Ordered (average)</u>	<u>Lab Tests (average)</u>	<u>X-rays (average)</u>
Primary CABG	_____	_____	_____	\$ _____
Primary Valve	_____	_____	_____	\$ _____
Overall Seton Experience 1997	<u>N</u>	<u>LOS</u>	<u>Mortality</u>	<u>Cost</u>
Non-surgical	_____	_____	_____	\$ _____
Surgical	_____	_____	_____	\$ _____

technology senior staff, physicians with both clinical and medical informatics background, clinical staff representing nursing, the clinical laboratory, pharmacy, radiology, cardiac rehabilitation, home health care, and administrative personnel representing medical records, the medical library and patient education outreach programs.

The purpose of the Cardiac Data Monitoring and Usage Committee is to evaluate which cardiac data elements to collect, what definitions to use and the most reliable source for each data element in the institution. In addition, the committee recommends formats for internal data reporting (e.g., physician profiles) and reviews external requests for cardiac data and the format for reporting data externally. Members on the committee include cardiologists, cardiac and vascular surgeons, clinical staff from the catheterization laboratory, operating room, coronary care unit, telemetry, cardiac rehabilitation, representatives from the hospital information and financial systems, quality assurance and the Heart Institute Database team.

The purpose of the Cardiovascular Task Force is to examine aggregate outcomes from the cardiac service line, to resolve quality issues that extend across hospital departments, and to facilitate providing

physicians with specific feedback on outcomes and utilization. The Cardiovascular Task Force includes department chairs of cardiology and cardiac surgery, hospital department directors and the administrative cardiac team.

One of the most valuable products that has been generated by these teams (primarily by the Cardiac Data Monitoring and Usage Committee) is the institutional cardiac data dictionary and data map. This project originated from concerns shared by many in the hospital that requests for cardiac data often yielded different results depending upon where in the organization the data report was produced. For example, something as basic as the number of diagnostic catheterizations performed varied substantially from reports produced by the catheterization laboratory versus those produced through financial services, as did the number generated by the Heart Institute database.

Table 3. Profile for cardiac surgeons.

1997 Statistics for Seton Medical Center

N of Cases:	_____
<u>Case Distribution</u>	
CABG	_____
VALVE	_____
COMBO	_____
Re-Do	_____
Overall mortality:	_____ %
Re-exploration:	_____ %
Stroke:	_____ %
Respiratory complication:	_____ %
Sternal wound infection	_____ %
% Needing blood	_____ %
New Q-wave infarction	_____ %
Event-free surgery	_____ %
Seton Volume 1997:	_____
Hospital Length of Stay (days):	_____
Seton 1995 Mortality:	_____ %
Expected:	_____ %
Adjusted:	_____ %
Dr. _____ Mortality:	_____ %
Expected:	_____ %
Adjusted:	_____ %

Total Cases (Seton & Non-Seton) in Database (1990-1997)	_____
Total Database Mortality (1990-1997):	_____ %
Expected:	_____ %
Adjusted:	_____ %

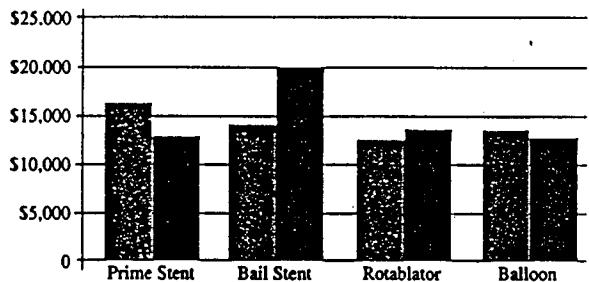


Figure 5. Stent/ReoPro costs.   
 [Patterned Box] = Use Pre   
 [Solid Black Box] = Use During

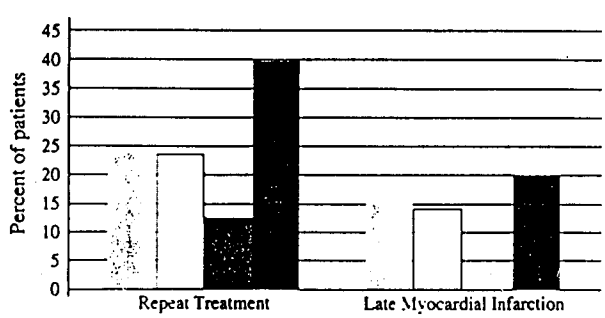


Figure 6. Stent/ReoPro late outcomes.   
 [Patterned Box] = Prim Stent + ReoPro   
 [Solid Black Box] = Bail Stent + ReoPro   
 [White Box] = Prim Stent; no ReoPro   
 [Solid Black Box] = Bail Stent; no ReoPro

Figure 7. Dictionary/Map components.

Dictionary/Map	Data Elements
• Element descriptors	• Database element name
• Primary source	• Format
• Target databases	• Codings
• Translations	• Definitions
• Compliance standards	

Upon closer examination, it became obvious that different definitions for a diagnostic procedure were being used in each area. Each database had its own internal and external drivers of data reporting. Similar situations led to the development of an institutional data dictionary that described the data sources and the variance in definitions and codings between the sources. In some cases, definitions that did not need to be different were reconciled. Throughout this process, the standards set by the ACC, the STS and JCAHO were followed where possible. This process also revealed that some of the same information was being needlessly collected multiple times during a patient's hospitalization. A cardiac data map was developed that tracked each place where a data element was collected in the hospital. The committee determined which source should be designated as the primary source; a plan was then formulated to set up possible electronic transfer of primary data to secondary data repositories (See Table 4).

This process had many benefits. While increasing data consistency and reducing redundancy, it also stimulated more cross-disciplinary communication and laid

the groundwork for data interfaces. It also built the foundation for building an institutional cardiac data warehouse that would be accessible to a broad group of users in the hospital. This process, which is continually monitored by the Cardiac Data Monitoring and Usage Committee, has reduced the inconsistency in reports that have been generated by the institution and has led to more efficient patient care with better feedback to the clinicians who provide care.

In summary, data reporting needs are driven by numerous internal and external factors. Successful and consistent data reporting requires ongoing assessment of the data requested, where it resides in the organization and how it is defined. This process is greatly facilitated by interdisciplinary teams that provide support for critical processes in this activity. There are substantial benefits gained from linking data definitions and data-reporting needs to the activities of professional societies such as ACC and STS. With these processes in place, good quality clinical and cost-effectiveness data can be maintained and used for accurate reporting and improvement in the management of cardiac patients.