CHAPTER

9

APPLICATIONS: MANAGEMENT AND FINANCIAL SYSTEMS

Learning Objectives

1. Describe the components typically included in an enterprise resource planning system.
2. Provide examples of transaction processing applications and discuss how they support financial management.
3. List components of the revenue cycle, describing how various components contribute to cash flow and revenue optimization.
4. Discuss desirable features of an automated enterprise scheduling system.
5. Distinguish between clinical decision support software and executive information systems.
6. Understand the use of computer applications as tools for research and medical education.

Overview

For many years, the healthcare field lagged behind other businesses in the design and implementation of robust information systems. Problems have included undercapitalization of the system development process and the failure of management to oversee system implementation effectively. However, the situation has changed substantially because of heightened competition, increased regulation, and changing payment mechanisms affecting the entire sector. Changes in the delivery and financing of healthcare that began in the late 1980s were pivotal to establishing information management as a key strategic resource in most healthcare organizations. Healthcare managers rely on information systems as essential tools for robust growth, effective competition and, in some cases, survival. In the current healthcare environment, which is evolving toward value-based care and consumerization, the importance of maximizing the contributions of information systems and "digital health tools" cannot be overstated (HIMSS 2019).

Most healthcare organizations began their automated information processing activities with computer systems that supported administrative operations—in particular, financial and accounting systems. While a significant number of healthcare applications serve financial purposes currently, robust clinical information systems are a top priority for most healthcare organizations. Note, however, that clinical information systems not only provide direct support to patient care processes but also populate the data repositories essential for performance measurement, external reporting, cost management, and other organizational accountability activities. Thus, the "ideal" clinical and administrative applications integrate into a comprehensive system that supports the continuum of information needs in an enterprise.

Most early information system applications in healthcare organizations were designed as stand-alone systems, and purchase decisions were based on maximizing desired specific functionality at acceptable costs. In the current environment, however, clinical and administrative applications are integrated, sharing functionality and transferring data across various elements of the enterprise information system as well as exchanging information with systems external to the enterprise. Purchase decision criteria now include interoperability, compliance with data transmission standards, and many other complex factors.

Migrating stand-alone legacy systems into an integrated environment was one of the most difficult challenges health information technology (HIT) teams encountered in constructing systems to meet the rapidly expanding information needs of healthcare enterprises (Gilchrist et al. 2008; Hicken, Thornton, and Rocha 2004; Kraatz, Lyons, and Thompkinson 2010). In fact, some teams concluded that starting from scratch was easier than retrofitting various systems from multiple vintages.

As technologies and system configurations continue to evolve, however, repeated "start-overs" usually are not a realistic option, for several reasons. Purchase and implementation costs of full-scale systems can be prohibitive, although purchase price has become virtually the least important criterion in system selection. Operations and planning are dependent on data and information stored in existing systems, and migrating data archives may be difficult or even impossible. In light of the extent of technology dependence in healthcare organizations, the disruption in service delivery and business operations during a full-system transition could be tremendous. Thus, managers must select system components with forethought for the ability to transition to next-generation products for better interconnectivity and interoperability in both clinical and administrative applications.

Enterprise resource planning (ERP) systems are bundled applications that integrate operational information derived from financial, project management, materials management, and other function-based areas into a robust database used to achieve business management objectives (Oracle.com

2020). These systems connect inventory and facilities management, resource scheduling, accounting and financial management, and other business events in a real-time environment. As with clinical systems, the market for ERP applications emerged from the need to update legacy software. The administrative applications typically incorporated in an ERP include the following:

- Financial information systems
- Human resources information systems
- Resource utilization and scheduling systems
- Supply chain management systems
- Facilities and project management systems
- Office automation systems

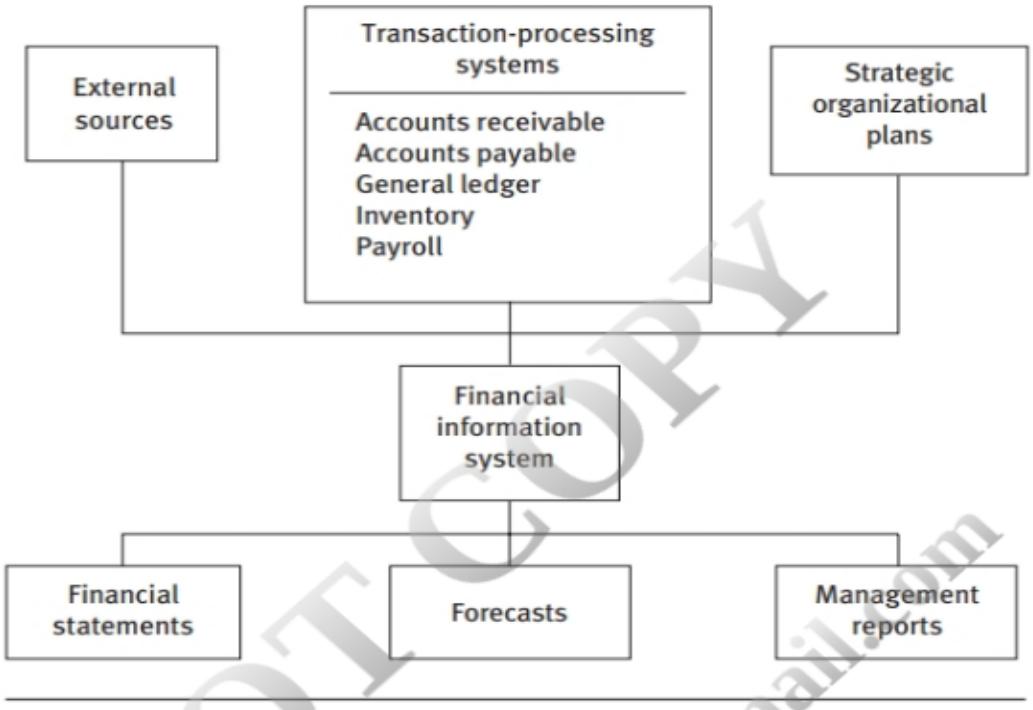
Each of these system components is described in this chapter with illustrative examples. Special features of these types of applications designed to meet the needs of nonhospital healthcare organizations, such as physician practices and home health care, are addressed. Additional uses of information systems in healthcare, such as medical research, education, and decision support, are discussed briefly.

Financial Information Systems

The highly competitive and regulated environments in which healthcare organizations operate require timely and accurate financial information that enables managers to monitor and guide operational performance. Managing competing demands for accountability and cost containment while providing high-quality services keeps managers acutely aware of the importance of sound financial management in guiding operational performance. Financial information systems support operational activities such as general accounting, patient accounting, payroll, contract management, and investment management. Financial systems also provide information to management for directing and evaluating organizational performance. Analysis of current and historical information aids in projecting future financial needs of the organization.

Financial information systems require input from transaction-processing systems, external sources, and strategic organizational plans (see exhibit 9.1). Such systems record the organization's routine business activities, collecting information from other administrative subsystems, including payroll, accounts payable, accounts receivable, general ledger, and inventory control. These transactions are the basis for many financial reports required by management. To support effective financial decisions, financial systems

EXHIBIT 9.1 Financial Information System



also need external data such as government statistics, inflation rates, and information about the marketplace. An organization's strategic plan should contain financial goals and objectives that help provide the framework for preparation of financial reports.

A fully integrated financial information system brings related information together for planning, monitoring, and control. Individual financial subsystems include the following:

- Payroll preparation and accounting, linked to a human resources information system
- Processing of accounts payable, linked to purchasing and inventory control systems
- Patient accounting, patient and third-party billing, and accounts receivable processing
- Cost accounting and cost allocation of non-revenue-generating activities and general overhead expense
- General ledger accounting
- Budgeting and budget control
- Internal auditing

- Financial forecasting
- Investment monitoring and analysis
- Financial statement preparation
- Financial reporting for operating supervisors, executive management, board members, external regulators, and third-party financing agencies

Developing and maintaining an effective financial information system necessitates the infrastructure of a good accounting system. Sophisticated cost accounting, essential in a negotiated pricing or value-based payment environment, enables the financial information system to generate accurate information on personnel and other physical resources used to deliver services. For services provided under managed care contracts, stakeholders as diverse as providers, managed care organizations, and employers need cost information to help negotiate rates and monitor contract performance. Integrated financial reporting based on a solid cost accounting system provides information for product costing, analysis of labor productivity, inventory control, and examination of the productivity return on capital investments.

Significant proportions of total payments for healthcare services provided are based on either a fixed payment per case (e.g., diagnosis-related groups) or a fixed payment per person per month (i.e., capitation payment systems). For effective management in this environment, a financial information system must have the capability to convert or link cost and net revenue information to multiple units of payment.

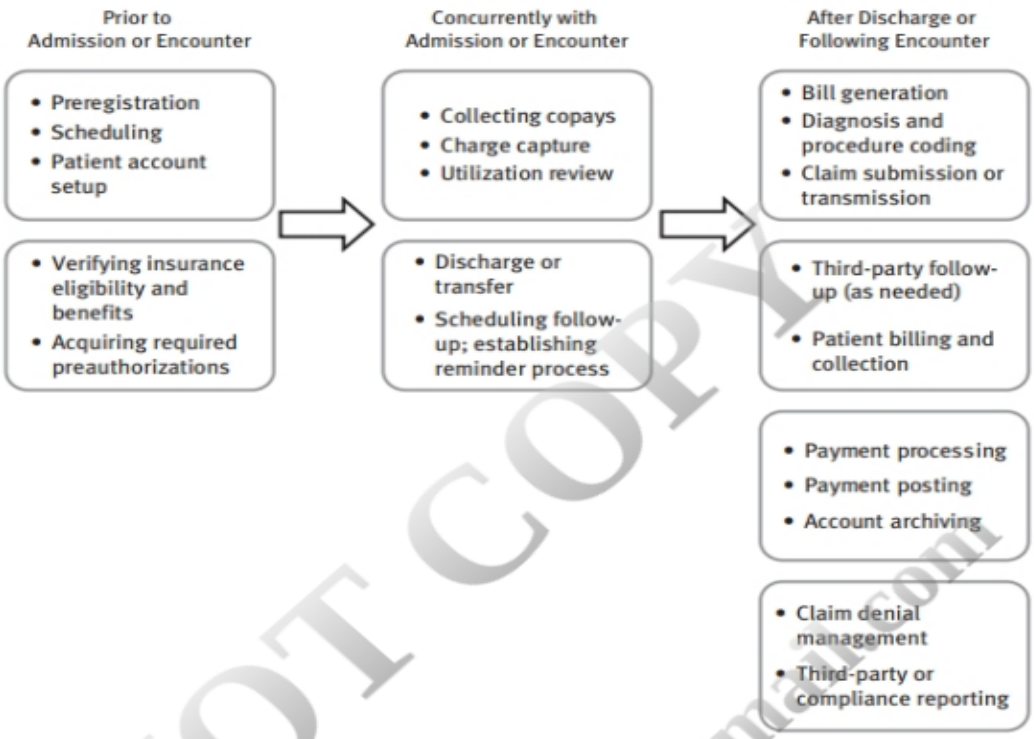
A market analysis prepared by the Dorenfest Institute for HIT Research and Education (Dorenfest Institute 2013) for the HIMSS Foundation described the financial management application as "highly saturated" with hospital installation rates for accounts payable, general ledger, and materials management at nearly 100 percent.

Revenue Cycle Management (RCM)

The revenue cycle in healthcare encompasses all business processes and clinical activities associated with generating and receiving revenue through patient care, from preregistration or scheduling through processing payments for services rendered and follow-up on uncollectible accounts (see exhibit 9.2). Although some real-time manual data capture processes are inevitable, almost exclusively the revenue cycle is automated, and data capture, transaction processing, data transmission, and archiving are integrated with the enterprise information system.

Managing the revenue cycle effectively is critical, as this process is the driver for cash flow as well as optimizing the overall income from clinical operations. The goal of revenue cycle management (RCM) is to make the time between service provision and payment for services as short as possible.

EXHIBIT 9.2
Revenue Cycle Components



Thus, the efficiency of all business processes associated with generating, submitting, and processing a claim for services provided is paramount to ensuring the effectiveness of the entire RCM system.

The revenue cycle begins with getting a patient in the system to receive services (i.e., registration, service scheduling, account setup). At this point, accurate information capture or entry is critical, as it informs planning and prepping for the clinical services, as well as providing key administrative information that will be used in every step of the process through claim submission and payment processing. Patient identification data and insurance coverage must be accurate and complete to avoid delays in processing eligibility for services or denial of claims. Many insurance companies require preauthorization for some services; thus, the system should be designed to allow time to secure the authorization before the service is scheduled. Because patient satisfaction is a key component of hospital ratings, the efficiency and ease of the patient's engagement in this step in the process is very important. Current data about coverage, copayment, and exclusions for insurance products accepted are essential.

Payment amounts for specific services are driven by several variables. First, there's the charge for the product or service based on the actual cost of resources (e.g., personnel, products, equipment usage) required to deliver the product or service. These billable units are maintained in the chargemaster, a complex database that houses the descriptions of the billable units and the associated codes used to generate a patient bill. The chargemaster serves as the input for the second variable, the negotiated prices charged to third-party payers. These prices vary, sometimes widely, by payer. For example, Medicare has a sophisticated and complex value-based payment model that rewards providers for efficient delivery of care with good outcomes. Other payers may negotiate lower rates for high-volume services or preferred provider designations. Finally, the actual reimbursement, or the amount paid, may differ from the amount billed after application of discounts, penalties, incentives, or uncollectable accounts.

The charges or prices that make up a patient bill are generated from diagnostic and procedure codes that convert large amounts of text-based information to numeric codes derived from one or more approved classification systems, such as the International Classification of Diseases, Current Procedural Terminology, or Systematized Nomenclature of Pathology. Because of the variability in medical language, and the importance of precision and accuracy, coding software is not so much automated as it is assistive to human medical coders. Medical coders are trained health information professionals who play a very important role in RCM. If the correct code is not selected, the reimbursement may not be correct or the claim may be denied pending correction, which affects cash flow. Frequent coding errors, which constitute billing errors, may result in penalties or sanctions from payers.

A key point is that RCM is a dynamic process subject to frequent and profound change as payment regulations and payer contracts evolve. The information systems that support these processes must be dynamic as well. Planned system updates to accommodate changes in the regulations or payer processes must be timely and comprehensive.

Some components of the RCM systems, such as registration, scheduling, and billing, have been utilized for many years, and many healthcare organizations are investing to replace older systems with newer applications that better integrate and improve compliance with federal information technology (IT) initiatives.

As with other business processes in healthcare, RCM can be outsourced to one of many third-party vendors that specialize in this service. Vendors must be vetted for their ability to integrate with the healthcare organization's financial and clinical systems, how they maintain processes compliant with current regulations, their security practices, their approach to managing denied claims, and other sector benchmarks for a robust RCM approach.

Human Resources Information Systems

Employees of a healthcare organization constitute its most important resource. Most organizations spend more than 50 percent of their operating budget on employee salaries and benefits. Thus, a good human resources information system (HRIS) is an important tool to assist managers in personnel planning, staffing, and productivity analysis. The common functions of an HRIS include, but certainly are not limited to, the following:

- Maintaining, updating, and retrieving information from a database of employee personnel records
- Providing automatic position control that is linked to the budget
- Producing labor analysis reports for each operating unit or cost center
- Producing reports used for assessing personnel problems, such as turnover and absenteeism
- Maintaining an inventory of special skills and required certifications of employees
- Producing labor cost allocations with linkage to the payroll system
- Providing information on employee productivity and quality control, assuming that appropriate labor standards have been developed
- Managing employee sick leave, vacation, and other earned time off
- Comparing the organization's compensation and benefit packages with industry norms

Large amounts of data are required to provide these reports and others that may be needed. The HRIS information processing and reporting functions are supported by information drawn from various databases that contain individual employee data, wage and salary records, the organization's job classification structure, benefit packages, employment contracts, and many other related data elements. Actual ownership of the various databases may be distributed among multiple departments. Thus, the structure of the databases is an important factor in data transfer from one element of the system to another.

Although essential for efficient business practices, the availability of computerized employee record files creates a security issue. Because protecting the employee's right to privacy is essential, organizations need to establish software and hardware security systems and set policies for accessing and updating electronic files containing personnel data and information (see chapters 5 and 8 for discussion on data security policies).

In addition to supporting operational work in the human resources department, a well-designed HRIS will produce reports for management

planning and control (see exhibit 9.3). For example, HRIS management reports can be used to monitor turnover rates, unfilled positions, labor costs, employee productivity, and utilization of benefits. Attitudes of employees and physicians can be monitored through periodic satisfaction surveys. This survey information, used in conjunction with activity and utilization data, can be an important component of planning changes to benefits provided to employees.

Software applications are used to maintain records related to verifying physicians' and other licensed professionals' credentials and defining practice privileges in the organization, as well as for ongoing evaluation of clinical performance. Credentials and privileging systems are important for monitoring quality standards and for maintaining documentation required by accrediting and regulatory bodies. The task of verifying academic and training credentials and mitigating malpractice exposure is frequently outsourced to a certified credentials verification organization (CVO) such as Professional Credentials Verification Service (www.pcvs.net), which is accredited by the National Committee for Quality Assurance. As for all information system partners and collaborators, accreditation is an important criterion for selection.

Data transmitted by the CVO must be connected to relevant data from the organization's clinical and administrative systems to monitor clinician productivity and conformance to quality standards. Often, health systems must integrate external benchmarks and regulatory agency standards for comparison with actual performance data. Because of the sensitive nature of the data in this system and the specificity of facility accreditation requirements for this function, a stand-alone system often is used to achieve the

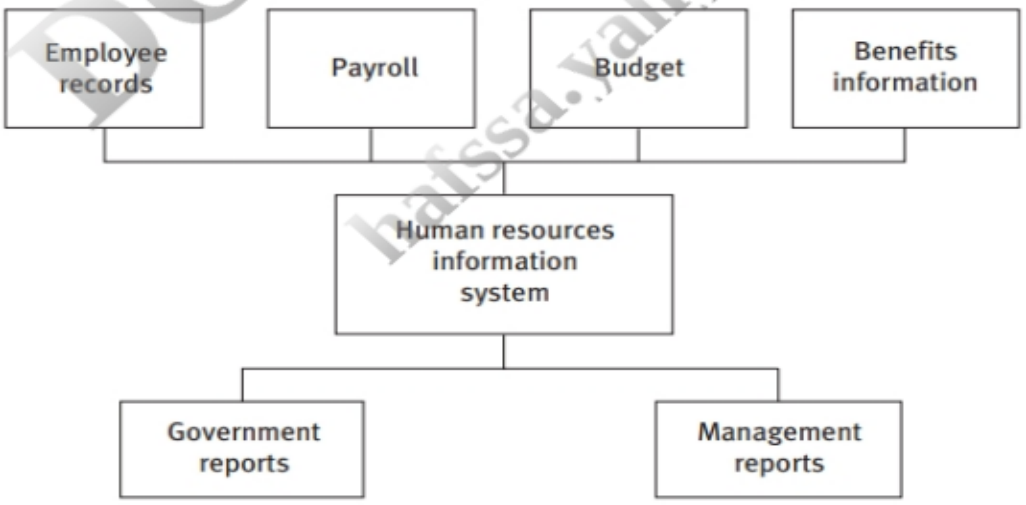


EXHIBIT 9.3 Human Resources Information System

desired functionality and system security. Example applications include MD-Staff (www.mdstaff.com), a cloud-based network that includes background screening, credentialing, and provider management options.

Resource Utilization and Scheduling Systems

Under fixed-price and capitation payment systems, cost containment and efficient resource utilization are pivotal to success. External mandates for utilization review by regulatory agencies and insurance companies are more than balanced by internal drivers for ensuring that resource utilization is optimized. Managers must ensure that services are available when needed and that personnel and technology are efficiently allocated and scheduled. These efficiency needs are met through computerized monitoring and scheduling systems.

Information systems monitor inpatient occupancy rates, clinic and emergency department activity, and utilization of individual service facilities such as the operating suite or diagnostic units. Patient scheduling systems are used for advance booking and scheduling of facilities—both for patient and physician convenience and for efficient (and cost-effective) allocation of resources, particularly staffing. Comprehensive and timely data are essential to monitoring use of expensive diagnostic and treatment technologies in the effort to achieve optimal revenue returns on capital investments.

Advance booking of hospital beds and preadmission systems are particularly useful for situations in which most of the admissions are elective (e.g., a specialized surgical facility). Advance booking also provides time for necessary precertification for managed care patients and others covered by insurance plans that require review and certification of medical necessity for procedures and inpatient admission. Preadmission information systems can be linked to individual physicians' offices as well. Computer programs can project the average length of stay for each elective admission once historical data (including diagnosis, surgical procedure, age of patient, and gender of patient) have been accumulated. After admissions are scheduled and the data are entered into the supporting database, the system calculates projected occupancy levels for each day.

Admissions monitoring and scheduling systems improve staffing and workflow in healthcare organizations. These systems can reduce daily fluctuations in a hospital's census and improve the effectiveness of flexible staffing systems. Acute care general hospitals must maintain an accurate accounting of bed census and occupancy if they are to survive. Census information helps administrators compare projected income against projected budgets. Administrators can also track demands for specific services and adjust staffing levels and scheduling of facilities as demand patterns change.

Computer programs also are available for scheduling operating rooms in hospitals and ambulatory surgery centers. These systems are designed to improve operating room utilization, contain costs, facilitate planning, and aid in scheduling specific surgical procedures for optimal staff utilization. Outpatient clinic appointment and scheduling systems are common in organizations with a large volume of outpatient activity.

Resource utilization and scheduling systems may be designed for use at the department level or for a small entity such as a physician practice, but enterprise-wide scheduling systems that meet multiple objectives are becoming common. These robust integrated systems support fiscal objectives such as balanced schedules, optimal staffing, and management of resources across the enterprise. From a patient perspective, the ability to schedule multiple diagnostic procedures in one session, and perhaps schedule all procedures in a single day, contributes to satisfaction with the encounter experience.

The scheduling system can include modules that capture patient insurance and billing information during the registration process, which can be matched against stored contract data to produce appropriate charge records. Most systems produce automated appointment reminders in a variety of formats, including computer-generated telephone calls, emails, and text messages.

Scheduling systems can be linked with materials management systems to ensure that equipment and supplies are available for scheduled procedures, including initiating the process to transport the supplies to the treatment area. As items are removed from inventory, ordering and restocking procedures are triggered.

Supply Chain Management Systems

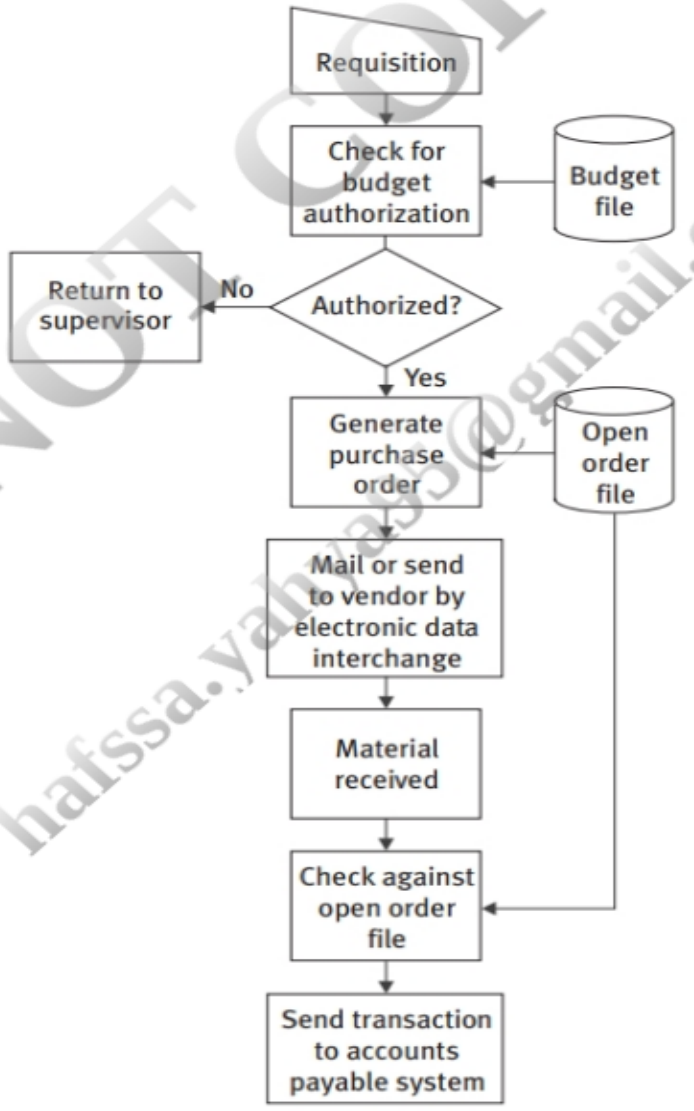
Computer systems are invaluable in effective management of supplies and materials, including data exchange with suppliers, automated purchase orders, inventory control, use of bar code devices for encoding supplies and materials, and computerized menu planning and food service management.

In a typical supply chain management system, requisitions for supplies and materials are electronically generated and matched against budgetary authorization for financial control. Reports of overdrafts on supply accounts are transmitted to the appropriate supervisor for follow-up action. Once requisitions are cleared, often using an automated workflow process for sequential authorizations, the system generates purchase orders. Purchase orders can be transmitted electronically to suppliers via established data-exchange protocols. As materials are received, bar coded products can be scanned and matched against an open order file. Automated purchasing systems may include direct linkage to an integrated accounts payable system, and

automatic reordering of selected items as inventory is depleted (see exhibit 9.4). Supply chain applications reduce processing costs and obtain materials on a just-in-time basis to minimize the need to carry a large inventory, which avoids storage space costs and prevents losses resulting from expired items.

Detroit Medical Center divides its materials resource management department into several functional areas: linen services, clinical engineering, contract administration, logistics management, procurement, supplier diversity, and systems development (www.dmc.org/vendor). The department communicates with current and potential business associates via a website,

EXHIBIT 9.4
Supply Chain Management System



providing information about open requests for proposals, standard contracts and policies, and status on open purchase orders. Some areas of the website are open access, which may generate interest from potential vendors, but areas that store proprietary or contract-related information are protected with a secure login and are accessible only to current business partners.

Coding standards are an important element of automated purchasing and supply chain management systems. Bar codes for all types of medical supplies and pharmaceuticals have become standard and are essential to efficient purchaser–vendor relationships in healthcare.

Computerized menu-planning systems store and analyze data on patients' nutritional and dietary requirements, food items in inventory and their costs, and decision rules for selecting from among alternative menus (see Healing the Body by Stimulating the Appetite). Decision criteria might include patient preferences or visual appearance of food in addition to nutritional adequacy and cost.

Healing the Body by Stimulating the Appetite

UAB Hospital in Birmingham, Alabama, has implemented a novel alternative to routine menu plans for inpatients who want more choice in their meal selections. Patients can order "room service" for delivery to their rooms between 6:30 am and 7:00 pm. Meal choices include breakfast foods, soups, salads, hot and cold sandwiches, pizza, meat-based entrees, and desserts. For the adventurous, a seasonal meal planned by a renowned local restaurateur is available.

Patients with dietary restrictions are flagged in the information system to be automatically connected with a dietary representative who will address their meal requests appropriately. Online menus include designations to aid patients in selecting "heart healthy" foods or those allowed on a diabetic diet.

This meal option is supplemented by nutritional education available on the patient education television channel and with telephone access to a registered dietitian.

More information is available at www.uabmedicine.org/patient-and-visitor-guide.

Facilities and Project Management Systems

Computerized systems help organizations plan, manage, and maintain physical facilities. Examples include preventive maintenance systems, energy