

Plan for Successful CDS Development, Design, and Deployment

CDS Roll-Out Requires Careful Preparation and Capacity-Building

Deploying CDS — rolling out a new CDS intervention — should only start after a carefully developed roll-out plan has been vetted by organizational leaders and clinical staff and their support for this plan confirmed. Establishing a capacity for CDS entails determining clinical goals and objectives, exploring appropriate CDS interventions with system developers or vendors, examining the impact of CDS on workflows, testing interventions before roll-out, measuring CDS impact, devising means to keep CDS information current, and other steps. Without this capacity, deploying CDS interventions will likely lead to clinician backlash due to workflow disruptions, and possibly distrust of CDS in general. While this guide presents a linear view of the roll-out process, in many cases this process is gradual and cyclical. The critical importance of the planning stage is reflected in the greater length of this how-to guide, relative to the other guides in this set.

This 'how-to' guide will help your organization:

- Think about clinical goals and how CDS can help achieve them
- Match and select the appropriate interventions for your clinical objectives
- Understand your workflow and how CDS intervention(s) may impact on the people and processes
- Work with system developers and vendors to ensure that the CDS addresses clinical goals and objectives, conforms to accepted system design principles and has is usable
- Understand end user perceptions and how to achieve clinician buy-in
- Understand the importance of having a plan to keep interventions and clinical information up-to-date

<i>Signs of Readiness for Roll-Out</i>	
✓	The selected clinical objectives are seen as important to the key stakeholders within the organization
✓	Hardware, software, and technical staff to implement and support CDS are in place
✓	Intervention(s) selected to help achieve a clinical goal are matched to workflow and accepted by end-users
✓	Intervention has been tested to ensure it performs the intended function at the appropriate point in workflow
✓	Future usability and workflow issues anticipated and a mechanism for capturing and responding to clinician feedback is defined
✓	A plan has been made for management and updating of clinical content

Key Steps toward Achieving the Capacity for CDS

Taking practical steps will help your organization achieve the capacity for CDS interventions. Within each step, tools and links to other resources are provided to help guide your activities.

Much of the material in this "How-To" guide was based on the collaborative development of and use of content in a 2011 book published by the Healthcare Information and Management Systems Society (HIMSS) entitled "Improving Outcomes with Clinical Decision Support: An Implementer's Guide, Second Edition."

Step 1: Select clinical goals that will guide selection of CDS interventions

CDS should focus on improving clinical processes and outcomes in areas where your organization can improve. It is usually best to begin with a goal with clear and non-controversial guidelines for the target condition. CDS interventions should be 'goal directed'. With a goal such as improving the care of patients with diabetes, CDS can become a tool to achieve a specific goal rather than a capability that must be implemented to meet external requirements such as federal EHR adoption incentives (Meaningful Use) or Patient Centered Medical Home (PCMH) certification. While these external factors should be attended to and can help to motivate change, clinical goals are paramount. Select clinical goals that are important for your organization and your patients.



To-Do: Select a clinical goal best suited to the organization's goals and needs.

Questions to Consider in Selecting Specific Clinical Goals
• Which conditions are the high priority conditions in our community?
• How is our organization performing in the care of patients with these conditions? Can we identify a gap in care processes relative to guidelines?
• Are these gaps in care amenable to IT-based interventions? Is CDS the appropriate tool for improving performance?
• Are we obligated to report quality measures for specific conditions? Are there any incentives for improving our performance on these measures? Are we already reporting these measures, and could we develop a ready baseline of performance on these measures before CDS roll out?

It is imperative that CDS end-users agree with the chosen clinical goal. In smaller practices, this will likely mean having a conversation with all stakeholders within the practice. In a larger institution where such a discussion might be impractical, achieving buy-in could require well-crafted structures and processes to ensure that respected and influential clinical staff agree with the overall goal and within, the specific CDS interventions' goal. If end-users disagree, they will not be as willing to spend the time and effort required to use the CDS intervention(s) effectively.

Step 2: Consult with EMR system designers and vendors about ways CDS might help to improve your clinical goals and related objectives.

Finding the appropriate intervention(s) for a clinical goal can be challenging. For example, care of patients with diabetes normally entails managing a cluster of symptoms and physiological states. Improving care for these patients, then, may require focusing on a number of objectives including HbA1c testing, blood pressure monitoring, lipid management, patient education and behavior change, and so forth. Likewise, a cluster of CDS interventions may be needed to assist with each of these objectives, including various reminders and computer-based guidance for specific tests and procedures (e.g., foot/eye exams, HbA1c monitoring, blood pressure monitoring, LDL control, patient education). A conversation with your system designer or your vendor can help to gauge what is available to achieve a clinical goal, what clinical objectives might be most appropriate, and how CDS interventions correspond to both.

Important in this discussion is determining the ability to customize a given CDS intervention to support local needs of end-users. For example, a practice or specialty within may want to change the value of

then an alert “triggers” an alert. When thinking about types of CDS interventions, certain types of functionality or capabilities may have to be in place for rules to gain the functionality required to meet clinical goals and objectives—for example linkage between the laboratory and pharmacy systems. This type of consideration should be discussed with your vendor, and system redesign or complex reprogramming should be avoided as much as possible.



To-Do: Discuss with your vendor/system designer how the clinical goal and related objectives might be improved through CDS.

Questions for a Conversation with Your Vendor/Designer

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| <i>Questions for a Conversation with Your Vendor/Designer</i> |
| • What types of CDS interventions (relevant data display, alerts, reminders, etc) are available within the EMR system to address our clinical goals and objectives? |
| • Within this cluster of interventions, which have been shown to have the most impact? Which are the easiest to turn on? Which are most likely to be accepted by end-users? |
| • How can we configure and customize CDS interventions to suit our practice needs and workflow? Can we select specific alerts and reminders, or are the rules preset packages of alerts that can only be turned on or off wholesale? |
| • Do we have the appropriate hardware and software to most effectively use CDS functionality? |
| • Are there already CDS “components” that we can use, such as logic, rules templates, screen designs, interfaces? |



Resources and Tools

CDS Intervention Types (Resource #1) – The HIMSS Guide provides a robust description of the intervention types with examples. This resource may be particularly helpful when thinking about which types of interventions may match the clinical objectives.

Step 3: Select CDS interventions to achieve clinical goals and objectives

Within the menu of potential interventions that might be available for a given clinical goal, your organization should think carefully about how many CDS interventions you would like to implement and which of these would be most effective. As mentioned above, multiple interventions will likely have a greater effect on a particular goal. You must weigh the effect of implementing multiple interventions with the potential effect of overwhelming end-users. In order to understand the potential effects of an intervention, baseline measures should be considered (more in next step). Other considerations for selecting an intervention include:

- ✓ Ease of Implementation
- ✓ Effect on Clinical Quality Reporting
- ✓ Financial Incentives for Implementation
- ✓ Workflow

When selecting interventions, it is imperative that end-users also agree with and support the CDS being implemented. End-users must recognize the areas for clinical process improvement and not feel as though CDS is being forced upon them. Because all members of a smaller practice will likely be involved

in CDS assessment and selection, achieving clinician buy-in to CDS will likely be easier. In a larger organization, however, clinical champions should consider seeking input on clinical objectives and interventions from clinicians who will be the primary users of the CDS under consideration.

Step 4: Specify baseline measures for the objectives to be addressed by selected CDS interventions

Performance on a specific clinical goal and corresponding objectives should be clearly delineated before rolling out a CDS intervention. While a higher-level consideration of baseline performance may be part of selecting a clinical goal (e.g., improve outcomes for patients with diabetes), it is important to be more specific and identify the clinical objectives and the CDS intervention that address it or them.

Establishing a pre-CDS baseline is important in determining the impact of CDS on care processes and clinical outcomes. For instance, if the goal is to improve diabetes care, then an objective such as greater compliance for foot/eye exams would correspond to a clinical reminder for such an exam. Before deploying this intervention, the organization should know the baseline rate of compliance for foot/eye exams.



To-Do: To help measure improvements, develop clinical objectives and baseline measures for your goals.



Resources and Tools

Metric Selection and Use (Resource # 24) – This worksheet will help to organize and think about the types of metrics your organization should consider using to measure baseline performance and assess effects of the CDS intervention(s).

Step 5: Map out current workflows and clinical processes affected by CDS interventions

Workflow can be defined as a series of tasks and actions performed by different actors in the completion of clinical processes or phases. The workflow for an outpatient encounter, for example, may consist of multiple tasks including intake, nurse assessment, clinician assessment, and check out. Within each phase, different actors such as clerks, medical assistants, nurses, and physicians perform various tasks: check in patient, record vital signs, review medications and charts, interview patient, diagnose, plan treatment, and so forth.

Workflows are heterogeneous and often idiosyncratic; they vary across and even within care settings, and are often structured to suit local conditions and styles of clinical practice. Implementing CDS will often change existing workflows, and clinicians often want to change CDS to suit their current processes. Realizing value and improvements from CDS, however, may require workflows to be redesigned.

An important step in developing a roll out plan, then, is mapping current workflows to understand how clinical phases and tasks within are completed today, and how these may be affected by the addition of CDS. This includes considerations of how CDS may need to be customized to suit local work processes. In this assessment, it's important to include where CDS interventions will be accessed in various phases and tasks, and to relate clinical goals and corresponding CDS interventions to steps in the workflow. Focus on ensuring that a CDS intervention is applied at appropriate stage of workflow, reflecting an understanding of the decision/action process. For example, try to support decisions as they are being made, rather than trying to change sub-optimal choices after they have been made.

There are different approaches to workflow assessment and mapping, and workflows may be mapped at high levels (e.g., task) or much more granularly (e.g., action). The resources and tools below provide options for documenting and redesigning current workflows for care improvement using CDS. For most organizations, EHR and CDS vendors should be able to assist in this process and should be consulted to determine the best means for integrating CDS interventions into your current clinical processes. CDS interventions depend on complete and accurate data (such as patient weight, smoking status, current medications), and mechanisms should be in place in the current or planned workflow to ensure this information is being entered appropriately and reliably. Vendors may provide multiple pathways for inputting data, such as free text and drop-down menus, and an efficient, standardized approach is needed to ensure that CDS interventions draw from appropriately structured data.



To-Do: Examine the clinical workflow and processes surrounding your clinical goals before developing and designing the CDS.



To-Do: Map current workflows to understand how clinical phases and tasks within are completed today, and how these may be affected by the addition of CDS.



Resources and Tools

The following papers and tools provide resources which will assist in mapping workflow for your organization.

Workflow Taxonomy (Resource # 6-7) – The Reference Taxonomy of Clinical Workflows provides a common set of terms to CDS designers and implementers to support communication about CDS and its use in clinical workflows.

- CDS designers can use the taxonomy to identify points in the workflow when CDS can be used and design a CDS tool to fit that context. Designers can then tag the CDS tools with terms from the taxonomy to inform practices about the intended use of the CDS.
- CDS repositories can create tags based on the taxonomy to enable workflow-related organization and searches.
- CDS implementers can refer to the taxonomy when developing maps of the workflows and can use the terms to improve communication with their CDS vendor.

Workflow Process Mapping Tool (Resource #8) – This tool is a flowcharting template example you can use for mapping workflows pertinent to the priority clinical decision support objectives you will be addressing with your interventions. The “swim-lane” diagram is particularly helpful to visual the interaction between stakeholders for a particular process.

[Case Report: Activity Diagrams for Integrating Electronic Prescribing Tools into Clinical Workflow](#) – This case report provides some complex swim-lane diagrams that may be of assistance when mapping workflows with multiple processes and stakeholders involved.

[AHRQ Workflow Summary Report & Tool Compendium](#) – The AHRQ Workflow Summary report and Tool Compendium (link in report and provided below) provide tools and information to help small to medium outpatient practices assess workflows. The report explains various methods of workflow assessment, the advantages and disadvantages to each, and also provides related resources. The tool

compendium offers an extensive list of workflow tools each with links to the tool where available and suggestions for use.

Step 6: Have a system for keeping interventions and knowledge current

Knowledge management should be considered and planned for early in the CDS initiative. How this is best accomplished over the “life of the alert” depends on the nature of the intervention, organizational and workflow plans built around it, and ways and pace to which medical evidence and practice change. Knowledge management can be automated by a vendor or a collaborative, or it can be the responsibility of a particular clinician or institution. The key is that there should be a systematic approach, staffing and other resources to keeping interventions and knowledge up-to-date. This may mean keeping something as simple as a file with dates of last update and pre-specified dates for revisions.

When planning the CDS, it is important to validate that software suppliers ensure the CDS content will adhere to existing national data, quality/performance standards, etc. The data needed to trigger or drive CDS rules should be consistent with emerging standards, and the rules, order sets and other interventions supplied in the system should support improved performance against national objectives. Further, in planning for knowledge management, make sure that the EMR and any related CDS content suppliers have processes in place to ensure that your interventions are evidence-based and current. Ideally, you should be able to engage in discussions about their editorial process, ongoing training of editors, literature surveillance and analysis, content update methodologies and tools, and ensure that these are in sync with your practice needs and expectations.



To-Do: Identify the people and processes involved in updating CDS interventions and keeping clinical knowledge in CDS current.



Resources and Tools

Questions to Consider about Organizational Knowledge Management (Resource #9) – This HIMSS Guide resource offers some key questions that an implementer should ask about knowledge management. The questions are particularly helpful to thinking about the kinds of systems and processes an organization should have in place to manage clinical knowledge and keep interventions updated.

Step 7: Take steps to ensure the usability of your intervention(s)

End-user’s satisfaction with CDS will be related to how easy these interventions are to learn and to use, and how well these interventions support current workflow –complete tasks and actions quickly and correctly. Improving care through CDS is achieved when used appropriately, and care providers will not use – or will create workarounds for – poorly designed, slow, and cumbersome CDS interventions. Ensuring usable CDS requires organizations to understand how interventions operate in real-world settings, and what end-users think about CDS performance relative to how they practice medicine. As part of the CDS selection process, organizations should try to understand the usability (vs. the potential frustrations) of CDS interventions under consideration. Resources listed below provide an overview of usability, and provide guidance on different methods that can be applied to identify usability issues with healthcare information systems generally, including CDS. A good first step is to discuss with vendors or

system developers the extent to which standard usability design features have been incorporated and usability assessed.



To-Do: Understand the limits of functionality for your proposed intervention(s) and solicit help in customization if possible.



Resources and Tools

The following resource will aid in understanding CDS usability and how to assess usability of CDS interventions.

Decision Support Evaluation Tools (Resource #5) – The following document contains a collection of practical recommendations and references to tools and publications that can be used to inform the design of CDS toward the goal of achieving optimal human-computer interaction characteristics.

[NIST Guide to the Processes Approach for Improving the Usability of Electronic Health Records](#) – This guide from the National Institute of Standards and Technology (NIST) offers guidance for designing and testing EHR applications based on user-centered design, and has suggestions for how to include end-users in the design process.

[HIMSS CDS FAQ](#) – The HIMSS CDS Task force has written this “Frequently Asked Questions” document to provide information about how to select, construct, and successfully implement a CDS rule as an eligible professional (EP) or as an eligible hospital in order to meet the requirements of Meaningful Use.

Step 8: Test intervention(s) for their effects on workflow and usability

Interventions should be tested in your organization’s environment and actual work processes prior to roll-out. Although the actual work processes will have been considered in Step 5, testing can help to highlight any aspects of the workflow that were not considered. In some cases, the results of the testing may delay the roll-out. If an intervention disrupts workflow more than expected, alterations to the intervention or to the workflow may be required.

Upgrades and modifications to the EMR and other systems – including addition of new CDS functionality – may have unexpected effects on key features such as usability, workflow and system response times. Evaluating and addressing these issues with end users prior to launch is important to avoid glitches that might frustrate or alienate these users.

New or enhanced interventions will likely be tested within the ‘live’ system, so make sure with the vendor that there are back-up and failsafe measures in place to ensure that the new intervention testing and subsequent release do not disrupt the system or other clinical processes. The implementers should anticipate needing to make changes to the intervention based on testing (such as adjusting the threshold or display properties of an alert) and prepare for them prior to implementation. If users in the practice have been engaged throughout the intervention configuration processes, there shouldn’t be any major surprises or rework.



To-Do: Test the intervention(s) in a real environment if possible and return to Steps 5-7 if testing uncovers issues with the intervention type or usability respectively.



To-Do: Check to see that there are back-up and failsafe measures in place.



Resources and Tools

Pre-launch Testing (Resource #23) – This worksheet can be used to document prelaunch testing and results. For some intervention types, professionals in your information services division or a consulting company assisting with intervention development may complete this worksheet. It is organized by intervention, since that is generally how the testing will be conducted.



Small Practice/Outpatient Practice Considerations:

Getting started, where to focus

- Start simple and focus on an “easy win” in both clinical goal and objectives, and corresponding CDS interventions. Make the early interventions easy to implement with outcomes that can be easily tracked. Add complexity to your interventions only after the practice gains more experience applying CDS strategies to improvement goals.
- Everyone in the practice affected by an intervention should have a say in its development. These individuals should have been involved to some extent from the earliest stages of clinical goal and objectives selection, and through final configuration and implementation.
- Recognize the need for diverse engagement in supporting CDS-related activities. An example is the successful role that nurses can play in facilitating CDS-mediated quality improvement in practices with EMRs. Entering vital signs into the EHR is often an essential for CDS rules to fire correctly. Other non-clinical staff may indirectly support CDS by providing information that facilitates electronic order entry, such as selecting the patient’s preferred pharmacy. Small practices should consider how to fully engage all those in the practice in optimizing CDS implementation efforts.

Workflow Considerations

- End-user interactions with the interventions should align with the clinician role and corresponding workflow. For example, the underlying data driving CDS interventions for nurses and physicians should be the same so that everyone is working from a common source of truth, but the intervention details should be optimized for the different but related actions and decisions that nurses (e.g., nurse assessment) and physicians (ordering) make.
- Clinical workflow can be complex and nuanced. Documenting workflows before and after CDS interventions can help ensure that all affected staff are fully on board with the new routines and tools and adapt successfully. Keep in mind “upstream” and “downstream” activities that need to happen before and after physician-focused CDS for the intervention to have its intended effect. For example, ensure that ample supplies of flu shots and nurse time are available to handle a desired uptick in flu vaccination rates in response to CDS focused on this objective.

System development, design, testing, enhancements

- Small practices typically lack the leverage that larger institutional EHR customers have with their vendors in requesting system modifications to better address workflow and other practice needs and constraints pertinent to CDS. Working with the REC and/or vendor user group can enable the combined voices of many practices to be conveyed to the EHR vendor.

- When communicating enhancement requests, it is best to identify the problems that the practice is facing – rather than propose a solution. Let the vendor assimilate and understand the problem deeply so that they can work *with* the practice to identify a good solution(s).
- Although addressing technical details will depend heavily on your information system supplier, consider the workflow implications for the practice of having the CDS intervention(s) unavailable in the event that the intervention itself, or broader system, is down for some reason. If the intervention is critical for patient safety or efficiency, develop a backup plan.

Knowledge management

- The practice's EMR supplier – and associated CDS knowledge-based content providers (e.g., drug-drug interaction checking, drug-allergy checking, reminders, order sets and templates) should make it as easy as possible for the practice to incorporate, validate updates, monitor, and ensure critical changes as needed to the CDS interventions. Determine with your system providers whether, when and how trained personnel in the practice (e.g. CDS Super user, physician champion, practice manager) can and should tailor CDS logic and/or content.