

Chapter 1

Identifying Stakeholders and Goals

To create a solid foundation for the clinical decision support (CDS) program, those responsible for its development should begin by identifying key stakeholders and working with them to establish goals and objectives. New teams and roles related to developing the CDS program and to realizing benefits from it will more than likely be required.

TASKS

1. Meet with key local committees, positions, and individuals engaged in activities pertinent to an organizational CDS initiative, and document their potential goals and objectives for the CDS program (Worksheet 1-1, page 17).
2. Synthesize and validate a unified working list of organizational goals and objectives for your CDS program. Break down each high-level goal into a set of more specific clinical goals, and then break down each clinical goal into measurable clinical objectives. Define baseline and target performance pertinent to each objective (Worksheet 1-2, page 19).

Key Lessons

- A successful CDS program emerges from, and in turn supports, key organizational **performance improvement** initiatives. Executive support for the program is vitally important.
- Program goals are determined from a thorough environmental survey of pertinent initiatives and stakeholders. A variety of external drivers and internal needs combine to drive priorities for development of CDS interventions.
- **Governance** and management structures and processes need to be established for the CDS program elements, which include intervention needs assessment, design, development, testing, **launch**, and evaluation.
- **Champions**—key supporters who are trusted by your staff—are an important resource for cultivating proper two-way communication about, and support for, the CDS program.

DISCUSSION

People: The Keys to Success

Although information systems process and deliver CDS interventions, a successful CDS program requires at least as much attention to *people* issues as it does to technology and information delivery. People determine the organizational needs and outcomes the CDS program will address and are a crucial factor in each step that determines whether or not these are achieved. Individuals must agree on specific CDS goals and objectives, and on which CDS interventions can help achieve their goals and objectives. They must support the implementation of CDS interventions, incorporate them into their **workflow**, and respond appropriately when they are delivered. These tasks can require significant behavior changes for both individuals and organizations. There is an extensive body of literature on successfully managing organizational change.¹ Reviewing these resources may prove useful in building your CDS program.

An essential first step in establishing a CDS program is identifying the key individuals, committees, and positions upon which the program's success will depend—we refer to these in this book as “stakeholders.” Effectively collaborating with these constituents is critical to CDS program success, and these relationships will be emphasized throughout the steps outlined in this book. Figure 1-1 lists various committees and roles that generally participate as stakeholders in CDS programs.

As you think about stakeholders, keep in mind that these roles and committees will interact with your CDS program in the context of your organization's overall governance and management structures and processes.

CDS Program Governance and Management

Even in relatively modest CDS programs consisting of a few CDS interventions, there are important decisions to be made and processes to be managed; CDS governance and management structures are therefore required to fill these needs. For example,

who will decide what issues will be addressed with CDS interventions? What is the nature and content of the CDS interventions? Who will be responsible for developing, implementing, and maintaining the interventions, and measuring their effects? These issues are handled differently in different organizations depending on the overall approach to governance and management and how related clinical and information technology (IT) initiatives are handled. Some organizations utilize existing clinical or IT/CIS committees. Increasingly, organizations are establishing dedicated positions, committees, and departments to manage the CDS program.

In either case, developing a CDS program as outlined in this book will often involve shifts in control and stakeholder interactions for various care processes. For example, CDS interventions focused on medication safety may affect the way the pharmacy and therapeutics committee, nurses, pharmacists, physicians, and patients interact at various stages in the medication management process. Ownership of process improvement by affected stakeholders should be fostered early in the development of CDS governance and management structures, particularly for any stakeholders that might be critical of the changes.

Figure 1-2, page 4, outlines different groups of CDS stakeholders and the functions of each with respect to the organization's CDS program. Figure 1-3, page 5, illustrates how these functions inter-relate in the program's life cycle. We will refer back to these figures throughout this book since they describe, in a generic way, an organizational framework for the many activities related to a CDS program. As your CDS program unfolds, you might find it helpful to use these figures to create an organizational chart and list of stakeholder roles and interactions within the program.

CDS Program Goals, and Clinical Goals and Objectives

CDS program goals consist of strategic targets, such as improved medication safety and improved cost

Figure 1-1: Stakeholders for individual CDS interventions and overall CDS program

Committees

- Pharmacy and Therapeutics
- Quality Assurance (organizationwide)
- Quality (Departmental)
- Patient Safety
- Utilization Review (organizationwide or departmental, such as blood product use)
- Medical Staff
- Residency/training
- Clinical information systems (e.g., implementation, oversight, benefits realization)
- Guideline/Practice Standards, Clinical Strategy, Disease/Care Management
- Medical Records

Positions

- Medical Director of Clinical Decision Support
- Chief Medical Officer/Medical Director
- Chief Medical Information Officer/Medical Director of Information Systems
- Chief Information Officer
- Pharmacy Director
- VP/Director of Nursing
- Quality Officer
- Patient Safety Officer
- Risk Management Officer
- Department Chairs
- Residency/Training Directors
- IPA/Physician Group chairs
- Legal Counsel

Other CDS stakeholders

- Clinicians vocal on clinical computing/CDS issues (positively or negatively)
- Clinical thought leaders
- Patients/patient representatives

effectiveness of care, which the organization plans to address with CDS interventions. The process outlined in this book emphasizes maintaining a tight

link between organizational priorities and the CDS program's interventions and results. Many businesses use management systems that link high-level

Figure 1-2: Generic outline of CDS program stakeholder groups and responsibilities

Executive leadership: sets strategy, clinical standards, allocates resources

Management/Oversight

- **Healthcare organization departments/functions:** responsible for processes/outcomes that will be affected by CDS program
 - **Clinical departments (e.g., laboratory, pharmacy, medicine, surgery)**
 - **Organized medical staff**
 - **Cross-cutting functions (e.g., quality, safety, disease management)**
 - **Clinical director of information systems/medical informatics**
 - **Other organizational committees and departments**
 - **CDS oversight/Benefits realization:** provides guidance/review of CDS initiatives
 - **CIO/IT steering:** responsible for IT infrastructure for CDS
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Implementation/Project management: develops, deploys, monitors CDS interventions

- **CDS-specific:** overall responsibility to deploy/maintain CDS knowledge assets
 - **General IT:** overall responsibility to deploy/maintain clinical information systems
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End-users and related positions

- **End-users:** recipients of CDS interventions (e.g., patients, nurses, pharmacists, physicians)
- **Related staff:** generate data for, or are affected by, interventions
- **Subject matter experts:** clinical authorities for content in CDS interventions
- **Clinical thought leaders and champions (i.e., clinicians respected and listened to by colleagues):** promote dissemination

goals to specific performance objectives and process outcomes.² These approaches will likely find wider application in patient care delivery as health system reimbursement is increasingly tied to clinical performance. CDS program goals will emerge from the interplay of external drivers and internal priorities and needs.

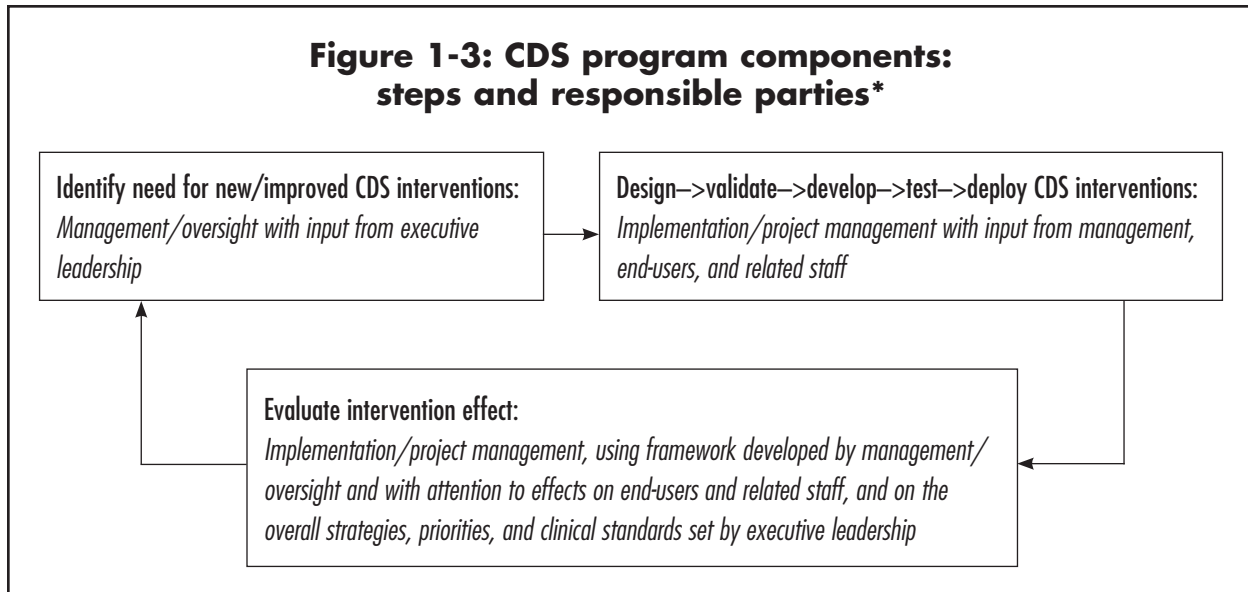
External Drivers

Quality Measures and Pay-for-Performance Programs

An important healthcare marketplace trend to consider as a backdrop for CDS programs is the emergence of pay-for-performance initiatives that more

tightly couple provider reimbursement to measurable value in the process and outcomes of care. Those who pay for care, including employers, health plans, and the federal government, have set up dozens of these programs, and many millions of dollars of performance-linked compensation have already been paid to physicians and hospitals.³

Pay-for-performance and related clinical quality improvement initiatives rely on quality measures. These measures address the extent to which healthcare services shown to improve outcomes are actually being delivered to patients for whom they are indicated. For example, both the **Joint Commission on Accreditation of Healthcare Organizations**



(JCAHO) and the **Centers for Medicare & Medicaid Services (CMS)** require hospitals to report quality measures, such as the percentage of eligible patients with acute myocardial infarction that are prescribed aspirin and beta blockers at hospital admission and discharge, and the percentage of patients admitted to the hospital with congestive heart failure who have a documented assessment of their left ventricular ejection fraction.⁴ The **Agency for Healthcare Research and Quality (AHRQ)** maintains a clearinghouse of evidence-based quality measures,⁵ and the **National Quality Forum (NQF)** endorses quality measures.⁶

Improving performance on these measures is an excellent target for CDS interventions, especially in circumstances when such improvement has a directly measurable return on investment (e.g., through a pay-for-performance initiative). An important step in determining objectives for a CDS program is, therefore, a careful assessment of external and internal quality initiatives that are affecting your organization, or might be soon.

CDS Functional Requirements and HIT Product Certification

Efforts are emerging to define necessary CDS functionality in CIS. Your organization may already be tracking them. These efforts include **healthcare information technology (HIT)** product certification by the **Certification Commission for Health Information Technology (CCHIT)**,⁷ the **Leapfrog** CPOE testing protocol,⁸ and minimum CDS requirements for electronic prescribing systems covered by the Medicare Modernization Act.⁹ More broadly, the **Office of the National Coordinator for Health Information Technology (ONCHIT)**¹⁰ in the United States is charged with facilitating “the effective use of information technology to improve the quality, efficiency, and safety of health care for all Americans.” This office likely will play an increasing role in matters related to CDS deployment. All these evolving initiatives are currently in early stages; readers are encouraged to check their latest status to determine what, if any, specific implications these efforts might have for your CDS program.

Internal Drivers

Those who are or will become CDS stakeholders in your organization may have already identified key

* As with Figure 1, this is an iterative process.

CDS-related priorities, such as improving the safety or cost-effectiveness of patient care, before a formal CDS program begins. There might even be initiatives under way in specific areas to address these high-level goals, such as improving performance on individual **National Committee for Quality Assurance (NCQA) HEDIS** measures¹¹ or CMS hospital quality measures,¹² or addressing specific JCAHO¹³ and NCQA¹⁴ accreditation requirements.

The CDS program is a toolkit for addressing those goals. It will require resources to develop, deploy, and evaluate the knowledge delivery interventions. The management buy-in for addressing the goals and objectives can help with securing these resources. For example, if there is organizational commitment to a disease management initiative, this support can be leveraged to obtain software, CDS content, and staff time needed to implement CDS interventions that further enhance the initiative's effectiveness.

In addition, support from clinicians who are concerned about specific clinical goals can help drive the behavior change that will be required to deploy CDS interventions aimed at that goal. For example, modified workflows will often be required to incorporate the interventions into daily routines. This change may initially require effort and patience. The more those affected (and their management) understand how the interventions serve important

organizational and patient care needs, the more successful they are likely to be in making the necessary changes.

The success of both individual CDS interventions and the overall CDS program therefore depends heavily on the extent to which the organization and its leadership are involved. Numerous studies show that more than just well-designed and user-friendly CDS **applications** are needed. Intervention acceptance and success also depends on skillful attention to communication, implementation management, ongoing focus on overall goals, and strong commitment from leadership.¹⁵ Figures 1-1 through 1-3 help identify the specific stakeholders in these activities and map their interactions within the CDS program. Organizations that have effectively deployed CDS interventions share success factors summarized in Figure 1-4.

Figure 1-5 lists some high-level goals that many healthcare organizations are working on and that could be addressed within a CDS program. These can serve as a starting point in thinking about what goals might be particularly opportune for CDS in your institution. Note that each CDS goal in this figure is broken down into more specific goals and objectives. This goal decomposition is a key step toward identifying appropriate CDS interventions, and will be explored in more detail shortly.

Figure 1-4: CDS program success factors

- Deep executive support for clinical quality improvement and belief in the value of information technology to help achieve it.
- A history of successful clinical information technology projects, fostering a strong belief among clinicians and organizational leaders that CIS are valuable and desirable tools.
- Excellent communication about the clinical and technological nature of the CDS program to all involved stakeholders.
- Involvement of key **users** and clinical champions well in advance of the implementation of any new CDS program.
- Strong support and rapid problem resolution by project staff before, and especially during, early implementation.

Figure 1-5: Examples of organizational CDS goals and corresponding clinical goals and objectives

High-level CDS Goal	Typical Clinical Goal	Typical Clinical Objective
Develop disease management/condition-specific initiatives to improve outcomes for particular complaints, diagnoses or procedures (e.g., diabetes) ¹⁶	<ul style="list-style-type: none"> • Decrease complications associated with target diagnoses (e.g. diabetic kidney disease) 	<ul style="list-style-type: none"> • Increase number of diabetics who receive annual screening for proteinuria
Improve overall care safety	<ul style="list-style-type: none"> • Minimize adverse drug events • Optimize critical information transfer among clinicians within hospitals, inpatient and outpatient clinicians, generalist and specialist clinicians 	<ul style="list-style-type: none"> • Decrease occurrence of severe drug interactions • Decrease inadequate follow-up of critical test results, such as abnormal biopsies, radiological studies, and laboratory tests
Optimize reimbursement for care	<ul style="list-style-type: none"> • Increase percent of patients with target conditions who meet pay-for-performance criteria • Improve billing levels and appropriateness 	<ul style="list-style-type: none"> • Increase percent of eligible patients with heart attack given beta blockers on arrival at the hospital • Improve coding levels from ambulatory encounters
Optimize cost-effectiveness of care	<ul style="list-style-type: none"> • Improve appropriateness of referrals • Reduce unnecessary tests • Reduce inpatient length of stay 	<ul style="list-style-type: none"> • Reduce unnecessary referrals for Pap smears • Reduce overly-frequent x-ray studies
Enhance patient education and empowerment	<ul style="list-style-type: none"> • Optimize patient adherence with indicated screening tests for preventive care 	<ul style="list-style-type: none"> • Increase percentage of eligible women who receive screening mammography
Foster compliance with clinical guidelines, ¹⁷ evidence-based practice, ¹⁸ and reporting and regulatory requirements ¹⁹	<ul style="list-style-type: none"> • Optimize performance on specific quality measures 	<ul style="list-style-type: none"> • Offer Chlamydia screening to all eligible women
Address clinicians' recognized and unrecognized information needs	<ul style="list-style-type: none"> • Provide "just-in-time" relevant treatment information for a disease/condition, within clinical workflow 	<ul style="list-style-type: none"> • Address the majority of questions clinicians pose to computer-based resources within two minutes

Determining CDS Targets

The discussion about identifying stakeholders and categorizing potential CDS goals outlined above provides the framework for determining high-priority targets that your organization will address with CDS interventions. A variety of processes that can help with this selection, some of which your organization already may be using, are outlined in Figure 1-6.

It is often the case, especially in larger organizations, that there are relatively independent efforts focused on similar objectives. For example, two different clinical departments might be pursuing care improvement efforts (such as focusing on safer and more effective heparin administration) that could benefit from richer cross-fertilization. Identifying such synergies is an important benefit of a thorough environmental analysis for the CDS program.

The survey of local initiatives may uncover potential new goals and objectives. For example, discussions with key stakeholders might reveal that some of the issues listed in Figure 1-5 are not being addressed but should be. As you flesh out the specific targets of greatest importance to address in the CDS program, you can consider some of the categories and examples outlined in Figure 1-7.

Ideal targets for CDS interventions might be

- Patient management issues that occur frequently;
- Activities that are associated with a significant gap in performance or a missed opportunity to optimize care;
- Care events in which the performance shortfall substantially boosts clinical costs or lowers quality and safety; and
- Activities in which performance can be improved through better distribution of knowledge, improved communication or heightened awareness.

Issues that occur less frequently, but which could have catastrophic consequences, are also potentially attractive candidates for decision support interventions. Figure 1-8, page 10, is a draft heuristic that illustrates how these factors relate in suggesting the overall desirability of addressing any individual objective.

Once an organization begins deploying CDS interventions, various stakeholders typically approach those responsible for the CDS program with requests to add new interventions that address specific needs. Standards for how such requests are submitted and prioritized can be helpful in ensur-

Figure 1-6: Sources for determining CDS targets

- Institutional analyses of quality, safety, patient satisfaction, cost, and regulatory problems (e.g., from committees such as pharmacy and therapeutics, quality assurance, patient safety, utilization review, or others)
- High-level committees that prepare the overall response to environmental drivers, such as accreditation requirements (e.g., related to care safety and quality), pay-for-performance, and related quality measurement/improvement initiatives
- Technology-supported analyses and mining of local care and outcomes, conducted in-house²⁰ or with support from vendors
- Interviews with clinicians, medical directors, and other stakeholders
- Surveys assessing stakeholders' CDS-related activities, needs, and priorities
- Direct observation of information needs in clinical settings
- Community-based priorities and programs

Figure 1-7: Some categories and examples of clinical goals and objectives

Target	Examples/References
<ul style="list-style-type: none"> • Clinical interventions for which there is strong evidence that patient benefit outweighs potential harm 	<ul style="list-style-type: none"> • Interventions identified in evidence-based clinical practice guidelines²¹ • Interventions marked as “beneficial” in Clinical Evidence²² • Findings in AHRQ Evidence Reports²³
<ul style="list-style-type: none"> • Clinical interventions for which trials have demonstrated that CDS approaches are or might be effective in improving healthcare processes and outcomes²⁴ 	<ul style="list-style-type: none"> • Practices supported by evidence²⁵ • Practitioner performance²⁶ • Medication safety²⁷ • Disease management²⁸ • Chronic care management²⁹
<ul style="list-style-type: none"> • Institute of Medicine (IOM) priority areas for transforming healthcare quality 	<ul style="list-style-type: none"> • Asthma, diabetes, hypertension, immunizations, patient self-management¹⁶
<ul style="list-style-type: none"> • National quality measures, especially those being investigated in “pay for performance” pilots (such as those linked to management of acute myocardial infarction, community acquired pneumonia, heart failure, among others) 	<ul style="list-style-type: none"> • CMS Hospital Quality Initiative³⁰ • Medicare Physician Group Practice Demonstration³¹ • JCAHO/CMS initiative to align hospital performance measures³² • Leapfrog Group; Rewarding Results³³ • Bridges to Excellence³⁴
<ul style="list-style-type: none"> • Results of systematic analyses of clinical errors or quality problems 	<ul style="list-style-type: none"> • USP MedMarx database³⁵ • HHS patient safety reporting systems³⁶ • McGlynn et al. The Quality of Health Care Delivered to Adults in the United States³⁷ • NCQA State of Health Care Quality report³⁸ • Preventing adverse drug events³⁹ • Types of medical errors⁴⁰
<ul style="list-style-type: none"> • CDS interventions addressed in CIS certification programs, and government-supported CIS initiatives 	<ul style="list-style-type: none"> • Certification Commission for Health Information Technology⁷ • e-prescribing covered under Medicare Modernization Act⁹ • Doctors’ Office Quality Information Technology (DOQ-IT)⁴¹

Figure 1-8: Factors affecting the desirability of a CDS objective

Clinical Objective Value Score = $(P+O+C+N+G)-(D+C)$, where*

P= Patient impact (individual/population) (positive, e.g., quality, safe, cost-effective care; improved morbidity and mortality, of interest to patients)

O= Organizational impact (positive, e.g., regulatory or audit compliance, appropriate resource use, liability)

C= Clinician impact (favorable, e.g. enhanced workflow; consistent with consensus, local standards, feasible to address, of interest to clinicians)

N= Number of patients positively affected

G= Gap between ideal and actual behavior pertinent to the intervention

D= Difficulty associated with addressing the objective

C= Cost of addressing the objective

ing that limited resources for implementing CDS interventions are effectively applied. The variables and relationships in Figure 1-8 can be used in this prioritization.

Keep in mind that just because an organization has the capability to deliver CDS interventions, this might not necessarily be the most appropriate response for every problem. In some cases, a better approach might involve some care process modification (to workflow or policies) that does not involve clinical knowledge delivery.

Stakeholders Revisited

Identifying Champions

Dialogue about potential CDS goals, objectives, and strategies will primarily involve the governance and management levels in Figure 1-2. As these interactions unfold, various stakeholders might take a range of positions regarding the CDS targets and the prospect of addressing them with CDS interventions. Those who are strongly supportive of the CDS program in general, or specific interventions, are potential champions.

Identifying and cultivating champions early in the process is an important component of success.

Champions represent the interests of the front-line users and form a vital bridge between the proponents of a CDS program or intervention, and the front-line clinicians, staff, patients, and others whose activities will be most affected by CDS. Champions have been defined as “the smallest group of persons to whom everyone else will listen.” They should have considerable involvement early in the development of a program or intervention; their concerns should be heard and addressed attentively. In turn, champions can help explain the emerging CDS program to their peers, speaking as a trusted colleague, and win and maintain support at the executive and management levels.

In addition to looking for champions among formal governance and management leadership, consider other opinion leaders in the organization to whom others will listen. This latter group can exert substantial influence over the collective attitude of an organization toward the CDS strategies and tactics. These people may include leading clinicians, others who may have achieved recognition for their work, and prominent patient advocates.

* The strength of objective, systematic evidence about the magnitude of the variable should be considered when practical.

Working with Implementation Champions

Many of the tasks outlined below will occur during the implementation phases of the CDS program described in later chapters. However, understanding the full scope of potential work with champions early in the process can help you establish a solid and extensible foundation for collaborating with these stakeholders throughout the program life cycle.

In later implementation stages, such as CDS intervention development, testing, and **rollout**, a broad set of stakeholders will come into play. These include departments and roles where work relates to the clinical objectives of interest, or might be affected by corresponding CDS interventions. Also involved are those who capture data necessary to trigger clinical **alerts, reminders**, and other proactive CDS interventions. Champions should be sought among these groups to ensure that all available support is effectively utilized from those who will be affected by the program. Note that this broader set of implementation stakeholders can come from all levels in Figure 1-2.

After identifying who might serve as a champion for one or more CDS interventions, the next step is to engage these individuals to support the program. Asking departmental and administration leaders for nominations can effectively leverage the organizational structure, but other volunteers also should be widely and directly solicited. Demonstrations of the proposed interventions may help enlist this support. In addition, direct observation of individuals performing their jobs both may help identify those whose jobs may be affected by the interventions as well as provide a natural opportunity to recruit such individuals as champions.

A process should be put in place for developing and maintaining champions as a productive and helpful resource for the CDS program. Training on the technical and clinical aspects of proposed interventions is important so that all champions share a common and accurate understanding of the use, advantages, and limitations of the proposed system. Regularly requesting advice from the champions

about system issues (configuration, interface design, content of interventions, etc.) and deployment issues, and then providing feedback regarding the disposition of these suggestions, is important to give the champions a sense of project ownership and to maintain their motivation.

In turn, the champions can serve as ambassadors to their co-workers and departments in promoting the interventions, supporting training efforts, soliciting advice, providing feedback, and helping in other ways as an ongoing resource for promoting successful intervention use and evolution. For CDS interventions likely to be controversial and/or disruptive to workflow, working closely with champions as a link to the affected community can mean the difference between intervention success and failure.

Since the time commitment required of champions can be significant and their role can be so essential to CDS program success, many organizations will compensate key champions. This often takes the form of including this role explicitly in job responsibilities and setting aside work time specifically to accomplish pertinent tasks. However, not all champions require compensation, especially for more modest levels of program support. For many, the opportunity to help shape the CDS program and generate its **desired outcomes** may be ample compensation.

Not Everyone Is a Champion

Many stakeholders will not be as positive about the CDS program and interventions as the champions. Thoughtful individuals might be neutral, or be “**resistors**” who push back, or “**detractors**” who actively work against the proposed plan. Keep in mind that these individuals may be those whose work is affected in some way by the intervention, as well as those who are its intended recipients. It is essential to engage resistors and detractors in active dialogue—they can be a critical source of feedback about the program and play an important role in its success or failure.

The CDS team should work to fully understand their concerns, since usually they reflect legitimate issues with the underlying approach. As such, these concerns should be addressed to the extent practical, particularly for any common themes that emerge. This should be done early in the development and implementation process to reduce problems later that could potentially derail the intervention or program.

Solid clinical leadership can help minimize the negative effects from issues that cannot immediately be resolved. This leadership involves clearly setting goals and expectations, communicating often and effectively, and modeling and reinforcing desired behaviors regarding the CDS program. Implementers often find that thoughtful attention to resisters' and detractors' concerns will convert them into the most fervent champions. We will revisit working with champions, resisters, and detractors in subsequent chapters.

Cost-justifying the CDS Program and Preparing to Realize Benefits

Selecting, developing or procuring, deploying, and evaluating CDS interventions to improve outcomes will consume a significant amount of your organization's limited resources, including time, attention, effort, staff and capital. Reaping the desired clinical and financial return on this investment requires careful attention and effort focused on benefits realization.

Benefits Planning and Realization

Benefits realization from clinical information systems requires a systematic approach. Experts in this field are beginning to define its essential elements.⁴² Key organizational steps to realizing benefits from clinical information systems (including CDS interventions) are listed below, with each followed by the chapter in this book that explores that step in depth.

- Organizing for benefits with a benefits realization team (Chapter 1);

- Designing explicitly for benefits (Chapter 3);
- Planning for benefits by addressing change management issues during system implementation (Chapters 4 and 5);
- Measuring the benefits (Chapter 6); and
- Accountability for benefits (Chapter 6).

So far in this chapter we have discussed examining organizational structures *already in place* that might interplay with CDS interventions individually or with a more comprehensive CDS program. More robust CDS programs will generally require new, or at least modified, organizational roles and teams. One such team to consider is a performance improvement or benefits realization team.

The CDS goals and clinical goals and objectives outlined in Figure 1-5 are associated with the business goals listed in Figure 1-9. A benefits realization team can assume responsibility for defining and validating these goals and objectives, helping determine accountability for the benefits, ensuring that CDS interventions and corresponding process changes help achieve them, and measuring and reporting progress toward the targets. This team can also help educate internal stakeholders about the expected benefits and efforts to realize them, and report the achieved benefits externally if desired (e.g., via journal articles or society meetings).

In smaller organizations or narrowly focused CDS programs, available resources might be limited to a single individual and role responsible for these functions. Conversely, in large organizations or comprehensive programs, the functions might be spread across several roles and groups outlined in Figure 1-2.

To accomplish these goals, a benefits realization team ideally includes individuals with technical expertise; clinical, administrative and financial operational experience; and medical informatics-related health services research experience. Because CDS interventions often involve many areas in the organization, the benefits realization team should be richly interdepartmental. However, it should be more than a collection of department heads or rep-

Figure 1-9: Types of business benefits that can accrue from CDS programs

- Reduced resource wasted due to redundant and inefficient activities to support clinicians' decision making
- Reduced costs of care (e.g., via more appropriate testing, cheaper and more appropriately utilized medications and therapies, reduced staff rework and better care delivery coordination)
- Reduced costs associated with medical errors (e.g., from legal liability and averted safety problems, and additional work, tests, therapies to remediate them)
- Reduced liability insurance premiums based on demonstrably improved safety
- Increased revenue (e.g., from pay for performance incentives)
- Increased market share (e.g., from more engaged and satisfied patients and demonstration of high-quality process and outcomes)
- Improved staff retention (e.g., by providing a high quality professional knowledge management and decision support environment)
- Improved staff utilization (e.g., redeploy QA nurse from chart reviews to CDS implementation)
- Enhanced leverage to improve outcomes from investments (and data) in CIS
- Enhanced quality of healthcare professional education provided by the organization
- Improved health services research capabilities and ability to attract grants

representatives. Creating a benefits realization *function* to underpin the team enables focus beyond the sum of individual operating department responsibilities. This combination of expertise and participation will help ensure that new CDS interventions are effective and that analyses of these effects are credible. Because the CDS targets are generally closely related to the organization's core mission, the CDS benefits team should report directly or indirectly to executive leadership.

Cost Justification

It is against this backdrop of anticipated benefits that the costs associated with CDS interventions and programs should be approached. For some organizations, this investment is implicitly considered necessary to accomplish its clinical quality-related mission. In other organizations, a more explicit justification will be helpful to obtain the needed resources and

support. If initial CDS interventions (e.g., links to online reference materials) will be implemented for some reason in a very limited way without involving organizational governance, then cost-justification at this point might not be a major issue.

Many organizations using this book will already have made substantial investments in CIS, perhaps including CPOE or EMR, and will, therefore, have a framework for cost-justifying the CDS program elements. Though there might be a tendency to consider this program as a component of the IT strategy (especially if its resources are budgeted under IT), its broader implications and more direct coupling with the organization's overall strategy should be clear by now.

As with any cost-justification, it is important to compare the full spectrum of resources consumed and benefits realized both with and without the new approach that is the subject of the cost-justification; in this case, an individual CDS intervention or a

suite of such interventions within a CDS program. The cost justification, therefore, includes considering resources such as staff, dollars, time, and energy currently applied in addressing a particular goal or objective. It also includes the results achieved from this investment, with the costs and results associated with a more coordinated approach to applying knowledge resources to address the target.

Consider, for example, the case of medication safety. In many organizations there are a variety of stakeholders in addressing these needs (e.g., patients, nursing, pharmacy, medical staff, and pharmacy and therapeutics committee) who might not be working on this important issue in an optimally effective and efficient manner. Besides the direct costs (e.g., related to adverse drug events) and quality implications of a suboptimal organizational approach to medication management, the time spent by pharmacy and therapeutics committees and other stakeholders on these matters can be very expensive. Cost savings can be realized through a more focused and coordinated approach to delivering essential knowledge to stakeholders (e.g., via well deployed reference information, alerts, and calls by pharmacists) that would emerge by addressing this issue within a carefully developed CDS program. These savings can accrue as a result of targeting resources to high-yield opportunities for improvement, reducing redundant and inefficient efforts, and avoiding quality and safety problems (and their associated costs) that might otherwise slip through a fragmented safety net.⁴³

In general, cost-justifications and performance improvement targets should be based on available literature when possible. A variety of studies have suggested that substantial savings can accrue from applying CDS to the medication management process. For example, preventable adverse drug events in hospitals have been estimated to generate \$4,685 in excess costs per event, averaging \$2.8 million for a 700-bed teaching hospital.⁴⁴ An analysis of CPOE in ambulatory settings suggests that \$2 billion could be saved in the U.S. through

their ability to prevent these adverse events.⁴⁵ One hospital described a \$5–10 million return on investment from its advanced CDS interventions.⁴⁶ Other analyses have yielded lower estimates for the cost of adverse drug events, but even if the actual savings are only a fraction of the higher estimates, the financial benefits to an organization over time would be quite substantial. This is especially true when one factors in costs associated with litigating and settling malpractice actions resulting from adverse drug events, and the suboptimal use of staff time in preventing these events.

The business benefits outlined in Figure 1-9 that can accrue from well-implemented CDS programs can be used to generate financial benefits estimates needed for cost justification. The first bullet in the figure speaks to inefficiencies and other problems associated with procuring, maintaining and disseminating knowledge interventions on mission-critical matters in a suboptimal and uncoordinated manner across an organization. This item alone leads some organizations to ask, “How many versions of the truth can we afford to support?” and conclude that they cannot afford *not* to have a coordinated CDS program to address high-priority goals.

Analyzing the anticipated costs and benefits of a proposed CDS program in the context of current practices provides the foundation for a business case for the program, including areas likely to produce the greatest yield. While it will be straightforward to quantify some elements, other elements (e.g., healthier and more satisfied patients) may not be directly quantifiable, though their intangible or strategic value should be documented nonetheless. If a benefits realization team is in place or can be adapted from other existing teams, it would naturally serve as the focal point for developing this case. In many instances, though, the impetus for creating a CDS benefits realization or performance improvement team will arise as a response to an initial business case (formal or informal) for the CDS program.

Business literature and other resources are available to help those organizations interested in formal

cost justification.⁴⁷ In these cases, it is useful to work closely with the organization's financial officer on articulating the CDS program's clinical, strategic and financial value, in addition to the costs.

Chapter 6 will discuss in detail assessing the value of the CDS program after it has been implemented. At that point you will validate the value proposition you began establishing at the program's inception.

WORKSHEETS

This book is intended to support the development of a comprehensive organizational approach to improving outcomes with CDS; it is also intended to support the development of individual interventions surrounding a single goal or objective. For many institutions, it is assumed that the organizational survey of stakeholders and goals will be comprehensive. The resulting CDS program, therefore, will ultimately be broad in scope and deep in interventions deployed to address the wide range of clinical goals. In other organizations, a CDS program will begin as a more focused effort to address a particular need with a focused group of stakeholders.

In either case, CDS interventions will focus on specific goals. Since many of the worksheets focus on managing individual goals, there will actually be a set of worksheets that characterizes the activity pertinent to each separate goal within the CDS program. For example, two sample versions are presented below for Worksheet 1-1. The first addresses the stakeholders and goals pertinent to a comprehensive CDS program, and the second is directed toward a more focused CDS initiative. Depending on the scope of your CDS initiative, you can either attempt to consolidate all elements of your CDS program pertinent to each worksheet in one document or maintain a set of worksheets corresponding to the various goals covered by your program.

Step 1: Identify and contact the key local committees, positions, and individuals currently in place that will have a stake in the CDS program, either by proposing, validating, sup-

A Note on the Worksheets and CDS Program Scope

The worksheets are designed so that you can actually use them to gather and analyze data in the process of building your CDS program. Throughout this book, we have included recommendations and sample data to give you an idea of how to fill in each worksheet. The CDS goal of improving anticoagulation management, together with related CDS interventions, threads throughout the sample worksheets to illustrate how the data builds and the program unfolds from sheet to sheet. Blank, electronic versions of worksheets are available from the book's Web site (www.himss.org/cdsguide) for you to download and use.

We recommend compiling these worksheets into a notebook. This is a convenient way to bring together documentation on all the details of your unfolding CDS program (e.g., its specific goals and objectives, CDS interventions, and results). The notebook (in print and/or an electronic version) can be a useful tool in the many different interactions with stakeholders recommended throughout this book. These include developing and getting feedback on CDS targets, creating and validating intervention specifications, and evaluating results and planning enhancements. It also provides a detailed, tangible source for answers to questions about the history, status, and plans for the CDS program.

porting, communicating, or using the CDS interventions (see Figure 1-1, page 3). Begin considering their current roles and activities and how they might relate to a more coordinated CDS program. Consider also new positions and teams that might be needed to ensure the program's success. Use Worksheet 1-1 to document potential CDS goals and clinical goals and objectives of importance to, or already being addressed at, your organization.

You can use Figure 1-1 to create a list of key stakeholders in your organization's current and emerging CDS efforts and begin assessing their current and potential role in these efforts. Think broadly about potential stakeholders, as suggested in the stakeholder discussion on pages 17–18. For example, pay careful attention to those individuals whose behavior might require change due to the CDS program.

In your survey, broadly consider the scope of potential CDS initiatives (e.g., as suggested by Figures 1-5 and 1-7) to avoid missing important opportunities that might otherwise be overlooked. Look carefully at the case management activities in your organization. These initiatives often are quite labor-intensive and could be ripe for CDS interventions. If your organization has or is contemplating a clinical transformation process to improve operations and outcomes, seek ways to ensure that this transformation process and the CDS program are mutually supportive and tightly integrated.

Similarly, look for pertinent initiatives under the following headings: patient safety, quality improvement, care improvement, clinical pathways, disease management, or strategic initiatives. These, too, will be prime candidates for tight integration with the organization's CDS efforts.

Specific CDS goals and objectives that are important in your organization will emerge from dialogue with the stakeholders listed in Figure 1-1. Worksheet 1-1 can be used to document these discussions. CDS interventions focused on issues of

greatest importance to the organization will have the best opportunity to succeed.

Because different constituencies (such as management, clinicians, and patients) might have different perspectives on the importance of each goal or objective, consider these perspectives individually and collectively. For example, CDS interventions focused on goals that are a high priority for management, clinicians, and patients will likely receive the sustained focus and support that are required for successful implementation. Conversely, interventions focused on goals that are of low priority to one or more of these constituents will have less chance of succeeding.

Strong imbalances in the priority given to a goal or objective among different stakeholders can indicate the need for dialogue and education to achieve a shared vision on the issue. Reconciling such differences before specific CDS interventions focused on the goal are developed and implemented could save significant time, aggravation, and money.

Step 2: Synthesize and validate a working list of CDS goals, and clinical goals and objectives for your CDS program. Define baseline and target performance for the clinical objectives.

The analysis in Worksheet 1-1 of current and potential clinical goals within your organization provides the foundation for synthesizing and prioritizing the CDS program goals. Prioritizing can be important if limited resources or other factors tightly constrain the number of issues that the CDS program can contemplate at one time. It might be useful to first begin developing detailed clinical goals and objectives for the CDS goals and focus areas that are expected, based on Worksheet 1-1 data, to be of greatest importance to your organization.

In Worksheet 1-1 you began breaking down clinical goals into measurable objectives based on stakeholder discussions. It is important to think more comprehensively about the range of objectives that might be helpful in achieving the goal. To help prepare for measuring progress toward CDS targets, Worksheet 1-2 includes a column for documenting

Worksheet 1-1: Stakeholders, goals, and objectives

*This worksheet is used to document your discussions with stakeholders about their priority clinical goals and objectives, as outlined in this chapter. Careful attention to **all** key stakeholders cannot be overemphasized. With Figures 1-1 and 1-2 as guides, list each stakeholder in the first column.*

In the next column, indicate the role that this person or group will play in the CDS program (e.g., from Figure 1-2). You should also note whether they are a potential champion or resistor/detractor for addressing a particular goal or objective (that you will list in the next columns) with CDS interventions, and whether they might play a key role in obtaining resources or funding.

In the third column, list the high level clinical goals that emerged from your discussions as important to this person or committee. These goals define broad care processes or outcomes that you will address with CDS interventions. Besides listening for spontaneously-offered stakeholder priorities, use the sources in Figure 1-6 to probe for organizational focus on the goals in Figure 1-5.

In the fourth column, break down the goals you have elicited into their component clinical objectives. The more specific and quantifiable you make these objectives, the more likely you will be to devise interventions that produce measurable results. For example, an objective such as “improve prescribing practices for heparin” will likely be less useful than a more specific one, such as “decrease incidence of heparin overdose.”

Example 1: Focused Program

Stakeholder(s) (Title)	Role	High Level Clinical Goals	Clinical Objectives
Melinda B. (Chief Medical Officer)	Proponent, clinical thought leader; budget owner	Anticoagulant safety	Improve subcutaneous heparin prophylaxis for post-surgical patients
John A. (Chief Nursing Officer)	Proponent, clinical thought leader	Anticoagulant safety	<ul style="list-style-type: none"> • Reduce bleeding complications in the cardiology areas • Improve checking of partial thromboplastin time (PTT) in patients on intravenous (IV) heparin • Improve checking of CBC in patients on IV heparin • Improve compliance with care guideline for when to choose subcutaneous heparin versus low molecular weight heparin

Worksheet 1-1 continued

Example 2: Comprehensive Program

Stakeholder(s)	Role in CDS Program	High Level Goals	Clinical Objectives
James C. (Chief Quality Officer)	Proponent, general quality leader	Disease-specific prevention (outpatient)	<ul style="list-style-type: none"> • Improve checking of urinary protein and eye exams in diabetics • Improve prescription patterns for asthmatics on inhaled steroids
		Antibiotic utilization (inpatient)	Improve compliance with antibiotic prescriptions based on culture data
Claire D. (Chief Nursing Officer)	Detractor	Accuracy of nursing documentation	Improve likelihood of advanced directives being reviewed with patients
			Improve accuracy of allergy documentation
Ken V. (Director of ICU)	Proponent, clinical thought leader	Ventilator management	Reduce number of patients receiving paralytics
			Reduce ventilator-associated lung injuries
		Management of pressors for blood pressure support	Reduce use of high dose norepinephrine as opposed to multiple pressors
Eric E. (Director of Oncology Service)	Proponent, clinical thought leader	Management of patients in bone marrow unit	Decrease likelihood of high dose chemotherapy being started too late after admission
			Reduce vancomycin overutilization in patients with neutropenic fever

Worksheet 1-2: Objectives and performance

This worksheet helps integrate, prioritize, and refine the survey of clinical goals and objectives. You can generate a separate version for each of the priority high-level clinical goals you documented in Worksheet 1-1; these goals are listed at the top of each copy of Worksheet 1-2. Much of the data needed to complete this worksheet will be derived from interactions with stakeholders and committees as part of completing Worksheet 1-1. Therefore, you can begin working on Worksheet(s) 1-2 as part of that survey as soon as key themes begin to emerge.

In the first column of each version of Worksheet 1-2, you can more comprehensively define a set of clinical objectives required to achieve the goal. Then, in the second column, you can identify workflow-based processes and actions that will address each objective. For each action, use the third column to document (as quantitatively as is practical) the baseline performance level of that action. The fourth column is used to record the desired outcomes (again, ideally in a quantifiable way) that would indicate success in achieving the objective.

Several key issues mentioned above should be recorded in the Notes column. These include rationale for pursuing the objective, key stakeholder(s), and major initiatives currently in place to address this objective. In addition, matters pertinent to CDS cost-justification (e.g., inefficiencies and opportunities in current approaches) should be documented as well.

Your stakeholder and environmental survey of CDS opportunities may identify more important clinical goals than can comfortably be addressed at this stage of your program. The information in the notes column can help prioritize your Worksheet(s) 1-2 (i.e., those with the strongest momentum, rationale, cost/benefit opportunity) and might be logical choices for next-round CDS efforts.

The example below uses the focused example from Worksheet 1-1.

Clinical goal: Anticoagulation Improvement Program

Clinical Objective	Desired Action	Baseline Performance	Desired Outcomes	Notes
Improve post-op heparin prophylaxis	Entry of physician order for subcutaneous heparin	Review of inpatient order entry data reveals approximately 62% compliance on the three surgical wards.	100% compliance for appropriate patients, defined as no history of neurosurgery or other major bleeding risk and no history of heparin related allergy or problem in the past	Objective is big push for quality officer; lots of time and attention being devoted to the gap; interest in exploring CDS to help make current improvement approach more efficient and effective
Improve monitoring for PTT on a timely and regular basis	Order for PTT entered by physician	88% of reviewed patients have PTT ordered within the first six hours	100% compliance	

Worksheet 1-2 *continued*

Clinical Objective	Desired Action	Baseline Performance	Desired Outcomes	Notes
	Collection of PTT by nursing	66% of reviewed patients had PTT collected within the first six hours	100% compliance	Some wards are not staffed with nursing assistants, leading to delays in drawing the PTT
	Reporting of PTT by clinical laboratory	59% of reviewed patients had PTT reported within the first six hours	90% compliance, allow for some delay based on time of day and lab reporting schedule, but only one hour leeway	Shift changes seem to have a big effect on the delay to reporting of PTT
Improve compliance with care guideline for enoxaparin and subcutaneous heparin	Order for enoxaparin in patients admitted with deep vein thrombosis without embolism	75% of hospitalized patients with DVT still receive IV heparin	100% compliance with enoxaparin and DVT policy	

measurable **baseline performance** levels and desired outcomes.

Worksheet 1-2 is a sample CDS program goal worksheet that illustrates the process of articulating **clinical objectives** and desired actions necessary to accomplish specific high-level clinical goals. You will likely complete this set of worksheets for your CDS program over time, building, refining, prioritizing, and validating their contents during multiple meetings with internal stakeholders and based on other research as discussed above.

An explicit and detailed picture of care improvement opportunities emerges from completed Worksheet(s) 1-2. They should trigger a thoughtful gap analysis, i.e., an effort to understand the care structure and processes that result in the difference between the current and desired performance.

This analysis is an essential prerequisite to developing successful improvement strategies that will help uncover promising modifications to informa-

tion management and workflow. These strategies may include CDS interventions, but do not assume that this will always be the case. Despite the focus of this book on these knowledge-based interventions, it is important to recognize that these might not always be the best or first approach to addressing every performance gap; the analysis will help identify their proper role.

CONCLUDING COMMENTS

The extent to which careful attention to stakeholder needs and related organizational processes can help ensure a CDS program's success cannot be overstated. Time invested early in the process to fully understand the needs and motivations of all stakeholders in the program will provide a payback in later implementation stages. Likewise, capitalizing on existing organizational momentum toward what will become CDS program goals and objectives can

help overcome the obstacles that the program inevitably will encounter and ensure its ultimate success.

After completing this section, you will have working documents (Worksheets 1-2) that define your CDS program targets in detail. These documents can help provide a clear and shared vision of these targets for all the stakeholders in Figure 1-2. Although substantial effort is required to get to this point, the list should remain dynamic. Expect that as the CDS implementation process unfolds, the targets and priorities will evolve, perhaps as a result of new insights, or changes within the local environment and in the external forces in healthcare acting upon it.

The implications of addressing the issues discussed in this section go beyond the CDS program

itself. For example, the detailed articulation of goals and objectives for clinical improvement in Worksheet 1-2 could be the most complete synthesis of these issues in your organization. As such, they could be useful for addressing the targets in ways other than the primarily computer-based approaches discussed in this book. For example, they might suggest workflow reorganization and other mechanisms to help achieve the goals.

The next chapter will help you assess your information systems infrastructure that is available for selecting specific interventions (discussed in Chapter 3) that will be used to accomplish the program's goals and objectives.

References

- 1 See, for example, Kotter JP, Cohen DS. *The Heart of Change: Real-Life Stories of How People Change Their Organizations*. Cambridge, MA: Harvard Business School Publishing; 2002.
- 2 Kaplan R, Norton D. Using the balanced scorecard as a strategic management system. *Harv Bus Rev*. 1996;74(1):75–85.
- 3 The Leapfrog Group maintains a Web-based compendium of incentive and reward programs aimed at improving care that provides details on scores of these programs (http://www.leapfroggroup.org/leapfrog_compendium).
- 4 Both JCAHO and CMS require reporting of “core measures.” They are working toward convergence of these requirements; details can be found at http://www.jcaho.org/pms/core+measures/aligned_manual.htm and <http://www.cms.hhs.gov/quality/hospital>.
- 5 <http://www.qualitymeasures.ahrq.gov>.
- 6 <http://www.qualityforum.org>.
- 7 <http://www.cchit.org>.
- 8 http://www.leapfroggroup.org/media/file/Leapfrog-Computer_Physician_Order_Entry_Fact_Sheet.pdf.
- 9 Teich JM, Osheroff JA, et al. *Clinical Decision Support in Electronic Prescribing: Recommendations and an Action Plan*. Report for the Department of HHS. March 2005. *J Am Med Informatics Assoc* 12(4), July/Aug 2005 (in press). Also available at <http://www.amia.org/pubs/whitepapers/docs/cdwhitepaperforhhs-final2005-03-08.pdf>.
- 10 <http://www.hhs.gov/healthit>.
- 11 National Committee for Quality Assurance. What is HEDIS? <http://www.ncqa.org/Programs/HEDIS>.
- 12 <http://www.cms.hhs.gov/quality/hospital>.
- 13 Joint Commission on Accreditation of Healthcare Organizations. Position statement on reporting medical errors. <http://www.jcaho.org/accredited+organizations/patient+safety/medical+errors+disclosure/index.htm>.
- 14 National Committee for Quality Assurance. Accreditation parameters. <http://www.ncqa.org/Programs/Accreditation/MCO/mcostdsoverview.htm>. Note especially quality improvement processes.
- 15 See, for example, manuscripts of organizations that have won the Davies Award for Excellence in EHR Implementation: http://www.himss.org/asp/davies_organizational.asp.
- 16 For a list of topics identified nationally as high priority for this type of program see the following: Institute of Medicine (IOM). *Priority Areas for National Action: Transforming Health Care Quality*. 2003. (A summary is available at <http://www.ahrq.gov/qual/iompriorities.htm>; the full report is available at <http://www.nap.edu/books/0309085438/html>); see the AHRQ priority topics for research at <http://www.ahrq.gov/about/mmarsrch.htm>.
- 17 For example, note recent increased emphasis on implementing guidelines in practice (*Ann Intern Med*. 2003;139:6, 493–498). Consider guideline types as outlined in the 1992 IOM report and discussed in the 1998 *JAMIA* (<http://www.jamia.org/cgi/content/abstract/5/4/357>). The guideline types and examples provided by the Institute's report include screening and prevention (vaccination for pregnant women who are planning international travel); diagnosis and pre-diagnosis management of patients (evaluation of chest pain in the emergency department); indications for use of surgical procedures (indications for carotid endarterectomy); appropriate use of specific technologies and tests as part of clinical care (use of autologous or donor blood for transfusions); and

- guidelines for care of clinical conditions (management of patients following coronary-artery bypass graft).
- 18 E.g., see Figure 1-7, row 1.
- 19 Such as JCAHO/NCQA accreditation and quality measures (e.g., NCQA/HEDIS) and those in the National Healthcare Quality Report (<http://www.ahcpr.gov/qual/nhqr02/premeasures.htm>), the National Quality Measures Clearinghouse (<http://www.qualitymeasures.ahrq.gov/browse/browsecondition.aspx>), and the National Quality Forum hospital performance measures (<http://www.qualityforum.org/txhospmeasBEACHpublic.pdf>).
- 20 E.g., as described in Evans RS, Gardner RM, Bush AR, et al. Development of a computerized infectious disease monitor (CIDM). *Comput Biomed Res.* 1985; Apr;18(2):103–13.
- 21 National Guideline Clearinghouse, <http://www.guidelines.gov>.
- 22 BMJ Publishing Group, Clinical Evidence Web site, <http://www.clinicalevidence.com>.
- 23 Agency for Healthcare Research and Quality. Evidence-Based Practice: <http://www.ahrq.gov/clinic/epcix.htm>.
- 24 Users' Guides to the Medical Literature: XVIII. How to use an article evaluating the clinical impact of a computer-based clinical decision support system. *JAMA.* <http://www.ucl.ac.uk/kmc/publications/pdfs/JAMA1999.pdf>.
- 25 Agency for Healthcare Research and Quality. Making health care safer: a critical analysis of patient safety practices. AHRQ, July 2001, <http://www.ahrq.gov/clinic/ptsafety/summrpt.htm>. See especially the 11 practices strongly supported by evidence, and Chapter 53, clinical decision support systems.
- 26 Garg AX, Adhikari NKJ, McDonald H, Rosas-Arellano MP, Devereaux PJ, Beyene J, et al. Effects of computerized clinical decision support systems on performance and patient outcomes: a systematic review. *JAMA.* 2005; 293:1223–1238.
- 27 Kaushal R, Shojania K, Bates D. Effects of computerized physician order entry and clinical decision support systems on medication safety: a systematic review. *Arch Intern Med.* 2003;163:1409–1416.
- 28 Weingarten SR, et al. Interventions used in disease management programs for patients with chronic illness: which ones work? Meta-analysis of published reports. *BMJ.* 2002;323:925.
- 29 Rundall TG, et al. As good as it gets? Chronic care management in nine leading U.S. physician organizations. *BMJ.* 2002;325:958–61.
- 30 See <http://www.cms.hhs.gov/quality/hospital> (scroll down the page to see the variety of quality measurement and improvement initiatives).
- 31 See <http://www.cms.hhs.gov/researchers/demos/pgp.asp>.
- 32 See http://www.jcaho.org/pms/core+measures/aligned_manual.htm.
- 33 Rewarding results: aligning incentives with high-quality health care. <http://www.leapfroggroup.org/RewardingResults>. See also footnotes to quality measures in footnote to Figure 1-1.
- 34 National Committee for Quality Assurance. *Bridges to Excellence: Rewarding Quality across the Healthcare System.* <http://www.ncqa.org/Programs/bridgestoexcellence/>.
- 35 U.S. Pharmacopeia, National Database for Medication Errors. <https://www.medmarx.com>. See also America's riskiest drugs. *Forbes.* February 24, 2003. http://www.forbes.com/2003/02/24/cx_mh_0224risk.html.
- 36 Agency for Healthcare Research Quality. Patient safety reporting systems. <http://www.ahrq.gov/qual/taskforce/hhsrepor.htm>.
- 37 McGlynn, et al. The quality of healthcare delivered to adults in the United States. *New Engl J Med.* 2003; 348:2635–2645.
- 38 National Committee for Quality Assurance. *The State of Health Care Quality.* 2004. www.ncqa.org/communications/SOMC/SOHC2004.pdf.
- 39 Gurwitz, et al. Incidence and preventability of adverse drug events among older persons in the ambulatory setting. *JAMA.* 2003;289:1107–16.
- 40 Dovey SM, Phillips RL, Green LA, Fryer GE. Types of medical errors commonly reported by family physicians. *Am Fam Physician.* 2003;67:697.
- 41 See <http://www.doqit.org/doqit/jsp/index.jsp>.
- 42 Thompson DI, Henry S, Lockwood L, Anderson B, Atkinson S. Benefits planning for advanced clinical information systems implementation at Allina Hospitals and Clinic. *JHIM.* 2005;19(1):54–62. The HIMSS CIS Benefits Task Force is building a database of CIS benefits; see <http://www.himss.org/asp/ContentRedirector.asp?ContentId=50254>.
- 43 Bates DW, Leape LL, Cullen DJ, et al. Effect of computerized physician order entry and a team intervention on prevention of serious medication errors. *JAMA.* 1998;280:1311–1316.
- 44 Bates DW, Spell N, Cullen DJ, et al. The costs of adverse drug events in hospitalized patients. Adverse Drug Events Prevention Study Group. *JAMA.* 1997;277:307–311.
- 45 Johnston D, Pan E, et al. (2003). *The Value of Computerized Provider Order Entry in Ambulatory Settings.* Boston: Center for Information Technology Leadership; 2003.
- 46 Teich JM, Glaser JP, Beckley RF, et al. *Toward Cost-effective, Quality Care: The Brigham Integrated Computing System.* Proceedings Nicholas E. Davies CPR Recognition Symposium. New York: McGraw-Hill; 1996; 2:3–34.
- 47 See, for example: Dodd DW. The return of rigorous cost justification. *College Planning & Mgmt.* 2004; 7(2): 14; How to create a "tight" WMS cost justification proposal. *Inventory Mgmt Report.* 2003; July: 1.

Additional Web Reading and Resources

- Addressing medication errors in hospitals: a framework for developing a plan. <http://www.chcf.org/topics/view.cfm?itemID=12682>.
- Bates DW, Gawande AA. Patient safety: improving safety with information technology. *N Engl J Med.* 2003;384:25:2526–2534.
- Institute of Medicine (IOM) Reports
 - Patient Safety: Achieving a New Standard for Care (2003: <http://www.iom.edu/report.asp?id=16663>).
 - Key Capabilities of an Electronic Health Record System (2003: <http://www.nap.edu/catalog/10781.html>; see especially Decision Support Core Functionality, described on page 8).
 - Fostering Rapid Advances in Health Care: Learning from System Demonstrations (2002: <http://www.iom.edu/report.asp?id=4294>; e.g., see executive summary and Chapter 4 on Information and Communications Technology Infrastructure).
- Crossing the Quality Chasm: A New Health System for the 21st Century (2001: <http://www.iom.edu/report.asp?id=5432>).
- To Err Is Human: Building a Safer Health System (1999: <http://www.iom.edu/report.asp?id=5575>).
- Kuperman G, Gibson R. Computer physician order entry: benefits, costs, issues. *Ann Int Med.* 2003;139:31–39.
- Metzger J, Stablein D, Turisco F. Clinical Decision Support: Finding the Right Path. First Consulting Group First Reports. September 2002. <https://www.fcg.com/research/serve-research.asp?rid=61> (registration and log-in required).
- Monographs of winning Davies Award submissions contain extensive information about how winners addressed people issues related to CIS and CDS implementation. http://www.himss.org/asp/davies_organizational.asp.