

2

Workflow in Physician Practices

Ten Questions to Consider Concerning Practice Workflow

1. How would you identify and define the distinct tasks of your practice?
2. What specific people perform these tasks?
3. Does your practice have formal policies on how processes are carried out?
4. What are the communication and information patterns in your practice?
5. How would you rate communication in your practice?
6. Does your practice have a person in charge of resource management?
7. Have you attempted to reengineer your practice?
8. How many staff members need access to the same documentation at the same time?
9. Does your practice measure productivity per physician?
10. How does work flow from one staff member to the next?

Health care can be considered the most precise industry. No where or at no time can an error occur. To help ensure this, workflow technologies are becoming very critical in the physician practice. Workflow is a very interesting concept as it provides physicians and staff with a new way of looking at how processes and procedures are completed. So aside from itself being a process, it can also be thought of as a new way of thinking about how business is done.

Workflow in the Primary Care Physician's Office: A Study of Five Practices

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Workflow in business systems is not uncommon; for ten years it has been an important technology.¹ Many restaurants, for example, especially those serving fast food, use workflow systems to route order information, often coupled to touch screens for rapid data entry. Workflow is no less important in the physician's office; in fact, the flow of information in the health-care setting is more critical than it is in most other industries. Yet despite the conclusion of many researchers and analysts that workflow systems at the point of care will deliver reduced costs, improve productivity, and more effectively manage the sea of documents flooding the average physician's office, workflow automation in the physician's office is rare.

Defining Workflow

Workflow, a term that originated in the mid-eighties, has many definitions. For this study, we define workflow as a computer-assisted (or automated) organizational process. An organizational process is a collection of activities related to a specific commitment, adding value to a product or service of the organization.² Workflow is often used synonymously with reengineering, but workflow automation and business process reengineering are not the same thing. *Workflow automation* is a software technology that provides a *means* of automating a business process. Reengineering is the act of analyzing the business processes of a company or practice and changing them with the goal of improvement. Thus, business organizations can automate business processes using workflow software without reengineering them. Likewise, businesses can reengineer business processes without workflow automation.

Workflow is also not the same as *workflow automation*.³ Any application that can route a document so that it flows (like e-mail) from one user to another can claim to be workflow. True workflow automation includes an array of essential features that go far beyond the simple routing of documents and depends on two critical factors, (1) automating manual process

steps and (2) distributing information to the workgroup, in this case, to the physician and his or her staff.

An automated workflow system has the following characteristics:

- **Tasks** These are activities that must be completed to achieve a business goal. The CPR (computer-based patient record) and workflow system in this study are task-based.
- **People** Tasks are performed in a specific order by specific people (i.e., nurses, physicians) based on business roles.
- **Roles** Roles are defined independent of the people or the processes that fill them; for example, the CPR defines a nurse's role as different from a physician's role in the physician's office.
- **Processes** Processes are the sequences of steps to be performed based on business conditions. Workflow automation may mirror existing processes or call for redesigning processes to eliminate redundancies and bottlenecks and to account for simultaneity. Since redesigning processes involves an examination of why people do what they do and often requires changing the way people do their work, it may foster fear, uncertainty, politics, and resistance to change.
- **Practices** Practices are what actually happen in organizations. Only by capturing the practices is it possible to truly automate businesses.
- **Policies** Policies are formal written statements of how certain processes are handled. In most physician practices, policies are unwritten and must be remembered by the person assigned to the task.

Objectives of This Study

This study describes the results of data collected from physicians of five independent ambulatory care practices that have installed a computer-based patient record (CPR) and workflow system from a Marietta, Georgia, vendor. The objectives of the study were to evaluate time savings, quality of care, office productivity and user acceptance of a CPR integrated with a clinical workflow system. The five participating practices vary in size from solo practitioners to six providers at two sites. Practices C, D, and E were well established and using traditional paper records before implementation of the CPR. Practices A and B are start-ups and opened their doors using the CPR. All five practices are completely paperless except for printed prescriptions and paper generated by external sources such as referring physicians, insurance companies, and laboratories. Most of these external source documents are scanned directly into the CPR and can be very rapidly retrieved.

Survey Methods

The evaluations were accomplished through taped interviews, observations, and postinstallation surveys ranging from six months to three and one half

TABLE 2.1. Patient volume pre- and postinstallation of a CPR and workflow system

Practice	No. of patients at time of installation	No. of patients as of April 1, 1999
A	0 (May 1998)	1,000
B	0 (Oct 1998)	700
C	3,500 (Dec 1995)	7,600
D	5,000 (Feb 1997)	6,300
E	20,000 (Oct 1997)	25,000

years (beta site) after installation of the CPR and workflow system (Table 2.1). The postinstallation surveys were completed by 10 physicians and physician extenders, 10 clinical personnel, and 6 nonclinical workers in the five practices. The 26 respondents were asked to rate each question in a series on a scale of 1 to 5 with 1 the lowest and 5 the highest. The questions asked for user perceptions of three general categories of CPR utility: time saving, quality of patient care, and office productivity. The survey consisted of questions including one question about workflow. In addition, a key person at each site was asked to fill out a questionnaire allowing free text concerning office productivity and profitability. In practices D and E, the key people were office managers; in offices A, B, and C a physician responded to this questionnaire. All respondents remained anonymous. The small number of sites and users beg caution in the interpretation of the results, although preliminary observation of 15 other sites in operation less than six months point to similar results.

Transition to the CPR

At each of the practices, physicians were trained for four hours on the CPR. The clinical and nonclinical staffs required less than four hours of training. All but one of the physicians reported that after one to two week's time they felt "proficient" using the CPR and workflow system. None of the offices experienced any significant downtime after they went on line or reported any significant losses of office productivity during implementation and training.

Description of the CPR

The CPR and workflow system used by the healthcare providers in this study is a client-server application that utilizes a monitor in every exam room. It operates on a Windows NT and SQL Server platform. The application focuses on structured data entry that permits queries, quality assessments, collections of specific data (Open and Closed Assessments, Drug History, Family History, etc.), and research. The CPR has been specifically designed for easy clinical data entry using touch screens, for browsing and skimming, and for the aggregation of data according to the preferences of

each office. The screens are uncluttered and feature large icons. The CPR also supports free text data entry via either keyboard or dictation. By using dynamic “short lists,” each physician can chart a typical encounter in 30 seconds or less, far less than the 2 minutes it typically takes a doctor to complete a paper chart. The workflow automation is supported by a Navigational Interface as opposed to the more common Multiple-Document Interface (MDI) of most CPRs. At the heart of the workflow system is the Office Screen, which tracks a patient throughout the visit. From this screen, observers are able to see where each patient is, which provider the patient is waiting for, what service the patient is waiting for, and finally, how many minutes the patient has been waiting.

Consistent with true workflow automation, information, beginning with patient check-in, flows from screen to screen in a cumulative and value-added process until patient checkout. Members of the workgroup add value by adding more information or by making judgments based on the information provided to them by the application.⁴ This information is available in real time to multiple users throughout the process. Also consistent with true workflow automation, in every practice involved in this case study—and all other practices served by this vendor—there is 100% physician compliance. This is critical, since health care in the physician’s office is a collaborative process.

Automation of Office Processes

To automate office processes, the processes first must be identified. A CPR can automate four core processes of a physician’s office: (1) information retrieval, (2) care documentation, (3) orders, and (4) communications.⁵ Information retrieval refers to the medical history that the physician needs in order to make informed clinical decisions. Care documentation relates both to delivery of care and capture of charges. Order selection refers to prescriptions, lab tests, immunizations, and so on. Communication refers to messaging between physician and patients, physician and staff, and physician and colleagues.

In addition, there are subsets to these core processes. (For an example of the automation versus the manual process of a prescription refill requested by phone, see Table 2.2.) The workflow must be configurable to accommodate the processes and subsets of processes of each office, as these vary in type and sequence based on specialty and physician preference. For example, an orthopedic surgeon may want X rays of the patient before each examination; other physicians would not need X rays. An obstetrician may want to know the blood pressure and urine protein level of every patient, while to a dermatologist these measures would be of little or no importance. The processes most commonly identified in a typical primary care office would include patient check-in, medical record retrieval, triage (determin-

TABLE 2.2. Step-by-step comparison of prescription refill process after telephone encounter

Task	Traditional model	Office automated with CPR
Determine when prescription was first filled.	Pull chart and check paper record.	Open Encounter Screen in response to message flashed from telephone encounter nurse.
Determine when prescription was last refilled.	Determine from paper chart when prescription was last refilled.	Touch button to check last or open encounter.
Determine what other medications the patient is taking.	Determine from paper chart what other medications the patient is taking.	Touch button to check entire medication list.
Determine drug allergies, if any.	From paper chart determine drug allergies, if any.	Touch button to check entire allergy list.
Calculate dosage.	Calculate manually.	Computer automatically calculates dosage.
Add new refill to record.	Manually write in new refill into paper record.	Prescription automatically entered into record.
Transmit prescription to nurse.	Send message to nurse.	Send message to nurse via computer. [Total time elapsed to this point: 30 seconds]
Transmit prescription to pharmacy.	Nurse calls in prescription.	Nurse calls in or faxes prescription.

ing chief complaint and checking vital signs), documentation of the patient history, review of systems, physical examination, lab orders, procedure orders, assessment, treatment plan, checkout, and finally, storage of the medical record. Following is a broad and simplified composite description of the workflow processes in the five primary care practices examined in this study.

Check-In and Record Retrieval

In a nonautomated physician's office, the paper chart itself is a medium for workflow. While some offices wait for the patient to arrive before pulling the medical record from the storage cabinet, more efficient practices already have the paper chart waiting at the reception area. Even though this system improves the movement of the patient through the office and reduces patient waiting times, it requires many man hours of preparation either early in the morning or at the end of the day for the next day's schedule. In the paperless office with workflow, check-in can be accomplished by simply clicking on the patient's name on the appointment

schedule. Not only is the medical record automatically called up, a log is made of the patient's arrival and arrival time, and the triage nurse is notified that a patient is waiting. The seamless flow of information allows the front office staff and the triage nurse to work together to maximize their productivity.

Triage

The triage nurse's duties vary between offices but typically consist of eliciting the chief complaint and the history of the present illness, measuring the pertinent vital signs, and choosing a patient priority level. These functions should remain unchanged in the automated office; however, documentation of common conditions can be made much quicker by using a "pick list," or template of frequent complaints. Research shows that use of default templates both improves efficiency and increases compliance with practice-defined guidelines.⁶ As stated earlier, in the five practices under study touch screens are used to facilitate rapid data entry. The triage nurse using automatic workflow has another advantage over a paper-burdened counterpart: he or she can tell which examination rooms are empty and of those which ones are prepared for the next patient. This simple function of the CPR saves the nurse from manually walking to the room to see if it is ready before assigning a patient to the room. Frequently in nonautomated offices, a color-coded light system is used for this task, and while it may be functional, the light system requires constant human intervention to keep it up-to-the-minute accurate.

Diagnosis and Documentation

The physician's responsibilities of taking the patient's history, performing an examination, choosing appropriate diagnostic studies, making a diagnosis, and deciding on a course of action remain unchanged in the automated office. The documentation and ordering of labs, procedures, and medications, however, are far more efficient and thorough. While the physician can see the information the triage nurse has previously gathered, he or she also has a "pick list" to document additional historical information that is deemed important. By keeping typing and dictation to a minimum, the documentation process, as noted earlier, is dramatically faster.

The CPR must be configured to the physician performing the exam. A pediatrician's exam is vastly different from that of an ophthalmologist, and the documentation must reflect these differences. Even preferences within a specialty or within a medical practice require that the CPR be configurable to the individual physician. A physician can define a specific set of normal and abnormal findings that are frequently encountered in his or her practice, thus allowing for rapid entry of common physical findings.

Examples might include “Complete physical,” “Pharyngitis,” and “Bilateral otitis media.” In addition, even these common examination findings are changeable because of medicine’s unpredictable nature.

Most physicians work within a finite set of diagnoses, and of them a small subset accounts for 80% to 90% of the patients in a practice. By taking advantage of this fact, the CPR can reduce the amount of time required to document the patient’s diagnosis. Common diagnoses can be placed on a “Top Ten” list, while less common diseases are available on an alphabetical list. For the diseases with which the physician may be less familiar, a categorical list is available to prompt the memory, possibly saving significant reference and textbook research.

The “common things are common” phenomenon is also true of patient advice and therapy options. For each diagnosis, the physician has a list of patient instructions, medications, laboratory orders, procedures, and referral options that may be chosen. This list serves two functions—it reminds the physician of actions he or she may wish to take, and it allows for rapid ordering and documentation of those actions. A physician may wish to advise every patient with strep pharyngitis to replace toothbrushes after three days of antibiotic therapy. By creating a patient instruction icon to that effect under the strep pharyngitis template, the doctor is reminded to tell the patient this important piece of information and can, with a touch of the screen, instantly document that the advice was given.

When the physician chooses a medication to treat the patient’s illness, the medication is checked against the patient’s allergy list, the dosage is calculated, the therapy is documented in the medical record, the patient’s drug list is updated, and the prescription is printed. With the CPR, these functions are accomplished with just one touch and errors are virtually eliminated. In all five practices in this study, dictation has been reduced to almost zero.

Labs and Procedures

The CPR and workflow system allow instant communications within the office and simultaneous access of a medical record by various people in the office. When the healthcare provider orders a lab or procedure, the nurse is notified automatically and immediately. The physician need not waste productive time trying to locate a nurse or turning on a certain light—both of which may be easily forgotten. While the physician is still with the patient, the nurse can prepare for the procedure. In the case of vaccinations, the dosage, manufacturer, lot number, and intended site of administration can be documented before even entering the exam room and while the physician is still charting the exam. The nurse can enter the results of labs and the information will appear in the exam room for the physician, thus preventing interruptions.

Checkout and Record Storage

After the exam and after all ordered services have been completed, the patient is automatically checked out of the office. At this time the CPT codes and ICD-9 codes are transferred from the CPR to the practice management system. The person greeting the patient at the payment window simply has to post the payment and give the patient the printed prescription. The medical record is automatically stored in the server, thus eliminating the need to file a paper record. The information is available to any authorized person at any computer in the office. This eliminates lost records within the organization and allows the office to back up the records for off-site storage and protection.

Survey Results

Consistently across all five practices, the primary care providers perceive a positive impact of the CPR and workflow system on overall office productivity and time saving (Table 2.3). The highest scores, however, go to satisfaction with the workflow system. When asked about the “overall quality of workflow,” the physicians responded with an average (mean) score of 4.60 out of a possible 5.

Office Productivity

At all five sites the physicians indicated that they were satisfied with the efficiency of their office’s business operations (4.40) and that they were *very* satisfied with the management of patients from check-in to checkout (4.60). Interviews disclosed that the physicians perceive that productivity has been increased because of everyone’s ability to prioritize their work. The medical record is instantly and simultaneously available throughout the office, thus eliminating many man-hours of searching for and filing medical charts. Because electronic charting is much faster than recording on paper, less time is needed to document visits. Most of the physicians report that they can document a typical pediatric encounter in 30 seconds or less. Communication within the office greatly reduces the lag time created by paper-based workflow systems and color-coded light systems.

Time Savings

Closely related to office productivity is the efficient use of time. Five questions related to time savings. The physicians produced a mean score of 4.54 when asked their perception of easily accessing a patient’s medical record. When asked about finding specific information within a patient’s medical record, their mean score was slightly lower: 4.36. When asked about

TABLE 2.3. Postinstallation attitudes about the CPR, workflow system, and business processes

	Physicians	Clinical Staff	Non-Clinical staff
CPR improves healthcare delivery.	4.40	4.22	4.50
CPR gives easy access to patient's medical record.	4.54	4.55	4.50
Overall quality of care delivered by office.	4.31	4.74	5.0
CPR helps prevent overlooked information.	3.90	4.22	4.5
Satisfaction with overall quality of workflow.	4.60	4.55	4.5
Satisfaction with overall efficiency of office's business operations.	4.40	4.1	4.0
CPR gives easy access to specific information within a patient's medical record.	4.36	4.00	x
CPR provides confidentiality and security.	4.18	4.44	x
CPR provides better preventative medicine, including immunization rates.	4.50	4.44	x
CPR prevents prescribing medications to which the patient is allergic.	4.31	X	x
CPR aids interoffice communications with clinical staff.	4.54	X	4.6
CPR aids interoffice communication with administrative staff.	3.90	X	x
Satisfaction with amount of time spent on direct patient care.	4.40	X	x
CPR management of patients from check-in to checkout.	4.60	X	x
CPR aids in communicating patient information.	X	4.55	x
CPR aids in organization of patient records.	X	4.1	x
Satisfaction with overall integrity of business office information.	X	X	4.4
CPR ensures accuracy of coding for billing purposes.	X	X	4.2

5 = strongly agree; 1 = strongly disagree; X = question not given to this category of respondents.

Questionnaire adapted from Zdon and Middleton.⁷

the efficiencies of interoffice communication with the nonclinical staff and the clinical staff, their mean responses were 4.31 and 4.54 respectively.

Each step in the healthcare delivery sequence can be shortened because of better communication. With the CPR in this study, physicians can instantly transmit orders to nurses without interrupting the patient

encounter. Nurses can pass laboratory results to the physician while the physician is in the exam room—again without interrupting the encounter. All of this can be accomplished because of simultaneous access to the patient's medical record by any staff member.

Patient tracking within the office prevents patients from being overlooked by the office staff and allows the staff to perform the needed services in an order that suits both the urgency of the situation and the convenience of the patient. By simply reducing the time required to document most encounters by 1 to 2 minutes, the CPR can easily save a busy provider an hour per day. Pharmacy calls are reduced because the prescriptions are legible, the instructions are clear, and drug allergies are flagged. The instant communication within the office allows for the rapid turnaround time on patient telephone calls.

In addition to the actual advantages of the CPR, the paperless office avoids the disadvantages of the paper record. No one has to create the vast numbers of paper files. There are no lost medical records—this alone could save hours per day in most medical offices. There are no chart pulls or filing to be done. Illegible medical records are no longer a medico/legal issue. Lost messages are a thing of the past.

Improved Quality of Care

Five questions related to the physicians' perception of quality of care. Physicians strongly agreed (4.40) that the CPR adds value in delivering better patient care. They also agreed (4.50) that the CPR helps them practice better preventive medicine, including increased immunization rates. They agreed that the systems in place prevent prescribing medication that could result in drug allergies (4.31) and that the overall care their office delivers to their patients is of high quality (4.31).

Quality of care is a major advantage of the CPR over paper medical records. With the CPR there is instant and accurate summary-level information. The patient's problem list, medication list, allergies, and immunizations are the more common items that are extracted from each encounter and encoded into separate tables for easy access at any time in the future. This information leads to better management of interrelated problems, such as drug-to-drug interactions, drug allergy reactions, and missed vaccine opportunities. Improving the patient's visibility in the office through patient tracking prevents important life-threatening situations from going unnoticed behind a closed exam room door. Growth charts are accurate and effortless. Waiting times are reduced so that important medical issues can be dealt with in a timely manner. More time is available to the provider to spend directly examining and interacting with the patient. In turn, better patient care directly corresponds to greater physician satisfaction with his or her work.

Profitability

Increased profitability as expressed in a larger patient volume was reported by all three established practices during interviews and observations (see Table 2.1). All three practices are undergoing physical expansion of their offices. Several key features contributed to this. The CPR eliminates lost charges and reduces keystrokes in the front office. A physician who saves 1 hour per day because of faster documentation can use that time to see several more patients. The increased office productivity and time savings drive down overhead while increasing the practices' market share. The CPR has also allowed the practices to convert previous storage space into productive (profitable) space.

Other Lessons and Considerations

During implementation and subsequent observations of these five practices, lessons and considerations have emerged. Some of the highlights are noted here.

- The primary key to successfully automating workflow in the physician's office is communications: getting the right amount of information to the right people at the right time so that they can make good decisions.
- The automated workflow must follow the physician's manual workflow; the processes must be minimally reengineered.
- Any reengineering must simplify manual processes as much as possible.
- "Dynamic short lists" or templates must be configurable to the preferences of each practice and/or to the preferences of each physician.
- Physicians will engage in data entry when the process is rapid and simple.
- Physicians will enthusiastically embrace electronic charting when the process is rapid and simple and yields an accurate, comprehensive, and complete patient record in 2 minutes or less.
- Simultaneity in accomplishing office tasks yields significant time savings.
- If satisfaction levels are high, physicians will adapt their activities to take advantage of the computer and, if necessary, do work-arounds (i.e., stay late to do what cannot be done on the computer).⁸

Thoughts

Experts agree that the challenge for today's physician is to provide better patient care while reducing the cost of providing care. Many analysts agree also that significant increases in physician office productivity will not occur until the physician interacts directly with the computer. Along with others in this industry, we predict that practices and healthcare organizations that do not embrace the CPR and workflow automation will be woefully

unprepared for the massive changes still to come in ambulatory care. The results from the practices evaluated in this study, while not definitive, add weight to the proposition that a CPR that automates workflow has the enormous potential of producing satisfied physicians, better customer service, and lower operating costs. In the long run, those physician practices that provide the best customer service will gain the most customers and will continue—like the practices in this case—to steadily grow. Workflow technology for the physician’s office is here. Driven by the demands of physicians, patients, courts, and insurers, the migration to this new technology will surely be swift.

Workflow Concepts: The Challenges of Managing Healthcare Business Processes

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One of the most critical challenges facing healthcare organizations, group practices, hospitals, integrated delivery networks/systems, ambulatory clinics, and other similar healthcare/medical delivery environments is managing and improving the business processes inherent in the delivery of quality, cost-effective patient care.

These challenges arise because the output of any healthcare organization—patient care, outcomes management, disease management, and others—is a direct function of the output of its business processes. In the healthcare environment, business processes include scheduling, admission/registration, documentation of the inpatient/outpatient encounter, orders, protocols, treatment plans, clinical decision support, and insurance claims processing. These processes are complex and can be difficult to manage.

- The information needed to make decisions may not be readily available and may be scattered around the organization in many different forms: paper documents, word processing/transcription files, computer database files, images, wave forms, and others. Assembling the information takes time, if it can be done at all.
- Bad decisions may be made because critical information never reaches the clinician or other decision maker.
- Because of inexperience or poor training, business processing rules may not be applied consistently.
- Transition of work from one stage of the business process to another may be done slowly, incorrectly, or not at all, causing delays, errors, and possible mistreatment of the patient.
- Difficulties arise in locating and determining the status of tasks that are “somewhere” in the business processes. Often, users of the process can react to bottlenecks and overloads only after they become a serious problem. Changing business processes may require major retraining and lengthy “shakedown” periods before users can be assured that the process is operating reliably, making it difficult to respond to

changing patient requirements or to introduce new healthcare/medical offerings.

Tools for Managing Workflow Processes

Workflow technology helps to automate and improve business processes. It begins with an analysis of work processes in order to divide them into component tasks. Defining each task includes specifying the people who do the work, the information needed, the business rules for how to perform the task, the potential outputs, and the people who perform the next step in the process.

Once the tasks have been defined, workflow technology can be used to automate the process, including reengineering the process to optimize both the process and the automation technology.

- It assembles the information needed to perform each task, typically holding this information in a “case” or “folder” that moves through the process itself.
- It provides guidance on how to perform each task according to the correct business rules. In fact, workflow tools can be used to apply sophisticated business rules correctly and consistently.
- It directs the task, along with the information needed to perform it, to the appropriate person.
- It also speeds up a process by dividing a task into parts or parcels, coordinating the work of multiple people on the various parts or parcels, and reassembling the parts or parcels to complete the original process.

Workflow Technology Improves Processes

Workflow technology is a valuable tool for managing day-to-day operations as well as for improving business processes over time. Workflow technology can provide visibility into the location and status of work so that they can be monitored and, if necessary, expedited. Workflow technology makes it much easier to modify business processes or to introduce new ones in order to respond to changing market conditions. Less training and testing is required to implement change because workflow technology incorporates and automates business rules that can be applied to the performance of each task and to the routing of tasks throughout a process.

Benefits of Workflow

Workflow technology can increase productivity and quality by providing prompt, reliable routing of information and consistent enforcement of business rules so that fewer errors occur. It can also improve decision making

by delivering the right information to the right person in the right form at the right time. This can be images, data from a database, work processing/transcription documents, or any other computerized information. Workflow also provides data to measure and improve businesses processes on both a day-to-day basis and over time. The results:

- Lower costs
- Increased productivity
- Improved consistency and quality of patient care
- Improved healthcare provider satisfaction
- Improved patient satisfaction
- Greater organizational flexibility
- Improved utilization of resources
- Improved operational efficiencies
- Increased competitiveness

Workflow and Usability

VINSON J. HUDSON

Now that medical practice providers have administrative, financial, managed care contract management, and clinical information applications available, how will they use the captured and stored data? Providers are interested not only in application integration but in managing the many tasks required to deliver optimal care to a patient population.

The future of healthcare delivery is in ambulatory medicine that directs utilization of care to quality and cost efficient institutions. Therefore, for medical practice and ambulatory care enterprises to improve productivity through the next millennium, the flow of tasks that manage care must be better, faster, easier, and more effective. Processes and tasks are increasing in complexity, requiring quicker medical decision making. Vendors of information technology provide the component applications to automate individual tasks, but the toolsets to deliver chained tasks are lacking.

Computerization of health information in medical practices is attractive. Why? This is where the physicians are; this is where 80% of the national health expenditure is controlled; this is where large populations of patients are; and this is where quality healthcare must be delivered too manage costs. Typical individual practices spend a little more than 1% of their operating budget on information technology. This is too small an investment to achieve any reasonable productivity gains. However, their budget allocations, their current propensity to consolidate costs, and a current average information system solution expenditure of nearly \$12,000 per doctor makes them attractive to any information technology company.

There are pressures on medical practices to realize that an electronic practice management system is as essential as an EKG machine. They must accept that information systems can provide instant access to critical patient information, ease of placing orders, facilitation of data capture, required documentation of medical services, electronic authentication, flexible security, and several other functions to assist in managing care. When this occurs, an industry boom will be heard across healthcare delivery. The federal government's Evaluation and Management (E&M) codes and the regulations

of the Health Insurance Portability and Accountability Act of 1996 appear to be the catalyst for this explosion.

Integration is much more than linking data and applications. It is helping medical providers move on the issue of “what do I do next?” If a patient’s health outcome depends on a sequence of business and clinical tasks, how can technology help the doctor efficiently move through this workflow?

Workflow and Internet Technology

Workflow is a set of tasks that require sequential or concurrent cooperation from individuals interested in achieving a common defined goal. *Workflow automation* or management is the automated coordination, control, and communication of work, of both people and computers, in the context of business processes, through the execution of software in a network of computers whose order of execution is controlled by a computerized representation of the business processes.⁹

Standards allow organizations with different workflow systems to interact. They allow software component development to grow, giving a rich array of options for user organizations. Standards provide an infrastructure for inter-organizational process automation, which is essential to using workflow technologies.

In late 1993, the Workflow Management Coalition (WfMC), a nonprofit, international organization was formed. The organization has over 200 workflow vendors, users, and analysts that have progressed toward establishing vendor-independent workflow standards. The coalition has devised a framework called the Reference Model, which includes five categories (or interfaces) of interoperability and communication standards that allow multiple workflow products and related business process modeling tools to coexist and interoperate across the enterprise and within a user’s environment.

The interfaces defined by WfMC illustrate the workflow community’s concentration on flow:

- Interface 1 describes how to define a workflow process.
- Interface 2 describes how client applications can interact with a workflow process.
- Interface 3 defines how a workflow process can launch applications.
- Interface 4 describes how a work item can be transferred from one workflow engine to another.
- Interface 5 deals with the audit information produced by a workflow process.⁸

It is worth restating that medical organizations must have the following to thrive in the rapidly changing healthcare environment:

- A strategic solution to the problem of delivering care with superior quality at the lowest cost.
- A powerful information system that applies workflow technology to healthcare by automating clinical, financial, and administrative processes, orchestrating the work of people and other systems by delivering the right information to the right place at the right time.

Workflow automation is highly visible in several other industries. The healthcare delivery industry is still learning to put components together to automate the capture and storage of data in discrete functional areas. Medical organizations appear to be in the embryonic stage of process management. New approaches and applications are beginning in large enterprises that will gradually feed into smaller medical practices. Workflow will serve as an integral part of the practice's information management system. Also, since workflow automation coordinates people, work, and information, it will be used to leverage clinical intellectual property.

Five Workflow Architectures

Workflow technology is inherently based on the idea of coordination and collaboration. Therefore, architectural compatibility is needed. This goes beyond running existing workstations around Microsoft, Sun Microsystems, Netscape, and IBM.

Workflow is much more realizable through five distinct workflow architectures:

- **Fat client/fat server** A personal computer at both the client (user) and server nodes to address the back office and heavy transaction applications.
- **Thin client** A machine that offers processing features above the "dumb" terminal of the past and less than a full personal computer. It possesses some browser features specific to a single task (collecting vitals, entering orders, etc.). The thin client workflow architecture offers a full-featured intraorganizational alternative to traditional fat clients.
- **Internet-based** A portal to an automated process where third parties have only limited access to workflow functionality.
- **GroupWare-based** Addresses the cyclical nature of technology. It now goes beyond e-mail to connect users and route information. New Group Ware-based workflow integrates with the communication infrastructure GroupWare components, such as Java-based thin client architecture and GroupWare-based workflow.
- **Wide-area workflow** Offers the ability to visually model, measure, and automate information-based processes. It extends traditional workflow capabilities to an application model, providing universal accessibility to

workflow processes by separating the process from the application interface. Users can participate in a workflow process using client/server interfaces and integrated ancillary business applications, as well as via fax, telephones, e-mail, the Web, pagers, and wireless devices. Virtually any electronic medium can serve as the medium for a workflow process.

Application Orientation

Application orientation refers to the central focus of a workflow application. The orientation can be process-centric, document-centric, or communication-centric.

- **Process-centric:** The central focus is a set of pre-defined rules that make up a single process.
- **Document-centric:** The focus is on the assembly, creation, and overall management of single or multiple documents. The document is the process, and how the process evolves depends on the type of document and its content.
- **Communication-centric:** An inbound call initiates a workflow process, which could route the call using process rules and information gathered from the caller to ensure that he or she is linked with the right individuals(s).

Case for Medical Practice Workflow Automation

There is a good case for deploying workflow automation technologies in the healthcare delivery business:

1. Proactively managing patient care is rising to critical levels. A month's delay in assessing the treatment of congestive heart failure (CHF) patients, for example, can mean thousands of dollars of unnecessary expenditures. Effective patient/case/disease state management is not just an academic issue for healthcare enterprises; it's a strategic issue.
2. The ability of technology itself to address real business problems is improving. The merging of business practice and clinical systems can make deploying workflow technology complex. But it also means that complex business problems like managing utilization review, tracking the status of risk patients, controlling versions of protocol and guideline implementations, and verifying that all tasks have been completed can be addressed—dramatically increasing the payoff from deploying the technology. In addition, Internet-based solutions are driving down the cost of the technology to the user.

3. Outsourcing of traditionally internal processes is increasing. Although healthcare organizations are getting bigger, downsizing is occurring at the same time, increasing the need for outside expertise. This means an even greater need for an infrastructure to facilitate data exchange and collaborations with tasks managers.

4. Corporatization of medical practices is increasing as a major driver for the industry.

5. Insurers and payers are becoming more receptive to electronic submissions.

The use of workflow automation tools as a binding technology to improve health delivery organizations has taken root and provides a means for streamlining practice operations, reducing costs, and maximizing productivity.

Medical Practice Workflow Automation

A business process consists of a set of processes and tasks and (tasks that make-up a work process) the collection and assembly of their supporting content. When the work item content is relatively simple and the order of tasks is fixed with each performed by a different person, a map and workflow routing engine are important. This is the case with some of the early large-scale workflow implementations, such as insurance medical claims processing, where the work item is an imaged HCFA 1500 claim form with attachments and the process is very structured.

When the work item is a complex patient encounter environment, where there is a large amount of content and the order of the tasks and the medical staff person performing the tasks may not be fixed, other aspects of workflow become more important than routing. In a medical practice, it is critical that all work items contain consistent content, that the content is consistently processed, and that tasks are completed on time. Management of patient work item content is more important than patient work item routing.

Let us look at one of many complex examples:

1. A physician arrives at the practice in the morning and wants to log on to the information system. This physician may log on to more than one workstation (e.g., desktop, laptop, wireless, or nurses' station). When the physician signs on, certain messages automatically appear marked "Urgent," "Routine," or "New lab results."

2. The first patient arrives to check in. The receptionist can set an "arrive" flag that alerts the nurses' station that the patient is here. If this is a new patient, the receptionist registers the patient, creates an electronic medical record, and notifies the medical records department that a new chart needs to be created.

3. The patient is escorted to an exam room. At the nurses' workstation, the nurse enters a message to the physician's workstation that the patient has been placed in the exam room. The physician can view a list of scheduled appointments that is updated in real time. The system also shows the physician which patients are actually waiting to be seen and their urgency.

4. The physician sees a patient who has multiple problems. The system should show the steps needed to initiate a medication list and a problem list (including ICD-9 code). The physician should begin a progress note on the system for the current visit. The system should allow the physician to initiate dictation linked to the progress note (e.g., the CPR application calls a digital dictation line and allows dictation into telephone or microphone attached to the workstation).

5. The physician wants to review old lab results while in the progress note module. This entails moving back and forth between screens. It also includes links to an EKG machine for viewing the tracings.

6. Now a sequence of tasks is needed: Order lab (including ID-9); initiate referral to consultant, which includes a message and the referral to the insurer; check on status of referral to get approval/denial from health plan/insurer and the report from the consultant; generate a charge for the appointment, linking CPT and ICD-9 codes; and update the problem list to include some, but not all, of the diagnoses used for this visit (e.g., URI, warts, diabetes all used as diagnoses for current visit, but only diabetes is to be added to problem list).

7. The patient is now ready to leave and the following tasks are needed: write prescription for medications; write prescription for physical therapy; provide patient with updated medication list; provide patient with list of labs, consultations requested with locations of consultants; schedule a follow-up appointment; and schedule a reminder to be sent out (e.g., for routine repeat exam in one year).

8. The physician wants to alert all diabetic patients on oral agents that new medication has been approved. This entails generating a list of all patients with (a) diabetes listed on problem list and (b) a specified list of medicines (glipizide, glyburide, etc.) on the medication list.

9. The physician reviews a list of all patients with pending lab/consultations in progress, with a list of which labs have been completed and which have not been done; a list of all patients who have completed labs, where letters should be generated to notify patients of results; and a list of patients who are overdue for follow-up appointments (e.g., were sent a letter to return for Pap smear in one year but have not yet done so).

10. The nurse receives telephone and fax prescriptions refill requests during the day. The faxed refill requests are routed into the CPR. The nurse is reminded to forward the refill request to the physician and be notified when the physician has authorized it. Then the CPR sends fax authorizations to the pharmacies.

Workflow Future

Medical practice workflow management systems need to deal with the heterogeneity of platforms within and across cooperating enterprises along with legacy applications and data. At the same time, market forces are increasing demand for advanced features for supporting care delivery processes, which require adaptation through dynamic changes and scalability.

To achieve this, medical practices and vendors of information systems must clasp hands across the purchase table to meet the needs of both. Vendors must eliminate preconceived perceptions of what goes on in a medical practice and begin listening to the business and clinical needs of their customers. Medical practices must understand their needs so that they can articulate productivity requirements to vendors.

Workflow products are needed to handle complex physician's office work items. Some products will manage the work items and others will manage the flow of the work items from workstep to workstep. Practice management system applications may take advantage of either type of workflow product or both, depending on the nature of the application.

Notes

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