

A Toolkit for Redesign in Health Care

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Denver Health

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Contents

- Introduction.....1
- Description of Denver Health.....1
- Forces Which Compel System Redesign/Transformation.....2
- Redesign Planning Steps3
 - Step 1. Assess Readiness for Major Redesign.....4
 - Step 2. Establish the Perspectives for Redesign6
 - Step 3. Create a Structure for the Redesign Process.....8
 - Step 4. Gather External Data9
 - Step 5. Gather Internal Data.....11
 - Step 6. Choose the Tools To Enable Redesign Implementation.....23
- Strategies for Translating Information Into Proposed Projects for Implementation.....28
- System Metrics.....30
- Acronyms and Abbreviations44

Figures

- 1. Perspectives for transformation6
- 2. Sample primary data collection tool: intern.....16
- 3. Sample pie chart: trauma resident (24-hour shift)17
- 4. Sample Pareto diagram: trauma nurse (24-hour observation)18
- 5. Sample Pareto diagram: trauma nurse and interruptions (24-hour observation)19
- 6. Sample value stream map: phlebotomy21
- 7. Sample area diagram: phlebotomy.....22
- 8. Sample top-down format: laboratory test23

Sample Forms

- A. Site visit/conference call questions32
- B. Employee focus group questions.....33
- C. Confirmation letter for patient/family focus group.....34
- D. Patient/family focus group facilitator questionnaire.....35
- E. Patient/family focus group consent form36
- F. Staff process flow observation form.....38
- G. Patient process flow observation form.....39
- H. Staff member consent form.....40
- I. Patient consent form42

Appendixes

- A. Review of the Literature45
- B. Definitions64

Introduction

The broader and deeper the scope of the redesign effort of a hospital, the more likely redesign produces system-wide transformation. For the purposes of this project, “redesign” and “system transformation” will both be used to describe the desired process outcomes.

In October 2003, Denver Health began a major effort to redesign/transform the process of care in the hospital in a comprehensive manner. This project was supported by the Agency for Healthcare Research and Quality through Contract No. 290-00-0014.

This document presents the following information:

- A brief description of Denver Health gives context for the redesign process. It enables others to identify the attributes of their system that are similar to or different from those of Denver Health and to assess how these attributes may influence their application of the approach to redesign described below.
- Forces that compel health care systems to embark on redesign or system transformation.
- Steps to be taken in planning for redesign/system transformation. In general, the steps are listed and discussed in the temporal sequence in which they occurred. Following these steps in this sequence will provide a robust approach for planning redesign.
- Strategies for translating information gathered into proposed projects for implementation. This is presented to show the depth and breadth of activities which can emerge from the planning process. Some of the proposed projects which emerged from Denver Health’s planning process may be different from those that would emerge from another institution’s planning, depending in part on the forces that affect the institution and the information arising from its external and internal data gathering. However, delineating the projects provides examples for consideration.
- Potential metrics for use in the implementation phase. The metrics would vary to some extent, depending on the nature of the projects to be undertaken. However, the system metrics that suggested here should be useful capturing meaningful change at the system level.

The information detailed in this report provides an approach to redesign utilized by Denver Health. It is presented here with the intent to help others who wish to undertake the process of redesign or system transformation.

The implementation phase has just begun, so this document does not provide information on the actual implementation of the redesign process or data on outcomes of redesign.

Description of Denver Health

Denver Health is a large integrated, urban, academic safety net institution. Various aspects of this system are listed below.

Components of the Integrated System

- 911 system for City and County of Denver.
- 398-bed acute care hospital with Level I trauma center.
- 8 family health centers (federally qualified health centers).
- 12 school-based clinics.
- Public health department for the City and County of Denver.
- 100-bed non-medical detoxification center.
- Correctional care facility.
- HMO for Medicaid, Child Health Plan, and commercial product.
- Call center—regional poison center, drug line for national companies, nurse advice line, translation line, centralized scheduling.

Demographics of Population Served

- Approximately 150,000 individual users.
- Approximately 70 percent of patients are members of ethnic minority populations.
- 27 percent of the patients are non-English speakers.
- 42 percent of charges are for uninsured patients.
- \$285 million in care to uninsured patients in 2004.

Organizational Aspects of the System

- Is an independent government entity.
- Employs 4,100 individuals, including physicians.
- Has a formal academic affiliation with the University of Colorado School of Medicine.
- Provides a learning environment for 160 interns and residents at any given time, integrated with University of Colorado School of Medicine
- Employs physicians who have a full time faculty appointments at University of Colorado School of Medicine

Information Technology Structure

- \$225 million investment in information technology since 1997.
- Integrated information technology across the entire system.
- Single patient identifier for the integrated system.
- Single electronic medical record across the integrated system.
- Integration of financial, clinical, radiology, pharmacy, and laboratory data.
- Computers in all clinic offices; chartless environment.
- Initial phases of roll out of computerized provider order entry.

All Denver Health community health centers, the hospital, emergency services, pharmacy, and laboratory systems use the same unique identifier for patients; thus, outpatient, inpatient, and ancillary service data can be linked to evaluate health services utilization, medication use, and provider compliance with guidelines.

Forces Which Compel System Redesign/Transformation

There are many reasons which compel all health care systems to embark on process redesign/system transformation. These include:

- Continued rise in hospital costs.
- Concerns about patient safety and quality.
- Little change in the core health care processes over decades.
- Silos of care provision.
- Little application of knowledge from other industries.
- Enormous redundancies in care delivery processes.
- Numerous patient handoffs.
- Major workforce shortages.
- Employee dissatisfaction.
- Resident work hour limitations.
- Limited involvement of the patients and their families in hospital care.
- Patient dissatisfaction.

Although the impact of each one of these factors may vary from system to system, all of these factors impact every health care delivery system to some degree. At Denver Health, of most concern at this point in time were the following: costs, safety, quality, lack of change in processes through the application of tools from other industries, redundancies in processes, and workforce shortages. This led us to focus on tools which addressed these major concerns. It is critically important for the leadership of a system to articulate these forces and how they necessitate change.

Redesign Planning Steps

After the decision on the need for system redesign was made, steps were taken to plan for process redesign as follows:

1. Assess readiness for major redesign.
2. Establish the perspectives for redesign.
3. Create a structure for the redesign process.
4. Gather external data.
 - Conduct a literature review.
 - Form an External Steering Committee.
 - Conduct site visits.
5. Gather internal data.
 - Conduct employee focus groups.
 - Conduct patient focus groups.
 - Observe current processes.
 - Present data.
6. Choose tools to enable redesign implementation.
 - Tools that facilitate process change.
 - Tools that facilitate change in the environment, culture, and/or workforce.

It should be noted that this planning process took place over a 12-month period. The duration of this planning process underscores the need for a well thought-out sequence of events, which

must be accomplished before a major comprehensive redesign/system transformation effort can begin.

Step 1: Assess Readiness for Major Redesign

Before launching a major redesign effort the leadership should address the readiness for embarking on hospital redesign or system transformation. This can be assessed in part by asking and answering the questions below:

- What other redesign projects have been completed?
- What were the lessons learned from these projects?
- Does the workforce believe that there were benefits from implementing these projects?
- Is there a compelling reason(s) for redesign?
- Are top administrative, physician, and nursing leadership committed to redesign?
- Can champions be identified and developed?
- Is the culture committed to data and information sharing?
- Does the workforce have the needed skills and tools to accomplish redesign?
- Does the system have the resources to undertake the redesign process?

It is important for both leadership and employees to identify and examine past redesign efforts. Once past redesign projects are identified, those responsible for managing the projects should develop a document which:

- Describes project goals.
- Determines if goals were achieved.
- Describes the barriers to achieving the goals.
- Delineates the factors contributing to success.
- Identifies lessons learned.

Sharing these past projects with everyone creates a sense that the organization has experience with successful redesign projects and therefore can successfully tackle system redesign. For example, Denver Health's previous redesign efforts include improvements in both business and clinical processes. Business redesign efforts included:

- The transition of the entire system from a department of city government to an independent government entity.
- The development and implementation of a comprehensive information technology strategy for the entire hospital system.

Clinical redesign efforts included:

- Complete restructuring and integration of behavioral health with other system components.
- Redesign of primary care processes.
- Implementation of an open access system.
- Diabetes disease management system.
- Structured community outreach effort.

At the beginning of this current redesign effort the participants in these past redesign efforts delineated the lessons learned. Many of these past lessons were validated as the current planning process evolved:

- A compelling reason to change is needed.
- Redesign must address issues people are battling. For providers, compelling reasons are:
 - Improving their ability to provide care.
 - Improving the quality of patient care.
- All stakeholders need to be at the table.
- Frontline people need to be involved and heard.
- A leader for the change is crucial.
- Leaders of change need the skill set to define issues and accomplish the change.
- Consultants can be very helpful in providing expertise, but internal people need to lead the change.
- Balance is needed between acquiring data to define the problem, implementing the intervention, and evaluating outcomes within a short time frame.
- The need for cultural change must not be underestimated.
- A well thought-out communication plan is necessary.
- Key message must be something everyone can understand.
- Expect and communicate failures, holdups, etc. as well as successes.
- Education and training are essential.
- Appropriate infrastructure must be available.
- Education and training are essential.
- Sustainability requires transformation; inability to go back to the old way is the best approach to sustainability.

Many compelling reasons for change were identified. For management, a compelling reason for change is often financial, but for providers the most compelling reason is improvement in patient care or the process by which they can provide care. (This will be discussed further in Step 2.)

Both top hospital management and clinical leaders must be engaged for successful hospital system redesign; the broader in scope the project the higher the level of staff who must be engaged in the redesign process. (This will be discussed in more detail in Step 3.)

Hospital system transformation depends on democratization of data; the more comfortable the organization is with sharing and understanding data, the easier transformation will be. (This will be discussed further in Steps 4 and 5.)

It appears that most health care workers do not have the necessary skill set for implementing major redesign. Therefore, the needed skills and tools must be identified and provided. (This will be discussed in more detail in Step 6.)

The system must have and be willing to commit sufficient resources to bring a project to a pre-determined endpoint. Failure to do this will undermine future efforts.

It may not be necessary to answer all of these questions on readiness before beginning the hospital redesign process, but there should be plans to quickly address all or most of these issues.

Step 2: Establish the Perspectives for Redesign

It is valuable to establish perspectives from which the redesign process will be viewed. These perspectives will serve as guides to the redesign effort and will help focus process changes. Figure 1 served as a template of the perspectives for redesign at Denver Health and has helped guide the transformation planning effort. Health care systems are very complex, and the processes of care are so interrelated that multiple concurrent perspectives seem both valuable and necessary for successful redesign. For system-wide transformation, the perspectives for redesign and the areas of activity should include:

- Quality
- Safety
- Customer service
- Efficiency
- Architecture/physical environment
- Workforce development, including physician development

Figure 1. Perspectives for Transformation

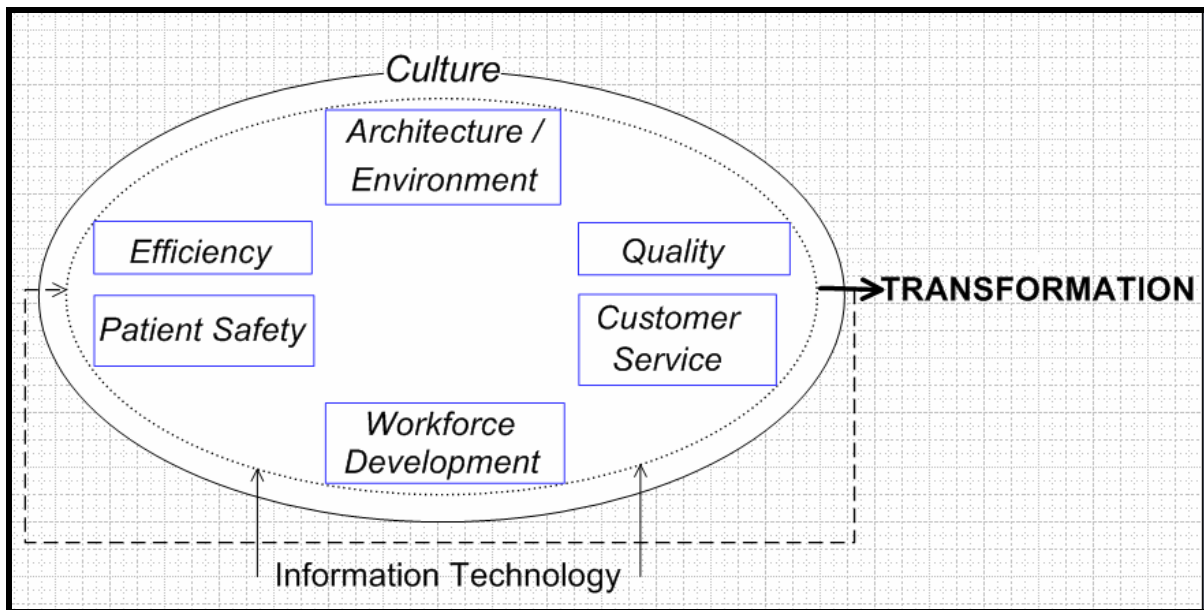


Figure 1 shows that architecture, quality, customer service, workforce development, patient safety and efficiency all are perspectives from which to drive transformation. Each of these perspectives creates feedback loops between and within each perspective, represented by the dotted circle touching each of the perspectives and the broken line emanating from transformation back to the perspectives. For example, utilizing quality as a perspective can result

in transformations in processes that not only improve quality but also improve customer service. All of the perspectives are surrounded and embedded in the culture of the organization.

The process transformations driven from these perspectives are supported by information technology. Information technology is not the driver but rather the facilitating mechanism for achieving the desired change. However, it should be noted that Denver Health already has a sophisticated information technology system in place.

Based on the research conducted for this project, it appears that other health care systems that have undertaken redesign/system transformation have adopted some of these perspectives and have used tools that translate these perspectives into action. For example:

- Virginia Mason Medical Center used the Toyota Production System, or Lean, and appears to have focused on efficiency.
- The Department of Veterans Affairs health care system appears to have utilized the perspective of safety to drive its transformation. Six Sigma tools can be used to implement redesign from this perspective.
- Intermountain Health Care of Salt Lake City and those institutions engaged in the Institute for Healthcare Improvement's Pursuing Perfection projects appear to have adopted the perspective of quality to drive system change.
- Baptist Hospital, Inc. in Pensacola, Florida, appears to have primarily utilized the perspective of customer service to implement system transformation. Utilization of the Baldrige criteria appears to facilitate this approach.
- The Planetree Institute model of patient-centered care includes concepts and new ways to design healing environments in health care systems and focuses on the physical environment for transforming health care delivery.
- Some institutions that pursue magnet status in nursing appear to focus on workforce development to achieve redesign. To some degree, the use of Clinical Microsystem approaches which emphasize team functioning is a workforce development perspective.

A number of these tools are discussed in Step 6.

Clearly, these perspectives may overlap both in concept and outcome. Keeping all these perspectives in focus as one begins redesign of health care systems will help prevent suboptimization. For example, if the redesign initiative focused solely on efficiency, this could negatively affect customer service or workforce development.

It is important to remember that system redesign or transformation must be embedded in the culture of the organization as reflected in Figure 1. Establishing an organizational culture committed to redesign or transformation cannot be underestimated. There are many approaches that help create this culture. These include, but are not limited to:

- Giving the project an identity.
- Communicating regularly with the workforce regarding the need for change.
- Communicating the progress and impact of redesign efforts.
- Actively engaging the workforce in the process of redesign.
- Training the workforce to use tools that empower them to participate in the change.
- Meaningfully engaging the leadership.

Jonkoping County Council in Sweden, one of the leaders in health system redesign and transformation, named a major redesign project “The Esther Project,” thereby providing a human face to transforming the care process from primary care through hospital care. The Institute for Healthcare Improvement projects were called Pursuing Perfection. At Denver Health, the redesign project was entitled “Getting it Right: Perfecting the Patient Experience.”

As in all change process efforts, communication is necessary. The communication approaches found helpful at Denver Health were:

- Regular columns in the employee newsletter written by the Chief Executive Officer (CEO).
- Lectures and discussions on the project to leadership, physicians, and middle managers.
- An employee newsletter devoted to redesign.
- A specific intranet site devoted to Getting It Right: Perfecting the Patient Experience.
- Employee forums with the CEO.
- Employees creating a code of behavior.

These perspectives were proposed early in the course of the project and confirmed by the review of the literature, discussions with the External Steering Committee, and site visits. These approaches are discussed in detail in Step 4.

Step 3: Create a Structure for the Redesign Process

Three components are needed in creating a structure for redesign:

- Establishing a point person to lead redesign.
- Developing a team to oversee the planning approach.
- Developing a broad-based internal group of leaders and champions.

The higher in the organization the lead person, the more likely that the redesign effort will be operationalized and sustained. All employees will understand the importance of this effort when it is led by a person of responsibility for the hospital system. At Denver Health, the CEO/Medical Director leads the redesign project.

A core project team must also be formed. This group carries out many of the actual approaches used. Its composition depends heavily on the scope of the project. However, regardless of scope, one person must assume the role of project manager. The core team must include individuals with the competency to gather, analyze, and interpret the data. The addition of an industrial engineer or operations management engineer is an important member of the project team. The Denver Health core team included:

- Industrial engineer
- CEO/Medical Director
- Value Analysis Coordinator (a nurse with clinical expertise)
- Director of Health Services Research
- Data and research analysts

It is equally important to have broad-based operational support through the creation of an Internal Steering Committee whose members include providers and administrators at various levels of leadership in the organization and in many departments of the hospital system. This group can become the leaders and champions of redesign throughout the organization.

The Internal Steering Committee should review information gathered at various stages of the redesign process, determine whether the information is valid and identify potential strategies for improvement. The members of this committee will also be key in assisting with the cultural change within the organization. Members can include:

- Chief Executive Officer
- Chief Operations Officer
- Chief Information Officer
- Chief Financial Officer
- Chief Nursing Officer
- Chief of Human Resources
- Medical Director
- Chief of the medical staff
- Clinical department chairs
- Director of Quality Improvement
- Nursing Administration
- Pharmacists
- Laboratory Director
- Materials Management Director
- Nursing staff
- Physician staff

Step 4: Gather External Data

There is always wisdom in learning from others. We found there were three helpful approaches in learning from others:

- Conduct a review of the literature.
- Form an External Steering Committee.
- Conduct site visits.

Conduct a Review of the Literature

Reviewing both the health care and non-health care redesign literature is both necessary and important. A separate literature review, focused on redesign efforts, was conducted (see Appendix A). This review utilized the six perspectives of quality, safety, customer service, efficiency, architecture/environment, and workforce development illustrated in Figure 1. Gathering this information is helpful in understanding not only current and past redesign initiatives, but also the applied theory behind the tools that have been used.

Form an External Steering Committee

During the beginning stages of Denver Health's system transformation, it was beneficial to create an External Steering Committee consisting of leaders in health care and other industries.

This committee included representatives from the following:

- Hospitality industry.
- Supply chain management industry.
- Information technology industry.
- Professional health care organizations.
- Architecture firms.
- Quality organizations.
- Regulatory entities.
- Payers.
- Other health care organizations.

The non-health care members provided different perspectives in reviewing data and different approaches for achieving meaningful redesign. These members had specific experience related to successful redesign and process improvement. Health care representatives provided insight into strategies they had tried and lessons they had learned from health care improvement projects.

This external group met quarterly and members had individual quarterly telephone calls with the CEO. The quarterly committee meetings were structured half-day meetings chaired by the CEO. The group provided guidance regarding alternative approaches and insights into data gathering and interpretation.

Some illustrative questions posed to the External Steering Committee over the course of the year were:

- Were the lessons learned from past projects likely to be helpful in guiding the current effort?
- Which institutions/industries should we consider for site visits and calls?
- Is our assessment of the lessons learned from these visits the ones which are likely to be helpful in our efforts?
- What is the ideal balance between training all employees and highly training a subset of employees?
- Can many small projects lead to system transformation?
- How many projects are enough?
- How do we avoid suboptimization and unintended consequences?
- What is best way to display and analyze all the process flow data?
- What system metrics should we use to measure success?

Conduct Site Visits

If site visits occur, one must ask where to go, whom to send, and what data to collect. It is suggested that site visits or conference calls include both health care and non-health care industries. There is much that can be learned from the non-health care industries, and it is important that they be included. Examples of industries that could be visited or contacted are:

- Aerospace.
- Auto.
- Airline.
- Information technology.
- Manufacturing.
- Distribution or shipping.
- Service sector.

These industries have developed strategies and approaches to improve quality, efficiency, customer service, and safety. Some of these strategies and approaches can be applied to the health care environment to redesign health care systems.

Health care systems have not reached the depth and breadth of redesign that other industries have achieved, but it is valuable to visit health care systems as well. Examples of health care institutions that could be visited include those that:

- Have published or presented major redesign projects.
- Have won awards.
- Are magnet hospitals.
- Are part of the Pursuing Perfection project.
- Have major new construction emphasizing a healing environment or safety.
- Have pioneered implementation of health information technology.

Nothing can take the place of a site visit to another organization, but much can be gained by a properly structured conference call with a leader in the redesign effort at that institution. The time and dollars saved by having a conference call rather than traveling to another site can be considerable. This is particularly true for some sites that charge fees for visits.

It is recommended the team of individuals participate in the site visits and conference calls. The team should include a clinical person—a physician or nurse, an analyst and/or engineer, and a member of the Internal Steering Committee. These visits not only generate insights, but they also create organizational champions. Of note, when Virginia Mason began its system transformation effort, the entire leadership team was sent to a factory in Japan for 2 weeks to work the lines and learn first hand the Toyota Production System. This hands-on intensive approach has continued.

Before any visit or conference call is undertaken, a standard set of questions should be developed. Form A is a sample list of site visit and conference call questions.

Step 5: Gather Internal Data

In addition to what can be learned from others, there is also much to learn from one's own organization. Internal data gathering includes the following:

- Conduct employee focus groups.
- Conduct patient focus groups.
- Observe current processes.
- Present data.

Conduct Employee Focus Groups

Employee focus groups are a method for gathering data, informing the workforce, and helping create a culture to support transformation. These focus groups help to determine the status of the institution from the employee's viewpoint. To accomplish this, it is recommended that standard questions be developed and asked of all employees. Questions can be sent in advance so employees will be ready to contribute, and those who are unable to attend can send in their answers. Sample questions that can be asked of employees are listed in Form B.

It is suggested that the focus groups be divided by categories of personnel, such as housekeeping or respiratory therapists. It is best to conduct clinical and nonclinical groups separately as their issues appear to be quite different. Focus groups were conducted with the following groups of Denver Health employees:

- Food and environmental services.
- Ward clerks.
- Speech Therapists.
- Occupational therapists.
- Physical therapists.
- Laboratory technicians.
- Licensed practical nurses, health care technicians.
- Radiology technicians.
- Respiratory therapists.
- Pharmacists.
- Nursing leadership, charge nurses, nurse educators, nurse practitioners, nursing council.
- Materials management.
- Engineering.
- Physicians.

These focus groups should be conducted by someone at the executive level as opposed to immediate supervisors so that ideas and information can be freely exchanged. During the Denver Health project, all the groups were facilitated by the CEO. The meeting should be held at a time that will make it easy for the employees to attend, and the meetings should be no longer than 1½ hours. Minutes should be taken or meetings should be tape recorded so that common themes can be documented.

The minutes can then be sent to supervisors and executives responsible for these areas. Some employee suggestions can and should be acted on immediately even if they are not related to redesign. This immediate response will help build support and reinforce a culture for redesign of a hospital system. It is critically important to inform all participants that redesign will take time; and if they do not see their suggestions acted on immediately, it does not mean they are being ignored.

The cross-cutting issues identified by employees can help prioritize areas for redesign during the implementation phase. At Denver Health, important cross-cutting issues identified to date from the employee focus groups are:

- Desire for respect from other disciplines and employee groups.
- Need for effective communication across disciplines.
- Need for clear clinical escalation processes.
- Desire for increased autonomy of non-physician health care professionals.
- Need for process streamlining.
- Need for greater ease of accessing small equipment such as wheel chairs.

Conduct Patient Focus Groups

Patient and family focus groups can provide insight into the care provided and other hospital experiences during a patient's stay. It is important to include both the patient and at least one family member involved in the patient's stay because each experiences different aspects of the care processes.

It is suggested that patient/family focus groups consist of no more than 10 patients and 10 family members. This size allows for an expected no show rate of 1-2 families and allows for each family to contribute during the 1½-hour time frame. It is best to recruit patients who have had a recent inpatient stay, such as within the previous 6 months.

If your institution has a substantial socioeconomic, cultural, and language diversity in the patient population served, you may find it helpful to have different focus groups. For example, Denver Health had four sets of focus groups:

- Insured English speakers.
- Uninsured English speakers.
- Insured Spanish speakers.
- Uninsured Spanish speakers.

If the patient and family member agree to attend, a confirmation letter can be sent to the patient (Form C), which includes time, place, and directions. Recruiting is also improved if a stipend or gift can be offered.

It is suggested that a set of standardized questions be developed for the focus group. As noted above, the time should be limited to 1½ hours. Form D provides sample patient/family focus group facilitator questions used at Denver Health.

If the results of these focus groups are expected to be used for research, the protocol will need to be approved by the human subjects institutional review board (IRB). Form E is an example of an IRB-approved patient and family consent form for participation. If the focus group information is to be used for operational purposes only and is not to be published or presented, IRB approval will not be necessary.

Patient focus groups at Denver Health revealed that patients want to be active participants in their care through shared information and shared responsibility. This concern must be considered in redesign.

Observe Current Processes

It is essential to understand current processes before process redesign can begin. The value of this step cannot be underestimated both in the planning and subsequent choice of tools for the implementation phase.

There are different approaches to depict process data. Each approach can provide different insights and answer different questions. Therefore, experimentation with data presentation is extremely helpful during the redesign planning phase.

Before processes are mapped, it is necessary to identify who will conduct the observations and to define the scope of the process to be observed. It is also necessary to define a beginning, an end, and a methodology for all of the processes to be observed.

The mapping team should include a nurse and analytical person and an industrial or operations engineer from the core analytical team. Observation ability and mapping improve with time; therefore standardization of the data collection tool and consistency in members of the team may be important.

During process mapping, the following information is collected:

- Name of process.
- Process owner.
- Process output/product.
- Who is involved in delivering the process.
- Who cares about the process.
- Extent of the process to be mapped.
- Activities that define the process.
- Start point.
- End point.

The process-flow mapping can be conducted with patients, staff, and ancillary services with the mapping of movement of people, materials, and information. It is possible to map out any process or system in the hospital. It is advisable to meet with the supervisor of the group to be observed before proceeding, both to alleviate concerns about redesign project team staff who will be gathering information from the department or unit and to ask the supervisor what he or she perceives as problems.

It is vital to monitor and document all of the important events during a patient's stay, staff work shift, or the movement of materials and information. Through this information, operational staff will be able to identify the following types of events that can be changed to improve processes:

- Waste (non-value-added time) such as travel or waiting time, searching, and gathering.
- Bottlenecks.
- Redundancies.
- Points of dissatisfaction.
- Inefficient use of workforce skills.

Forms F and G are sample data collection tools for mapping process flows. Appendix B illustrates standard definitions for the patient and staff activities in flows. Standardizing definitions is important to ensure that the observers are documenting activities in a similar manner, which improves the reliability of the observations.

A selection of business processes, ancillary service processes, and clinical processes will provide an overview of the range of hospital processes. Some of the processes and departments that may be selected for process mapping include:

- Admission process.
- Discharge process.
- Food service.
- Materials management.
- Phlebotomy.
- Pediatric patient stay.
- Medical patient stay.
- Trauma patient stay.
- Obstetric patient stay.

The admission and discharge processes are the patient entry and exit points. The clinical departments may be selected based on the highest volume clinical services. Patients, staff, and materials can be mapped for each of the relevant processes or departments.

Providers selected for observation include nurses, interns, residents, and attending physicians working in pediatric, medical, obstetric, and trauma services. It is helpful to start with a relatively simple process such as food service before attempting more complex processes such as discharge.

Forms H and I are examples of IRB-approved consent forms for participation by staff and patients, respectively. If this information is to be used for operational purposes only and is not to be published or presented, IRB approval will not be necessary.

Present Data

The information in this section illustrates different ways of presenting data to elucidate different problems. Please note that data as examples of redesign efforts that were undertaken are not presented here; process redesign did not occur in this planning phase.

Once data are collected, the data can be entered or scanned into a spreadsheet for presentation in a variety of ways to address different questions. Figure 2 depicts a sample of data entries using the primary data collection tool. It shows the type of data collection tool that can be used to gather information for describing processes.

In this example, the processes of a staff member are being recorded—in this case, an intern—using start time and end time for each activity, who the intern interacted with, and the category of the activity (Appendix B). The description of the activity can take two forms: an open-ended narrative description and a predefined categorical description. The predefined categorical

description is useful for illustrating the data. This data collection tool can also be used to describe patient activities and processes.

Time and type of activity are the major units in which processes are measured. Some of the ways that the data can be used to depict bottlenecks, redundancies, points of dissatisfaction, and inappropriate work force issues include the following:

- Pie chart
- Pareto diagram
- Value stream map
- Area diagram
- Top-down format

Figure 2. Sample Primary Data Collection Tool: Intern

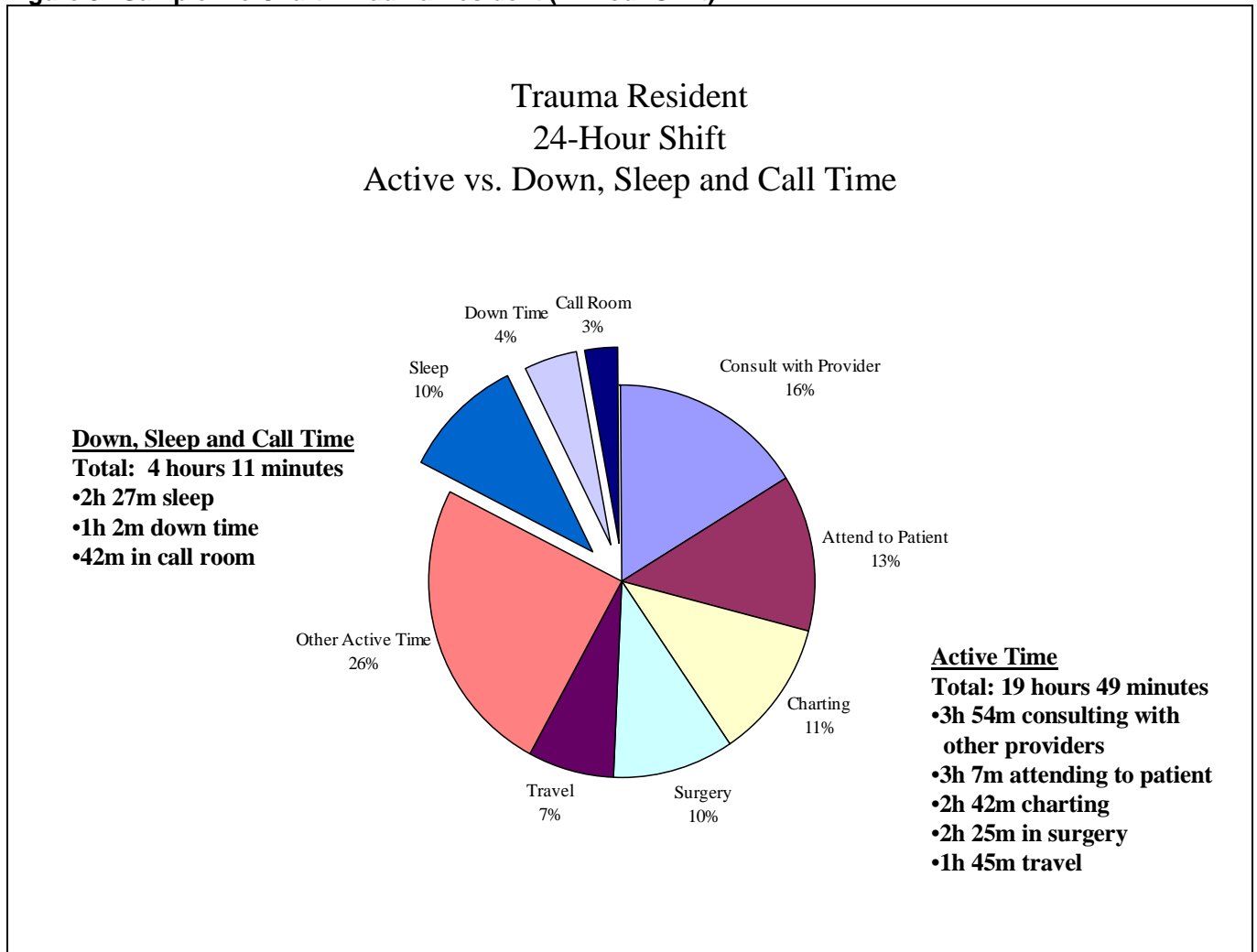
Time Start	Time End	Activity Duration	Staff Member	Interacted with	Date	Shift	Activity, Notes	Activity Category
7:00	7:07	0:07	Intern		6/14/2004	D	Writes progress note for patient	Charting (progress note)
7:07	7:30	0:23	Intern		6/14/2004	D	Waiting for rounds to start	Waiting
7:30	9:08	1:38	Intern	Physician team	6/14/2004	D	AM grand rounds	Rounds
9:08	9:35	0:27	Intern		6/14/2004	D	Entering orders on Computer	Entering orders
9:35	10:44	1:09	Intern	Cardiology team	6/14/2004	D	Cardiology rounds	Rounds
10:44	11:00	0:16	Intern	Resident	6/14/2004	D	To see patient on 8 east	Travel
11:00	11:02	0:02	Intern	Resident	6/14/2004	D	Discuss patient with resident	Consult with provider
11:02	11:03	0:01	Intern		6/14/2004	D	Break	Down time
11:03	11:09	0:06	Intern		6/14/2004	D	Entering orders on Computer	Entering orders

Note: Data in this figure are for illustrative purposes only.

Pie chart. Pie charts are helpful in providing a visual representation of the relative size of a component compared to the whole and other components. Figure 3 is an example of a trauma resident who was followed during a 24-hour shift. Time is the unit that defines this pie chart, and the different activities define different pieces of the pie.

Figure 3 distinguishes between active and nonactive time using the activity categories from the data collection tool. This type of chart answers questions about staff tasks and activities during the shift and what percentage of staff time each activity takes.

Figure 3. Sample Pie Chart: Trauma Resident (24-hour Shift)

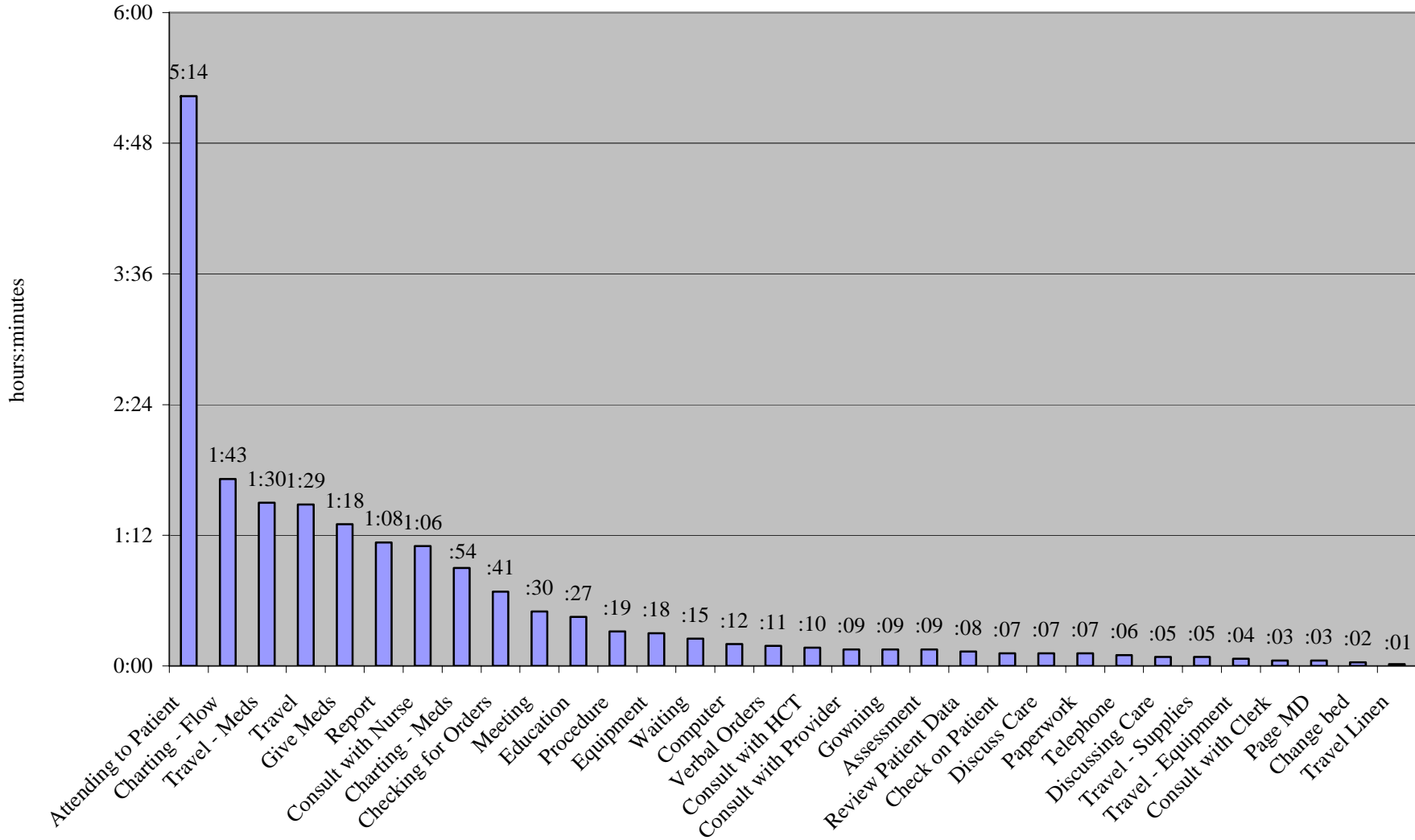


Note: Data in this chart are for illustrative purposes only.

Pareto diagram. Pareto diagrams display as a bar graph the activities being studied, arranged in order from largest to smallest. This tool is helpful in displaying staff activities and in depicting the ranking of activities.

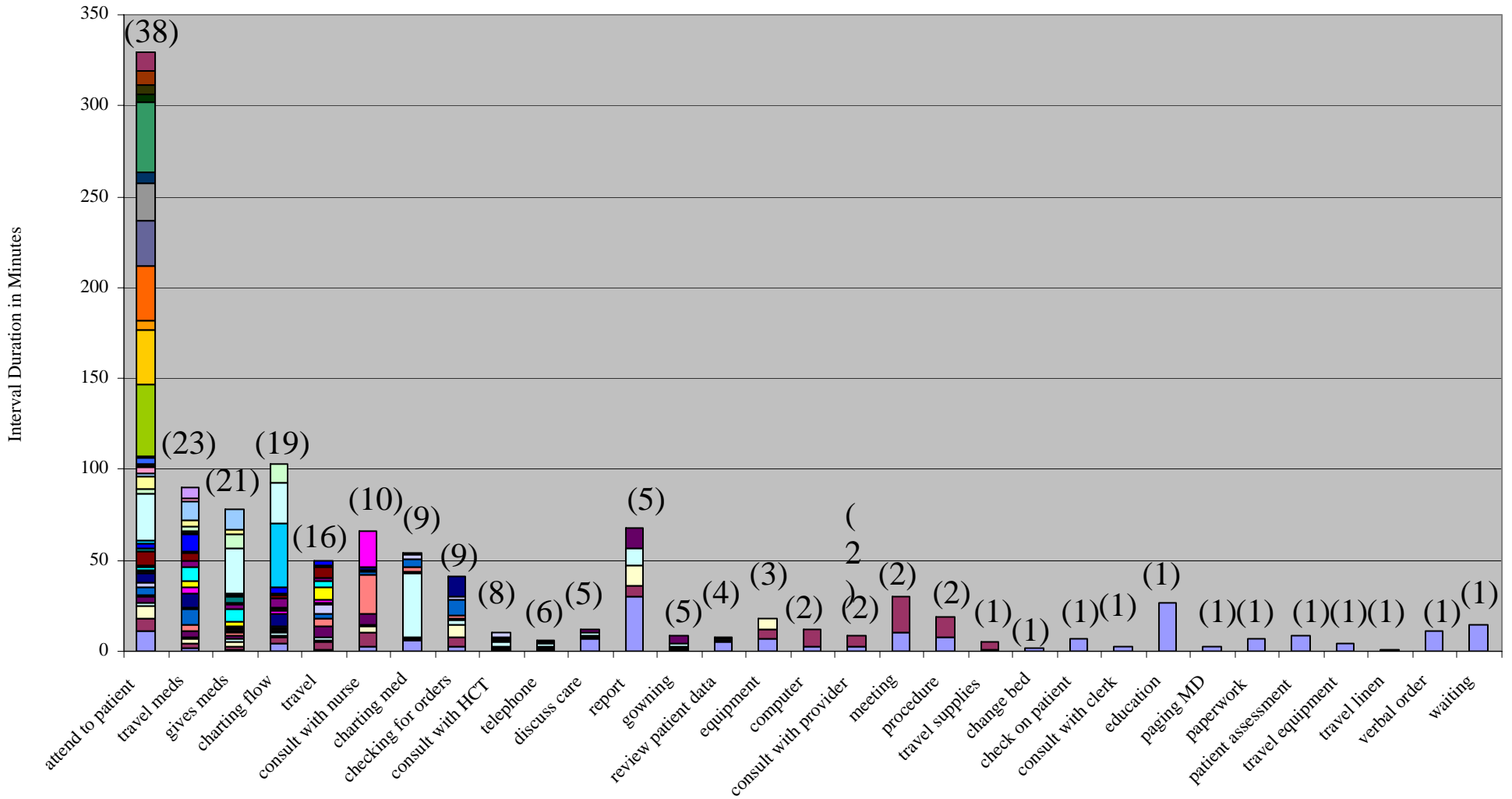
Figure 4 is a Pareto diagram that displays the time each activity consumes. Figure 5 displays the components of each bar as the individual activities that comprise the totality of the bar. This illustrates the total number of activities and the number of interruptions. For instance, Figure 5 shows that the trauma nurse attended to patients on 38 separate occasions. Therefore, this graph identifies job interruptions, although not all starts and stops of activities can be considered an interruption. (A value stream map, described below, can help distinguish between the natural beginning and end of an activity and an interruption.)

Figure 4. Sample Pareto Diagram: Trauma Nurse (24-Hour Observation)



Note: This Pareto diagram displays activities, ranked from those activities that consume the most time to those that consume the least. For example, attending to patients consumed the most time at 5.14 hours, with charting ranking the second most time-consuming activity. Data in this chart are for illustrative purposes only.

Figure 5. Sample Pareto Diagram: Trauma Nurse and Interruptions (24-Hour Observation)



Note: This Pareto diagram displays the same trauma nurse’s activities during the same 24-hour period illustrated in Figure 4. However, Figure 5 also breaks each bar into the frequency with which a particular activity began and ended. For example, the “attend to patient” bar has 38 components reflecting 38 separate times the nurse attended to a patient. Data in this chart are for illustrative purposes only.

Value stream map. A value stream map (i.e., a value-added or non-value-added [Visio] diagram) and process flow chart allow for the depiction of information and activity flow, indicating value-added and non-value-added activities for any type of process. These tools are frequently utilized in the Toyota Production System. Different shapes represent different events, such as activity, interruption, travel, wait, and downtime. This approach can help identify bottlenecks, redundancies, points of dissatisfaction, and inappropriate workforce issues.

A value stream is all the actions (both value-added and non-value-added) currently required to bring a product (blood draw, patient discharge, patient meals, patient x-ray, etc.) through the main flows essential to every product. A value stream map takes into account the activities that make up a process and the management and information systems that support the basic process.

A value stream map is useful for:

- Helping visualize more than just the single-process level.
- Identifying the sources of waste in the value stream.
- Providing a common language for talking about hospital processes.
- Making decisions about the flow apparent so that they can be discussed.
- Tying together Lean concepts and techniques, thus helping to avoid targeting processes that can lead to isolated islands of improvement instead of improvement in whole-production processes.
- Forming the basis of an implementation plan.
- Showing the linkage between information flow and patient/staff flow.

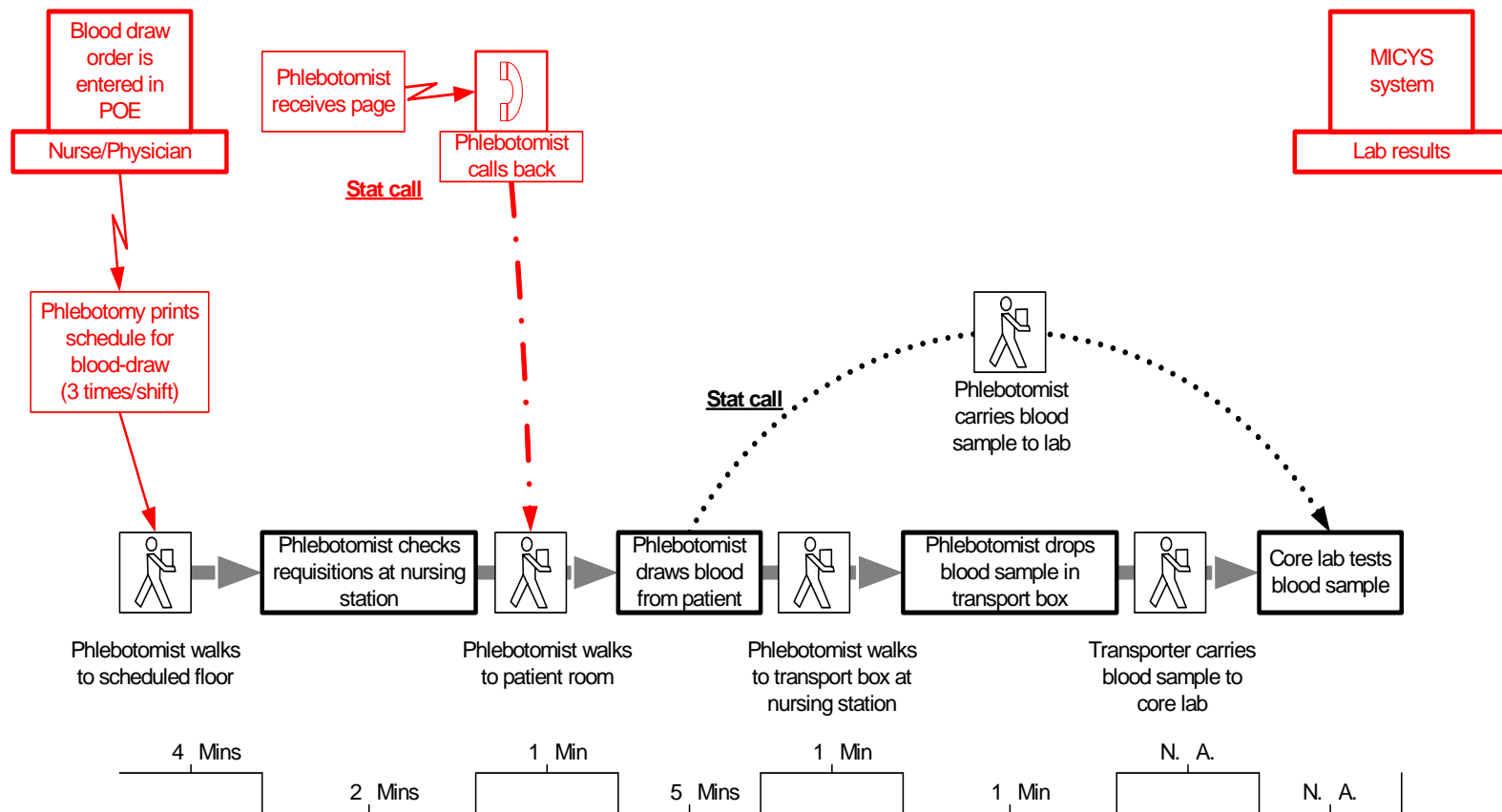
Non-value-added tasks are tasks that do not contribute to what a patient/insurer would pay for, such as tasks that do not transform the product/output (x-ray, blood draw, discharge). These include:

- Overproduction, typically using staff or equipment faster than necessary so they will have processes to complete.
- Waiting for a person or machine to complete an automatic process or for supplies or staff to arrive.
- Unnecessary transportation and rearrangement of people or materials prior to processing.
- Process design flaws, requiring staff to intervene more often than necessary.
- Stock on hand beyond any need to support normal operations or recovery from failures.
- Unnecessary motion for searching, reaching, carrying, or positioning of equipment and supplies.
- Production of defective goods.

Figure 6 is a value stream map of a phlebotomist. This diagram distinguishes non-value-added activities, such as travel time, from value-added activities such as the blood draw itself. The time for value-added and non-value-added activities is represented by the “castle wall” line at the bottom of the diagram. The non-value-added activities are depicted through the high portion of the wall and the value-added activities are represented through the dips in the wall. The non-value-added time may be further distinguished into necessary and unnecessary activities. The necessary non-value-added activities should be minimized and the unnecessary activities should be eliminated. Figure 6 also depicts the communication activities involved in the process from the point of receiving a request for a blood draw to creating the product of a laboratory result.

Figure 6. Sample Value Stream Map: Phlebotomy

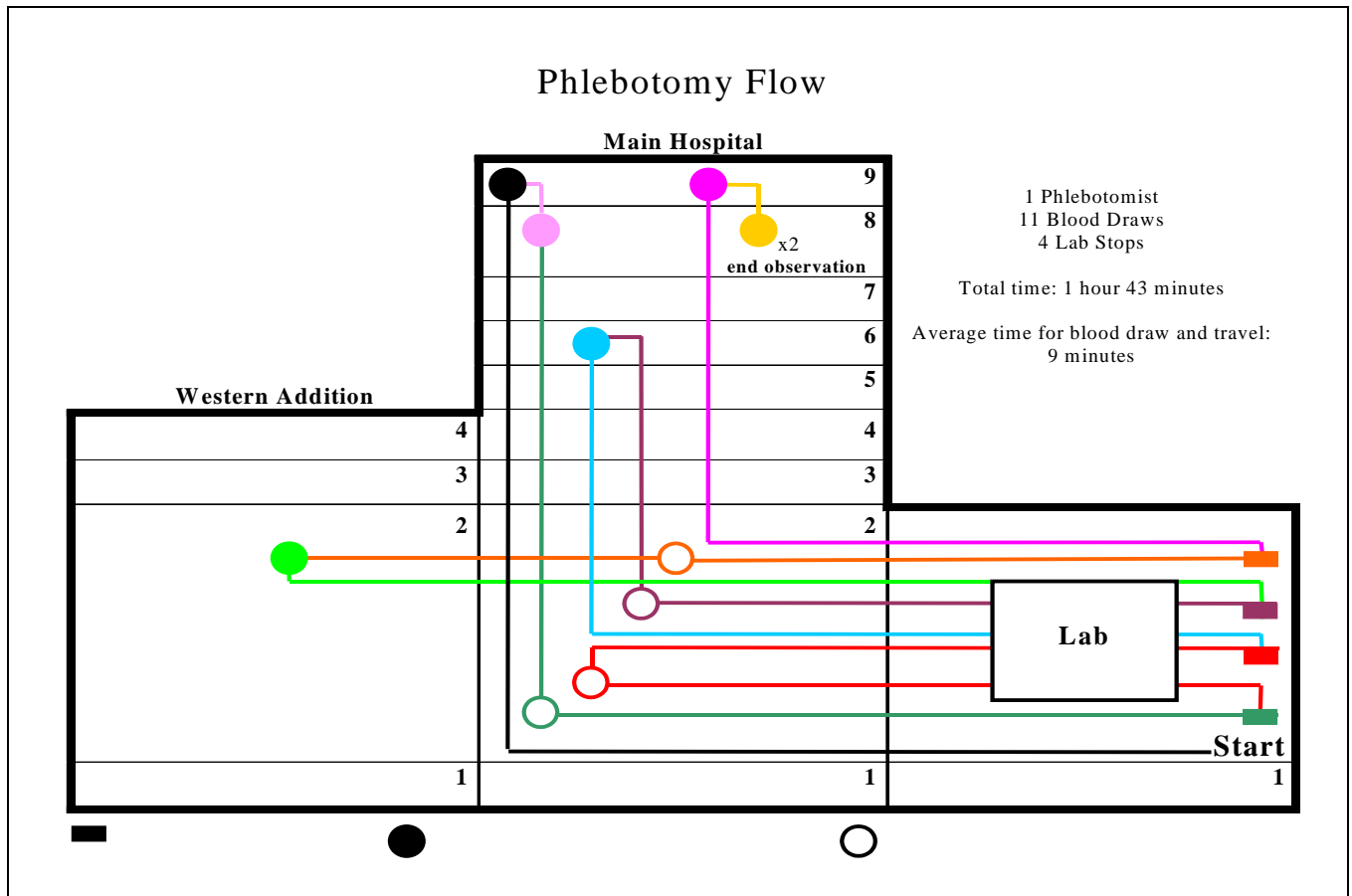
PHLEBOTOMY HIGH-LEVEL VALUE STREAM MAP (CURRENT STATE)



Area diagram. Figure 7 depicts an area diagram and is a representation of movement of staff throughout a geographic area. This could be a hospital campus, building, or unit. This type of diagram is useful in showing excessive and unnecessary travel.

Figure 7 is an example of area diagram of movement through a hospital building for a phlebotomist. The circles depict stops and signify the start time for each activity—in this case, a blood draw. A pedometer may also be used to determine travel distance and would complement this data and illustration.

Figure 7. Sample Area Diagram: Phlebotomy



Note: Data in this chart are for illustrative purposes only.

Top-down format. Figure 8 is a top-down format map. It shows the different activities, people, and their role in a process. This particular example illustrates the steps that occur between ordering a laboratory test and recording results in the medical chart. It also shows which person does each task.

This type of diagram can be helpful in understanding the number of handoffs and the number and type of staff involved in a process. This depiction can help identify redundancies and inefficient use of the workforce.

Observation of the current Denver Health process and the display of the data demonstrated that administrative, ancillary service, and clinical processes all offered many opportunities for improvement in efficiency, safety, customer service, quality, and workforce satisfaction. The observations particularly demonstrated the inefficiency in current processes including:

- Redundancies.
- Non-value-added activities, such as excessive travel.
- Numerous interruptions.

Redesign must address these core problems to be of maximal value.

Figure 8. Sample Top-Down Format: Laboratory Test

Lab Ordered and Results Recorded in Medical Chart

	Nurse/Resident/Physician	Phlebotomist	Transporter	Lab Tech	Physician
1. Blood draw Ordered	→	→			
2. Phlebotomist receives blood order for print out from POE.		↓			
3. Phlebotomist checks with nursing station on the floor.		↓			
4. Blood draw taken.		↓			
5. Blood draw recorded.		↓			
6. Blood draw transported to lab.		→	→		
7. Blood draw received and analyzed by lab technician.			→	↓	
8. Results entered into lab information (MYCIS) system.				↓	
9. Results entered into patient medical chart, ready for physician to review.				→	→

Note: Data in this chart are for illustrative purposes only.

Step 6: Choose the Tools To Enable Redesign Implementation

The majority of the health care workforce currently lack the tools needed to implement system transformation. Therefore, identifying the tools to be used in system redesign is a critical step. There are a variety of tools that have been used by both health care and non-health care systems for redesign. Many of these tools can be divided into two types:

- Tools that facilitate process change.
- Tools that facilitate change in the environment, culture, and/or workforce.

Some of these tool sets and their key characteristics are listed below. References providing more details on these tools can be found in Appendix A. This is not an exhaustive list of potential tools but rather those that have been used by others in health care and those considered here.

Tools That Facilitate Process Change

Plan, Do, Study Act (PDSA). This is a model for testing ideas in rapid cycles that one believes may create an improvement. When undertaking an improvement to a system, there are three preliminary questions and four essential steps which are repeated until the desired outcome is achieved. PDSA builds in recognition that, with systems, it is unrealistic to expect change to produce the right result every time because there are often complex interactions and dependencies that can be disturbed in unexpected ways. It is *always* necessary to check that the predicted improvement has actually happened.

The three preliminary questions are:

- What are we trying to accomplish?
- How will we know that a change is an improvement?
- What changes can we make that will result in improvement?

The four steps are:

- **Plan:** Who will do the work and when?
What equipment or training do they need?
How will information for assessing success be collected and recorded?
When will progress be reviewed?
- **Do:** Do the work according to the plan.
- **Study:** Study the information gathered.
Was the desired outcome achieved? If not what actually happened?
- **Act:** Decide what action is needed; for example:
 - Adopt the change permanently.
 - Abandon the change.
 - Make some adjustments and start the cycle again.

Additional information can be found at: <http://www.tin.nhs.uk/index.asp?pgid=1130>, <http://apiweb.org> and <http://www.ihl.org>.

Lean (or the Toyota Production System). Lean thinking is a way to work more efficiently and effectively while providing customers with what they want when they want it. It is a philosophy and set of tools that aims to eliminate waste from processes. It also focuses on what adds value in processes from the perspective of the customer. The frontline workers are heavily involved in this approach.

The 10 rules of Lean production can be summarized as follows:

1. Eliminate waste.
2. Minimize inventory.
3. Maximize flow.
4. Pull production from customer demand.
5. Meet customer requirements.
6. Do it right the first time.
7. Empower workers.
8. Design for rapid changeover.
9. Partner with suppliers.
10. Create a culture of continuous improvement.

While the primary focus is waste, the outcomes of utilizing Lean tools are efficiency, quality, and customer service. Implementation requires a commitment and support by management and participation of all the personnel within an organization to be successful. Some institutions have implemented Lean using an onsite trainer from industry. Additional information can be found at <http://www.lean.org>.

Six Sigma. Six Sigma is a disciplined, data-driven process that stresses eliminating defects and reducing variation while developing and delivering near-perfect products and services. This tool includes a rigorous improvement model known as DMAIC (Define, Measure, Analyze, Improve and Control).

Six Sigma is the goal, which means products and processes will experience only 3.4 defects per 1 million opportunities, or 99.99966 percent good. Six Sigma is a management strategy to use statistical tools and project work to achieve breakthrough profitability and quantum gains in quality. This is achieved by implementing process improvement, measurement-based strategies via Six Sigma improvement projects.

The Six Sigma approach may benefit those organizations where existing process improvement efforts may have not delivered the financial benefits promised and where productivity goals are not meeting targets. This approach fits with the safety and quality perspective of redesign. Additional information on this tool can be found at <http://www.6-sigma.com/>.

Tools That Facilitate Change in the Environment, Culture, and/or Workforce

Baldrige Criteria for Performance Excellence. The Baldrige criteria provide a business framework and tools to help improve organizational performance practices. The criteria are based on a customer- and process-centered approach that work to continually identify and improve key organizational processes with the goal of delivering better value to the customer.

The Baldrige core values and concepts include visionary leadership, patient-focused excellence, organizational and personal learning, valuing staff and partners, agility, focus on the future, managing for innovation, management by fact, social responsibility and community health, focus on results, and creating value and a systems perspective. It appears that one of its values in health

care is improving market share through achieving extraordinary customer service. Additional information can be found at <http://www.quality.nist.gov/>.

Clinical Microsystem. Clinical Microsystem refers to the work developed by Dartmouth College which focuses on the smallest replicable unit that actually does the work. This smallest unit not only includes a team of people, but also the local information systems, client populations, space, and work designs.

Clinical microsystems are the small functional, frontline units that provide most of the health care to most of the people. These units are the essential building blocks of the larger health care system. The quality and value of care produced by a large health system can be no better than the services generated by the small systems of which it is composed. The toolset used by these systems includes the “5Ps” (Purpose, Patients, Processes, Professionals, and Patterns).

Improvements in clinical microsystems lead to transformation of the workforce and the culture. As part of measuring the impact of this tool on workforce development, the Institute for Healthcare Improvement (IHI) has suggested the use of a series of 12 questions (“Q12”) that identify staff engagement developed by the Gallup Organization. Additional information can be found at <http://clinicalmicrosystem.org> and <http://www.IHI.org>.

Talent profiling. Talent profiling differs from other tools in that it has as its prime focus the worker rather than the process. Its goal is to get the right person in the right job, based on an in-depth understanding of the talent characteristics of each person and the most critically important characteristics needed to be successful in each role. Numerous consulting firms provide talent profiling services.

Consultants and training programs that teach these tools are currently adopting some concepts from each method for improvement such as “Lean Six Sigma.” Which tool is chosen may not be as important as the mere choice of a tool and the subsequent training of the workforce in the use of the tool.

Training the Workforce To Use the Tools

Denver Health selected three tools to implement in the redesign process:

- **PDSA**, which was in current use by the workforce, would continue to be used because the workforce had extensive experience and familiarity with this approach.
- **Lean** was chosen as the principal tool set for process redesign as it appeared to best address the major issues observed in the current processes. Its focus on waste afforded Denver Health the most opportunity to reduce expenses—a step that was clearly necessary in order to survive in face of growing numbers of uninsured and decreasing revenues. Its focus on value from the customer perspective fit the customer service need. It also fit the organization in that it appeared to require a great deal of presence on the “floor” with observation, substantial intuitiveness, rapid-cycle improvement, and broad-based employee involvement and empowerment.

- **Talent profiling** was selected as a valuable asset in matching employees with roles. This is particularly important in health care, an industry that is experiencing shortages and high turnover rates in some health care professions.

After selecting the tool, the training strategy must be developed:

- Who will be trained?
- Who will do the training?
- How will the content of the training curriculum be determined?

All institutions, both in health care and in other industries (especially service and manufacturing) that have undergone substantial redesign or transformation, have committed to training the workforce in using the chosen tools. However, there are different approaches to training the workforce:

- Intensively train all employees in using the tools.
- Conduct “just in time” training for team members as they are assigned to work on projects.
- Conduct general training for all or many employees coupled with extensive training of a small cadre of employees.

There are advantages and disadvantages to each approach to training the workforce. At Denver Health, training the workforce in PDSA involved general concept training prior to the beginning of this redesign project.

For the two new tools, Denver Health will adopt the strategy of general training for many employees with intensive training of a few. For Lean training, all executive team members and all physician department chairs will receive an introduction to Lean principles and tools; all middle managers will be trained in a broad overview of the tool.

Twenty-five employees including three physician department chairs were intensively trained to become experts in Lean production and rapid process improvement projects in order to facilitate projects. These 25 employees (“Black Belts”) represent the majority of the hospital system’s departments and a broad array of disciplines.

The Lean training tool was developed in collaboration with the Mid-America Manufacturing Technology Center Association (MAMTC). MAMTC is a nonprofit service organization that helps small and mid-size manufacturers increase their sales and productivity, reduce costs, and improve quality. One of the primary tools they use to help manufacturers is Lean training. Denver Health collaborated with MAMTC to adapt the Lean curriculum to health care by using examples from actual Denver Health hospital operations.

The following courses were provided to the staff:

- Lean Overview and Introduction
- Lean 101
- Value Stream Mapping
- Tools-5S System
- Tools -Setup and preparation reduction

- Tools-Standardized work

There are various consultants and training programs available to teach Lean production tools. Some have begun to adapt their curriculum to the service industry, particularly health care.

The Denver Health workforce will be trained in talent profiling using a similar approach to the Lean training approach. There will be a broad overview of the talent profiling tools for executives, physicians, and middle managers; a group of employees who will be those primarily involved in hiring staff will receive extensive training in using the talent profiling methods. Denver Health will work with a private firm on creating these profiles for the hospital workforce.

Strategies for Translating Information Into Proposed Projects for Implementation

The lessons learned from external and internal data gathering were focused on three components of the system:

- People
- Processes
- Communication and culture

Therefore, the redesign projects and the system transformation which emerged from this extensive planning effort focus on these three areas. A strategy was developed for the approach to implementation of system-wide transformation through this information. The following describes the proposed projects for the subsequent implementation phase.

People

- Lesson learned: The right person must be in the right role.
 - Planned response: Talent profiling.
- Lesson learned: People should function at the highest level of their knowledge and skill.
 - Planned response: Increase role of nurses, nurse practitioners, and physician assistants. Expand ability of non-physician professionals in writing orders.
- Lesson learned: Create champions.
 - Planned response: Establish cadre of employees with unique skills—the experts in Lean.
- Lesson learned: Health care workers need new tools to allow them to redesign processes.
 - Planned response: Training in Lean, adoption of Clinical Microsystem concept for work groups, and talent profiling.

Processes

- Lesson learned: Efficient, effective, timely, and accurate process flow requires use of real-time data on products and people.
 - Planned response: Develop mini command center for movement of materials and supplies and pilot test the use of radio frequency identification for one type of equipment.

- Lesson learned: Match work teams with work demands.
 - Planned response: Change shift times and geographic distribution of workers for certain processes.
- Lesson learned: System transformation is best accomplished through a balance of many, well chosen rapid-cycle projects and system projects. Core process redesign is best accomplished by those engaged in the process.
 - Planned response: The 25 trained “Black Belts” will conduct 50 rapid-cycle projects per year. Their process improvements projects will be focused on processes in their assigned and familiar areas of work responsibility. A small number of system-wide projects of high strategic value will be undertaken.

Criteria were also developed to help select both system and small rapid cycle projects. These selection criteria are expected to help guide those trained in Lean tools in identifying projects and increasing the probability that these projects would be successful. Project selection will focus on those with:

- High strategic value.
- Substantial inefficiencies.
- Identified champions.
- A team that is ready for the task.
- Good (albeit not assured) chance of success.
- Institutional resources to bring project to completion.
- Measurable outcomes.

Communication and Culture

- Lesson learned: Effective communication must be timely, complete, accurate, and come to closure. Communication can be synchronous or asynchronous. The former is necessary in health care, but the latter is more efficient.
 - Planned response: Develop multiple types of structured communication for synchronous communication, including:
 - Situation-Background-Assessment-Recommendation (SBAR) for nurse-physician communication.
 - Defined escalation processes for clinical circumstances.
 - Multidisciplinary rounds with daily care plans.
 - Huddles/time outs.
 - Use of wireless devices.
 Institute multiple approaches for asynchronous communication, including:
 - Text paging.
 - Secure e-mail.
 - Computerized provider order entry.
 - Picture archiving and communication system.
 - Feasibility assessment of single integrated (across all disciplines) electronic record on a clinical service.
- Lesson learned: Create a culture of accountability and continuous improvement.

- Planned response: Develop with employees a set of expected and preferred behaviors.
- Lesson learned: Immediate rewards are important as incentives for improvement and alignment of corporate and employee goals.
 - Planned response: New employee bonus/rewards program.
- Lesson learned: Corporate and employee goals must be aligned.
 - Planned response: New bonus/rewards program.

System Metrics

During the implementation phase of process redesign, those involved will want to know whether the process changes have improved the health care system. One can develop these system metrics from the initial perspectives that were chosen at the beginning of the process. As noted above, for Denver Health these were efficiency, patient safety, quality, customer service, workforce development, and/or architecture/environment.

Defining the system measures before the project is started permits one to assess in advance if the measurement truly reflects the desired outcomes and determine if the data are available to create the measure. It is important to have the ability to acquire baseline (pre-project) data to measure the effectiveness of the change or intervention. It is important to develop a set of metrics for evaluating the impact of the many process improvements that will be implemented throughout the hospital system. In order for there to be replication of redesign efforts in other hospital systems, there needs to be an incentive for hospitals to invest in this effort. Both system-wide metrics and individual process improvement metrics need to be developed.

Some common system metrics that can be considered are described in the following table. This table describes a variety of financial, operational, clinical, and employee variables and maps them to each of the six perspectives. For example, cost per discharge is listed as a variable and it maps to efficiency. Many variables represent more than one perspective, emphasizing the need to consider all six perspectives with system-wide transformation. Many of these system metrics are commonly reported by hospitals for ongoing operations and management, such as average length of stay (ALOS) and cost per discharge. Other metrics may require primary data collection, such as total travel distance and discharge process time.

Given that there will be many concurrent rapid-cycle projects and system-wide projects, it may not be possible to identify which projects, singly or in combination were responsible for the change in a specific metric or metrics. In order to transform the system, it is not feasible to conduct one project at a time. However, each individual rapid cycle and system project should have specific metrics that address system-wide goals and perspectives.

Table of System Metrics

Measure	Efficiency	Patient Safety	Quality	Customer Service	Workforce Development	Architecture/ Environment
JCAHO Core Measures ¹		X	X			
Cost per Discharge ²	X					
FTE per Adj Occupied Bed	X					
ALOS (Total) ²	X		X			
ALOS for Top 10 Diagnoses	X		X			
Mean Wait Time in ED for Hospital Bed	X	X	X	X		
Physician Productivity (Relative Value Units)	X					
Net Revenue	X					
Medication Errors ³		X				
Errors Related to Procedure/Treatment or Test ³		X				
Number of Cardiac Arrests (cor-0)		X	X			
Re-Admission Rates	X	X	X			
Total Travel Distance	X			X	X	X
Patient Complaint Rate				X		X
Patient Satisfaction ⁴				X		X
Discharge Process Time	X			X		
Risk Adjusted Mortality		X	X	X		
Nurse Turnover Rate	X				X	X
Nurse Vacancy Rate	X				X	
Employee Turnover Rate	X				X	X
Employee Vacancy Rates	X				X	
Employee Satisfaction					X	X

¹ The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) Core Measures were designed to permit more rigorous comparisons using standardized, evidenced based measures in the areas of acute myocardial infarction), heart failure, pneumonia, pregnancy and related conditions, and surgical infection prevention. A description of these measures can be found on <http://www.jcaho.org/pms/core+measures/core+measures.htm>.

² Metric can be compared pre- and post-implementation of process improvements and to University HealthSystem Consortium (UHC) benchmark. UHC, formed in 1984, is an alliance of academic health centers situated mainly in the United States. As a membership organization, UHC provides its 90 full members and 123 associate members with a variety of helpful resources aimed at improving performance levels in clinical, operational, and financial areas.

³ The UHC Patient Safety Net is a data collection and reporting tool that allows member hospitals to identify and report patient safety issues. Through this system, Denver Health reports patient safety events and therefore will be able to identify improvements in patient safety.

⁴ Press Ganey administers patient satisfaction surveys to almost 900 hospitals throughout the country. On a weekly basis the hospitals send Press Ganey a list of inpatients for which Press Ganey selects a random sample to survey. Press Ganey calculates the percentiles and scores for these hospitals, including trends, and distributes results on an annual basis. Denver Health has been using this survey since 2001. More information can be obtained at <http://www.pressganey.com/>

Form A. Site Visit/Conference Call Questions

Date: ____/____/____

Time: _____AM/PM

Interviewer(s): _____

Site/institution: _____

Person(s) interviewed: _____

1. What was the motivation going in for a radical redesign?
2. What are the goals for transforming your organization?
3. What steps did you take to transform your organization?
 - With leadership/management?
 - With the frontline workforce?
 - With culture?
 - With input, from your customers?
4. What were the timelines for this transformation for each of the steps?
5. From your personal experience in health care, what processes would you change?
6. What were the critical juncture points?
7. What worked well during this transformation? What did not work well?
8. What were the problems/issues that you confronted? What would you approach differently?
9. Which of the components of these processes are transferable to other organizations, particularly health care? Which ones are not?
10. What do you estimate were the costs of this transformation and the components of these costs?
11. What was the role of information technology?
12. What was the role of human resources?
13. Where did you need to make organizational structure or key competency changes and how were these accomplished?
14. Can you describe the most important end-results?
15. Can you name the tools/concepts that you applied? For example, Six Sigma, Lean, etc.

16. What other industries did you look at as for examples of redesign?

17. What were the critical factors involved in maintaining the success and visibility of the projects?

Form B. Employee Focus Group Questions

Date: ____/____/____ Time: _____AM/PM

Department(s): _____

1. Are there parts of your job that you think someone else should be doing instead of you?
2. Are there things you think should be part of your job that someone else is doing?
3. What are the things that keep you from working efficiently?
4. Are there things you see happening to patients that you think you should tell someone but you don't know whom to tell?
5. Given what you see every day, if you were a patient in the hospital what would you want to be different?
6. What things would you want to do for yourself if you were a patient? What things would you want your family to be able to do?

Notes:

Form C. Confirmation Letter for Patient/Family Focus Group

Date

Patient Name

Address

City, State, Zip

Dear (PATIENT NAME):

Re: _____ Patient Focus Group, April 13, 2004

We would like to thank you and your family member for agreeing to participate in _____ focus group on improving patient care on _____, from _____ . Please **arrive by** _____ to register as a participant. The group meeting will held in meeting room _____ and will begin promptly. Doors will be closed by _____. In an effort to show our appreciation for your willingness to participate in this group, you and your family member will each receive snacks and \$ _____ cash.

Below is a map to the _____. Parking is available in the public parking lot behind the building. Parking coins will be provided to you during the focus group session to allow you to exit the parking lot at no charge. Directions are provided below and a map is attached. If you have any questions, or need transportation assistance please contact _____.

Thank you,

Directions:

Form D. Patient/Family Focus Group Facilitator Questionnaire

Date: ____/____/____	Time: ____AM/PM
Patient group: _____	
Facilitator: _____	
Facilitator Title: _____	

Questions for Patients and Families After a Recent Hospital Stay

1. What were the most important events during your hospital stay?
2. What were the most positive?
3. Where there any negative events during your hospital stay? <ul style="list-style-type: none">• How would you have changed it, or how would you have like to have seen it go?
4. Did you receive enough information to make informed decisions? <ul style="list-style-type: none">• Was the information presented in such a way that it was understandable?• What would you change?
5. How much of their time is down time and how would they rather use it?
6. What type of issues/events during the patient's stay could be categorized as redundant or repetitive and how this affected the stay?
7. How the patient may want to be engaged in the process of care?
8. What types of information would you like to have access to, that would improve your stay?
9. How would the patient like to use technology such as e-mail?
10. Do you or your family wish to take part in your care? How would you like to participate? <ul style="list-style-type: none">• Eat in a cafeteria.• Walk to other departments for tests/x-rays.• Assist with bathing activities.• Would you like to have access to your chart?

Non-English speaking question:

If your care provider spoke your native language would you trust them more or less than someone who needs a translator?

Notes:

Form E. Patient/Family Focus Group Consent Form

Project Description

You (you equals you/your child) are being asked to take part in a research study of improving the way hospitals work and provide care to patients. You are being asked to be in this study because you or a family member was a patient in the hospital at _____, where this study is taking place. You will be part of a group of _____ people. The other members of the group were also selected because they or their family member were in the hospital at _____. Each member of the group will be asked about their and/or their family member's hospital experience. You will be asked for ways you think this experience could have been improved. You will also be asked about the parts of your hospital experience that you thought were good.

Up to _____ local subjects will be enrolled in this research study.

Procedures

If you agree to take part in this study, we will ask you to read and sign this consent form. You will also be asked to participate in a focus group that will take place at _____ sometime during February 2004 through October 2004. This focus group will meet once, for 2-3 hours, to discuss your or your family's hospital experience at _____.

Discomforts and Risks

The study may include risks that are unknown at this time.

Benefits

This study is designed for the researcher to learn more about improving hospital care. This study is not designed to treat any illness or to improve your health.

Study Sponsor

The sponsor for this study is the _____.

Cost to Subject

There is no cost to you for participating in this study. You will be paid \$_____ for your participation in this study. If you arrive late or leave the focus group session before it has been completed, you will not be paid for your participation.

Voluntary Participation and Study Withdrawal

Taking part in this study is voluntary. You have the right to choose not to take part in this study. If you do not take part in the study, your doctor will still take care of you. You will not lose any benefits or medical care to which you are entitled. If you choose to take part, you have the right to stop at any time. If there are any new findings during the study that may affect whether you want to continue to take part, you will be told about them. The study doctor may decide to stop your participation without your permission, if he or she thinks that being in the study may cause you harm, or for any other reason. Also the sponsor may stop the study at any time. The investigator may withdraw you from the study if your participation in the focus group is having a negative effect on the other participants or if you arrive to the focus group session late or leave the session early.

Invitation for Questions

The researcher carrying out this study is _____. You may ask any questions you have now. If you have questions later, you may call _____. You will be given a copy of this form to keep.

Confidentiality

We will try to keep your research records confidential, but it cannot be guaranteed. Records that identify you (including your medical records) and the consent form signed by you, may be looked at by the following people:

- Federal agencies that oversee human subject research
- Institutional Review Board
- The investigator and research team for this study
- The sponsor or an agent for the sponsor
- Regulatory officials from the institution where the research is being conducted, to ensure compliance with policies or monitor the safety of the study

The results of this research may be presented at meetings or in published articles. However, your name will be kept private. You will also be asked to sign a separate authorization form. This form will explain who will have access to your protected health information.

Injury and Compensation

You should inform your care provider(s) if you decide to participate in this research study. If you have questions about injury related to the research, you may call _____ at _____ and/or your private physician. _____ should be informed about any injury you experience while you take part in this study. If you are hurt by this research, we will provide medical care if you want it, but you will have to pay for the care that is needed.

AUTHORIZATION:

I have read this paper about the study or it was read to me. I understand the possible risk and benefits of this study. I know that being in this study is voluntary. I choose to be in this study. I know I can stop being in this study and I will still get the usual medical care. I will get a copy of this consent form. (Initial all the previous pages of the consent form).

Signature: _____ **Print Name** _____ **Date** _____
subject

Print Name _____ **Date** _____
child

Consent form explained by: _____ **Print Name** _____ **Date-**

Investigator _____ **Date** _____

Form F. Staff Process Flow Observation Form

Note: Complete each field as necessary based on the staff activities observed.

Observer Name: _____ **Department/Area:** _____ **Page:** ___ of ___
Date: ___/___/___ **Staff Member:** _____
Position Title _____
Time/Shift: _____

Activity, Comments	Interacted With	Time Start	Time End	Distance Traveled

Form G. Patient Process Flow Observation Form

Note: Complete each field as necessary based on the experience of the patient.

Observer Name: _____ Department/Area: _____ Page: ___ of ___
Date: ___/___/___ Patient No.: (1) (2) (3) (4) (5) Time/Shift: _____

Activity, Comments	Interacted With	Time Start	Time End	Distance Traveled

Form H. Staff Member Consent Form

Project Description

You are being asked to take part in a research study that is looking at ways to improve the way hospitals work and provide care to patients. You are being asked to be in this study because you are a medical staff member at _____, where this study is taking place. You will be observed for the duration of your shift in the hospital. We will document where you go in the hospital and how long you stay there. We will also document the medical care you provide, the people you communicate with, and other tasks performed. The duration of these events will also be documented.

Up to ___ local subjects will be enrolled in this research study.

Procedures

If you agree to take part in this study, your duties during your shift will not be changed in any way. We will ask you to read and sign this consent form only. From this point on, we will observe your movements throughout the hospital until the end of your shift. The information collected that could identify you on an individual basis will be kept in our records until _____ and during this time will be kept confidential. You are being asked to be in this study because you are clinical staff that provides direct patient care in the _____ Department.

Discomforts and Risks

The study may include risks that are unknown at this time.

Benefits

This study is designed for the researcher to learn more about improving hospital care. This study is not designed to treat any illness or to improve your health.

Study Sponsor

The sponsor for this study is the _____.

Cost to Subject

There is no cost to you for participating in this study. You will not be paid for participation in this study.

Voluntary Participation and Study Withdrawal

Taking part in this study is voluntary. You have the right to choose not to take part in this study. If you do not take part in the study, your doctor will still take care of you. You will not lose any benefits or medical care to which you are entitled. If you choose to take part, you have the right to stop at any time. If there are any new findings during the study that may affect whether you want to continue to take part, you will be told about them. The study doctor may decide to stop your participation without your permission, if he or she thinks that being in the study may cause you harm, or for any other reason. Also the sponsor may stop the study at any time.

Invitation for Questions

The researcher carrying out this study is _____. You may ask any questions you have now. If you have questions later, you may call _____ at (____)____-____. You will be given a copy of this form to keep.

If you have questions regarding your rights as a research subject, please call the Institutional Review Board office at (____)____-____.

Confidentiality

We will try to keep your research records confidential, but it cannot be guaranteed. Records that identify you (including your medical records) and the consent form signed by you, may be looked at by the following people:

Federal agencies that oversee human subject research

Institution Review Board

The investigator and research team for this study

The sponsor or an agent for the sponsor

Regulatory officials from the institution where the research is being conducted, to ensure compliance with policies or monitor the safety of the study

The results of this research may be presented at meetings or in published articles. However, your name will be kept private. You will also be asked to sign a separate authorization form. This form will explain who will have access to your protected health information.

Injury and Compensation

You should inform your care provider(s) if you decide to participate in this research study. If you have questions about injury related to the research, you may call _____ at (____)____-____ and/or your private physician. _____ should be informed about any injury you experience while you take part in this study.

AUTHORIZATION:

I have read this paper about the study or it was read to me. I understand the possible risk and benefits of this study. I know that being in this study is voluntary. I choose to be in this study. I know I can stop being in this study and I will still get the usual medical care. I will get a copy of this consent form. (Initial all the previous pages of the consent form).

Signature: _____ Print Name _____ Date _____
Subject

Consent form explained by: _____ Print Name _____ Date _____

Investigator _____ Date _____

Form I. Patient Consent Form

Project Description

You (you equals you/your child) are being asked to take part in a research study that is looking at ways to improve the way hospitals work and provide care to patients. You are being asked to be in this study because you are a patient at _____, where this study is taking place. You will be observed for the duration of your hospitalization. We will write down where you go in the hospital and how long you stay there. We will also write down who gives you medical care and what they do to you.

Up to ___ local subjects will be enrolled in this research study.

Procedures

If you agree to take part in this study, your care will not be changed in any way. We will ask you to only read and sign this consent form. From this point on, we will observe your movements throughout the hospital until you are discharged and not ask anything else of you. The information collected that could identify you as a patient will be kept in our records until October 2004. Patients have been selected to participate in this study if they are admitted to the hospital or visit the emergency room at _____ from _____ through _____ 2004.

Discomforts and Risks

The study may include risks that are unknown at this time.

Benefits

This study is designed for the researcher to learn more about ways to improve hospital care. This study is not designed to treat any illness or to improve your health.

Study Sponsor

The sponsor for this study is the _____.

Cost to Subject

There is no cost to you for participating in this study. There are no procedures or drugs required by the study. All of the costs associated with your hospital stay will be billed to you or your insurance, just as they would without participation in this study. You will not be paid for participation in this study.

Voluntary Participation and Study Withdrawal

Taking part in this study is voluntary. You have the right to choose not to take part in this study. If you do not take part in the study, your doctor will still take care of you. You will not lose any benefits or medical care to which you are entitled. If you choose to take part, you have the right to stop at any time. If there are any new findings during the study that may affect whether you want to continue to take part, you will be told about them. The study doctor may decide to stop your participation without your permission, if he or she thinks that being in the study may cause you harm, or for any other reason. Also the sponsor may stop the study at any time.

Invitation for Questions

The researcher carrying out this study is _____. You may ask any questions you have now. If you have questions later, you may call _____ at (____)____. You will be given a copy of this form to keep.

If you have questions regarding your rights as a research subject, please call the Institutional Review Board office at (____) ____-____.

Confidentiality

We will try to keep your research records confidential, but it cannot be guaranteed. Records that identify you (including your medical records) and the consent form signed by you, may be looked at by the following people:

- Federal agencies that oversee human subject research
- Institution Review Board
- The investigator and research team for this study
- The sponsor or an agent for the sponsor
- Regulatory officials from the institution where the research is being conducted, to ensure compliance with policies or monitor the safety of the study

The results of this research may be presented at meetings or in published articles. However, your name will be kept private. You will also be asked to sign a separate authorization form. This form will explain who will have access to your protected health information.

Injury and Compensation

You should inform your care provider(s) if you decide to participate in this research study. If you have questions about injury related to the research, you may call _____ at (____)____-____ and/or your private physician. _____ should be informed about any injury you experience while you take part in this study. If you are hurt by this research, we will provide medical care if you want it, but you will have to pay for the care that is needed.

AUTHORIZATION:

I have read this paper about the study or it was read to me. I understand the possible risk and benefits of this study. I know that being in this study is voluntary. I choose to be (or to have my child) in this study. I know I can stop being in this study and I (my child) will still get the usual medical care. I will get a copy of this consent form. Initial all the previous pages of consent form.

Signature: _____ Print Name _____ Date _____
subject

Print Name _____ Date _____

Signature: _____ Print Name _____ Date _____
legally authorized rep./proxy

Consent form explained by: _____ Print Name _____ Date _____

Investigator _____ Date _____

Acronyms and Abbreviations

adj	adjusted
ALOS	Average length of stay
CAT	Computed axial tomography
CEO	Chief executive officer
cor	heart
ED	Emergency department
FTE	Full time equivalent
h	hour
m/min	minute
HCT	Health care team
HMO	Health maintenance organization
IRB	Institutional review board
med	medication
MRI	Magnetic resonance imaging
PDSA	Plan, Do, Study, Act

Appendix A. Review of the Literature

Quality of Health Care

Agency for Healthcare Research and Quality. Executive Summary. In: *National Healthcare Quality Report*. Rockville, MD: Agency for Healthcare Research and Quality. 2003;1-8.

American Organization of Nurse Executives. *Patient Care Redesign: Lessons From the Field*. Weaver D (Ed.). Chicago: AHA Press.1999.

Benedetto AR. Adapting manufacturing-based Six Sigma methodology to the service environment of a radiology film library. American College of Healthcare Executives. Fellowship case reports. Accessed 8 October 2004. Available at: <http://www.ache.org/membership/AdvtoFellow/CASERPTS/benedetto01.cfm>.

Berwick DM. *Escape Fire: Designs for the Future of Health Care, Collected Speeches, 1992-2002*. San Francisco: Jossey-Bass (A Wiley Imprint). 2004.

Berwick D, James B, Coye MJ. Connections between quality measurement and improvement. *Medical Care*. 2003;41(1 Suppl):I30-I38.

Chassin MR. Is health care ready for Six Sigma quality? *The Milbank Quarterly*. 1998;76(4): 565-91, 510.

Chassin MR, Galvin RW. The urgent need to improve health care quality. Institute of Medicine National Roundtable on Health Care Quality. *Journal of the American Medical Association*. 1998;280(11):1000-1005.

Clarke A, Rao M. Developing quality indicators to assess quality of care. *Quality and Safety in Health Care*. 2004;13(4):248-249.

Cleary PD. A hospitalization from hell: a patient's perspective on quality. *Annals of Internal Medicine*. 2003;138(1):33-39.

Epping-Jordan JE, Pruitt SD, Bengoa R, et al. Improving the quality of care for chronic conditions. *Quality and Safety in Health Care*. 2004;13(4):299-305.

Epstein AM, Weissman JS, Schneider EC, et al. Race and gender disparities in rates of cardiac revascularization: do they reflect appropriate use of procedure or problems in quality of care? *Medical Care*. 2003;41(11):1240-1255.

Ettinger W, Van Kooy M. The art and science of winning physician support for Six Sigma change. *The Physician Executive*. 2003 September-October; 29(5):34-38.

First Consulting Group. *Advanced Technologies to Lower Health Care Costs and Improve Quality*. Massachusetts Technology Collaborative Innovation Outlook Series. 2003. Available at: http://www.masstech.org/institute/health/STATFinal9_24.pdf

Forrester NE. Accelerating patient-care improvement in the ED. *Healthcare Financial Management*. 2003 August;57(8):38-43.

Goldstein SM. Empirical support for the Baldrige award framework in U.S. hospitals. *Health Care Management Review*. 2002;27(1):62-75.

Griffith JR. Championship management for healthcare organizations. *Journal of Healthcare Management*. 2000;45(1):17-30.

Health Grades, Inc. *HealthGrades Quality Study. Patient Safety in American Hospitals*. Golden, CO: Health Grades, Inc. 2004.

Hibbard JH. Engaging health care consumers to improve the quality of care. *Medical Care*. 2003;41(1):I61-I70.

Isaacs LS, Knickman JR (Eds.). *To Improve Health and Health Care. Volume VI. The Robert Wood Johnson Foundation Anthology*. San Francisco: Jossey-Bass. 2003.

James B. Information System Concepts for Quality Measurement. *Medical Care*. 2003;41(1):I71-I79.

Johnstone PA, Hendrickson JA, Dernbach AJ, et al. Ancillary services in the health care industry: is Six Sigma reasonable? *Quality Management in Health Care*. 2003;12(1):53-63.

Kirk SA, Campbell SM, Kennell-Webb S, et al. Assessing the quality of care of multiple conditions in general practice: practical and methodological problems. *Quality and Safety in Health Care*. 2003;12(6):421-427.

Kizer KW. The "new VA": a national laboratory for health care quality management. *American Journal of Medical Quality*. 1999;14(1):3-20.

Leape LL. Reporting of adverse events. *New England Journal of Medicine*. 2002;347(20):1633-1638.

Leatherman ST, Hibbard JH, McGlynn EA. A research agenda to advance quality measurement and improvement. *Medical Care*. 2003;41(1 Suppl):I80-I86.

McGlynn EA. An evidence-based national quality measurement and reporting system. *Medical Care*. 2003;41(1 Suppl):I8-I15.

McGlynn EA. Introduction and overview of the conceptual framework for a national quality measurement and reporting system. *Medical Care*. 2003;41(1 Suppl):I1-I7.

McGlynn EA. Selecting common measures of quality and system performance. *Medical Care*. 2003;41(1 Suppl):I39-I47.

McGlynn EA, Cassel CK, Leatherman ST, et al. Establishing national goals for quality improvement. *Medical Care*. 2003;41(1 Suppl):I16-I29.

Monitoring reduces hospital-acquired infections by 19%. *Performance Improvement Advisor*. 2003;7(8). Atlanta: National Health Information.

Nelson EC, Batalden PB, Huber TP, et al. Microsystems in health care: part 1. Learning from high-performing front-line clinical units. *The Joint Commission Journal on Quality Improvement*. 2002;28(9):472-493.

Nelson EC, Batalden PB, Homa K, et al. Microsystems in Health Care: part 2. Creating a rich information environment. *The Joint Commission Journal on Quality and Safety*. 2003;29(1):5-15.

Ohldin A, Taylor R, Stein A., et al. Enhancing VHA's mission to improve veteran health: synopsis of VHA's Malcolm Baldrige award application. *Quality Management in Health Care*. 2002;10(4):29-37.

Patterson R (Ed.). *Changing Patient Behavior: Improving Outcomes in Health and Disease Management*. San Francisco: Jossey-Bass. 2001.

Rakich JS. Quality, CQI and reengineering in health services organizations. *Journal of Health & Social Policy*. 2001;13:41-58.

Sandrick K. Tops in quality. *Trustee*. 2003 September;56(8):12-16, 1.

Scalise D. Six Sigma in action: case studies in quality put theory into practice. *Hospitals & Health Networks*. 2003;77(5):57-62, 2.

Schuyve PM. The evolution of external quality evaluation: observations from the Joint Commission on Accreditation of Healthcare Organizations. *International Journal for Quality in Health Care*. 2000;12(3):255-258.

Scott T, et al. The quantitative measurement of organizational culture in health care: a review of the available instruments. *Health Services Research*. 2003 June;38(3):923-945.

Shine KI. *2001 Robert H. Ebert Memorial Lecture. Health Care Quality and How to Achieve It*. New York: Milbank Memorial Fund. Available at: <http://www.milbank.org/reports/020130Ebert/020130Ebert.html>.

Sirio C, Segel KT, Keyser DJ, et al. Pittsburgh regional healthcare initiative: a systems approach for achieving perfect patient care. *Health Affairs (Millwood)*. 2003;22(5):157-165.

Stryer D, Clancy C. Boosting performance measure for measure. *British Medical Journal*. 2003; 326(7402):1278-1279.

Thomson American Health Consultants. Make these changes to cut delays, diversion hours. *ED Management*. 2003;15:64-5.

Patient Safety

Bagian JP. Commentary. Promoting patient safety at VA: learning from close calls. *Forum*. 2001 October;1-2, 8.

Battles JB, Lilford RJ. Organizing patient safety research to identify risks and hazards. *Quality and Safety in Health Care*. 2003;12 Suppl 2:ii2-ii7.

Behm D. A blueprint for patient safety. Planned layout of new facility near West Bend hailed as revolutionary. *JSONline: Milwaukee Journal Sentinel*. 19 July 2003.

Center for the Study of Healthcare Management. Designing a Safe Hospital. University of Minnesota: Carlson School of Management Publication Series 1. Available at: <http://www.csom.umn.edu/Assets/4220.pdf>

Chassin MR, Becher EC. The wrong patient. *Annals of Internal Medicine*. 2002;136(11):826-833.

Cook AF, Hoas H, Guttmanova K, et al. An error by any other name. *American Journal of Nursing*. 2004;104(6):32-43, quiz 44.

Croskerry P, Shapiro M, Campbell S, et al. Profiles in patient safety: medication errors in the emergency department. *Academic Emergency Medicine*. 2004;11(3):289-299.

Feinstein KW. We can't reward what we can't perform: the primacy of learning to change systems. *Health Affairs (Millwood)*. 2002 July-December; Suppl Web Exclusives:W118-119.

Fiesta J. Liability for falls. *Nursing Management*. 1998;29:24-26.

Fried MW. Human investigations: Answering to an ever higher authority. *Gastroenterology*. 2002;123(6):1761.

Gabbard GO. The illusion of safety. *American Journal of Psychiatry*. 2004;161(3):427-428.

Henneman EA, Gawlinski A. "Near-miss" model for describing the nurse's role in the recovery of medical errors. *Journal of Professional Nursing*. 2004;20(3):196-201.

Hobgood C, Hevia A, Hinchey P. Profiles in patient safety: when an error occurs. *Academic Emergency Medicine*. 2004;11(7):766-770.

Kerzman H, Chetrit A, Brin L, et al. Characteristics of falls in hospitalized patients. *Journal of Advanced Nursing*. 2004;47(2):223-229.

Kjellberg K, Lagerstrom M, Hagberg M. Patient safety and comfort during transfers in relation to nurses work technique. *Journal of Advanced Nursing*. 2004;47(3):251-259.

Kostpopoulou O, Wildman M. Sources of variability in uncertain medical decisions in the ICU: a process tracing study. *Quality and Safety in Health Care*. 2004;13(4):272-280.

Krohn R. In search of the ROI from CPOE. *Journal of Healthcare Information Management*. 2003;17(4):6-9. Available at: <http://www.himss.org/content/files/jhim/17-4/krohn.pdf>

Lanham B, Maxson-Cooper P. Is Six Sigma the answer for nursing to reduce medical errors and enhance patient safety? *Nursing Economics*. 2003;21(1): 39-41, 38.

Larson L. Connectivity: getting staff to use patient safety tools. *Trustee*. 2004;57(4):6-10.

Leape L, Epstein AM, Hamel MB. A series on patient safety. *The New England Journal of Medicine*. 2002;347(16):1272-1274.

Malone B. Pursuing patient safety. *Quality and Safety in Health Care*. 2004;13(2):86-87.

Mawji Z, Stillman P, Laskowski R., et al. First do no harm: integrating patient safety and quality improvement. *Joint Commission Journal on Quality Improvement*. 2002;28(7):373-386.

Mello MM, Hemenway D. Medical malpractice as an epidemiological problem. *Social Science and Medicine*. 2004;59(1):39-46.

Murff H.J, Gosbee JW, Bates DW. Chapter 41. Human Factors and Medical Devices. In: *Making Health Care Safer. A Critical Analysis of Patient Safety Practices*. (Prepared by the University of California San Francisco–Stanford University Evidence-based Practice Center under Contract No. 290-97-0013.) Rockville, MD: Agency for Healthcare Research and Quality. 2001. AHRQ Pub. No. 01-E058. Available at: www.ahrq.gov/clinic/ptsafety/chap41a.htm.

O'Neill KA, Shinn D, Starr KT, et al. Patient misidentification in a pediatric emergency department: patient safety and legal perspectives. *Pediatric Emergency Care*. 2004;20(7):487-492.

Ostrosky-Zeichner L. Medical order formatting in the era of patient safety. *Critical Care Medicine*. 2004;32(3):882-883.

Plews-Ogan ML, Nadkarni MM, Forren S, et al. Patient safety in the ambulatory setting. *Journal of General Internal Medicine*. 2004;19(7):719-725.

Revere L, Black K. Integrating Six Sigma with total quality management: a case example for measuring medication errors. *Journal of Healthcare Management*. 2003;48(6):377-379; discussion 392.

Rubin G, George A, Chinn DJ, et al. Errors in general practice: development of an error classification and pilot study of a method for detecting errors. *Quality and Safety in Health Care*. 2003;12(6):443-447.

Scalise D. Six Sigma in action: case studies in quality put theory into practice. *Hospitals & Health Networks*. 2003;77(5):57-62, 2.

Segel K, Feinstein K. What patient safety is teaching us. *Grantmakers in Health*. 24 September 2001:1-2.

Shojania KG, Duncan BW, McDonald KM, et al. Safe but sound: patient safety meets evidence-based medicine. *Journal of the American Medical Association*. 2002;288(4):508-513.

Stryer D. Patient safety, research and evidence: getting to improved systems. *Journal of General Internal Medicine*. 2004;19(7):808-809.

Stump LS. Re-engineering the medication error-reporting process: removing the blame and improving the system. *American Journal of Health System Pharmacy*. 2000;57 Suppl 4:S10-S17.

Thomas EJ, Petersen LA. Measuring errors and adverse events in health care. *Journal of General Internal Medicine*. 2003;18(1):61-67.

Vincent C, Moorthy K, Sarker SK, et al. Systems approaches to surgical quality and safety: from conception to measurement. *Annals of Surgery*. 2004; 239(4):475-482.

Wachter RM, Shojania KG. The Patient safety movement will help, not harm, quality. *Annals of Internal Medicine*. 2004;141(4):326-327.

Wachter RM, Shojania KG. *Internal Bleeding: The Truth Behind America's Terrifying Epidemic of Medical Mistakes*. New York: RuggedLand. 2004.

Youngberg BJ, Hatlie MJ. *The Patient Safety Handbook*. Sudbury, MA: Jones and Bartlett. 2004.

Efficiency

Amberg M. The Benefits of Business Process Modeling for Specifying Workflow-Oriented Application Systems. *Business Information Systems*. Bamberg, Germany: University of Bamberg. 1996 April:1-6.

Barry-Walker J. The impact of systems redesign on staff, patient, and financial outcomes. *Journal of Nursing Administration*. 2000;30:77-89.

Bremner B, Dawson C. Can anything stop Toyota? *BusinessWeek*. 17 November 2003; 3858:114-20, 122.

Burns LR, Wharton School Colleagues. *The Health Care Value Chain: Producers, Purchasers and Providers*. San Francisco: Jossey-Bass. 2002.

Farhoomand AF, Ng P. *FedEx Corp.: Structural Transformation Through e-Business*. University of Hong Kong. 2000.

Chyna JT. Reengineering your medical staff organization: care, efficiency and relationships. *Healthcare Executive*. 2001 July/August;16(4):20-25.

Dickstein Shapiro Morin & Oshinsky, LLP. Think, think again. *Harvard Business Review*. 1996 September-October:150-158.

Drescher NI. Redesign of medication and supply distribution in a day surgery center. *AORN Journal*. 2000;72:854-861.

Fraser SW. *The Patient's Journey: Mapping, Analyzing and Improving Healthcare Processes*. United Kingdom: MPG Books. 2002.

Gaucher EJ, Coffey RJ. *Breakthrough Performance: Accelerating the Transformation of Health Care Organizations*. San Francisco: Jossey-Bass. 2000.

General Accounting Office. *Hospital Emergency Departments: Crowded Conditions Vary among Hospitals and Communities*. Report to the Ranking Minority Member, Committee on Finance, U.S. Senate. GAO-03-460. Washington, DC: U.S. General Accounting Office. 2003 March. Available at: <http://www.gao.gov/new.items/d03460.pdf>

Ghorra S, Reinert SE, Cioffi W, et al. analysis of the effect of conversion from open to closed surgical intensive care unit. *Annals of Surgery*. 1999;229(2):163-171.

Guarisco S, Oddone E, Simel D. Time analysis of a general medicine service. *Journal of General Internal Medicine*. 1994;9:272-277.

Institute for Healthcare Improvement. Improving Patient Flow: The Esther Project in Sweden. Available at: <http://www.ihl.org/IHI/Topics/Flow/PatientFlow/ImprovementStories/ImprovingPatientFlowTheEstherProjectinSweden.htm>.

Institute for Healthcare Improvement. *Optimizing Patient Flow: Moving Patients Smoothly through Acute Care Settings*. [Innovation Series white paper]. Boston: Institute for Healthcare Improvement. 2003.

Kelly K, Mass M. *SONA 7: Health Care Work Redesign*. Thousand Oaks, CA: SAGE Publications. 1995.

Kenagy JW. *Delivering on the Promise: An Adaptive Approach to Information Technology in Healthcare*. Cambridge, MA: Kenagy & Associates. 2004.

Lillrank P, Kujala J, et al. Patient in process – a new approach to managing patient processes in healthcare. *3rd International Conference on the Management of Healthcare and Medical Technology*. 7-9 September 2003. Warwick, United Kingdom.

Litvak E, Long MC, Cooper AB, et al. Emergency department diversion: causes and solutions. *Academic Emergency Medicine*. 2001;8(11):1108-1110.

Long JC. Healthcare Lean. *Michigan Health and Hospitals*. 2003;39(4):54-55.

Mangum S, Cutler K. Increased efficiency through OR redesign and process simplification. *AORN Journal*. 2002;76(6):1041-46.

Martin LL, Gertsen F, Johansen J. Applying Lean thinking in hospitals – exploring implementation difficulties. *3rd International Conference on the Management of Healthcare and Medical Technology*. 7-9 September 2003. Warwick, United Kingdom.

Minichiello TM, Auerback AD, Wachter RM. Caregiver perceptions of the reasons for delayed hospital discharge. *Effective Clinical Practice*. 2001;4(6):250-255.

Nussbaum B. The power of DESI. *Business Week*. 2004 May 17:86-94.

P&G continues restructuring and streamlines its workforce. *Chemical Market Reporter*. 14 June 1999;255(24).

Panchak P. Lean health care? It works! *Industry Week*. 1 November 2003:1-5.

Quintero JR. Achieve cost benefits with innovative care management. *Nursing Management*. 2002;33(4):35-42.

Reid W. Developing and implementing organisational practice that delivers better, safer care. *Quality and Safety in Health Care*. 2004;13(4):247-248.

Rozich JD, Resar RK. Using a unit assessment tool to optimize patient flow and staffing in a community hospital. *Joint Commission Journal on Quality Improvement*. 2002;28(1):31-41.

Russell LB, Gold MR, Siegel JE, et al. The role of cost-effectiveness analysis in health and medicine. *Journal of the American Medical Association*. 1996;276(14):1172-1177.

Siegel E, Reiner B. Work flow redesign: the key to success when using PACS. *American Journal of Roentgenology*. 2002 March;178:563-66.

Spaite D, Bartholomeaux F, Guisto J, et al. Rapid process redesign in a university-based emergency department: decreasing waiting time intervals and improving patient satisfaction. *Annals of Emergency Medicine*. 2002;39(2):168-77.

Steckler A, Linnan L. *Process Evaluation for Public Health Interventions and Research*. San Francisco: Jossey-Bass. 2002.

Walley P. Cellular operation design in healthcare. *3rd International Conference on the Management of Healthcare and Medical Technology*. 7-9 September, 2003. Warwick, United Kingdom.

Ying A, MercuryMD Inc. Impact of Hospital Computer Systems on Resident Work Hours. Boston: Medical Records Institute.

Customer Service

Alderson PO. Noninterpretive skills for radiology residents: customer service and satisfaction in radiology. *American Journal of Roentgenology*. 2000;175:319-323.

Baird K. *Customer Service in Health Care: A Grassroots Approach to Creating a Culture of Service Excellence*. San Francisco: Jossey-Bass. 2000.

Burns JP. Performance improvement with patient service partners. *Journal of Nursing Administration* 1998;28(1):31-37.

Colwell CB, Pons PT, Pi R. Complaints against an EMS system. *Journal of Emergency Medicine*. 2003;25(4):403-408.

Conner JM, Nelson EC. Neonatal intensive care: satisfaction measured from a parent's perspective. *Pediatrics*. 1999;103(1):336-349.

Dologite KA, Willner KC, Klepeiss DJ, et al. Sharpen customer service skills with PCRAFT Pursuit. *Journal for Nurses in Staff Development*. 2003;19(1):47-51.

Frampton SB, Gilpin L, Charmel PA. *Putting Patients First: Designing and Practicing Patient-Centered Care*. San Francisco: Jossey-Bass. 2003.

Godfrey MM, Nelson EC, Wasson JH, et al. Microsystems in health care: part 3. Planning patient-centered services. *The Joint Commission Journal on Quality and Safety*. 2003;29(4):159-70.

Goonan KJ, Stoltz PK. leadership and management principles for outcomes-oriented organizations. *Medical Care*. 2004;42(4 Suppl):III31-III38.

- Harrison A. The war on waiting. *Health Care UK*. 2000 Winter:52-60.
- Hoff RA, Rosenheck RA, Meterko M, et al. Mental illness as a predictor of satisfaction with inpatient care at veterans affairs hospitals. *Psychiatric Services*. 1999;50(5):680-685.
- Kipp, K.M. Implementing nursing caring standards in the emergency department. *Journal of Nursing Administration*. 2001;31(2):85-90.
- Kuisma M, Maatta T, Hakala T, et al. Customer satisfaction measurement in emergency medical services. *Academic Emergency Medicine*. 2003;10(7):812-815.
- Laing A. Meeting patient expectations: healthcare professionals and service re-engineering. *Health Services Management Research*. 2002;15:165-72.
- Landon BE, Zaslavsky AM, Beaulieu ND, et al. Health plan characteristics and consumers' assessments of quality. *Health Affairs (Millwood)*. 2001;20(2):274-286.
- Lewis B. Children's hospital designed for needs, comfort of anxious families. *The Tennessean* [online version]. 4 December 2003.
- McInnes KG. I CARE: An organization-wide customer service education program. *Journal for Nurses in Staff Development*. 2003;19(4):195-202.
- Miller MA, Kinsel K. Patient focused care and its implications for nutrition practice. *Journal of the American Dietetic Association*. 1998;98(2):177-181.
- Moore M, Ahmed T, Glazer A. Using an automated knowledge agent for reference and customer service. *Journal of the Medical Library Association*. 2004;92(2):271-273.
- Richins SM. Customer service for step-down patients. *Journal of Nursing Administration*. 2002;32(11):558-560.
- Schwab RA. Emergency department customer satisfaction: the point of view paradox. *Annals of Emergency Medicine*. 2000;35(5):499-501.
- Seago JA. Evaluation of a hospital work redesign: patient focused care. *Journal of Nursing Administration* 1999;29(11):31-38.
- Trotter G. Against customer service. *Journal of Emergency Medicine*. 1998;16(2):227-234.
- Turhal NS, Efe B, Gumus M, et al. Patient satisfaction in the outpatients' chemotherapy unit of Marmara University, Istanbul, Turkey: a staff survey. *BMC Cancer*. 2002;2:30. Epub 2002 November 20.

Verdessi BD, Jara G, Fuentes R, et al. The role of discriminant analysis in the refinement of customer satisfaction assessment. *Revista de Saude Publica*. 2000;34(6):623-630.

Wasson JH, Godfrey MM, Nelson EC, et al. Microsystems in health care: part 4. Planning patient-centered care. *The Joint Commission Journal on Quality and Safety*. 2003;29(5):227-37.

Worthington K. Customer satisfaction in the emergency department. *Emergency Medicine Clinics of North America*. 2004;22(1):87-102.

Young WB, Minnick AF, Marcantonio R. How wide is the gap in defining quality care? Comparison of patient and nurse perceptions of important aspects of patient care. *Journal of Nursing Administration*. 1996;26(5):15-20.

Workforce Development

Abrass CK, Ballweg R, Gilshannon M, et al. A process for reducing workload and enhancing resident's education at an academic medical center. *Academic Medicine*. 2001;76(8):798-805.

American Organization of Nurse Executives. *Patient Care Redesign: Lessons From the Field*. Weaver D (Ed.). Chicago: AHA Press.1999.

Baker C, Beglinger J, King S, et al. Transforming negative work cultures: a practical strategy. *Journal of Nursing Administration*. 2000;30(7-8):357-363.

Beck N, Kieser A. The complexity of rule systems, experience and organizational learning. *Organization Studies*. 2003(24(5):703-814.

Boex, J.R. and Leahy, P.J. Understanding Resident's Work: Moving Beyond Counting Hours to Assessing Educational Value. *Academic Medicine*. 2003;78(9):939-944.

Breslin PT, Gale SO, Weitzner WM. Operational and design strategies for a reduced workforce: address staff shortages by investigating operational model and facility design that encourage efficiency and productivity. *Healthcare Financial Management*. 2003 March;57(3):62-65.

Burke RJ, Greenglass ER. Hospital restructuring and nursing staff well-being: the role of personal resources. *Journal of Health and Human Services Administration*. 2001 Summer;24(1):3-26.

Carnevale AP, Fry RA. The Economic and Demographic Roots of Education and Training. [Paper commissioned by The Manufacturing Institute]. Washington, DC: National Association of Manufacturers. 27 November 2001.

Carzoli RP, Martinez-Cruz M, Cuevas LL, et al. Comparison of neonatal nurse practitioners, physician assistants, and residents in the neonatal intensive care unit. *Archives of Pediatric & Adolescent Medicine*. 1994;148(12):1271-1276.

The Manufacturing Institute, Center for Workforce Success. Results of workforce development survey of NAM Associations Council. National Association of Manufacturers Web site. Accessed 9 June 2004.

Hecht WA, Landstrom G, Nisbet MM, et al. Meeting the nursing shortage head on. A round table discussion. *Healthcare Financial Management*. 2003 March;57(3):52-58, 60.

Ettinger W, Van Kooy M. The art and science of winning physician support for Six Sigma change. *The Physician Executive*. 2003 September-October 2003;29(5):34-39.

Galvin RS, McGlynn EA. Using performance measurement to drive improvement: a road map for change. *Medical Care*. 2003;41(1 Suppl):I48-I60.

Gasiorek-Nelson S. DAU opens its doors in Hunstville, Ala.: taking education directly to the workforce. *Program Manger*. 2002 March-April:18-21.

Gonzalez-Torre PL, Adenso-Diaz B, Sanchez-Molero O. Capacity planning in hospital nursing: a model for minimum staff calculation. *Nursing Economics*. 2002;20(1):28-36.

Green BA, Johnson T. Replacing residents with midlevel practitioners: a New York City-area analysis. *Health Affairs (Millwood)*. 1995 Summer;14(2):192-198.

Hofer T, Hayward RA, Greenfield S, et al. The unreliability of individual physician "report cards" for assessing the costs and quality of care of a chronic disease. *Journal of the American Medical Association*. 1999;281(22):2098-2105.

Howie JN, Erickson M. Acute care nurse practitioners: creating and implementing a model of care for an inpatient general medical service. *American Journal of Critical Care*. 2002 September;11:448-458.

Ingersoll GL, Fisher M, Ross B, et al. Employee response to major organizational redesign. *Applied Nursing Research*. 2001 February;14:18-28.

Ingersoll GL, Kirsch JC, Merk SE, et al. Relationship of organizational culture and readiness for change to employee commitment to the organization. *Journal of Nursing Administration* 2000 January;30:11-20.

Izzo JB, Withers P. Winning employee retention strategies for today's healthcare organizations. *Healthcare Financial Management*. 2002 June;56(6):52-57.

Janz BD. Cooperative learning and cycle time reduction. *Cycle Time Research*. 1996;2(1):29-40.

Jones KR, Redman RW. Organizational culture and work redesign: experiences in three organizations. *Journal of Nursing Administration*. 2000;30(12):604-610.

Jones KR, Redman RW, VandenBosch TM, et al. Evaluation of the multifunctional worker role: a stakeholder analysis. *Outcomes Management for Nursing Practice*. 1999;3(3):128-135.

Kelly K, Mass M. *SONA 7: Health Care Work Redesign*. Thousand Oaks, CA: SAGE Publications. 1995.

Kotter JP. *Leading Change*. Boston: Harvard Business School Press. 1996.

Landon BE, Normand SL, Blumenthal D, et al. Physician clinical performance assessment: prospects and barriers. *Journal of the American Medical Association*. 2003;290(9):1183-1189.

Moore SS, Nettleman MD, Beyer S, et al. How residents spend their nights on call. *Academic Medicine*. 2000;75(10):1021-1024.

Neuman K. Understanding organizational reengineering in health care: strategies for social work's survival. *Social Work in Health Care*. 2000;31(1):19-33.

Pillar B, Jarjoura, D. Assessing the impact of reengineering on nursing. *Journal of Nursing Administration*. 1999;29(5):57-64.

Reason J. Human error: models and management. *British Medical Journal*. 2000;320:768-770.

Reason J. Human factors aspects of safety management systems. Presented at the 15th Annual FAA/TC/CAA Maintenance Human Factors Symposium, March 27-29, 2001. London, England.

Riportella-Muller R, Libby D, Kindig D. The substitution of physician assistants and nurse practitioners for physician residents in teaching hospitals. *Health Affairs (Millwood)*. 1995 Summer;14(2):181-191.

Russell JC, Kaplowe J, Heinrich J. One hospital's successful 20-year experience with physician assistants in graduate medical education. *Academic Medicine*. 1999June;74(6):641-45.

Schulman M, Lucchese KR, Sullivan AC. Transition from housestaff to nonphysicians as neonatal intensive care providers: cost, impact on revenue, and quality of care. *American Journal of Perinatology*. 1995;12(6):442-446.

Snell RS. The learning organization, sensegiving and psychological contracts: a Hong Kong case. *Organization Studies*. 2002 July-August;23(4):549-569..

Thrall TH. Work redesign. *Hospitals & Health Networks*. 2003 March;77(3):34-38, 40, 2.

Trisolini MG. Applying business management models in health care. *International Journal of Health Planning and Management*. 2002;17(4):295-314.

Workforce Innovation Networks. Theory of change for workforce innovation networks (WINs). 2002. Available at: <http://www.jff.org/jff/PDFDocuments/TheoryChangeWINs.pdf>

Young J, Urden LD, Wellman DS, et al. Management curriculum redesign: integrating customer expectations for new leaders. *Nurse Educator*. 2004;29(1):41-44.

Zarbo RJ, Nakhleh RE, Walsh M, et al. Customer satisfaction in anatomic pathology. A College of American Pathologists Q-probes study of 3065 physician surveys from 94 laboratories. *Archives of Pathology and Laboratory Medicine*. 2003 January;127(1):23-29.

Architecture/Environment

Alvarez L. Where the healing touch starts with the hospital design. *New York Times*. 7 September 2004:F-5.

Beale C, Brideau L, Caldwell K, et al. Trends in critical care planning and design. Panel discussion. *Health Facilities Management*. 2004 January;17(1):24-37.

Center for the Study of Healthcare Management. Designing a Safe Hospital. University of Minnesota: Carlson School of Management Publication Series 1. Available at: <http://www.csom.umn.edu/Assets/4220.pdf>

Fong DB. Illuminating thoughts: Devising lighting strategies for clinical spaces. *Health Facilities Management*. 2003 July;16(7):24-29.

Greene J. Building smarter EDs. *Hospitals & Health Networks*. 2002;76(12):32-36, 1.

Hamilton K, Kunkle J, Levine J, et al. The future of the facility. Executive dialog series. *Health Facilities Management*. 2003;16(1):23-37.

Hamilton DK. Before breaking ground, take stock. Spending millions on a new hospital won't fix a dysfunctional organization. *Modern Healthcare*. 2003 October;33(40):19.

Haugh R. Administrative. In: Scalise D, Thrall TH, Haugh R, et al. The patient room. *Hospitals & Health Networks*. 2004 May;78(5):34-38, 40, 49-51.

Hendrich AL, Fay J, Sorrells AK. Effects of acuity-adaptable rooms on flow of patients and delivery of care. *American Journal of Critical Care*. 2004;13(1):35-45.

Institute of Medicine, Board on Health Care Services. Work and workspace design to prevent and mitigate errors. In: Page A (Ed.). *Keeping Patients Safe: Transforming the Work Environment of Nurses* (226-285). Washington, DC: National Academies Press. 2004.

Martell LK. Postpartum women's perceptions of the hospital environment. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*. 2003;32(4):478-485.

Martineck T. Facility profile. Design makes most of mountain location. *Health Facilities Management*. 2003;16(6):14-15.

Martineck T. Facility profile. Emory hospital provides oasis in midtown Atlanta. *Health Facilities Management*. 2004;17(3):10-11.

McLaughlin S. Sneak peek: A look at JCAHO's reorganized Environment of Care chapter. *Health Facilities Management*. 2003 September;16(9):33-36.

Pangrazio JR. Room with a view: looking at the future of patient room design. *Health Facilities Management*. 2003 December;16(12):30-32.

Rich M. Healthy hospital designs: improving décor and layout can have impact on care; fewer fractures and infections. *The Wall Street Journal*. 27 November 2002:B-1, B-4.

Romano M. Turning green. Healthcare works to catch up with other industries in environmentally sensitive design and construction. *Modern Healthcare*. 2004 Mar 29;34(13):29-31.

Rostenberg B. The architecture of reform. How design of imaging facilities can be template for a new health system. *Modern Healthcare*. 2003 Dec 1;2003;33(48):20.

Runy LA. Universal rooms. In: Scalise D, Thrall TH, Haugh R, et al. The patient room. *Hospitals & Health Networks*. 2004 May;78(5):34-38, 40, 49-51.

Sandrick K. A higher goal. Evidence-based design raises the bar for new construction. *Health Facilities Management*. 2003 September;16(9):16-21.

Scalise D. Bedside technology. In: Scalise D, Thrall TH, Haugh R, et al. The patient room. *Hospitals & Health Networks*. 2004 May;78(5):34-38, 40, 49-51.

Simmons M. Facility profile. Cityscape theme supports caregiving. Goryeb Children's Center, Morristown, N.J. *Health Facilities Management*. 2003 April;16(4):12-13.

Tools for Redesign

General Conceptual Framework for Health Care Redesign

Bergey J, Smith D, Tilley S, et al. Why Reengineering Projects Fail. [technical report]. Pittsburgh: Carnegie Mellon University Software Engineering Institute. 1999.

Carter T. Hospitals and reengineering. *Journal of Hospital Marketing & Public Relations*. 2002;14(1):59-78

Cole DA. Creating outcomes with redesign efforts. *AORN Journal*. 1999;70(3):406-413.

Hansten R, Washburn M. *Toolbook for Health Care Redesign*. Gaithersburg, MD: Aspen Publishers. 1997.

Harrison MI. *Diagnosing Organizations: Methods, Models and Processes*. Thousand Oaks, CA: SAGE Publications. 2005.

Lee SY, Alexander JA. Managing hospitals in turbulent times: do organizational changes improve hospital survival? *Health Services Research*. 1999 October;34(4):923-946.

Locock L. Healthcare redesign: meaning, origins and application. *Quality and Safety in Health Care*. 2003 February;12(1):53-57.

Malhotra Y. Business process redesign: an overview. *IEEE Engineering Management Review*. 1998 Fall;26(3):27-31.

Porter ME, Teisberg EO. Redefining competition in health care. *Harvard Business Review*. 2004 June;82(6):64-76.

Tarantino DP. Process redesign. Part 1: process selection. *The Physician Executive*. 2003 November-December;29(6):71-73.

Teng JTC, Jeong SR, Grover V. Profiling successful reengineering projects. *Communications of the ACM*. 1998;41(6):96-102.

Walston SL. Reengineering hospitals: evidence from the field. *Hospital and Health Services Administration*. 1997 Summer;42(2):143-63.

Walston SL, Burns LR, Kimberly JR. Does reengineering really work? An examination of the context and outcomes of hospital reengineering initiatives. *Health Services Research*. 2000 February;34(6):1363-88.

Walston SL, Kimberly JR, Burns LR. Institutional and economic influences on the adoption and extensiveness of managerial innovation in hospitals: the case of reengineering. *Medical Care Research and Review*. 2001 June;58(2):194-228.

Walston SL, Urden LD, Sullivan P. Hospital Reengineering: An Evolving Management Innovation: History, Current Status and Future Direction. *Journal of Health and Human Services Administration*. 2001;23(4):388-415.

Operations Research as a Tool

Brinckloe WD. *Managerial Operations Research*. New York: McGraw-Hill. 1969.

Duckworth WE, Gear AE, Lockett AG. *A Guide to Operational Research*. 3rd ed. London; New York: Chapman & Hall/Halsted Press. 1977.

Mitchell G. *The Practice of Operational Research*. Chichester, England; New York: John Wiley & Sons Ltd. 1993.

Application of Lean as a Tool

Koenigsaecker G. A manager's guide to implementing Lean. *Manufacturing and Technology News*. 16 May 2001;8(9):6-11.

Lean Concepts LLC. Case studies. Available at: www.leanconcepts.com. Accessed 13 February 2004.

Liker JK. *The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer*. New York: McGraw-Hill. 2004.

Thompson DN, Wolf GA, Spear SJ. Driving improvement in patient care: lessons from Toyota. *Journal of Nursing Administration*. 2003 November;33(11):585-595.

Womack JP, Jones DT. Beyond Toyota: how to root out waste and pursue perfection. *Harvard Business Review*. 1996 September-October;74(5):140-158.

Womack JP, Jones DT. *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*. New York: Free Press. 2003.

Institute for Healthcare Improvement Toolkit

Nelson E, Nolan K, Nolan T, et al. IHI's health system measures kit: version 1.0. Pursuing Perfection & IMPACT Network. Institute for Healthcare Improvement. 2004.

Application of Six Sigma as a Tool

Benneyan JC, Lloyd RC, Plsek PE. Statistical process control as a tool for research and healthcare improvement. *Quality and Safety in Health Care*. 2003 December;12(6):458-464.

Bertels T, Williams M, Dershin H. Six Sigma: a powerful strategy for healthcare providers. *Aon Healthcare Alliance Health Line*. Special Edition 2001;1-5.

Dusharme D. Quality conversation with Mikel Harry. The foremost expert on Six Sigma talks about its past, present and future [online article]. *Quality Digest*. 2004 February;24(2).

Rozgus A. Using the sixth sense: by implementing the Six Sigma approach, companies can move ahead of the pack. *The Concrete Producer*. 2003 August;1.

Scalise D. Six Sigma: the quest for quality. *Hospitals & Health Networks*. 2001;75(12):41-46, 2.

Seecof D. Applying the Six Sigma approach to patient care. [online article]. *Healthcare Solutions Insights*. 2000 May 1;2(5). GE Medical Systems Healthcare Solutions. 2000.

Baldrige Criteria

Baldrige National Quality Program. *2004 Health Care Criteria for Performance Excellence*. Gaithersburg, MD: National Institute for Standards and Technology. 2004.

Dunn P, Santamour B. How health care won its first Baldrige. *Hospitals & Health Networks*. 2003;77(9):67-74, 2.

Clinical Microsystems

Batalden PB, Nelson EC, Edwards WH, et al. Microsystems in health care: part 9. Developing small clinical units to attain peak performance. *The Joint Commission Journal on Quality and Safety*. 2003;29(11):575-585.

Batalden PB, Nelson EC, Mohr JJ, et al. Microsystems in health care: part 5. How leaders are leading. *The Joint Commission Journal on Quality and Safety*. 2003;29(6):297-308.

Buckingham M, Coffman C. *First, Break all the Rules: What the Worlds Greatest Managers Do Differently*. New York: Simon & Schuster. 1999.

Godfrey MM, Nelson EC, Wasson JH, et al. Microsystems in health care: part 3. Planning patient-centered services. *The Joint Commission Journal on Quality and Safety*. 2003;29(4):159-170.

Huber TP, Godfrey MM, Nelson EC, et al. Microsystems in health care: part 8. Developing people and improving work life: what front-line staff told us. *The Joint Commission Journal on Quality and Safety*. 2003;29(10):512-522.

Kosnik LK, Espinosa JA. Microsystems in health care: part 7. The microsystem as a platform for merging strategic planning and operations. *The Joint Commission Journal on Quality and Safety*. 2003;29(9):452-459.

Mohr JJ, Barach P, Cravero JP, et al. Microsystems in health care: part 6. Designing patient safety into the microsystem. *The Joint Commission Journal on Quality and Safety*. 2003;29(8):401-408.

Mohr JJ, Batalden PB. Improving safety on the front lines: the role of clinical microsystems. *Quality & Safety in Health Care*. 2002 March;11(1): 45-50.

Nelson EC, Batalden PB, Huber TP, et al. Microsystems in health care: part 1. Learning from high-performing front-line clinical units. *The Joint Commission Journal on Quality Improvement*. 2002;28(9):472-493.

Nelson EC, Splaine ME, Plume SK, et al. Good measurement for good improvement work. *Quality Management in Health Care*. 2004 ;13(1):1-16.

Wasson JH, Godfrey MM, Nelson EC, et al. Microsystems in health care: part 4. Planning patient-centered care. *The Joint Commission Journal on Quality and Safety*. 2003; 29(5):227-237.

Appendix B. Definitions

Staff Observation

Adjust equipment	Adjusting any type of patient specific equipment such as an IV pump.
Administrative	Performing administrative or office type duties.
Answer call light	Answering a call light initiated by a patient or a patient's family member.
Answer telephone	Answering the telephone.
Answering page	Responding to a page.
Answers alarm	Answering an alarm on patient-specific equipment such as an IV pump or cardiac monitor.
Assessment	Assessing a patient's condition. A provider or a nurse can do this.
Attend to patient	Any nonspecific contact with the patient.
Attending class	Attending an educational class.
Bathe patient	Bathing or washing a patient.
Calls for assistance	Calling for assistance to help with a task.
Charting	Documenting in the patient's medical record.
Charting (flow)	Documenting on the patient's bedside flow sheet.
Charting (meds sheet)	Documenting on the patient's medication sheet (usually performed by a nurse).
Charting (orders)	Writing orders in the patient's medical record.
Charting (progress note)	Documenting the patient's progress in the medical record.
Checking for orders	Checking the medical record for new orders.
Cleaning	Cleaning a patient room post-discharge.
Cor-0 or Code blue	Working in a code or Cor situation.
Consult with nurse	Discussing a patient's medical care with a nurse.
Consult with provider	Discussing a patient's medical care with a provider.
Crushing meds	Crushing or preparing medications before administration to a patient.
Down time	Time that is not used to benefit the patient, such as eating lunch.
Entering orders	Entering orders into a CPOE (computerized physician order entry) system.
Gives meds	Administering medications to a patient.

Lab draw	Obtaining a specimen from a patient.
Looking up labs	Looking up laboratory results on a computer.
Making copies	Making photocopies.
Monitors EKGs	Watching the unit's central cardiac monitor station.
Obtain vital signs	Obtaining vital signs on a patient.
Obtains medication	Obtaining medication(s) from the pharmacy or a medication distribution system.
Office work	Administrative duties related to the operations of a department.
Pages provider	Paging a physician.
Paperwork	Working on nonmedical paper work (e.g., payroll).
Place page	Paging other staff personnel.
Procedure (simple)	A nonsurgical procedure usually performed in the patient's room (e.g., patient's catheter).
Procedure (invasive)	An invasive procedure not performed in the operating room (usually performed at the bedside (e.g., a central line).
Pyxis med station	Automated medication-dispensing station.
Report	Giving or receiving report from another person, shift, or unit.
Review med sheet	Reviewing the patient's medication sheet (usually performed by a nurse).
Review chart	Reviewing the medical record, checking for new orders, or checking for order accuracy.
Rounds	Attending patient care rounds (usually attended by physicians).
Searching	Searching for some item not readily available.
Supplies	Obtaining needed supplies.
Surgery	Performing surgery. This is done in the operating room.
Talk to family	Speaking with a patient's family member.
Technical problem	Working on or fixing some type of technical problem, usually related to computer systems.
Telephone call	Making a telephone call.
Transport	Moving a patient from one area of the hospital to another.
Travel	Moving from one area of the hospital to another.
Travel linen	Traveling to a linen closet to obtain linens.
Travel medications	Traveling to a medication station or a medication room with the

	purpose of obtaining medications.
Travel supply	Traveling to a supply station or a supply room with the purpose of obtaining supplies.
Waiting	A period of inactivity while waiting.

Patient Observation

Adjust equipment	A clinical person makes any type of adjustment to patient-specific equipment such as an IV pump. (An example would be a nurse adjusting the infusion rate on the IV pump.)
Admission process	Patient undergoes any part of the admission process, such as an initial history and physical.
Ambulates with nurse	Patient walks around the unit with the nurse in attendance.
Answer alarm	A nurse or other clinician enters the room to attend to an alarm on a piece of medical equipment.
Ask/answer questions	Patient answers or asks questions of a clinical person.
Assessment	Clinician assesses the patient's condition (may be part of a history and physical).
Attend to patient	Any nonspecific contact with the patient by a clinician.
Baby assessment	Assessment of a newborn by a clinician.
Baby to/from nursery	Transportation of a newborn to or from the nursery.
Bathe	Patient is bathed or washed by a member of the health care team.
Blood draw	Patient's blood is taken either by a clinician or lab personnel.
Care question	Patient asks question(s) of a clinician regarding his or her care.
CAT scan	Patient undergoes a CAT scan.
Check on patient	A clinician looks in on the patient to make sure everything is OK but does not do anything specific or have actual hands-on contact.
Cor-0 or Code blue	The patient is involved in a cor or a code situation.
Discharge	Patient is discharged from the hospital.
Discharge education	Patient undergoes education before discharge (i.e., education on medications, wound care, etc.).
Discuss care	Patient discusses the plan or course of care with a clinician.
Eating	Patient is eating.
Equipment placed/checked	A clinician sets up and/or checks medical equipment in the patient's room.

Evaluation	Evaluation of the patient's condition by a clinician.
Examine patient	Hands-on examination of the patient by a clinician.
Feed baby	Feeding of the newborn by hospital personnel.
Gets dressed	The patient gets dressed.
Lab draw	The patient has a specimen taken either by a clinician or lab personnel.
Linen change	Bed or linen is changed.
Linens	Linens are delivered into the patient's room by hospital personnel.
Monitor patient	A clinician is at the bedside monitoring the patient but does not have any other contact with the patient. (Often the patient is unaware of this act.)
No patient activity	No activity from the patient. (The patient may be resting or sleeping during this time.)
Paperwork	Patient fills out paperwork (i.e., admission or discharge papers).
Patient education	Education of the patient and/or the patient's family by hospital staff regarding their medical condition or clinical care.
Patient leaves	Patient leaves the hospital without being discharged.
Placed on monitor	Patient is placed on a cardiac monitor.
Procedure (simple)	A nonsurgical procedure usually performed in the patient's room such as a catheter.
Procedure (invasive)	An invasive procedure performed at the bedside such as a central line.
Receives food	Patient receives food from hospital personnel (usually by food service personnel).
Receives meds	Patient receives medications from a clinician (usually a nurse).
Recovery	Patient recovers after surgery.
Report	Clinical or change of shift report at the patient's bedside.
Restroom	Patient uses the restroom.
Room maintenance	Maintenance personnel enter the patient's room to perform general maintenance.
Rounds	Medical rounds performed at the patient's bedside.
RT treatment	Patient receives a respiratory therapy treatment (can be given by a respiratory therapist or a nurse).
Shift report	Clinical change of shift report at the patient's bedside.
Supplies	Medical supplies delivered into the patient's room.
Surgery	Patient undergoes surgery.

Telephone call	Patient makes a telephone call.
Test performed	Patient undergoes a noninvasive test such as an EKG.
Therapy	Patient undergoes therapy.
Transport	Hospital personnel transport patient from one area of the hospital to another.
Uses call light	Patient uses a call light to call for assistance.
Visiting	Patient visits with family or friends in the patient's room.
Vital signs	Vital signs obtained by clinical personnel.
Wait	Period of inactivity while waiting.
Walking	Patient walks around the unit without assistance.
X-ray	Patient undergoes an X-ray procedure, either in the patient's room or in the radiology department. (This does not include CAT scans, MRIs, or interventional procedures.)