CHAPTER SIX

REENGINEERING

Adequate organizational performance is a major concern for health care managers. Performance issues generally come to the surface in terms of the financial situation and of market share in competitive health markets. Health care institutions can be classified into three groups in terms of their performance: 1) those that perform adequately with no imminent risk in their finances or market share; 2) those whose performance is marginally adequate; and 3) those whose performance is less than expected. Irrespective of their category, health care institutions must pay close attention to their performance. Declining profit margins, shrinking market shares, high patient dissatisfaction—all are certain indicators of performance problems. Especially, poor performers operating with negative margins are in great need of improvement. Yet, at the other end of the continuum, the benchmark institutions cannot afford to lose their market leadership in either efficiency or effectiveness, which can occur unless they continuously improve their operations.

Health care managers use various methods to improve institutional performance in terms of finances and productivity, but also in the quality of care they provide. To improve financial performance, health care managers have often sought organizational change, restructuring, and downsizing. Although those methods may improve the financial base of the organization or productivity at least temporarily by "cutting the fat," namely by reducing the staff across the board, they create other problems. In particular, reducing staff can lead to major problems in the quality of care. These methods not only violate the basic premise of optimality (they create suboptimal solutions), but also fail to follow the known Pareto principle: "While improving a part of the organization, one should not make other parts of the organization worse off."

Two other contemporary and popular methods that aim to improve both performance and quality are total quality management (TQM) and continuous quality improvement (CQI) (discussed further in Chapter Twelve), which are geared to make incremental changes over time. Thus, realization of their performance gains may take a long time (often 5–6 years), and success lies with management's commitment to and persistence in this gradual change. During the long implementation processes, management's commitment can become diluted and TQM/CQI can lose its initial lure, to end up in failure. Another reason for TQM/CQI program failures is that responsibility for carrying out its tasks is assigned to only a limited number of people, without organizational commitment across the board (Bergman, 1994).

Reengineering is a methodology intended to overcome the difficulty in realizing TQM/CQI performance over a long duration, as well as the myopic conduct of organizational change, restructuring, and downsizing. Hammer and Champy (1993), who launched the reengineering movement in the early 1990s, suggest a radical redesign of business processes to achieve dramatic improvements in performance measures: quality and cost, service and speed. They urge that conventional wisdom and familiar assumptions be discarded in favor of fresh forward rethinking to design contemporary business processes. In health care, reengineering conceptualizes the delivery process differently, from financing to delivery of the care. Specifically, a strategic view of arranging, delivering and managing care with new methods is the essence of reengineering health care—change is required across departmental and organizational, operational, and administrative procedures.

An early example of applying reengineering in health care is patient-focused (or patient-centered) care. Think about a hospital that offers patient-focused cardiac care for a patient recuperating from a heart attack or bypass surgery. Caregivers (nursing staff) are trained to perform EKGs and draw blood, so fewer staff care for the patient. That enhances the consistency of patient care and makes the stay as comfortable as possible—elements of the quality of care. Patients also are given one-on-one education about heart disease and cardiac rehabilitation exercise, and their families receive education about their health.

To accomplish patient-focused care, the provider melds cross-departmental functions to address patients' immediate medical care, recovery, and health education. That is a new way of thinking and organizing the health care delivery process, from a set of functional departmental processes to a comprehensive, integrated, and seamless process that is centered on the patient.

Reengineering should eliminate delays and duplications in health care delivery, so recovery is speeded and costs are reduced. New health care delivery processes have to be designed with the cooperation of systems engineers, clinical care professionals, and administrators alike, to eliminate unnecessary tasks and automate any tasks that lend themselves to automation. The new processes may require new skill sets for employees who must handle automation or other information technology components of the new system. Thus employees must be retrained if they are to provide the comprehensive, undisruptive care described in the cardiac care example above. The assumption is that highly technically specialized caregivers can also perform informational and educational tasks of patient care; that with the help of technology, tasks can be redefined with no additional burden. The goal is to break down "silo" mentality among the departments by examining such common processes as admissions, scheduling, and discharge plans to serve patients in a less fragmented and more comfortable way. This aim is especially important in reengineering the processes of such ancillary departments as housekeeping, foodservice, pharmacy, and supply chain.

To reengineer the system, health care managers must be able to understand work-design, jobs, job measurement, process activities, and reward systems—all well-known concepts of industrial engineering. With that knowledge, they can recognize the bottlenecks in the old system, identify unnecessary and repetitive tasks, and eliminate them in the reengineered system of care. Beyond those skills, however, the structure of the health care organization, the roles of managers and the people in processes, and especially their culture, beliefs and values must be taken into account, as these factors, too, influence the chances of success for a reengineering project.

Note, moreover, that once processes are reengineered, health care managers must continue reengineering to lead their organizations in the market.

Work Design in Health Care Organizations

As part of reengineering, administrators of health care organizations must recognize the power of human resources management. Considering that more than 40 percent of a health care organization's expenses are expenditures for manpower, the need to manage that resource is obvious. Furthermore, with the aging population and the resulting intensity of tertiary care, the overall proportion of a health care facility budget devoted to labor is likely to grow.

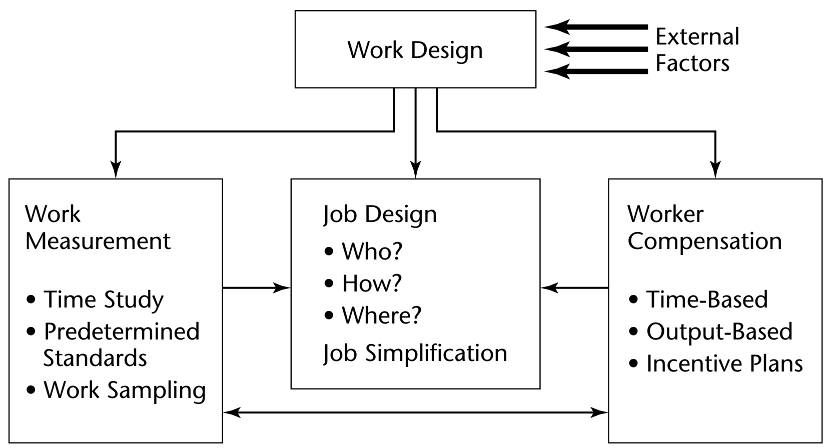
Management of human resources can be difficult. However, ensuring the productivity and satisfaction of clinical staff is not guided only by the ability to deal effectively with employees. Human resources management must start by understanding the work environment, and particularly the design of the work itself. An operations perspective emphasizes that the work design must be such that employees are satisfied, organizational productivity is high, and costs are minimal.

Work Design

Work design consists of job design, work measurement, work simplification, and worker compensation (see Figure 6.1). The remainder of this chapter discusses these components, with particular emphasis on work measurement.

Work design is influenced by other areas of the organization. For instance, regulatory requirements, such as reporting work accidents to the Occupational Safety and Health Administration (OSHA), require time from staff members that must be accounted for when developing a time standard; a process layout or the structure of product line management may require a broader job description; automation of processes can eliminate certain aspects of the job description. Then, too, work design also affects the other areas. If the job description is not understood by employees, dissatisfaction results and productivity suffers; or enlarging a job may motivate worker and increase her or his satisfaction. Finally, the above four components of work design affect each other. For example, the range of job tasks determines the amount of time needed to do the job and is often directly related to compensation.

FIGURE 6.1. WORK DESIGN—A SYSTEMS PERSPECTIVE.



The previous discussion examines decisions about work design from a systems perspective. However, health care managers must be careful not to make the decisions in isolation. They must realize the importance of the system-wide consequences of their decisions and carefully undertake analysis to consider alternative solutions.

Job Design. Who is responsible for what tasks? How are they supposed to do their job? Where will they do their job and under what conditions? These are the important questions to answer when designing a job. The primary goal is to create a work system that promotes productivity, efficiency, and effectiveness while balancing costs and benefits for both the individual worker and the organization as a whole.

To be successful, job design must be consistent with the health care organizations' goals and must be in written form; it should be understood by both management and employees. The job of work design should be undertaken by experienced personnel who realize the intricacies involved. One of the most important sources of information when developing a job description and its responsibilities, for new jobs but particularly for job revisions, is the employee. Managers and coworkers also should be included in the design process.

Over time, the management principles guiding the design of jobs have changed considerably. A century ago, the management techniques concentrated on improving the productivity of an organization by standardizing labor practices. Frederick Winslow Taylor's scientific management approach (1911) relied on time studies. Taylor claimed that conflicts between management and labor arose because management did not realize how long jobs actually took. He stressed the need to collect reliable data on work times to improve productivity and efficiency. There is little doubt that his analytical, efficiency-oriented approach was very much a reaction against the wastefulness and expense of turn-of-the-century labor practices.

The work of Taylor was expanded by others, including Frank and Lillian Gilbreth with their emphasis on motion studies. Work measurement and simplification were then introduced and practiced by many manufacturers. Work was divided, labor was specialized, and parts were standardized. The result was a boom in United States productivity, particularly in manufacturing and agriculture. The goal of the scientific management or efficiency school was ultimately to collect reliable data on the work performed and use it to design more efficient work methods and systems. The approach worked best with routine, predictable, repetitive, and separable tasks.

Does the scientific management approach have health care applications? After all, the delivery of patient care is by no means routine, predictable, or standard. In fact, however, the principles have been applied to certain areas in health care. Of course, in any organization, there are routine and predictable activities, particularly among lower-level administrative duties. Even the development of the various levels of health care professionals: medical doctors (MDs), nurse practitioners (NPs), registered nurses (RNs), licensed practical nurses (LPNs), and nursing assistants (NAs) is an example of the division of labor. Forms and paperwork have been standardized; information systems allow the automation of routine and predictable tasks; robots have been used in radiology and laboratory departments to perform non-judgment tasks. Nonetheless, many responsibilities of health care personnel do not lend themselves straightforwardly to scientific management principles, being unpredictable and requiring the exercise of judgment. Moreover, they often involve interacting with the patient who is not an object.

Aspects of scientific management that are particularly useful in health care, however, are work sampling and time measurement to identify, understand and standardize the predictable parts of a job. The uses of those tools are discussed in the next section.

The behavioral management school, also called the human relations school, developed as an alternative to the systematic and logical emphasis of the efficiency school. Behavioral management focuses on satisfying the needs and wants of the employee. Its supporters reject a focus on technical efficiency as the overriding consideration in designing work systems. Rather, motivation of the workers, particularly intrinsic motivation, is viewed as the best way to improve productivity and worker satisfaction. Specialization, meaning a narrow scope of duties is claimed to create monotonous jobs that instill a sense of worthlessness in workers, resulting in low morale and high absenteeism. In health care, those apply primarily to support, not professional personnel.

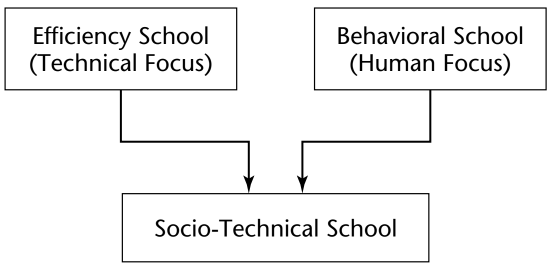
The behavioral school believes that jobs can be improved through job enlargement, rotating jobs, and job enrichment. Job enlargement means giving the worker a larger proportion of the total task as horizontal loading, adding work at the same level of skill and responsibility. For instance, a nurse might be made responsible for patients in several departments. Job rotation, though important in industries (for instance, amusement park workers) is less applicable in health care, where licensing and professional requirements aim to protect the patient. Job enrichment has employees add the responsibility of planning and coordinating their tasks: vertical loading by increasing the worker's responsibilities. Job enrichment is especially common in health care. For instance, nurses are often given the responsibility of leading a continuous quality improvement program or sitting on marketing and strategic planning committees. Job enrichment aims to motivate employees by increasing their responsibilities and—importantly—their autonomy.

As Herzberg (1959) puts it, increasing satisfiers (motivators) and holding dissatisfying factors (hygiene factors) constant should lead to more content workers and thus to greater productivity.

The behavioral approach to job design has serious drawbacks. First, studies have shown only a weak direct link between satisfaction and productivity. Dissatisfaction does tend to reduce productivity, but only indirectly by increasing absenteeism and turnover, both of which are very costly for the organization: not only in monetary costs (for example, the necessity to hire an agency nurse at a premium wage), but also by hurting staff morale, interrupting the continuity of care, and in short, harming the quality of care. However, an organization focused primarily on improving worker satisfaction may actually find productivity decreasing while costs continue to increase. In that case an organization cannot compete successfully in a health care market that, because of factors such as managed care, emphasizes mostly profit margins; and that because of increased competition, stresses efficiency. Finally, the behavioral model fails to consider the technological aspects of the organization.

What is needed is a blending of the efficiency and behavioral schools in a socio-technical approach (see Figure 6.2). The socio-technical approach seeks both technological and sociological benefits, recognizing the choice of technology and technological changes: layout redesign, automation, and implementation of new techniques influence the social structure of the organization and thus ultimately worker satisfaction and productivity. Job design must be consistent with both technological efficiency and the organization's social structure. As for job enrichment, task variety, skill variety, task autonomy, and feedback are all very important. However, the socio-technical approach goes one step further: it gives workers a say about what work is done and how it is done. A potential problem, however, can be managers who are reluctant to entrust any of their authority to their workers.

FIGURE 6.2. SOCIO-TECHNICAL SCHOOL APPROACH.



Another important aspect of work design is attention to working conditions. The physical environment can significantly affect worker performance, the quality of health care, and workplace accidents. Aspects of the working environment that should be considered include safety, temperature (60–70 degrees preferred), humidity, ventilation (particularly important in the operating room), colors (could you work in a hospital with red walls?), and noise, as well as pattern of work breaks. Of course, workplace regulations must be met.

Work Measurement Using Time Standards

Now that we know how the job is done, it is important to know how much time it takes to complete the job. Do you know what all that nursing personnel in your organization are doing and where they spend their time? Does a particular physician take three times as long to do his paperwork as the others in his group practice? Time standards are important in establishing productivity standards, determining staffing levels and schedules, estimating labor costs, budgeting, and designing incentive systems.

A time standard is the length of time it should take a qualified worker to complete a specified task, working at a sustainable rate, using given methods, tools, equipment, and raw materials, and facing similar workplace conditions. The abilities and skills of workers will vary, and so will the conditions under which they work, so adjustments must be made for those factors. The health care manager must develop a time standard for each job, to estimate the number of employees needed to do it, and also to measure their productivity.

When establishing a time standard, it is essential to capture every aspect of the job and also every factor that may influence it. A change in any of those can change the time needed. For instance, if a robot is introduced into the lab to sort and label test specimens, the time needed for lab personnel to sort and label will be reduced, giving them more time for other work. Whenever a significant change in procedures or technologies is made, the time standard should be updated with a new study. There are three common methods of work measurement based on time standards: stopwatch time studies, historical times, and predetermined data, each of which is discussed below.

Stopwatch Time Studies. A stopwatch time study bases the time standard observations of one worker taken over a number of trials (cycles). Introduced by Frederick Taylor, time studies are now the most widely used method of work measurement (Stevenson, 2002; p. 324). A time study begins by identifying the task to be studied and informing those who work on it about the study. It is essential to explain the study to those being observed, to avoid misunderstandings and suspicions. Honest explanations can eliminate workers' fears and gain their cooperation, avoiding the Hawthorne effect. The next step is to decide on the number of cycles to observe. The number should be based on 1) the variability of the observed times, 2) the desired accuracy, and 3) the desired level of confidence for the estimate. Finally, the activity is timed and the standard time computed.

To compute a time standard, three times must be calculated—observed time, normal time, and standard time. The observed time is the average of the observed times:

$$\mathrm{OT} = \frac{\sum x_i}{n} \qquad [6.1]$$

where
OT = observed time
x_i = observed time for worker i
n = number of observations for worker i.

This average observed time must be adjusted for worker performance to yield normal time. Normal time is the observed time multiplied by a performance rating. That is done by multiplying the observed time by the performance rating that has been established for the entire job.

$$\mathrm{NT} = \mathrm{OT} * \mathrm{PR} \qquad [6.2]$$

where
NT = normal time
OT = observed time
PR = performance rating

Note that this formula, [6.2], assumes that a single performance rating has been made for the entire job. A job, however, is defined as a combination of elements or tasks, and each task may have a different performance rating. For instance, if we are measuring the time it takes to obtain a clinical test result, the job is defined simply as the time it takes from test completion to charting the result. However, that job has many elements: transport of the test sample to the lab, labeling the specimen, conducting the test, recording the results, and transferring the results back to the patient's room or physician. Each element, or task, that composes this job may have a different performance rating. In this case, the normal time equals:

$$\mathrm{NT} = \sum E_j * \mathrm{PR}_j \qquad [6.3]$$

where
NT = normal time
E_j = the observed time of element j
PR_j = performance rating of element j

The performance rating adjusts the observed time for the time of an average, or "normal," worker's pace. When being observed, a worker may pursue his own interests by purposely slowing the pace so that the new standard will be easier to meet. The worker being observed may be below or above the natural ability or skill level of his or her co-workers. A normal rating equals 1.0. Therefore, a performance rating above one is given to a faster-than-average worker, a rating of less than one to a worker whose pace is slower. As could be expected, because the performance ratings are subjective, they often cause conflict between the workers and their management.

Normal time represents the amount of time it takes a worker to perform the job without interruption or delay. But no one can be asked to work 100 percent of the time. Personal needs (for example, going to the bathroom, and required rest breaks) and unavoidable delays (such as technological problems or waiting for a medical record) are inevitable. Thus, the normal time is adjusted by using an allowance factor, to provide a standard time:

$$ST = NT * AF \qquad [6.4]$$

where
ST = standard time
NT = normal time
AF = allowance factor

There are two ways to compute the allowance factor. Allowances can be based on job time, where:

$$AF_{job} = 1 + A \qquad [6.5]$$

where A equals the allowance factor based on job time.

This formula is appropriate when the various jobs in a health care organization require different allowances. However, if jobs cannot be differentiated or are similar, the factor can be based on a percentage of time worked:

$$AF_{day} = 1/(1 - A) \qquad [6.6.]$$

where A equals the allowance factor based on a workday.

Typical allowance factors for working conditions are found in Table 6.1.

Example 6.1

The nursing unit manager at HEALTH FINDER HOSPITAL wants to evaluate the activities in the patient care unit. The manager hired an analyst, who timed all the patient care activities for this job, which has twenty elements. The observed times (OT) and the performance ratings for six samples of a particular employee are recorded in Table 6.2. From those measurements the nursing manager wants

TABLE 6.1. TYPICAL ALLOWANCE PERCENTAGES FOR VARYING HEALTH CARE DELIVERY WORKING CONDITIONS.

Allowance Level	Percent
1. Basic-low (personal, fatigue, standing)	11
2. Basic-moderate (basic-low and mental strain)	12
3. Basic-high (basic-moderate and slightly uncomfortable heat/cold or humidity)	14
4. Medium-low (basic-high and awkward position)	16
5. Medium-moderate (medium-low and lifting requirements up to 20 lbs.)	19
6. Medium-high (medium-moderate and loud noise)	21
7. Extensive-low (medium-high and tedious nature of work)	23
8. Extensive-medium (extensive-low and with complex mental strain)	26
9. Extensive-high (extensive-medium and lifting requirement up to 30 lbs.)	28

Source: Adapted from B. W. Niebel, 1988.

to know the standard time for the whole job with its 20 tasks with extensive-medium level allowance. Assume that nursing tasks differ from other clinical and ancillary operations.

Solution: Table 6.3 displays the calculations summary for all 20 job elements involved in nursing care. Column (4) is the average of the 6 observations from column (3). Column (5) uses the normalizing formula [6.3]:

$$\text{NT} = \text{Sum of } ((\text{Avg. time for element } j) * (\text{Performance rating for element } j))$$

To calculate the standard time, an allowance factor should be determined using Table 6.1, in this case 26 percent.

The allowance factor for this job:

$$\text{AF}_{\text{job}} = 1 + A = 1 + 0.26 = 1.26.$$

Finally, the standard time for the nursing activities:

$$\text{ST} = \text{NT} * \text{AF} = 243.49 * 1.26 = 306.80 \text{ minutes or } 5.1 \text{ hours.}$$

The time study method of work measurement has several limitations: the performance and allowance ratings are subjective; only those jobs that can be observed can be studied. That makes it difficult to study administrators' or managers' work, or creativity-oriented or intense mental processes. Time measurement is most effective for short, repetitive tasks. Time studies are prohibitively expensive for irregular or infrequently occurring tasks, and they disrupt worker routine, and workers may resent them. ■

TABLE 6.2. OBSERVED TIMES AND PERFORMANCE RATINGS FOR NURSING UNIT ACTIVITIES.

Nursing Unit Activities	Performance Rating	Observed Time in Minutes					
		1	2	3	4	5	6
1. Patient assessment	1.08	12	11	12	9	13	12
2. Care planning	0.95	9	7	6	8	7	9
3. Treatments	1.12	8	8	7	9	10	11
4. Medication	1.05	4	3	4	5	6	4
5. Collecting blood/lab specimens	1.10	8	7	6	9	10	7
6. Passing/collecting trays, snacks, feeding patients	1.20	18	21	18	19	21	20
7. Shift report	0.97	5	6	5	7	8	6
8. Charting/documentation	0.98	8	5	6	8	9	10
9. Responding to patients' call lights	1.15	4	3	3	5	6	5
10. Staff scheduling phone calls	0.95	5	4	4	5	6	7
11. Phone calls to/from other departments	0.96	6	5	5	4	6	7
12. Transporting patients, specimens etc.	1.05	9	11	12	11	9	10
13. Patient acuity classification	1.11	5	6	5	6	7	4
14. Attending educational in-services	1.00	75	75	75	75	75	75
15. Order transcription and processing	0.94	5	6	4	6	7	6
16. Ordering/stocking supplies and lines	0.98	6	4	5	6	7	4
17. Equipment maintenance and cleaning	0.95	9	11	8	9	11	10
18. General cleaning/room work (garbage, making beds)	1.15	12	9	12	10	9	11
19. Assisting with the admission process	1.06	11	9	10	9	8	9
20. Breaks/personal time (not including lunch)	1.00	15	15	15	15	15	15

Standard Elemental Times and Predetermined Standards. Standard elemental times (historical times) are developed from the organization's historical time data. Over time, health care organizations can accumulate elemental times for certain tasks that are common to many jobs. These elemental times can then be combined to develop job times. Use of standard elemental times costs less and doesn't disrupt work. However, times taken from the files may be biased or inaccurate, or the files may not have all the elemental times needed for entire jobs. The applicability of elemental times to the complex job designs in health care is limited.

TABLE 6.3. OBSERVED AND NORMAL TIME CALCULATIONS FOR NURSING UNIT ACTIVITIES.

(1)	(2)	(3)						(4)	(5)
		Sample Observed Times in Minutes							
Nursing Unit Activities	Performance Rating (PR)	1	2	3	4	5	6	Observed Time (OT)	Normal Time (NT) OT * PR
1. Patient assessment	1.08	12	11	12	9	13	12	11.50	12.42
2. Care planning	0.95	9	7	6	8	7	9	7.67	7.28
3. Treatments	1.12	8	8	7	9	10	11	8.83	9.89
4. Medication	1.05	4	3	4	5	6	4	4.33	4.55
5. Collecting blood/lab specimens	1.10	8	7	6	9	10	7	7.83	8.62
6. Passing/collecting trays, snacks, feeding patients	1.20	18	21	18	19	21	20	19.50	23.40
7. Shift report	0.97	5	6	5	7	8	6	6.17	5.98
8. Charting/documentation	0.98	8	5	6	8	9	10	7.67	7.51
9. Responding to patients' call lights	1.15	4	3	3	5	6	5	4.33	4.98
10. Staff scheduling phone calls	0.95	5	4	4	5	6	7	5.17	4.91
11. Phone calls to/from other departments	0.96	6	5	5	4	6	7	5.50	5.28
12. Transporting patients, specimens etc.	1.05	9	11	12	11	9	10	10.33	10.85
13. Patient acuity classification	1.11	5	6	5	6	7	4	5.50	6.11
14. Attending educational in-services	1.00	75	75	75	75	75	75	75.00	75.00
15. Order transcription and processing	0.94	5	6	4	6	7	6	5.67	5.33
16. Ordering/stocking supplies and lines	0.98	6	4	5	6	7	4	5.33	5.23
17. Equipment maintenance and cleaning	0.95	9	11	8	9	11	10	9.67	9.18
18. General cleaning/room work (garbage, making beds etc)	1.15	12	9	12	10	9	11	10.50	12.08
19. Assisting with the admission process	1.06	11	9	10	9	8	9	9.33	9.89
20. Breaks/personal time (not including lunch)	1.00	15	15	15	15	15	15	15.00	15.00
								234.83 Job-OT	243.49 Job-NT

Predetermined standards, which are obtained from published data, have these advantages: A) standards are based on repeated observations of a large number of employees in an industry; B) no performance rating or allowance factor has to be obtained and operations are not interrupted; and C) standards can be established before the job is even performed (Stevenson, 2002; p. 329).

The best-known standards are those of the MTM (Methods-Time Measurement) Association. A more detailed discussion on sources and uses of predetermined standards is found in Chapter Nine, on productivity.

Work Measurement Using Work Sampling

Work sampling is a technique for estimating the proportion of time that a worker or machine spends on various activities. Work sampling does not require direct timing of an activity. Rather, observers make brief observations of a worker or machine at random intervals over a period of time and simply record the nature of the activity (Stevenson, 2002; p. 331). The resulting data are simply counts of the number of times that each category of activity or non-activity was observed. Table 6.5 is an example of a tallying sheet for a work sampling study in a nursing unit. Work sampling has two purposes: to estimate the percentage of unproductive or idle time for repetitive jobs, and to estimate the percentage of time spent on the various tasks in nonrepetitive jobs – for example, estimating the time an RN spends on direct, on indirect, and on professional or nonprofessional tasks of patient care.

Work sampling has several advantages over time study. The observations are spread over a period of time, so results are less susceptible to short-term fluctuations. There also is little or no work disruption, and workers are less resentful. Work sampling studies are less costly and less time-consuming, and many studies can be conducted simultaneously. Observers do not need extensive skills, as long as they are trained properly to conduct the observation.

Despite the advantages, there are certain shortcomings of work sampling studies. First of all, they provide less detail on the elements and tasks of a job, and often no record of the worker's method. Sometimes workers alter work patterns, which invalidates the results. If observers do not adhere to the random observation schedule, that further taints results. Work sampling studies should not be used for short, repetitive tasks.

The results obtained from a work sampling study of patient care tasks might enable a health care manager to usefully restructure the work in the nursing units. For example, if observations show that RNs are performing a high percentage of nonprofessional and/or indirect job activities (for example, changing sheets on an empty bed or emptying a bed pan), these activities could be assigned to employees

TABLE 6.4. ABRIDGED PATIENT CARE TASKS IN A NURSING UNIT.

Patient Care Tasks	Professional	Non-Professional	Direct	Indirect
1. Ace bandage application	*		*	
2. Admit – patient orientation	*		*	
3. Assist to/from bed, chair	*		*	
4. Bed bath	*			
5. Bed change – empty		*		*
6. Bed change – occupied	*		*	
7. Bed pan		*		*
8. Blood pressure	*		*	
9. Catheterization of bladder	*		*	
10. Census count		*		*
11. Charting	*		*	
12. Bowel control training	*		*	

with lower skill levels, since the tasks do not involve judgments about patient care. Thus costs would be lowered, and perhaps quality of care might be improved: non-RN employees earn less; and by directing RNs from nonprofessional, indirect tasks to direct and professional tasks, perhaps patients would receive more professional attention. Table 6.4 shows a small portion of the patient care tasks that are classified as professional, nonprofessional, direct or indirect care.

To conduct a work sampling study, a health care manager or analyst must first clearly identify the work situation and its work force, or the equipment that is to be observed. Once the target area of study is identified, then the number of times the work or equipment should be observed must be decided. The number of observations must statistically represent what actually takes place even when observations are not being made.

The methodological difference between a work sampling study and time study can be compared to thus: taking still pictures of a work situation and then observing different still pictures from different time frames versus videotaping the work situation, hence making continuous observations. However, it is possible, by taking enough still pictures, to reach conclusions that are statistically representative of that work situation. Because time studies require more resources than work sampling studies do, a work sampling study with a statistically representative sample could help health care managers capture necessary information quickly and more cheaply, as well as with less resentment from the staff. Table 6.5 is an example of a form collecting work sampling data to estimate the proportions of direct, indirect, professional and nonprofessional care in a nursing unit.

TABLE 6.5. WORK SAMPLING DATA COLLECTION FORM FOR NURSING UNIT.

Unit: 4W **Observer: CL** **Date: 11/02/05** **Shift: AM** **Time: 10:04**

Observed Staff Name & Title	Prof. Direct	Non-Prof. Direct	Prof. Indirect	Non-Prof. Indirect	In Communication with			On Break
					Patient	Staff	Physician	
G. Smith, RN	√				√			
V. Black, RN	√					√		
E. Mason, RN			√					
Z. Sander, RN		√						
P. Bills, RN	√						√	

In order to collect data appropriately, the observers who collect the data must be trained to assess the nature of the work using a list of items from Table 6.4. (The complete list contains over 120 items.) An observer going into a nursing unit should be able to identify the patient care tasks done by nurses as either professional or nonprofessional, and either direct or indirect patient care.

Training Observers. The selection of the observers and their training are important parts of work sampling. A balance between the costs and the expertise of the observers must be considered. For many activities, clerical workers, secretaries, and even local university students can be used. However, some observations require appropriate skill levels. For instance, a student would not produce valid and reliable results if he were to record specific direct care procedures for which an RN would have the skill to collect the data. A reliance on nurses for data collection is also warranted for observations in areas that may present a hazard to non-health personnel, for instance, the ICU or certain psychiatric settings.

A comprehensive training program of three steps should be standardized for all data collectors. Data collectors should be first educated as to the study's goals, protocol, collection procedures, and data submission procedures, and the guidelines for their behavior. Then, the observers should be trained in data collection. Training may include sessions using videotaped activities for practice in identifying and recording actual nursing services. In the third phase, observers participate with a project member in explaining the nature of the project to those who will be observed in the observation setting. In many studies, a standardized and comprehensive training program has produced intra-rater reliability of 90 percent or greater and inter-rater reliability of about 80 percent.

It is also possible to have workers self-report their activities. Self-reported logs are less expensive, but reduce the reliability and validity of the data collected. Even with a reminder device, people may not record their activities promptly, and some may not be honest in their reports. Furthermore, self-reporting uses people's time, and it creates frustration or resentment and a lack of cooperation. Nevertheless, there are certain activities for which self-reported logging may be appropriate: those that are complex, with many variables and exceptions; activities requiring thought; activities with a long cycle; or activities performed by relatively few people doing many processes.

Determination of Sample Size. Work sampling is based on probability theory. The sampled activities are viewed as representing the total population of activities; therefore, to obtain valid and reliable results, sample size must be carefully chosen.

Inherent in any work sampling study is a degree of error. Work sampling estimates can be interpreted only as approximations of the actual time spent performing a particular activity. A goal of work sampling is to minimize the degree of error and obtain a desirable confidence interval in which the actual percentage falls. For instance, the hospital administrator may want an estimate of MRI idle time that provides a 95.5 ($z = 2.00$) percent confidence of being within 4 percent of the actual percentage. Once the error level and confidence level are decided, the sample size can be determined using following formulas:

$$\text{CI} = \hat{p} \pm e \quad [6.7]$$

$$e = z\sqrt{(\hat{p} * (1 - \hat{p}))/n} \quad [6.8]$$

$$n = (z/e)^2\, \hat{p}(1 - \hat{p}) \quad [6.9]$$

where

CI = confidence interval

e = error

z = number of standard deviations needed to achieve desired confidence

$\hat{p}$ = sample proportion (number of occurrences divided by sample size)

n = sample size

If a preliminary estimate of $\hat{p}$ is not available, use 0.5; after twenty to thirty observations, recalculate the sample size based on the new estimate. Furthermore, if the resulting sample size is not an integer, it should be rounded up to the nearest integer.

EXAMPLE 6.2

A hospital administrator wants an estimate of x-ray idle time that has a 95.5 percent confidence of being within 4 percent of the actual percentage. What sample size should be used?

Solution: Given: $e = 0.04$; $z = 2.00$ (see Appendix A); $\hat{p} = 0.5$ (preliminary). Where $\hat{p} = 0.5$: $n = (2.00/0.04)^2 * .50 * (1 - .50) = 625$ observations.

If for 20 observations, it is observed that the x-ray was breaking down on average one time, the revised estimate is then $\hat{p} = 1/20 = 0.05$. The revised estimate of sample size is: $\hat{p} = 0.05$, $n = (2.00/0.04)^2 \times .05 \times (1 - .05) = 118.75$ or 119 observations.

Once the sample size is determined, the next step is to develop the random observation schedule. That means deciding on the duration of the study (for instance, how many days over which the observations will be made). If observations are grouped too closely, the behaviors observed may not truly represent typical performance. For deciding on observation times, a random number table is a useful tool (see Table 6.6). Adjustments may have to be made to the randomly determined times. For instance, the amount of direct nursing care required on a unit may vary by week versus weekend, time of day, and seasonality. The impacts of such variations should be accounted for in the work study methodology. Before any observations are made, workers and their supervisors must be informed about the purpose of the study and how it will occur to avoid arousing suspicions that will hinder the study (Hawthorne effect). Finally, proceed with observations. Recompute the required sample size several times during the study if initial estimates are not reliable. ■

Development of a Random Observation Schedule. A random number table is essential to determine the observation times for a work sampling study. A random number table contains a list of unordered sequences of numbers (see Table 6.6). Numbers that are obtained from this table can be translated into particular observation times. For each observation, three numbers should be obtained: the first represents the day, the second the hour, and the third the minute when the observation will be made. The number of digits needed for each number is determined by the number of days in the study, the number of hours per day, and the minutes per hour. When using a random number table, it is important to vary the starting point from one study to another to avoid taking observations at the same times.

One method of choosing a starting point is to use the serial number on a dollar bill. Let the first number of the serial number represent the row to begin with, and the second number the column. For example, a serial number starting with 43 points to the fourth row and third column in Table 6.6, and the eight digit

TABLE 6.6. RANDOM NUMBERS.

	1	2	3	4	5	6	7	8	9	10
1	35491937	20651090	30546738	27696713	91854858	26470901	29600381	43662404	55790910	53368767
2	90089321	75138197	18262296	58506988	53664329	58683691	44072656	72123301	28627532	72233733
3	74264444	20553216	88880910	32182848	99227273	42091243	00185415	08357505	41837616	31852225
4	06975941	19701236	59830829	79995795	34330400	63691396	97866058	36093751	13890129	32572320
5	85104515	28079011	30791869	49069307	25601053	20059512	59647584	82327514	25940454	28633012
6	49445830	31791906	92435664	55449680	36293078	76826714	89141197	12205275	33570010	27259183
7	97984536	60317366	21508928	98014497	61529058	44276591	14715726	69340554	66688546	10818201
8	50991720	74038271	96451777	08764415	56072460	46404128	38033324	01926168	11279991	95600259
9	64349299	37831506	63182639	04789945	77658452	04272124	48048380	41902751	02079296	17430093
10	34894237	13116155	43110883	70982790	83397806	76383491	01380231	72811348	13242203	92667968
11	90761790	74867084	76963011	32548196	41697527	51249421	45324317	73925689	24228978	39762050
12	49467328	98679191	80203395	22956834	97271339	11381340	51175058	25051425	76621924	94995977
13	32794406	31342191	02913167	57792667	39337813	59761552	37057187	42319104	03677954	56886523
14	78152505	09638226	07737349	68260524	75852472	36834815	00551441	02859120	70489943	27486952
15	60075996	31935541	70044884	58176246	35183489	71073623	13252209	79970687	52414096	69996058
16	45030940	76909062	89925239	75233560	08589156	96913497	69644209	02601417	06504579	98654452
17	77637463	25848336	76968202	33535876	71755667	69560190	32893639	80542894	60040669	41588322
18	83262443	46142158	11416863	85122725	64419508	22965410	22075332	43671820	84851088	52801519
19	55924210	17405029	23887208	06435470	91190846	07104170	01882290	61773826	51088549	46474896
20	15306521	71387249	39155916	93179719	66965894	49643197	06692649	45665977	11202987	88350481

Note: Random number generator formula: =RAND( ) * 1000 (generated using Excel).

number there is 59830829. Appropriate selection of days, hours and minutes takes these eight-digit numbers one after the other to develop the random observation schedule. For example, if the study covers between ten and ninety-nine days, a two-digit number is needed; if the activity is performed for eight hours daily, a one-digit hour number is needed; a two-digit number is needed for minutes, since there are sixty minutes per hour.

Example 6.3

A nursing manager wants to observe the time a nurse spends in direct and in-direct care over a five-day period, on a unit where the shift is 8 hours.

Solution: A one digit number will be needed for the day, one digit for the hour, and two digits for the minute. Using Table 6.6, starting from row 4, column 3, we obtain the random number 59830829. The first number is 5. Thus, we determine the day (in this case, the fifth day of the week, Friday). We move to the next number, 9, for the hour; but since activity is performed 8 hours daily, we discard that number, and move to the next one, 8. If we assume that the shift starts at 7:00 A.M., the number 8 represents 2:00 P.M. (assign 1 = 7:00 A.M., 2 = 8:00 A.M., . . . , 8 = 2:00 P.M.). The minutes are derived from the next two digits, 30. Put together, the first observation is made on the fifth day, 30 minutes into the eight hours of work, or at 2:30 P.M. This procedure is repeated for each observation to be taken. Then the observations should be sorted chronologically by day, hour and minute. ■

Example 6.4

The chief of the hospital maintenance technicians wants to estimate the proportion of time that technicians spend in a part of the maintenance process. The maintenance office is open 9 hours, starting at 8:00 A.M., every day of the week. Twenty observations will be taken during a month-long investigation. Determine the random observation times and develop an observation schedule, assuming that the serial number of a dollar bill starts with 25.

Solution: Since we know the starting point in Table 6.6 is the second row and fifth column, the random number is 53664329. Next we need to choose the reading direction of the succeeding random numbers: either by moving to the right on the same row, and when the row is finished, going down one row and moving from left to right; or by going down on the same column, and when the column is finished moving to the next column right and reading from bottom to top. For this case, we choose to read in the same column, going down. For days, read two digits from left to right—select two-digit number, if higher than 31, then move to the next digit to make a two-digit day observation, and so on. Within eight digit numbers, if there are not enough digits to identify day, hour and minutes for the observation, discard that random number and select the next one. For hours, read single digit numbers from left to right, discard 0 and assign 1 = 8:00 A.M., 2 = 9:00 A.M., and so on. For minutes, read two-digit numbers and discard numbers 60 or over. Prepare a chronological list of the observation time results by day, hour and minute, to be given to the data collection team. If a health care facility is open ten hours for business, then single digits from 0 through 9 can be used to make assignment for hours (0 = 8:00 A.M., 1 = 9:00 A.M., ... , 9 = 5 P.M.).

Table 6.7 shows the development of a work sampling schedule. Twelve random numbers have been discarded because one cannot draw the valid numbers

TABLE 6.7. DEVELOPMENT OF THE SCHEDULE FOR A WORK SAMPLING STUDY.

Observation	Random Number	Day	Hour	Minute	Notes
	53664329				discarded
1	99227273	22	7 = 2 P.M.	27	
2	34330400	30	4 = 11 A.M.	00	
3	25601053	25	6 = 1 P.M.	01	
4	36293078	29	3 = 10 A.M.	07	
5	61529058	15	2 = 9 A.M.	05	
6	56072460	07	2 = 9 A.M.	46	
	77658452				discarded
	83397806				discarded
7	41697527	16	9 = 4 P.M.	52	
8	97271339	27	1 = 8 A.M.	33	
	39337813				discarded
	75852472				discarded
9	35183489	18	3 = 10 A.M.	48	
10	08589156	08	5 = 12 P.M.	15	
	71755667				discarded
11	64419508	19	5 = 12 P.M.	08	
12	91190846	11	9 = 4 P.M.	08	
	66965894				discarded
	49643197				discarded
13	07104170	07	1 = 8 A.M.	04	
	96913497				discarded
14	71073623	10	7 = 2 P.M.	36	
	36834815				discarded
	59761552				discarded
15	11381340	11	3 = 10 A.M.	13	
16	51249421	12	4 = 11 A.M.	42	
	76383491				discarded
17	04272124	04	2 = 9 A.M.	21	
18	46404128	04	1 = 8 A.M.	28	
19	44276591	27	6 = 1 P.M.	59	
20	76826714	26	7 = 2 P.M.	14	

TABLE 6.8. FINAL WORK SAMPLING SCHEDULE.

Observation	Day	Time
18	04	8:28 A.M.
17	04	9:21 A.M.
13	07	8:04 A.M.
6	07	9:46 A.M.
10	08	12:15 P.M.
14	10	2:36 P.M.
15	11	10:13 A.M.
12	11	4:08 P.M.
16	12	11:42 A.M.
5	15	9:05 A.M.
7	16	4:52 P.M.
9	18	10:48 A.M.
11	19	12:08 P.M.
1	22	2:27 P.M.
3	25	1:01 P.M.
20	26	2:14 P.M.
8	27	8:33 A.M.
19	27	1:59 P.M.
4	29	10:07 A.M.

for day, hour, or minutes from the same string of eight digits. Table 6.8 shows the final schedule, with valid observations times sorted according to chronological order by day, hour, and minute. ■

Work Simplification

An important part of work design is using common sense to find easier and better ways of performing the work. Work simplification is not just speeding up the job time or finding a new way of working harder or faster. Rather, work simplification seeks a way to do a job with less effort, less cost, and less time, more safely, and without hurrying. Changing work methods, not job itself, is the aim. Work simplification can be achieved through: eliminating unnecessary parts of the work; combining and rearranging other parts of the work; simplifying the necessary parts of the work.

The three main tools used to map the work process and identify means to simplify it are: work distribution charts, flow process charts, and flow charts. Layout analysis also can be used (see Chapter Five).

Work Distribution Chart. A work distribution chart defines the functions of a particular department in terms of its major activities and pinpoints each employee's contribution to them. Table 6.9 is a partial work distribution chart for

TABLE 6.9. PARTIAL WORK DISTRIBUTION CHART FOR NURSING UNIT.

Activity	Hours	Nurse Manager	Hours	Nurse I	Hours	Nurse II	Hours
Patient admissions	12	Coordination with Admissions Dept.	8		2		2
Communications	16	Physicians and patient family	8	Patient family	4	Patient family	4
Direct patient care	48		8	Medication administration	20		20
Indirect patient care	16	Monitor charts	4	Meals	6	Update charts	6
Discharge planning	14		2		6		6
Scheduling & Adm.	4		4				
Miscellaneous	10	Supervisory meeting	4	Emergency coverage	2		2
		Sessions with trainees	2				
TOTAL	120		40		40		40

a nursing unit, such as generally prepared by an employee or supervisor. The key to an effective work distribution chart is being highly specific about the tasks. For instance, instead of saying that a nurse was doing paperwork, a more specific response is that the nurse was filling out an order for a laboratory test. The unit of analysis for analyzing the work distribution chart may be the department as a whole, an independent activity, or an individual person(s). Trouble can be identified by asking:

- Which activities consume the most time?
- Are the tasks evenly and fairly distributed?
- Is there over- or under-specialization?
- Are employees assigned too many unrelated tasks?
- Are talents used efficiently?
- Is the time spent on each activity justifiable?

Flow Process Chart. A flow process chart records a procedure as a graphic chart, using shorthand to simplify and unify the record (see Figure 6.3). It is used to examine the overall sequence of an operation in an attempt to identify nonproductive tasks, and highlights inconsistencies and redundancies. Any task beyond the operation itself (the circles in Figure 6.3) represents a potential delay that should be evaluated and perhaps eliminated. Important questions to ask include why a task is being done, what it contributes, where it is being done, when it is being done, who is doing it, and how? Steps that can be taken by examining a flow process chart include eliminating nonproductive tasks; combining certain job elements; changing the sequence, place or person associated with the task; and improving overall operations.

Figure 6.3 depicts a flow process chart for the emergency room, where efficient total turn-around time for lab processing is essential. This emergency department has inefficient turn-around times for stat laboratory tests, with delays from three tasks. From the flow chart, one can suggest: packaging, labeling, and information system (IS) entry should be combined into one task. In addition, the task "MD terminates lab order" can be eliminated. These steps would eliminate delays and reduce unnecessary operations.

Flow Chart. Flow charts depict the chronological flow of work in a logical manner to help the health care manager analyze, plan, and control the work flow. Figure 6.4 depicts commonly used flow chart symbols. One can draw detailed flow charts of operations by using computer programs like Visio. Figure 6.5 depicts a flow chart for the initial process and the improvement after reengineering for the emergency department's specimen and lab work described above.

FIGURE 6.3. FLOW PROCESS CHART FOR EMERGENCY ROOM SPECIMEN PROCESSING.

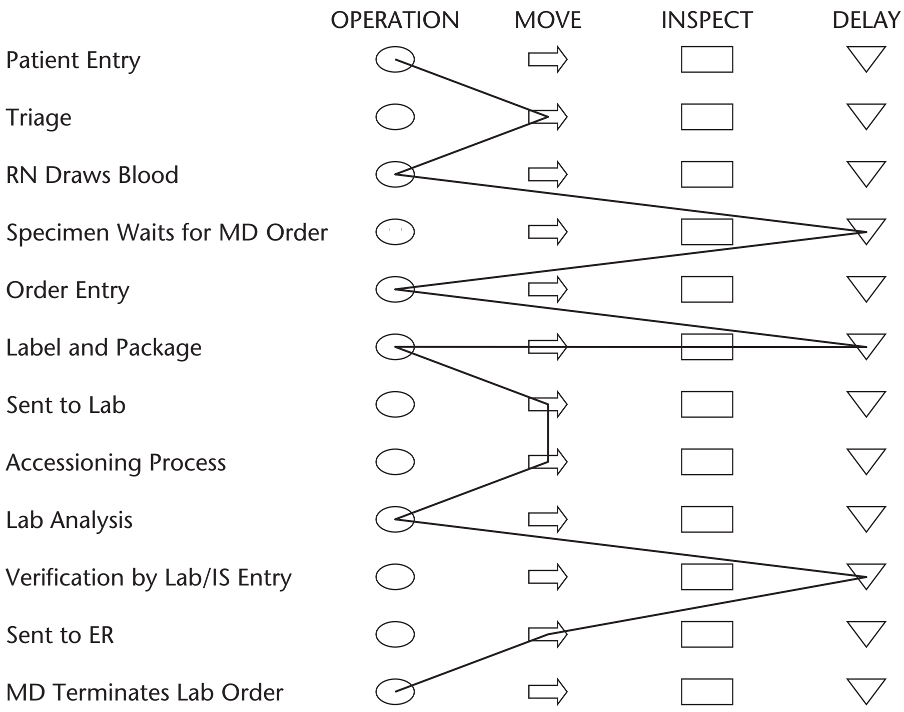


FIGURE 6.4. COMMONLY USED FLOW CHART SYMBOLS.

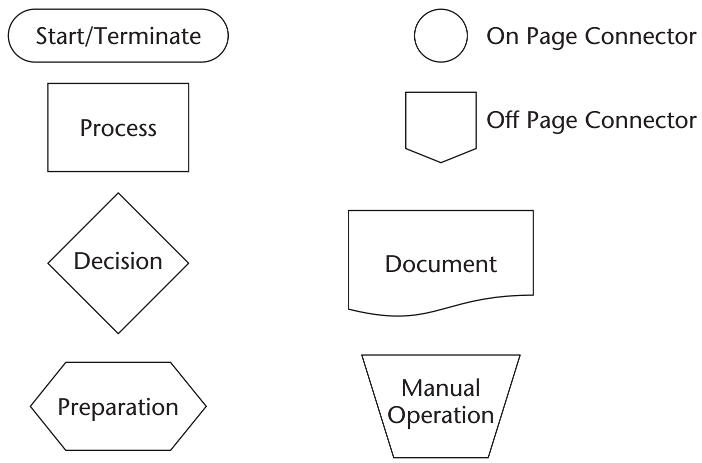
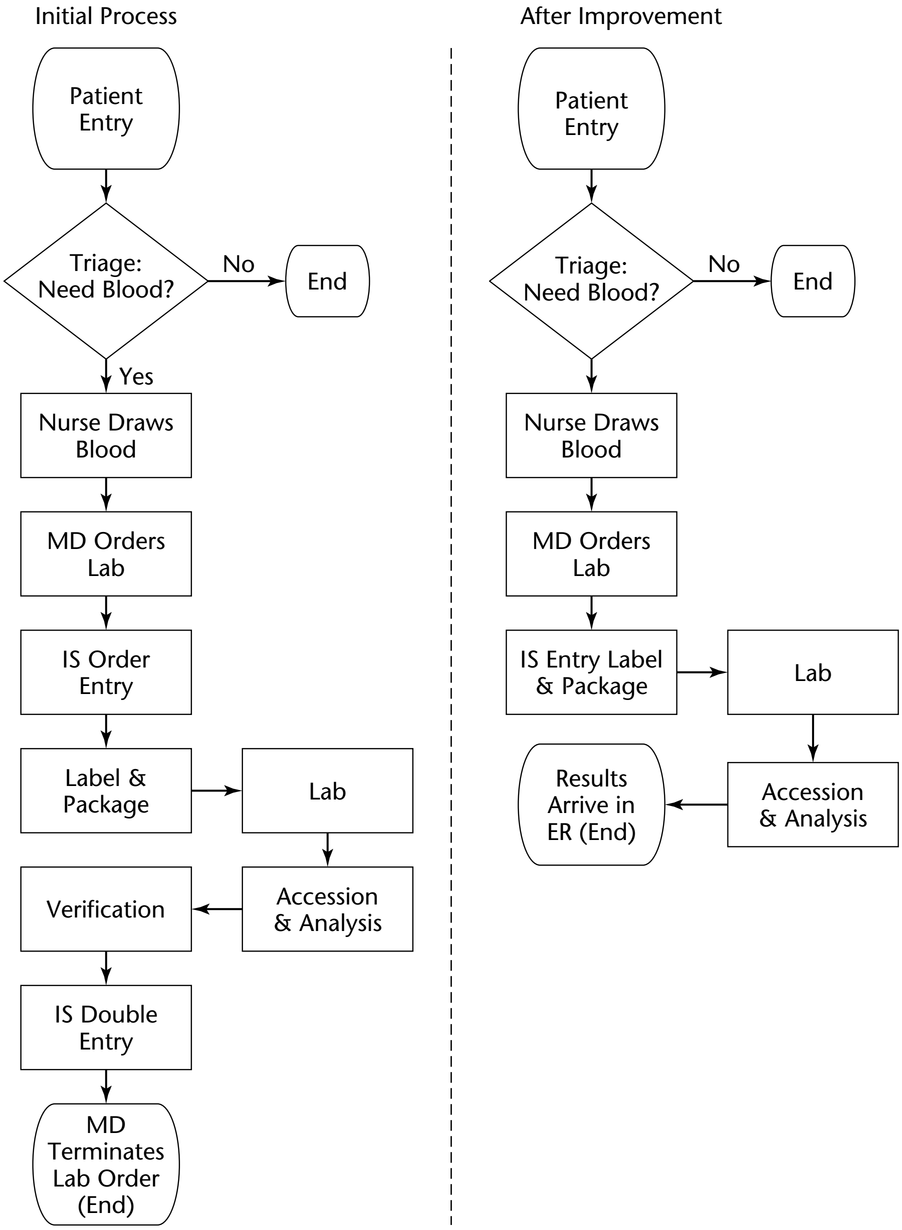


FIGURE 6.5. FLOW CHART FOR EMERGENCY ROOM SPECIMEN PROCESSING.



Worker Compensation

Compensation is an important matter to both the employee and the employer, though of course from divergent points of view. Without an adequate compensation package, employers may have difficulty attracting high-quality, competent employees, or may face workers with no extrinsic motivation to perform productively. On the other hand, higher wages and benefits erode the organization's profit. Because labor costs comprise approximately 40 percent or more of a health care organization's budget, establishing an appropriate wage schedule is essential to its survival in the long run.

There are two basic systems for compensating employees—time-based or output-based (incentive) systems. Time-based systems, the most common in health care, compensate employees for the time they work during a pay period. When quality is just as, or more important than, quantity, a time-based system is preferable. Output-based systems compensate employees according to how much output they produce during a pay period.

In health care, incentive-based plans are on the rise. Originally developed by hospital systems, managed care organizations, and health management companies, the incentive plans, both individual and group, are now being used more by individual hospitals, as well. Indeed, high-performing hospitals use incentive compensation. Incentive plans are designed to motivate employees to achieve certain goals of the organization: higher profits, lower costs, better quality of care, or greater productivity. Incentive programs can take one of two forms, profit sharing or gain sharing. Under profit sharing plans, employees receive a percentage of the organization's profits, under a prearranged formula. Under gain sharing plans, employees share a percentage of the cost savings achieved by increasing productivity.

Summary

Reengineering is a methodology intended to overcome the difficulty in realizing TQM/CQI performance over a long duration, as well as the myopic conduct of organizational change, restructuring and downsizing approaches. To reengineer the system, health care managers must be able to understand work-design, jobs, job measurement, process activities, and reward systems—all well known concepts of industrial engineering. With that knowledge, they can recognize the bottlenecks in the old system, identify unnecessary and repetitive tasks, and eliminate them in the reengineered system of care. Time standards are important in establishing productivity standards, determining staffing levels and schedules, estimating labor costs, budgeting, and designing incentive systems. In this chapter, measurement of time standards, work sampling, and work simplification techniques were given in-depth consideration.

Exercises

Exercise 6.1

In a routine clinical process, observed times in minutes were 84, 76, 80, 84, and 76. One observed employee was working twenty-five percent faster than the average worker. Allowance factors for this job, based on the workday, add to 20 percent. What are the normal and the standard times?

Exercise 6.2

Pre- and post-examination processing of patients in an outpatient clinic involves various tasks performed by clerks and nurses. A time study conducted by the decision support department is shown in Table EX 6.2.

TABLE EX 6.2

		Observations (in Minutes)										
Activity	Performance Rating	1	2	3	4	5	6	7	9	10	11	12
Registration	1.15	3	6	4	8	4	5	4	6	4	6	4
Co-payment	0.95	7	9	11	8	12	9	6	11	9	12	10
Wait for nurse	1.00	17	15	17	12	11	17	12	19	12	20	18
Vital signs	0.96	9	8	11	12	9	8	10	12	8	12	11
Wait for exam room	1.00	12	15	12	14	21	18	11	16	9	14	18
Placement to exam room	0.98	3	5	4	6	3	5	3	6	5	4	7
Wait for physician	1.00	10	17	21	11	13	15	14	12	19	15	9
Examination	1.00	18	15	19	22	18	12	19	21	16	21	17
Test order entry	1.02	4	7	3	5	4	11	9	12	11	14	9
Referral requests	1.11	11	10	16	9	8	9	7	7	9	7	6
Follow-up appointment scheduling	1.08	3	5	3	4	3	4	4	5	3	3	5

a. Determine the observed time for the pre-post exam process.
b. Determine the normal time for the pre-post exam process.
c. Determine the standard time for the pre-post exam process, using the basic-moderate allowance for the job.

d. Calculate the overall standard time for the exam process. Do you think the time spent in the outpatient clinic, without including the exam time, is reasonable? If not, what improvements would you recommend?

Exercise 6.3

The emergency department in a major medical center has delays in the stat laboratory tests turn-around time (TAT). According to standards, the stat lab results should be reported within 30 minutes. The analyst conducted a time study to measure the reporting times for 14 different lab tests over 15 observations. The performance ratings of the personnel handling the test are also recorded in Table EX 6.3.

TABLE EX 6.3.

		Observations (in Minutes)														
Lab Test	Performance Rating	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Hem 8	0.95	28	34	29	33	21	18	26	23	30	24	23	24	20	27	28
Hem 18	1.03	29	38	24	39	27	26	20	23	27	26	28	28	34	37	29
Apter	1.11	27	36	35	35	36	27	29	33	29	33	34	40	36	32	28
AMY	0.97	28	37	29	27	28	29	27	26	25	24	25	28	22	31	22
Ca	1.09	38	44	33	34	21	23	20	28	23	27	22	27	27	29	25
Glucose	0.98	52	54	49	43	51	56	60	37	39	40	29	43	44	50	43
Chem 7	1.01	28	37	27	35	33	30	31	27	25	33	32	34	29	25	25
K	1.04	12	25	18	11	19	27	11	19	14	15	14	15	18	16	12
HCG	0.98	18	29	16	20	23	15	15	14	16	18	19	22	18	18	21
ALP	0.97	29	39	30	32	32	34	32	34	32	34	34	38	36	33	33
ALT	0.94	29	39	30	32	29	36	23	25	28	28	31	29	33	32	33
B	1.03	29	38	36	23	25	28	32	34	32	29	38	36	23	25	28
AST	1.05	29	39	28	31	29	33	28	32	34	32	34	32	33	29	32
BBSP	0.94	26	32	18	26	39	28	31	29	26	28	31	29	19	28	32

a. Using the basic-low allowance for each job, calculate the standard time for each lab test.
b. What is the overall standard time for stat orders?
c. Are the overall stat time and individual test times within expectations? If not, what would you recommend?

Exercise 6.4

The Nursing Units Manager at HEALTH FINDER HOSPITAL wants to evaluate activities in the patient care unit. The manager hired an analyst who timed all the patient care activities, which include 17 elements. The observed times (OT) and performance ratings for six observations are shown in the Table EX 6.4.

TABLE EX 6.4

Patient Care Unit Activities	Performance Rating	Observations (in Minutes)					
		1	2	3	4	5	6
1. Patient assessment	1.10	9	11	11	9	13	11
2. Care planning	0.96	10	9	7	8	7	10
3. Treatments	1.14	8	9	8	9	10	10
4. Medication	1.07	4	3	4	4	5	3
5. Collecting blood/lab specimens	1.15	8	7	6	9	10	7
6. Passing/collect. trays, giving out snacks, feeding patients	1.12	18	21	20	21	21	20
7. Shift report	0.97	7	6	5	7	9	7
8. Charting/documentation	0.95	8	7	8	8	9	11
9. Responding to patients' call lights	1.10	4	5	4	7	6	8
10. Phone calls to/from other departments	0.95	6	7	5	4	9	8
11. Transporting patients, specimens etc.	1.06	11	11	12	12	9	10
12. Patient acuity classification	1.10	7	6	7	6	7	6
13. Order transcription and processing	0.95	5	7	4	6	7	6
14. Ordering/stocking supplies and lines	0.97	6	7	5	6	7	6
15. Equipment maintenance and cleaning	0.96	12	11	8	10	11	9
16. General cleaning/room work (garbage, making beds)	1.14	12	10	12	10	10	12
17. Assisting with the admission process	1.05	11	9	10	9	9	10

a. Determine the average observed time for each element.
b. Find the normal time for each element.
c. Utilize Table 6.1 to develop an allowance percentage for a job element that requires a moderate-low allowance.
d. Determine the standard time for the whole job (for all 17 elements).

Exercise 6.5

An initial work sampling survey to estimate the percentage of time that MRI equipment is idle between 8:00 A.M. and 8:00 P.M., found that the MRI was idle in 9 of the 120 observations.

a. Determine the percentage of idle time.
b. From the initial results, approximately how many observations would it require to estimate the actual percentage of idle time to within 4 percent, with confidence of 95 percent?

Exercise 6.6

The decision support system analyst has been asked to prepare an estimate of the percentage of his time that a lab technician spends on microscopic examination of blood cultures, with a 95.5 percent confidence level. Past experience indicates that the proportion will be 25 percent.

a. What sample size would be appropriate to have an error of no more than ±4 percent?
b. If a sample of 300 is used, what would be the potential error for the estimate?

Exercise 6.7

The chief of the hospital maintenance technicians wants to estimate the percentage of their time that technicians spend in a certain part of the maintenance process. The maintenance office is open 8 hours on weekdays. Twenty observations will be taken during a month. Determine the random observation times, using Table 6.6 and assuming that the first two digits of a serial number from a dollar bill are 32. Prepare a list of the observation time results chronologically by day, hour and minute, to be given to the data collection team.

Exercise 6.8

The director of radiology wants to estimate the percentage of their time that radiology technicians spend readjusting the machines for various images. The radiology department is open 10 hours on weekdays (8:00 A.M. to 6:00 P.M.). Twenty-five observations will be taken during a two-week period. Determine the random observation times using Table 6.6 and assuming that the first two digits of a serial number from a dollar bill are 43. Prepare a list of the observation time results chronologically by day, hour, and minute, to be given to the data collection team.

Exercise 6.9

Prepare a flow chart for a patient visit to an outpatient orthopedic clinic to show the flow for handling minor fractures requiring casts.

Exercise 6.10

Prepare a flow chart for a colonoscopy exam (from scheduling to discharge).

Exercise 6.11

Phlebotomy is an invasive procedure for collecting a blood sample. Prepare a flow process chart for the phlebotomy process in an outpatient setting.

Exercise 6.12

Prepare a work distribution chart for the office management staff of a group practice. Assume a supervisor manager and three clerks.