
Clinical Information Systems—Developing a Systematic Planning Process

David Goldberger
Richard Kremsdorf, MD

CHW is a large and diverse hospital system that developed a systematic planning process to define, prioritize, and assess the current status of those functionalities needed by caregivers to assist them in providing optimal care. In order to develop a durable consensus, a bottom-up approach was used. The details of the process including the structure of the meetings and many of the methodologies employed are presented. Key words: *CHW, clinical information systems, clinicians, strategic planning*

THE ADVISORY BOARD COMPANY has identified an innovative auditing and planning process developed at Catholic Healthcare West (CHW) used to prioritize clinical systems investments across the organization's 48 hospitals. It has numerous applications outside the hospital and in the ambulatory setting and thus is reported in this issue of *The Journal of Ambulatory Care Management*. The underlying premise of CHW's program is that effective clinical systems planning must proceed from the bottom up, drawing less on corporate information systems (IS) priorities or vendor product offerings than on the diverse workflow needs of caregivers. CHW's program is distinguished from other planning processes in three primary respects.

1. First, the process included an initial effort to develop a compendium of all potential clinical IS functionalities—ensuring that all parties involved in planning were working with the same set of assumptions and definitions.

2. Second, priorities were set through “caregiver summits” with clinical personnel from across the health system—grounding planning efforts in the

*David Goldberger, The Advisory Board Company,
Washington, DC*

*Richard Kremsdorf, MD, Five Rights Consulting, San
Diego, California*

The Advisory Board Company would like to express its appreciation to David Bowen, Richard Kremsdorf, MD, and Susan Perry, RN, of Catholic Healthcare West's Corporate Information Management department. Their knowledge, guidance, and generosity were invaluable as we sought to understand their clinical systems planning process. For further information on this article, The Advisory Board Company, please contact David Goldberger, The Advisory Board Company, Washington, DC; 202/673-5983, goldberg@advisory.com

At the time of writing Richard Kremsdorf was Vice President of Clinical Information Systems, Catholic Healthcare West, San Francisco, California

J Ambulatory Care Manage 2001, 24(1), 67-83
© 2001 The Advisory Board Company, Richard Kremsdorf,
and Catholic Healthcare West.

expressed needs of each hospital's clinical staff.

3. Finally, the process concluded with a comprehensive audit of clinical IS capabilities for each system hospital—ensuring that future investments would build on a clear understanding of each hospital's current capabilities.

This article provides an overview and analysis of CHW's planning process. While not all aspects of the program will be relevant to ambulatory care providers, elements of the program methodology are likely applicable to a wide variety of organizations (see box entitled "Case in Brief").

PROBLEM IN BRIEF

In research interviews, Chief Information Officers (CIO) cited four common frustrations with clinical systems planning:

1. Many CIOs and senior executives find it increasingly difficult to understand what clinical functionalities are in place across their health systems—making it hard to identify hospitals falling behind and best practices worth replicating systemwide.
2. Even with adequate clinical systems in place, suboptimal performance often goes unnoticed; many functionalities are limited in effectiveness due to insufficient caregiver training or limited deployment among hospital staff.
3. Underlying cause of suboptimal performance is insufficient knowledge of caregiver needs and workflows; without detailed understanding of care processes, new technologies often fail to deliver on potential.
4. Problems are compounded by territoriality among individual hospitals and between hospital departments; diverse hospital constituencies driven by conflicting priorities and interests often fail to approach clinical functions as inter-

Case in Brief

Goals

- Develop clinician-driven standards for inpatient clinical IS functionalities
- Measure the relative performance of each hospital against system standards
- Provide tools to help hospital executives prioritize future clinical IS investments

Key elements

- Functionality dictionary
- Caregiver summits
- Facility audits
- Systemwide status report

Early results

- Defined and measured performance of clinical IS functionalities across the health system
- Established clear guidelines for phasing in new clinical functionalities
- Developing systemwide vendor contracts to fill common gaps in clinical systems performance

dependent systems supporting facility-wide processes.

CLINicians Toolkit (CLINT)

This is a complex idea that needed a simple term to establish branding. CLINT stands for CLINicians Toolkit.

CLINT KEY ELEMENTS

Catholic Healthcare West's program consists of four key elements, described below.

Element #1—Functionality dictionary

Comprehensive list and description of every potential IS function is used to support

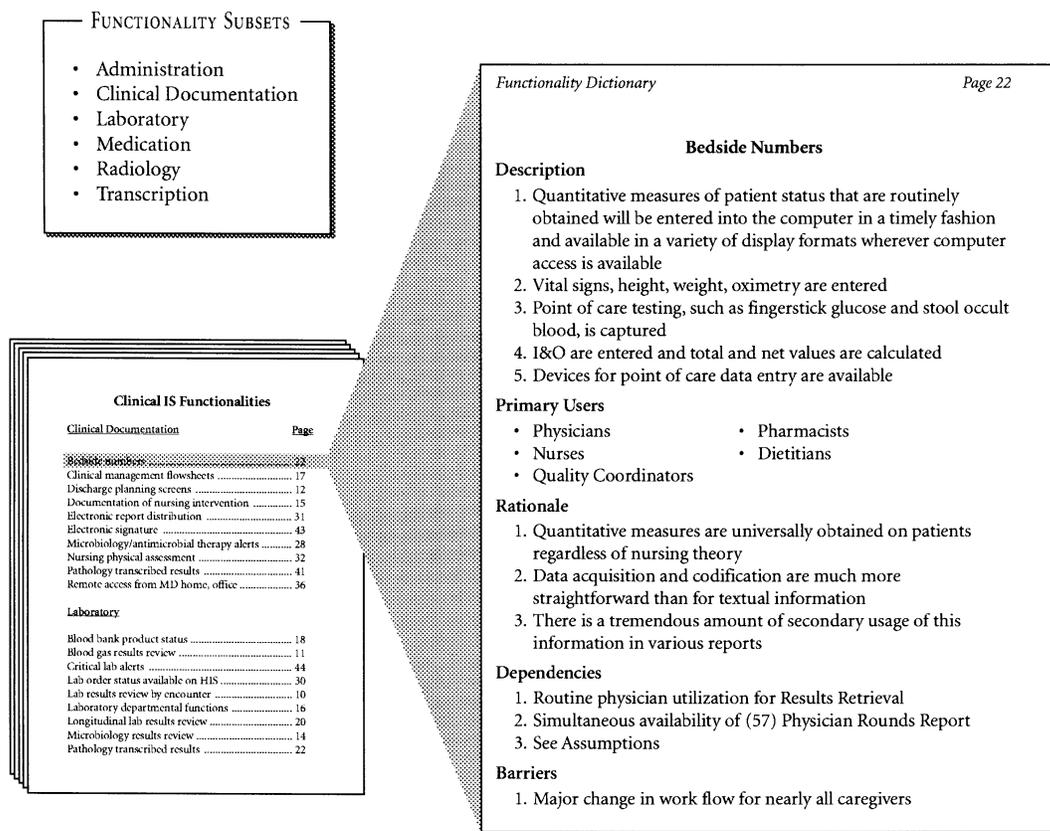


Figure 1. Functionality Inventory and Dictionary.

inpatient clinical care. The goal is to provide a common vocabulary on which to build clinical IS planning efforts.

- Draft of definitions created by the Medical Informatics Information Officer and reviewed by system medical directors of information management, nurse leadership, and a variety of IS department leaders.
- Final document provides listing of 54 clinical system functionalities, organized according to six subsets (see Figure 1).

Element #2—Caregiver summits

Regional meetings occurred including 15 to 40 clinical personnel from each region's

acute care facilities. The goal is to elicit feedback from a diverse group of clinical staff to prioritize clinical IS functionalities by select strategic criteria (see Figure 2).

Five steps at clinical IT summits

Step #1

Functionality Work Groups—Diverse mix of attendees convene in groups of four to six to discuss subsets of the 54 clinical IS functionalities: The goal is to enable group members to develop a broad understanding of each functionality and its role in clinical care delivery.

- Work plan: At least one group assigned to each of four functionality subsets

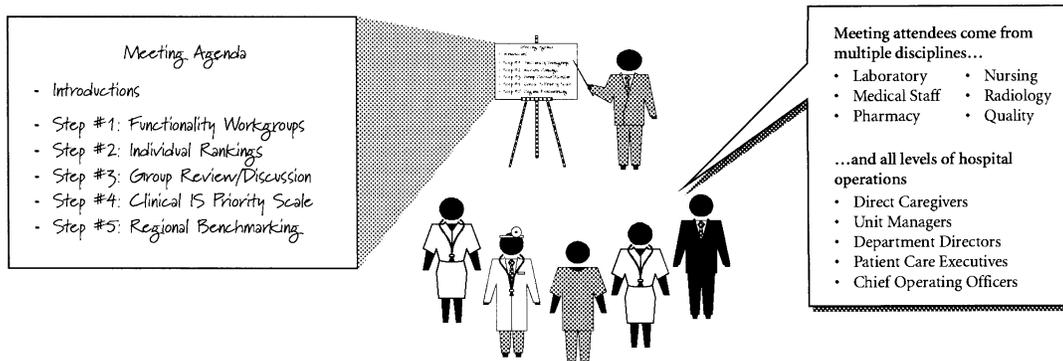


Figure 2. Caregiver Summits.

(administration, clinical documentation, medication, and radiology/lab/transcription).

- Group composition: Attendees span disciplines and hierarchical levels to ensure broad perspective.
- Agenda: Group members read the functionalities aloud, discuss, and weigh the relative value of each (see box entitled “A Broadened Perspective”).

Step #2

Individual Rankings—Members of each work group rank each functionality according to four equally weighted criteria. The goal is to enable attendees to quantify their perception of the relative value of each functionality, incorporating lessons learned from group discussion (see Figure 3).

Step #3

Group Review and Discussion—Individual results of ranking exercise presented before the larger group for review and revision. The goal is to reach group consensus on each clinical IS functionality’s relative level of importance.

Review Process:

- Individual scores projected in front of the entire group to show variations.
- Each group’s scores averaged and

presented; representatives from work groups explain ranking rationale to the larger group.

- Group discussion on whether rankings accurately reflect each functionality’s value; rankings may be changed, but only by group consensus.

A Broadened Perspective

The physicians would say, “what we want to do is get the lab results electronically, we don’t care whether or not the lab has a system.” But the physicians needed to come to the understanding that if the lab didn’t have a system there was no way that they [the physicians] would be able to look up results on their own computers. Since we had lab technicians and nurses in the discussions with the physicians, that fact came out—clinicians came to recognize that the ancillary departments needed systems in place before the clinicians could get their wants satisfied. And from the flip side, departmental leadership came to learn that it wasn’t enough to just get a lab system cranking out results—the clinical people needed a way to look up results as well.

—Richard Kremsdorf, MD
 Vice President of Clinical Information Systems
 Catholic Healthcare West

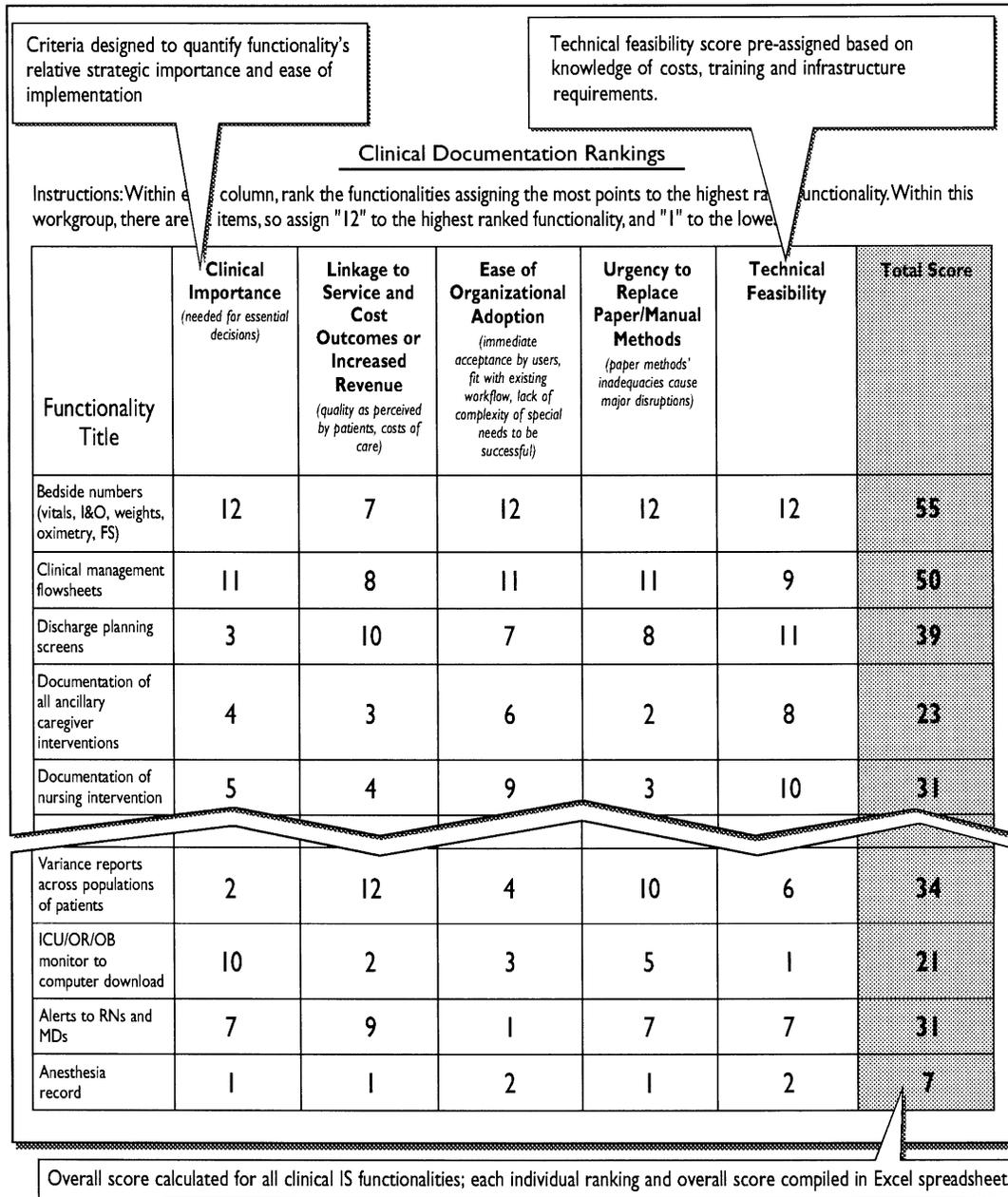


Figure 3. Functionality scoring system—clinical documentation rankings.
 Note: The examples are for illustrative purposes only. This figure is representative of one person's priorities.

Table 1. Definitions of functionality

Tier	Definition
Core	Minimum functions that should be in each and every acute care facility based on their direct link to improved patient outcomes (quality, service, and cost).
Midlevel	Essential functions that are more challenging technically or organizationally, have less immediate or certain payback.
Mature	Valuable and feasible functionalities that build on other functionalities or organizational changes and may incorporate more advanced technologies.

Step #4

Clinical IS Priority Scale—Based on individual rankings, group scores, and larger group discussion, clinical IS functionalities were assigned to one of three tiers—core, midlevel, or mature. The goal is to capture group consensus on the appropriate level of prioritization for each functionality (see Table 1).

Step #5

Regional Benchmarking—Group views running average of prioritization rankings compiled from all previous CHW regional summits. The goal is to highlight deviations from (evolving) system standard, and adjust group rankings when appropriate (see box entitled “Pressure Testing the Group’s Thinking”).

Element #3—Facility audits

Audit team visits system hospitals to determine the operational status of all clinical IS functionalities. The goal is to grade clinical IS capabilities at each system hospital.

Pressure Testing the Group’s Thinking

I would then say to the group “well you ranked this functionality at core, but these other regions ranked it at midlevel. Here is their rationale as to why they did this. What do you think about it?” Sometimes they would decide that the other regions’ rationale made more sense and they would change their ranking. Other times they would say “well, we’re different,” and they would leave the ranking as is.

—Richard Kremsdorf, MD
 Vice President of Clinical Information Systems
 Catholic Healthcare West

- **Audit team:** Vice President for Clinical Information Systems and CHW Information Officer for Clinical Enterprise Applications and RN recruited from system hospital.
- **Audit process:** Audit team converses with physicians, nurses, and unit clerks, observes as hospital staff uses clinical information systems.
- **Scoring methodology:** Team members independently assign grades to each functionality based on three criteria: functional richness, ease of use, and level of deployment. Three grades were entered into a simple formula to calculate final score for each functionality.
- **Data validation:** Scores of each audit team member presented and discussed; team settles on single score for each functionality, averages individual scores in the absence of consensus (see Figure 4).

Element #4—Systemwide status report

Comprehensive report listing assessment scores for each clinical IS functionality at each system hospital. The goal is to

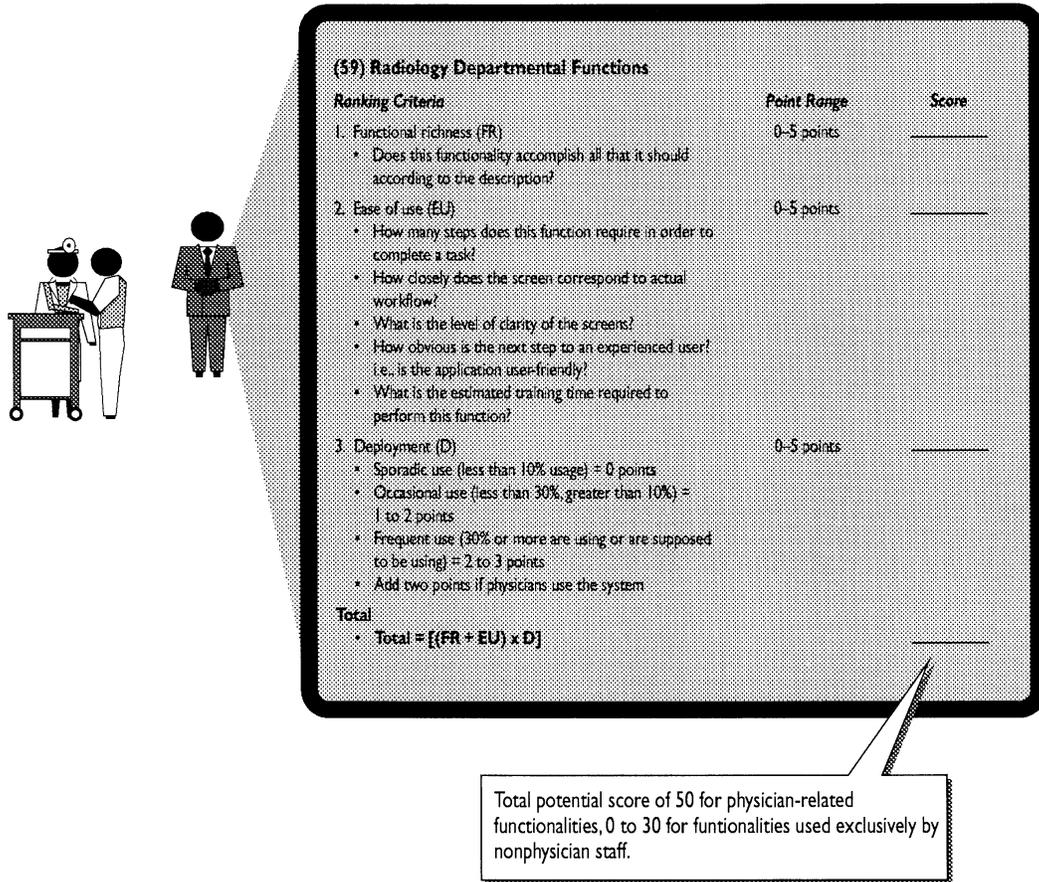


Figure 4. Auditing current capabilities—Radiology Department.

benchmark the operational status of each functionality across the system.

- Clinical IS functionalities at each hospital assigned to one of three status levels (red, yellow, or green); calibration determined by comparing individual functionality assessment scores across the system;
- Final report reveals assessment scores (numeric) and status level (shading) of 54 functionalities at each system hospital (see Table 2 and Figure 5).

RESULTS

The program at CHW has yielded two comprehensive data sets for corporate IS planners. The first set documents the relative level of importance that clinicians place on each of 54 clinical IS functionalities. The second set records the performance level of each functionality at each system hospital. Analyses of these data sets enable corporate IS planners to help hospitals prioritize IS investments, taking into account caregiver

Table 2. Shading criteria

Score range	Shade	Description
<10	Red	Hospital does not have functionality in place or the functionality is not being used
10–19.9	Yellow	Hospital has functionality in place, but system is lacking in functional richness, ease of use, or deployment
20–50	Green	Hospital has functionality in place; functionality is in full use by clinical staff

Note: Score ranges may be adjusted based on median scores and best demonstrated practices established within each functionality (e.g., see “discharge planning screens” in Figure 5).

needs and preferences, infrastructural capabilities, and system-level objectives. Specific tools used to accomplish this goal are listed and briefly described below.

Facility scorecard

- Audit team members visit key information management staff and executive leadership from each hospital to review customized clinical IS functionality “scorecard;” scorecard lists the performance level of each functionality compared with clinical IS road map, to

identify deficiencies on which hospitals should focus future IS planning efforts (see Figure 6 and box “Focusing Future Investment”).

Add-on product set [In development]

- Corporate IS working to develop systemwide IS contracts with select group of vendors to address common gaps in IS performance across the system. The contracts enable CHW to bring all hospitals up to standard “Phase I” levels of functionality at reduced cost.

Tier	Functionality Description	Hospital						System Benchmark
		A	B	C	D	E	F	
Core	Bedside numbers (vitals, I&O, weights, oximetry, FS)	50	27	0	0	0	0	45
	Clinical management flowsheets	30	8	0	0	0	0	24
	Discharge planning screens	0	0	0	0	0	0	0
Midlevel	Documentation of all ancillary caregiver interventions	29	0	0	0	0	0	0
	Documentation of nursing interventions	28	22	0	0	0	0	0
	Microbiology/Antimicrobial therapy alerts	0	0	5.7	0	0	0	27
	Nursing physical assessment	27	20	0	0	0	0	0
	Patient careplans/pathways/standard orders	0	0	0	0	0	0	20
Mature	Variance reports across populations of patients	0	0	0	0	0	0	30
	ICU/OR/OB monitor to computer download	0	0	0	0	0	0	0
	Alerts to RNs and MDs	0	0	0	0	0	0	21
	Anesthesia record	0	0	0	0	0	0	0

Figure 5. Assessment results: clinical documentation.

Note: Assessment scores are hypothetical and for illustrative purposes only. The shadings on the table are defined as follows: white = green; gray = yellow; black = red.

Tier	Functionalities—Clinical Documentation	Wells Hospital	System Benchmark
Core	Bedside numbers (vitals, I&O, weights, oximetry, FS)	0.0	45
	Clinical management flowsheets	0.0	24
	Discharge planning screens	0.3	0
Midlevel	Documentation of all ancillary caregiver interventions	0.0	0
	Documentation of nursing interventions	0.0	0
	Microbiology/Antimicrobial therapy alerts	0.0	27
	Nursing physical assessment	0.0	0
	Patient careplans/pathways/standard orders	0.0	20
	Variance reports across populations of patients	2.7	30
Mature	ICU/OR/OB monitor to computer download	0.0	0
	Alerts to RNs and MDs	0.0	21
	Anesthesia record	0.0	0

Figure 6. Sample facility scorecard.
 Note: Assessment scores are hypothetical and for illustrative purposes only. The shadings on the table are defined as follows: white = green; gray = yellow; black = red.

Focusing Future Investments

The fundamental problem is that at the hospital level, the executives are hearing all kinds of different stories as to what to prioritize, but they don't really know what to work on first. What we can now do is sit down with executives at an individual hospital and say, "well, here is the deal. We started out with 54 functionalities, and we looked at each hospital. Within Phase IA, there are only 12 functionalities. Within your hospital, within Phase IA, nine are green and three are red. So, focus on turning your red boxes to green."

—Richard Kremsdorf, MD
 Vice President of Clinical
 Information Systems
 Catholic Healthcare West

THE CLINicians Toolkit PROCESS CONTINUES*

A key element of the planning process is to validate and share the results of the process to date with a broad audience within CHW. To that end, three distinct groups were identified: Information Systems staff, executives, and the clinician community. CLINT stands for Clinicians Toolkit.

Information Systems staff

The prioritization process had focused on the needs and behaviors of the clinicians. For that reason, only a few Information Systems professionals had been involved in the earlier

*The following section was written by Richard Kremsdorf.

phases. Indeed, the process identified a gap between what capabilities were technically available on computers and how work was actually being done—which had not been broadly understood. Thus, in some cases, Information Systems staff were learning that the systems they had worked so hard to implement were not being used.

Consequently the first meetings in each region to share the results were held with the Information Systems staff. At these meetings, the extensive prioritization process was only briefly reviewed, with focus instead on how the assessments were performed and scored. Then one functionality at a time, one hospital at a time, the results were reviewed in detail, to show how the scores were calculated. Each participant got a book that contained the detailed scores for every functionality at every hospital in one's region. Thus, it was clear that the scoring was objective and fact-based. It was not a casual opinion, but rather the result of focused scrutiny applied relentlessly.

The key in these sessions was to focus on the validity of the assessment in a nonjudgmental way and to avoid explanations as to why things were the way they were. Even more important, the ground rules were to not have any discussion about how to solve the identified gaps, though the desire to do that was strong. In this way, the consensus about the needs going forward could be solidified before the disagreements about different potential solutions set in.

The validation of the scores was strong. In some cases, there had been improvements after the evaluation had occurred. In over 99% of the assessments, the results were accepted as accurate.

Executives

The top management team in the regions had until this time received only high-level information about the process. Most knew some type of clinical information systems planning was happening, but not the details.

A few were very involved, but that was the exception.

A key success factor was to have validated the assessments results with the Information Systems staff before presenting to the executives. That way, the opportunity for summary rejection of the assessment results was minimized.

The executive leadership team for each region, including the CEO, COO, CFO, CMO, and CIO was gathered for the discussion. The presentation was distinctly different from that presented to the IS staff. It started with a reminder of the aspects of the strategic plan of the region that could be accomplished using clinical information systems. Some examples of clinical work processes were described with and without the use of supporting systems. Then, the extensiveness of the prioritization process was emphasized, so that it would be accepted as valid. In particular, the criteria used to prioritize was described as well as the origin of those criteria, namely, from COOs and CFOs. The assessment scoring method was only briefly mentioned, with reliance instead on the validation of the results by the local staff.

The most important part was the display of the summary findings for the region. Since the results for each functionality had been summarized as a color, red (missing), yellow (present, but incomplete), and green (present), a single graphic could be used to summarize hundreds of results. The results for each hospital are presented in a column. At the top of the column are the highest priority functionalities. Thus, red boxes near the top of the graphic identified important functionalities that were not available to clinicians. The metaphor "we need to turn red boxes into green boxes" quickly became common parlance, underscoring the effectiveness of the display.

The final section of the discussion focused on specific applications with financial and strategic impact. An example of Physician Rounds Report was displayed and had

particular impact. This report is created by the physician and contains all the information available on the computer system that the physician needs to do inpatient rounds. It helps the physician to save 5–10 minutes per patient visit per day and so is a great efficiency tool. This application is immediately compelling to physicians and executives.

Another example, Casefinders, was also explained. Casefinders are reports that identify patients who have special needs that warrant intervention. For example, a respiratory Casefinder identifies all patients in the facility who are having problems with their breathing, based on aberrant measurements of respiratory rate, oxygen saturation, use of supplemental oxygenation, and blood gas results. A respiratory therapist can then look in on these patients and facilitate optimization of their care. Since such interventions can prevent costly catastrophic events, the financial as well as the clinical impact is immediately apparent.

Clinician community

The entire initiative is about providing the tools that clinicians need in order to provide optimal care. Though they have been involved all along, there is an ongoing need for further engagement, enlarging the circle of involvement. All of those who participated in the earlier portions of the process expressed interest in learning what we concluded. Finally, the broader and deeper the groundswell of support, the more likely that funds could be secured for such projects in the next budget cycle.

The Regional CLINT discussions are still unfolding. These discussions emphasize only the high level findings of the assessment, focusing instead on confirming the consensus about the implementation sequence.

The initial prioritization separated functionalities into three tiers: core, mid-level, and mature. However, there were still too

many functionalities in the core tier to be implemented in one fell swoop. Indeed, even within the core tier, some are much easier to implement than others. Thus, all of the core functionalities became Phase I implementation targets, but Phase I was broken down further into Phases IA, IB, and IC (see Appendixes 1 and 2). The idea is that Phase IA serves as the building block for Phase IB. Once Phase IA is done, the technology and the culture to be successful on Phase IB would be in place.

A key distinction was made early on: clinical documentation of a patient's status was separated into distinct components:

- Bedside Numbers: Quantitative measures of patient status that are routinely obtained will be entered into the computer in a timely fashion and available in a variety of display formats wherever computer access is available
- Medication charting: documentation of medication administration
- Nursing physical assessment
- Patient care plans/pathways
- Documentation of patient care activities and interventions by nursing
- Documentation of all ancillary caregiver interventions

During the initial prioritization, bedside numbers and medication charting rose into the core tier, while the other clinical documentation functionalities remained in the mid-level tier. This occurred because of the more pervasive use of the information gathered in the core functionalities and its operational and economic impacts. Once these issues are articulated, there is broad agreement with it, though it does not reflect the way clinical documentation has been historically implemented within CHW and elsewhere.

Often, capturing the bedside numbers electronically makes it more difficult for the physicians to do rounds, while creating a Physician Rounds Report holds the opportunity to expedite rounds. Similarly, unless

Casefinders or alerting is used, the potential value of having clinical data in electronic form is not realized. Instead, a pile of numbers on paper only becomes a comparable pile on a screen and not really a tool to facilitate optimal care.

One additional leap has been the addition of the use of a handheld computer to capture

the bedside numbers. While the applications to do this are not yet commercially available, in a setting where the right database infrastructure is in place, the development should be straightforward.

Happily, when all of these concepts are brought forward, the opportunity for improvement has been viewed as compelling.

Appendix 1 Clinical IS Road Map: Catholic Healthcare West's Functionality Listing by Phase

Phase/Description		Subphase	Description	Functionalities
Phase I Establishes infrastructure and incorporates workflow improvements for the high-volume, high-value clinical transactions.	IA		Basic administrative and clinical transactions required before complex workflows can be affected; effective establishment of these functionalities provides the foundation on which to build more complex functionalities	<ul style="list-style-type: none"> Departmental Operations <ul style="list-style-type: none"> Laboratory departmental functions Pharmacy departmental functions Radiology departmental functions Administrative Procedures <ul style="list-style-type: none"> ADT (Admission, Discharge, Transfer) System Order entry to all departments
		IB	Functionalities focused more deeply into caregivers' workflows.	<ul style="list-style-type: none"> Inpatient Care Management <ul style="list-style-type: none"> Drug utilization evaluation studies Caseload reports Administrative Procedures <ul style="list-style-type: none"> Electronic and printed order sets for common clinical pathways/standard orders
		IC	Functionalities requiring and supporting interdepartmental collaboration, which create new ways of providing care.	<ul style="list-style-type: none"> Clinical Care Delivery and Documentation <ul style="list-style-type: none"> Medication charting Clinical management flowcharts Inpatient Care Management <ul style="list-style-type: none"> Discharge planning screens
Phase II Broadens the range of caregiver activities included in clinical IS functionalities and builds more sophistication and complexity into the tools.	IIA		Electronically enabled caregiver no longer can accept paper-based methods; range of clinical IS functionalities expanded to eliminate more complex paper-based and manual functions.	<ul style="list-style-type: none"> Departmental Operations <ul style="list-style-type: none"> Electronic report distribution Alerts to Pharmacist Administrative Procedures <ul style="list-style-type: none"> Physician phone directory Web access for caregivers (including Medline)
		IIB	Clinical IS functionalities that support processes that are more technically challenging, involve multiple organizational groups and technologies, and build upon existing knowledge and caregiver trust in existing systems.	<ul style="list-style-type: none"> Administrative Procedures <ul style="list-style-type: none"> Electronic file cabinet for protocols and schedules Review of OR, Cath Lab, PT schedules Cross-continuum patient registration system MPI across >1 site of care Housestaff sign out cards/problem list
		IIC	Remainder of bedside and paper workflow is captured and integrated, tying in the new pieces with those already established.	<ul style="list-style-type: none"> Inpatient Care Management <ul style="list-style-type: none"> Critical lab alerts Departmental Operations <ul style="list-style-type: none"> Electronic signature
Phase III Addresses the most challenging work process in more specialized environments.			<ul style="list-style-type: none"> Clinical Care Delivery and Documentation <ul style="list-style-type: none"> Anesthesia record Telemedicine: Remote diagnostics Departmental Operations <ul style="list-style-type: none"> Digital radiography 	

Appendix 2

Functionalities by Work Processes and Phases

FUNCTIONALITIES BY WORK PROCESSES

Results retrieval

Clinical decisions commonly depend on the results of diagnostic testing. Such information needs to be pervasively available so that caregivers can make the most appropriate and expeditious decisions wherever they are physically located, unencumbered by competition for the physical asset (the chart), and with data presented in the way that optimize understanding of the clinical problem. Data from prior encounters enhance understanding of the patient's clinical trajectory, highlight potentially significant issues, and reduce duplicative evaluations.

Clinical care delivery and documentation

Patient care is a team activity. Consequently, sharing information among, and coordinating the activities of, the caregiver team are essential for clinical effectiveness. The information with the greatest impact is that which is used by the most people, unambiguous in its significance, and directly needed for the most important clinical decisions. Gathering all the data needed for a clinical judgment and presenting it optimally result in greater clinical effectiveness.

Inpatient care management

While primary caregivers focus on the patient in front of them, others look at a larger population, ensuring that the resources and needed attention are applied where most needed. Identifying those patients where there is likely to be a need for more help, more expertise, or there is an opportunity to improve the effectiveness of care is a key

way to leverage data that have been gathered in the course of Clinical Care Delivery. Fundamentally, it is a way to make sure no one "falls through the cracks" and that resources are focused on those in greatest need.

Departmental operations

Bedside patient care depends on the support of many people and systems outside the patient's room. These departments are "high transaction volume" environments where high service levels are essential for the rest of patient care to be efficient. Happily, extensive automation has already occurred in these areas, though gaps remain.

Administrative procedures

Many work processes must occur to enable and implement direct patient care. They are closely related to patient satisfaction and efficiency of operation of the clinical staff.

FUNCTIONALITIES BY PHASES

The CLINT functionalities were defined and prioritized by broad-based discussions throughout CHW among more than 250 caregivers, technicians, administrative staff, managers, and executives. Then, extensive assessments of these functionalities were done throughout CHW through contacts with over 200 CHW caregivers. The tiers from the discussions and learnings from the assessments have been combined into the phases which are described in this appendix. The CLINT phases form a logical sequence that describes how an organization can implement the CLINT functionalities—getting the most value and least disruption up front and building on the foundation of the earlier phases.

Table 1. Phases IA through IC functionalities

Phases	Work process	Functionality
Phase IA	Results retrieval	Lab results review by encounter Radiology transcribed results Microbiology results review Blood gas results review
	Clinical care delivery and documentation	Printed medication administration records Transcription Physician patient list
	Departmental operations	Laboratory departmental functions Pharmacy departmental functions Radiology departmental functions
	Administrative procedures	ADT (Admissions, Discharge, and Transfer) system Order entry to all departments
Phase IB	Results retrieval	Physician rounds report Longitudinal lab results review Longitudinal radiology results
	Clinical care delivery and documentation	Bedside numbers (vitals, I&O, weights, oximetry) Medication allergies Medication profile Medication vending machines
	Inpatient care management	Drug utilization evaluation studies Casefinder reports
	Administrative procedures	Electronic and printed order sets for common clinical pathway/standard orders
Phase IC	Clinical care delivery and documentation	Medication charting Clinical management flowsheets
	Inpatient care management	Discharge planning screens
	Administrative procedures	Electronic communication among all clinical caregivers

Phase I

Phase I establishes infrastructure and incorporates workflow improvements for the high volume and high value clinical transactions (see Appendix 2, Table 1).

Phase IA

The most basic administrative and clinical transactions have to work before more complex workflows can be affected. These are high volume and high value clinical transactions, which must be done, so that if there are inefficiencies the impact will be felt in delayed or ineffective clinical decisions, staffing to offset the inefficiencies, or poor service levels.

The effective accomplishment of these functionalities also establishes the basis for doing more complicated functionalities, by getting devices in place where caregivers can get to them, deploying passwords and familiarity with the system, and creating the habit that “the computer is where you look for information.”

Phase IB

These functionalities get more deeply into caregivers’ workflows, focusing on those tasks that can be cumbersome to do manually and whose workflow can be relatively straightforwardly improved. For example, data which is sought by many different

Table 2. Phases IIA through III functionalities

Phases	Work process	Functionality
Phase IIA	Results retrieval	Lab order status available on HIS Blood bank product status
	Inpatient care management	Microbiology/antimicrobial therapy alerts
	Departmental operations	Electronic report distribution Alerts to Pharmacists
	Administrative procedures	Physician phone directory Web access for caregivers (including MedLine)
Phase IIB	Results retrieval	Images of digital modalities (CT, MR, US, NM)
	Clinical care delivery and documentation	ICU/OR/OB monitor to computer download Nursing physical assessment Remote access from MD home, office
	Inpatient care management	Drug lab alerts
	Administrative procedures	Electronic file cabinet for protocols, schedules Review of OR, Cath. lab, PT schedules Cross-continuum patient registration system MPI across >1 site of care Housestaff signout cards/Problem list
Phase IIC	Results retrieval	Pathology transcribed results
	Clinical care delivery and documentation	Patient careplans/pathways Documentation of nursing interventions Documentation of all ancillary caregiver interventions
	Inpatient care management	Critical lab alerts
Phase III	Departmental operations	Electronic signature
	Clinical care delivery and documentation	Anesthesia record Telemedicine: CME Telemedicine: Remote diagnostics
	Inpatient care management	Alerts to RNs and MDs Physician order entry
	Departmental operations	Digital radiography

personnel in the hospital, and which therefore can have a huge impact on clinical decision-making, are put into electronic form so they can be made available in different ways, each optimized to serve a different purpose. Calculations are done automatically, improving availability, accuracy, and efficiency.

Phase IC

Functionalities requiring and supporting interdepartmental collaboration are added

here, building new ways to do work. Paper Medication Administration Records go away, leading to much more flexibility in displaying the effects of medication therapy using Clinical Management Flowsheets and enabling even better medication monitoring.

Phase II

Phase II broadens the range of caregiver activities included and builds more sophistication and complexity into the tools (see Appendix 2, Table 2).

Phase IIA

The electronically enabled caregiver at this point can no longer accept paper-based methods, so the range of tasks is broadened, with the easier extensions of the electronic capabilities established in Phase I.

Phase IIB

More complex and more technically challenging work processes are tackled here. Many more decisions about clinical processes, such as the degree of detail required for documentation, are made. Multiple organizational groups and technologies interact,

which is harder to make work than in earlier phases, but builds on existing knowledge and trust.

Phase IIC

The remainder of the bedside and paper workflow is captured and integrated, tying in the new pieces with all that has already been done.

Phase III

Phase III tackles the more challenging work processes in more specialized environments.