The Effects of Reengineering on Hospital Performance Indicators

Linda Rutgers Albery
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THE EFFECTS OF REENGINEERING ON HOSPITAL PERFORMANCE INDICATORS

by

Linda Rutgers Albery, Ed.D.

A Dissertation
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Doctor of Education
Department of Teaching, Learning and Leadership

Western Michigan University
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THE EFFECTS OF REENGINEERING ON HOSPITAL PERFORMANCE INDICATORS

Linda Rutgers Albery, Ed.D.
Western Michigan University, 2001

Reengineering was a management tactic designed to reduce costs and increase efficiencies in the workplace. Although many hospitals reported reengineering efforts were a priority during the latter part of the 1990s, little research has been done to determine the effects of reengineering on cost and quality performance indicators.

This research studied a large regional medical center located in southwest Michigan, which implemented patient-focused care redesign. Within this medical center, ten separate and distinct patient care departments were studied over a 5-year period. These departments included critical care, medical, surgical, obstetric and pediatric areas. During the first year of the study, data reflected pre-reengineering performance indicators. The last year of data collection reflected post-reengineering data. The intervening three years represented various stages of design and implementation of reengineering. Performance indicators were identified prior to the reengineering effort. Cost indicators included cost per case, cost per patient day and full-time equivalents (FTEs) per adjusted occupied bed. Indicators of quality included medication errors, patient falls and nosocomial infections. Other performance indicators included staff turnover rates, occupational exposure to blood and body
fluids, mortality and RN mix. Cost per case was reduced 8.5%. As an isolated performance indicator, cost per case demonstrates success for the reengineering effort. Yet, it is difficult to determine the hidden costs of errors, employee turnover, litigation and patient complications on actual case costs. Based on the inability to create this linkage, relative success of reengineering, from a cost perspective, cannot be fully determined.

Throughout the five-year period, the pattern varied for each of the quality indicators. Declines in RN mix did not demonstrate a significant relationship with the outcome indicators of patient falls and medication errors, two indices of quality from a nursing perspective. Reengineering may have had a short-term negative effect on quality indicators such as nosocomial infections, occupational exposures to blood and body fluids and employee turnover rates. Most indicators were at or near pre-engineering levels by the end of the five-year period with select indicators demonstrating improvement.
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KALAMAZOO, MICHIGAN

Date November 9, 2000

WE HEREBY APPROVE THE DISSERTATION SUBMITTED BY

Linda Rutgers Albery

ENTITLED

The Effects of Reengineering on Hospital Performance Indicators

AS PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE

DEGREE OF Doctor of Education

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Linda Rutgers Albery
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CHAPTER I

INTRODUCTION

Historical Background of Problem

Recent statistics from the Health Care Financing Administration suggest that spending on healthcare related services consumes 13.5% of the Gross Domestic Product (HCFA Review, 1999). With technological advances and exploding consumer expectations, healthcare costs are expected to continue to rise at an exponential rate. The basic infrastructure of healthcare has remained unchanged for thirty years (Ginzberg, 1996). Despite the great wealth and the manufacturing, service and creative capabilities evident in the U.S., the healthcare system is considered only average among big industrial nations (Abramson, 1990). In addition, the cost effectiveness of this vast expenditure is dramatically lacking when measured against performance. Healthcare is a system in need of basic redesign. The current structure of healthcare does not meet financing, provider or patient needs. This study will review the redesign process used in healthcare over the past decade, specifically looking at the effects of reengineering on hospital performance indicators.
Evolution of Hospital Based Care

The present hospital system is the result of centuries of evolution. Medieval hospitals of the thirteenth and fourteenth centuries created the model for hospitals today. As European towns grew and created urban clusters, there was a need to minister community health. Monks and nuns largely provided this health ministry. As people sought care, the focus was on comfort and healing (Abramson, 1990). Hospitals did not become credible places for the sick or injured until the advent of bacteriology in the nineteenth century. With the use of antiseptics and aseptic techniques, hospitals became more credible and more people went to hospitals for care.

The evolution of hospital care was incremental for centuries. In the twentieth century, the most significant change in U.S. hospitals occurred in the immediate post war years. During the first two decades after World War II, the number of non-federal general and special hospitals grew by 30% (Abramson, 1990). This growth occurred primarily in suburban areas as the population began to shift from urban areas. In part, the Hill Burton Act of 1946, which provided federal matching funds for hospitals, funded this growth. As the size and number of hospitals grew, so too did hospital admissions.

During this time of significant change, one event, the passage of Medicare and Medicaid legislation in 1965, has been identified as pivotal in changing the hospital business (Ginzberg, 1996). Prior to this event, hospital care was dollar constrained.
Within a few years after the implementation of Medicare, third party payments covered 90% of hospital expenses. These third parties (Medicare, Medicaid and private insurance companies) basically paid whatever bills were received. This financing situation created a spending environment, which significantly contributed to the financial woes still experienced today. The reimbursement for hospital care appeared unlimited. The more hospitals spent, the more they were reimbursed.

With hospitals accessing building funds and receiving higher levels of reimbursement, they were in a better position to borrow money. Investors were happy to comply since large payers along with state and federal governments underwrote many bonds and offered tax exemptions. The time period between 1965 and 1983 was a time of great wealth and unlimited spending for hospitals.

As revenues and admissions grew, the need for technology and qualified clinicians grew as well. Medical school subsidies increased, as did clinical and technical curricula offered in colleges and universities. People appeared satisfied with hospital care during the 1960s and 1970s. They had health insurance coverage and could receive care in suburban sites. Many people enjoyed health insurance as a fringe benefit of employment or as dependents of employed persons. Medicare and Medicaid covered others, like the elderly or poor. It was a time when physicians and hospitals greeted the need for medical care with enthusiasm because any care that was provided was paid for by some means of health insurance.
Emerging Financial Concerns

As Medicare was implemented, the relationship between the costs associated with providing health care and the amount of money available to pay for those costs diminished. In all other sectors of the U.S. economy, a relationship existed between available funds and funding. In the consumer environment, spending was and remains limited by the amount of money available. This applies to food, housing and entertainment related purchases. In the public domain, legislators traditionally employed an appropriations process designed to ensure that public outlays were kept under reasonable control and related to available budgetary funds (Ginzberg, 1996). Medicare financing provisions loosened most of the financial constraints under which hospitals had previously operated. This event, the onset of Medicare, contributed to consumer, physician, and hospital administrators' perceptions that there were no limits or parameters in delivering high quality patient care. Funding for healthcare appeared unlimited. In hindsight, it is clear that the American government underestimated, a) the extent to which Medicare would affect the flow of funds for healthcare, b) the behaviors of all who participated in the delivery of healthcare due to these funds, and c) the actuarial estimates of healthcare and new program costs (Ginzberg, 1996).

It did not take long for physicians and hospital administrators to discover that the more that was spent, the more reimbursement was received. Physician salaries skyrocketed while hospital programs flourished. Employee salaries rose and
technology advances soared. Although several attempts to control spending have been made by the federal government, two changes are seen as potentially the most aggressive and effective to date (Ginzberg, 1996). These changes are a) the implementation of Diagnosis Related Groupings as a prospective payment system for Medicare and b) the Balanced Budget Act of 1997 as a means to reduce reimbursement from Medicare to hospitals.

**Advent of Cost Control**

The first significant change relative to cost control was the implementation of diagnosis related groupings (DRGs), a prospective payment system used as the mechanism for reimbursement for Medicare. This was introduced in 1983. Since at least 44% of healthcare costs at that time were related to hospital care, the focus of this initiative rested primarily with hospital based acute care. Diagnosis related groupings began to limit reimbursement for specific hospital admissions and procedures. As opposed to unlimited reimbursement, DRGs provided hospitals with a predetermined amount of reimbursement for a given diagnosis. Diagnoses were grouped according to acuity and expected costs incurred by a hospital to provide care and treatment. This new reimbursement mechanism created a financial burden for the hospital which in turn, required hospitals to challenge their system of care. In order to remain profitable, the cost of care needed to be delivered at a level below the level of reimbursement. This was the first time since 1965 that hospitals had to work
within strict financial parameters. Hospitals began to reduce extraneous services, focus on the length of stay (LOS) for certain diagnoses, and ultimately, had to become aware of and work within financial parameters.

The second significant change, which targeted cost control and reimbursement, was the Balanced Budget Act of 1997 (BBA). This bill was enacted into law because of grave concerns over rapid cost increases and the probable insolvency of the Medicare Hospital Insurance trust fund. Preliminary estimates indicated that this bill would result in $150 billion savings in the first five years. These savings were to be primarily achieved through reductions in reimbursements to hospitals and other care providers. The Balanced Budget Act of 1997 was signed into law in August 1997. The effects of this legislation were projected to occur through the year 2002. This law enacted the most significant change to the Medicare and Medicaid programs since their inception 35 years ago.

**Healthcare as a Unique Business**

Although early changes to healthcare financing affected geographical locations of hospitals and technological advances in a positive manner, the basic infrastructure of hospitals has remained unchanged. These organizations have grown in size, scope and complexity. Specialized clinicians are employed for highly technical and professional job functions and the rate of specialization continues to increase among all clinicians. Although other industries can lay claim to similar
stories, there are a few conditions that make the hospital industry unique when compared to other sectors of the marketplace. These conditions include consumer and provider relationships, service equity, and the disposition of the consumer.

The relationship between consumer and provider is relatively constant across various industries. Traditionally, the consumer chooses a product and pays for it; the provider provides the product and charges a fee for it. In the hospital industry, the patient (generally known as the consumer) rarely pays for services. A third party, such as Medicaid, Medicare, Blue Cross Blue Shield and other private insurance companies, pays for most services. The provider (generally known as the hospital) is not in control of the product. The entity in control of the service or product delivered to the consumer is the physician who is rarely employed or formally affiliated with the hospital. This non-traditional relationship between consumers and providers creates unique complexities and confusion in an already complex system.

Another unique aspect of the healthcare industry relates to the consumer’s ability to pay for services. In most not-for-profit hospitals, all patients are treated equally regardless of their ability to pay for services. Rarely are direct providers aware of the patient’s financial status or benefit coverage. Care comes first and payment matters follow.

Health care consumers are often reluctant consumers and are frequently vulnerable. Many admissions to hospitals are due to trauma, psychiatric disorders or acute medical conditions. Most people would rather not be a patient in a hospital and that makes them reluctant hospital consumers. Additionally, while under the care of
hospital personnel, consumers appear to have fewer rights than residents of correctional facilities (Abramson, 1990). They are vulnerable consumers who are at the mercy of those in control of their care. This relationship between consumer and provider is another point of differentiation, which makes healthcare a unique business.

Even though a hospital is different than other sectors of the marketplace, hospital leaders and employees seek to satisfy their customers and provide optimal care. There continues to be an effort made to identify the patient as the customer and provide the patients with a satisfactory healthcare experience (Modern Healthcare, 1998). Unfortunately, there is an underlying dissatisfaction with hospital care, which exists in our country despite the intentions of those who deliver care (Health Care Advisory Board, 1999). In 1998, hospitals were among various industries surveyed to determine the extent to which customers were satisfied with the level of service. Hospital service ranked 29 out of 34 different industries (Health Care Advisory Board, 1999). In spite of efforts to improve the perception of hospital care, national patient satisfaction levels have remained stable and relatively low over a five-year period (Health Care Advisory Board, 1999).

The highly complex hospital industry is not meeting the needs of patients or financing sources. A reduction in reimbursement, rising expectations of patients, and continued advances in medical technology all point to a need to redesign hospital-based healthcare.
The Era of Redesign

The decade of the 1990's is well established as the time period in which hospitals needed to become a highly valued service rather than a necessary evil. In the early 1990's, with the Balanced Budget Act looming in the future, hospital administrators needed to position their institutions for long term viability. Cost reduction was a major emphasis for hospitals in order to survive the decade. Balancing the variables of physician and patient satisfaction with the ethical responsibilities of providing high quality care was viewed as a major challenge. Like other industries, most hospital organizations had engaged in various change efforts in the past to improve one or more aspects of performance. Although known by a variety of names, the goal of these change efforts was generally the same: to cope with a more challenging market environment by fundamentally changing how business is conducted. Examples of these change efforts include MBWA (management by walking around), downsizing, right-sizing, total quality management, continuous quality improvement, participatory management, quality circles and employee improvement teams. All of these are examples of the management strategies seen from 1960 to 1990 (McGill, 1988, Tosi, 1990, Kotter, 1995, Byrne, 1997). Reengineering was unquestionably the management tactic or fad for the decade of the 1990s.

Reengineering is defined as the radical redesign of business processes for dramatic improvements (Hammer, 1995). Reengineering came to the forefront of
American businesses as organizations were suddenly faced with the prospect of international competition combined with more demanding customers. There was a need to reduce costs, increase productivity, increase flexibility, shrink product cycle times and increase both quality and service. Reengineering became a mass phenomenon as organizations witnessed dramatic results achieved by a few pioneering businesses (Hammer, 1995). Prior to reengineering, improvement efforts in organizations were largely focused on task improvements. As a result of the industrial era, the role of an employee was largely defined in terms of a specific task. Reengineering focused on processes including the number of steps involved and the number of people involved in creating a final outcome or product. Through reengineering, a shift from a task focus to a process/outcome focus was sought and an employee’s responsibility and accountability was expected to expand (Hammer, 1995).

As many hospitals began to engage in reengineering efforts, a new twist on this business tactic began to emerge. This twist was called “patient focused care.” Patient Focused Care (PFC) involved organizing resources and personnel around patients rather than various hospital departments (Sherer, 1993, p.14). The intended result is fewer process steps, fewer people, lower costs, higher value actions and higher customer satisfaction.

In order to achieve patient focused care, both reengineering (process improvement) and restructuring (organizational redesign) were required. Patient focused care utilized continuous quality improvement tactics in order to create an
environment which improves clinical quality and enhances efficiency by eliminating waste found in the traditional delivery of healthcare.

Although patient focused care models vary, most involve teams of cross-trained staff who are self-managed, empowered and accountable for outcomes (Truscott, 1995). Crosstraining results in overlapping of job functions. This can produce role ambiguity and loss of professional identity for nurses and other professional health care workers. It can also create flexibility and group accountability for the outcomes of patient care. Whether engaged in traditional reengineering or reengineering with the patient focused care emphasis, the ability to achieve the intended outcomes in the hospital setting remained questionable.

Rationale for the Study

Reengineering was a common management tactic used by hospitals and other organizations during the nineties to reduce cost and improve outcomes. As with many management tactics, few studies evaluated of the success of reengineering. Cost and quality pressures continue to plague the hospital industry with no end in sight. As hospital executives anticipate further reimbursement reductions, they will seek ways in which to reduce cost without compromising care. An understanding of reengineering and the effects on patient outcomes is needed prior to implementing new iterations of reengineering in the future. The purpose of this study was to
identify and define the intended outcomes, measurable criteria and actual outcomes of an implemented reengineering project in one healthcare institution.

Research Question

Do performance indicators change as a result of reengineering in a hospital setting? Reengineering was intended to reduce costs associated with patient care. Costs can be measured in a variety of ways in the hospital setting including overall costs, cost per case, cost per patient day, profit margin or income on operations. Other indicators of performance in the hospital setting could possibly be influenced by the reengineering efforts. These indicators include patient care performance measures and employee performance measures. The relationship between reengineering and hospital performance indicators is subjective and requires further investigation.

Clarification of Terms

Reengineering: The process of fundamentally re-thinking and radically redesigning business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service and speed. (Hammer, 1995).

Work Redesign: Used interchangeably with reengineering.
Organizational Effectiveness: The degree to which an organization realizes its goals and implicitly takes into consideration a range of variables at both the organizational and departmental levels.

Patient Focused Care: Organizing resources and personnel around patients rather than various hospital departments (Sherer, 1993).

RN Mix: Proportion of registered nurses to total providers of nursing services.

FTE per Adjusted Occupied Bed: The number of full time equivalents reported as a ratio to the number of patients.

Length of Stay (LOS): Length of time between admission and discharge reported in days.

Mortality Rate: The number of deaths per 1,000 patient days.

Predicted to Actual Mortality: A measure of expected to actual mortality rates adjusted for severity using the Atlas scoring method (MediQual System, Inc.1995). The measure is provided in a ratio reflecting observed/predicted. Ratios greater than 1.0 indicate a higher than predicted mortality; ratios lower than 1.0 indicate a lower than predicted mortality.

Occupational Exposures: Occupational exposure to blood and body fluids as measured by the number of incidents per 1000 patient days.

Patient Falls: The unexpected descent to the floor by a patient as measured by the number of incidents per 1000 patient days.

Medication Errors: Violation of one or more of the five medication standards reported as incidents per 1000 patient days.
Co-morbidity: Indicates that one or more disease processes exist in addition to the primary diagnosis for a patient. Co-morbidity increases the potential severity of a patient’s illness.

Organization of the Study

In Chapter I, an introduction to the problem, background of the problem, rationale for the study and organization of the study was presented. A review of selected literature on work redesign, reengineering healthcare and reengineering outcomes are presented in Chapter II. In Chapter III, the methodology and research design is discussed. Chapter IV presents the study’s findings. Conclusions and recommendations of the study are presented in Chapter V.
CHAPTER II

REVIEW OF THE LITERATURE

This study examined the reengineering process and outcomes in hospitals. This section contains a review of related literature in the following areas: (a) rationale for reengineering hospitals, (b) financial outcomes, (c) clinical quality outcomes, (d) environmental outcomes, (e) other outcomes.

Rationale for Reengineering

In an effort to realign business with competitive demands, healthcare executives have been initiating reengineering during the past decade (Walston, 1999). Success stories from other organizations spurred this revolution. AT&T, Union Carbide and many hospital organizations had reported improvements in the areas of personnel management, fixed cost reduction and improvement in customer service (Walston, 1999). As the healthcare market became increasingly more competitive, hospital leaders were looking for ways to make their organizations both lean and effective. The 1996/1997 American Hospital Association study found that 86.3% of hospital CEOs listed cost reduction as the primary reason for implementing reengineering (Walston, 1999) while other reasons lagged behind. Although sincere
desires to improve operational performance existed, the driver for the reengineering initiative was cost reduction.

Financial Objectives and Outcomes

In reviewing the literature, cost reductions were achieved through a variety of methods and measured in a variety of ways. Delayering management or eliminating one or more levels of management through reorganizing and restructuring was a common component of many reengineering efforts. Through this effort, administrators and managers were targeted and in at least one case, contributed to 35% of the overall cost reduction effort (Leatt, 1997). In a summary study of clients, Harlin (1996), reported that cost reduction efforts were evaluated by measuring management wages as a percentage of total wages. Other organizations attempted to rid themselves of low value employees who were not essential to the core work of the organization. These workers were eliminated as a result of process improvement whereby processes were simplified and the number of steps and people involved in a process were reduced. Effectiveness of this effort was measured by aggregating wages of workers defined as “infrastructure” or otherwise defined as workers not included in direct patient care. Infrastructure wages as a percentage of total wages was used as the outcome measure (Harlin, 1996). The Harlin study pointed to cases which reduced both of these indices but did not use any statistics to indicate the degree of significance of the results. Further, those institutions that did reduce costs

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were not evaluated in an ongoing manner to determine the ability to sustain their cost reduction effort.

Walston (1997) found that a common strategy for achieving cost reduction was changing the RN skill mix. This process involved examining the skills required for each component of clinical care and creating teams of providers, which matched those skills to the needs of the patients. The outcome was generally a reduction in RNs and subsequently, a reduction in overall wages (O'Malley, 1990). In most studies reviewed, success was measured as a reduction in full-time equivalents (FTEs) or overall reduction in wage expenses. One case reported that the number of jobs actually increased 23% subsequent to reengineering while cost reduction efforts were expected to range between 9 and 14 million dollars annually (Modern Healthcare, 1994). This cost reduction was achieved through the elimination of higher paid management positions, reducing the RN mix and adding lower skilled and lower paid workers titled “patient care associates” to work under the direction of RNs (Modern Healthcare, 1994). One case review indicated a 3.4 million dollar cost reduction opportunity (Strong, 1997). However, the actions taken within the organization were so varied that it was virtually impossible to determine a relationship between the components of the redesign process and the actual financial outcomes.

Walston (1999) evaluated the change of “cost position,” defined as the change in the ratio of hospital cost per adjusted admission to the market cost per adjusted admission, for his study. He found no statistically significant change in cost position
for reengineered hospitals compared to those which did not reengineer. No other studies used cost position as a performance measure for reengineering.

Measuring cost reduction efforts is the key component of evaluating the success of reengineering efforts. A clear definition of measurable criteria and validation of baseline data is critical (Leatt, 1997).

Clinical Performance Outcomes

Although cost reduction was the clear goal of reengineering, maintaining and improving clinical performance was an underlying goal as organizations sought to improve their market position. However, identifying clear, clinical performance criteria prior to implementing reengineering efforts was seriously lacking. Leatt (1997) suggests that measures of quality care and service are particularly important when making organizational changes. The researchers suggested quality measures, including risk management and adverse event indices at the organizational level, be tracked and used by senior management to determine success of reengineering and the need for future change. These performance indicators could also be used to assess the extent to which reductions in RN mix, changes in staff roles, or the redesign of work processes lead to poor outcomes. Other clinical indicators could be defined and tracked at the department or patient level. These may include clinical path compliance, patient satisfaction and clinical indicators specific to a given patient population (Leatt, 1997).
Harlin (1996) identified a variety of performance measures as key to evaluating clinical quality. These included patient fall rate, readmission rate, mortality rate and medication error rate. Although correlations were made between these quality indicators and the reengineering process, there was no correlation between quality indicators and cost indicators.

Bryan (1998) conducted an 18-month follow-up study on one critical care unit which underwent reengineering. Clinical quality measures selected for the study included patient falls, medication errors, nosocomial infections and intravenous (IV) related complications. The researchers concluded that the clinical quality outcomes either improved or were maintained post reengineering. However, because this study was conducted over an 18-month time frame at 6-month intervals, the findings demonstrated a lack of consistency across the variables. As an example, the rate of medication errors went from 1.5% to 2.4% which does not demonstrate improvement. However, the other clinical quality variables did demonstrate improvement although no statistical significance was used in the study of these variables.

Moore (1999) studied 16 patient care units, 300 nurses and approximately 1,500 patients to determine the relationship between nursing related quality indicators and patient outcomes. The study period was 18 months. Quality indicators were delineated into three distinct groups: a) outcomes, b) process, c) structure. Outcome indicators included nosocomial infections, patient falls and a variety of patient satisfaction indicators. Process indicators included maintenance of skin integrity and nurse satisfaction. Structure indicators included RN mix and total hours per patient
The researchers concluded that the most consistent predictor of outcome indicators was the percentage of RNs caring for the patients. The higher the RN mix, the better the patient outcomes in terms of patient satisfaction. RN mix was not a significant predictor of adverse outcome indicators such as nosocomial infections and patient falls.

Professional nursing organizations argue that reducing RNs or reducing licensed care providers while increasing the proportion of unlicensed care providers creates risks for patients and reduces quality of care (Rowell, 1998). The American Nurses Association continues to sponsor studies to research these relationships.

Other reports of declining clinical quality as an outcome of reengineering (Curtain, 1997; Fiesta, 1998) were not statistically substantiated nor provided in detail beyond editorial commentary.

Other Outcomes

Few studies revealed intent to improve other performance measures beyond cost and to a lesser extent, clinical quality. However, the tenets of reengineering included creating work teams, empowering employees and moving decision-making authority to new areas within the organization. Subsequently, new areas to evaluate emerged as potential indicators of the reengineering process. These included staff turnover, staff satisfaction and others.
Ingersoll (1996) surveyed the literature to determine the effects of organizational redesign on institutional and consumer outcomes. Job satisfaction findings were mixed with some studies noting intermittent or partial changes while others found little or no change. Bryan (1998), hypothesized that restructuring based on patient-centered care concepts had the potential to dramatically improve organization performance. Patient satisfaction was expected to rise along with RN job satisfaction as a result of improvements in the practice environment. Bryan (1998), reported a decrease in RN job satisfaction even though these same RNs reported improvements in areas which are reported to highly influence RN job satisfaction. These areas included RN collaboration with physicians, RN/physician communication, RN autonomy and RN shared responsibility. Further, Bryan found no correlation between patient satisfaction, reported to be improved, and RN satisfaction which declined.

Summary

Because strategies to downsize, reengineer or otherwise attempt to cut costs were aimed at improving organizational performance, clear evaluation criteria were required but noted to be inconsistent and to a large extent, absent in the literature. There appeared to be no common basis for evaluating the outcomes of reengineering. One study concluded that their research “revealed a surprising lack of attention to measures of effect or outcome” (Walston, 1997). Various performance measures are

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used by organizations. However, there is no standardization and very little
forethought evident in the research. Comprehensive studies of organizational
reengineering and its effect on outcome are few and those which do exist generally
focus on segments of organizations rather than organizations as a whole (Ingersoll,
1996). The review of the literature revealed some limited attempts to evaluate the
outcomes of reengineering, although no studies reported statistically sound
correlation between financial and clinical quality indicators. The need for further
research, longitudinal studies and concrete measures was substantiated by this
literature review.

Organization of the Study

In Chapter I, an introduction to the problem studied, background of the
problem, rationale for the study and organization of the study were presented. A
review of selected literature on work redesign, reengineering healthcare and
reengineering outcomes has been presented in Chapter II. Methodology and research
design will be discussed in Chapter III. Chapter IV will present the study’s findings.
Discussion and recommendations are presented in Chapter V.
CHAPTER III

METHODOLOGY AND DESIGN

The purpose of this study was to examine changes to hospital performance indicators following implementation of a hospital based reengineering project. The research design and methods used in the study are presented in this chapter. The chapter has seven sections: (a) research setting, (b) description of the intervention, c) performance indicators, d) research questions, (e) data analysis and considerations, and (f) summary.

Research Setting

This study took place in a large regional medical center located in southwest Michigan. Within this medical center, ten separate and distinct patient care departments were studied over a 5-year period. These departments included critical care, medical, surgical, obstetric and pediatric areas. In addition, the aggregate organizational performance was studied during this same 5-year period. The data collection began in July 1994 and concluded in June of 1999 representing 5 fiscal years.
Description of Intervention

Work Redesign was a major initiative planned for and implemented within the research setting over a period of three years beginning 1995 to 1998. The stimulus for this initiative was the projected changes in the financial climate for hospital organizations. Senior management predicted that reimbursements would decline significantly based on the rise in managed care, decreased reimbursement from Medicare, historical flat reimbursement rates from Medicaid and the discussions surrounding the “Clinton” plan for health care. In addition, the local competitive environment was projected to escalate based on the status of clinical programs and other environmental factors. Improving service to patients and physicians were also key reasons to engage in a redesign process in order to maintain and improve the market position of the organization. The organization hired an external consultant to assist with this project. The consultants were selected based on their track record of improving both financial and service outcomes. A review of references substantiated the consultant’s claims of successful project completion.

Based on personal communication and internal documents available within the research setting, the goals of work redesign were to improve outcomes in the areas of cost, quality, satisfaction and service. The organization employed five different principals of “patient focused care”, the selected method of work redesign. They include: a) multiskilling of staff for more broadly defined roles and flexibility, b) redesigning structure and processes around patients, not departments, c)
simplifying processes to reduce time spent on paperwork and increase time spent in
direct patient care, d) creating teams with skills designed to meet services required by
patients, e) reducing layers of management while concurrently creating self-directed
work teams to reduce costs and improve problem solving.

This organization pursued a variety of strategies targeted to achieve
improvements in the performance indicators. These strategies included reducing the
RN mix by redesigning the patient care delivery model(s), reducing levels and
numbers of management personnel, implementing various data systems to assist staff
and management in monitoring performance indicators, redesigning select jobs to
create additional flexibility, and redesigning the organizational structure to combine
departments and services based on the service needs of patients.

The work redesign process was lead by two executives within the organization
with consultative assistance from an external organization. Organizational
restructuring and management delayering decisions rested with senior management.
Other decisions regarding redesigned jobs, redesigned delivery care models and
process improvements rested with teams comprised of management, staff and select
physicians.

Performance Indicators

Several indicators were used to assess both cost and quality performance over
the five-year period. These performance indicators are the dependent variables for
this study. Work redesign is the intervention noted to be the independent variable.

Work redesign was a massive organizational initiative, which was designed and
implemented throughout fiscal years 96 and 97. Fiscal year 95 represents the pre-
work redesign time frame while fiscal year 99 clearly represents post work redesign.
The intervening years represent various stages of design and implementation.

A definition, description and identification of data source(s) for each
performance indicator follows.

Financial Performance Indicators

Financial performance indicators were defined and derived from various
hospital based accounting and information systems.

Direct Cost. Direct cost is defined as expense directly related to the provision
of patient care services. Direct costs would include labor expenses of care providers
and immediate supervisors, supplies and equipment. Direct cost excludes overhead
and/or allocated expenses such as building depreciation, executive salaries, marketing
and public relations. Reducing direct costs was the primary goal of reengineering
(Hammer, 1995).

Direct cost data were obtained through the cost accounting system within the
organization. These data are reported in three formats: (a) aggregate direct costs per
month or year; (b) direct cost per case; (c) direct cost per patient day. FTEs per
adjusted occupied bed and management related data were derived from the payroll and cost accounting systems.

Direct costs vary due to both patient and provider influences. Patient influences include length of stay (LOS) and acuity measured as Case Mix Index (CMI). Provider influences include RN mix, staff seniority, supply costs, and practice patterns of physicians.

This organization attempted to reduce direct costs by reducing management personnel, reducing RN mix, increasing unlicensed personnel in patient care areas and redesigning jobs in an effort to reduce overall FTEs.

Proportion of non-licensed personnel. Proportion of non-licensed personnel is defined as the ratio of unlicensed personnel hours to total direct care provider hours. Registered nurses, licensed practical nurses, and respiratory therapists are among those healthcare providers who are licensed personnel involved in bedside patient care. Patient care aides, patient care associates and patient care technicians all fall under the category of unlicensed personnel. Some unlicensed personnel receive training at technical schools although most are trained on-the-job. Definitions and scope of responsibilities of unlicensed personnel varies among organizations.

Proportion of unlicensed personnel as well as RN mix was derived from the payroll system of the organization which segregates hours worked based on job classification. The data were available in an aggregate form and for individual patient care departments.
Quality Performance Indicators

Various quality indicators were defined and described for the purpose of this study. Quality indicators are derived from various sources and are influenced by a myriad of variables. One such quality indicator is mortality. Mortality, although influenced by non-physician providers, is rarely an indicator of nursing quality alone. Physician care is generally considered a highly influential variable on mortality. Other measures of clinical quality include patient falls, medication errors and nosocomial infection rates. Although improving quality was a focus for this organization, specific pre-work redesign performance indicators were not identified beyond patient and staff satisfaction. For the purpose of this study, patient satisfaction was excluded as a performance indicator. The organization changed patient satisfaction survey tools during FY98 so longitudinal review of patient satisfaction was unreliable.

Mortality. Mortality is considered a high-level performance indicator for a health care organization and is defined as the number of deaths per 1000 patient days. Through the organization’s Mediqual reporting system, an expected (or predicted) mortality rate can be derived and compared to the actual mortality rate. This represents an adjusted mortality rate and is reported in a ratio. Greater than 1.0 indicates an actual mortality rate greater than expected. Conversely, less than 1.0 indicates an actual mortality rate less than expected.

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Mortality rates are influenced by both patient and provider factors. Patient factors include the number and extent of co-morbidity and the number of patients who select “no code” status. Provider factors include documentation patterns and clinical skill. Expected mortality is derived using physician documentation on admission of the patient. Failure to accurately describe the patient’s condition, including co-morbidity, can influence the expected mortality score.

Patient Falls. Patient falls is defined as a patient’s unexpected descent to the floor with or without injury. Preventing patient falls is a critical safety measure most typically influenced by bedside care providers. Inadequate staffing and/or poorly trained caregivers can influence the rate of patient falls. Patient falls is reported as the number of incidents per 1000 patient days. This data were available in an aggregate form at the individual patient care department level and for the organization as a whole. The data are derived from incident reports, which are a self-reporting mechanism for hospitals obtained in the Risk Management Database. Information obtained on incident reports is protected as peer review information used solely for performance improvement and research.

Medication Errors. Medication errors are defined as a violation of one or more of the five standards for medication administration. They include: (a) right dose, (b) right time, (c) right medication, (d) right route, (e) right patient. Medication errors are reported as incidents per 1000 patient days. In this context, medication errors are typically associated with the role of the nurse. Medication errors differ from adverse drug events, which are more closely related to physician ordering, order
transcription and pharmacy dispensing functions. According to a recent report from
the Institute of Medicine (2000), both medication errors and adverse drug events are
significantly underreported in U.S. hospitals. In response to this report, the reporting
structure and process of error management has received a significant amount of
attention recently in the press and in healthcare organizations. It is expected that
reporting of errors will increase due to a higher level of awareness among those
involved. However, for the five-year period studied, there was no change in process,
structure or emphasis of medication error reporting.

**Nosocomial infections.** Nosocomial infections are defined as infections
acquired by the patient during the hospital stay. Compliance with hospital policies on
infection control is a key element to preventing nosocomial infections. Patient care
personnel and hospital systems can influence changes in infection rates. System
failures in the areas of sterilization procedures and equipment reprocessing can
seriously increase the risk to the patient. Patient care personnel can increase the risk
to the patient by failing to follow appropriate aseptic technique and sterile technique
as required. Finally, the hospital system can contribute to the risk factors by failing to
assess and improve employee competence in the area of risk reduction and employee
compliance with policies and procedures. Common nosocomial infections, which are
tracked in the hospital setting, include ventilator-associated pneumonia and surgical
site infections. Nosocomial infections are measured as incidents per 1000 patient
days.
Other Performance Indicators

Other performance indicators emerged from the literature which relate to the overall work environment. These include employee turnover rates, occupational exposures, Class III litigation claims and employee satisfaction.

**Employee turnover rate.** Employee turnover rate is defined as the ratio of employee terminations to total employees. Employee turnover is a key indicator of the hospital environment. Employee turnover and retention can be influenced by the organizational wage and benefit structure as well as environmental factors such as safety, opportunities for professional growth, professional satisfaction, relationships among employees, local unemployment rate and a variety of other factors. Employee turnover rates were obtained from the human resources department and were reported both in aggregate form and by major employee job category.

**Occupational exposure to blood and body fluids.** Occupational exposure to blood and body fluids is defined as an employee’s direct contact (skin, eye, mucous membrane, or needle puncture) with blood or other potentially infectious body fluids as a result of performing the duties. Working with patients creates risk for any healthcare worker due to the various infectious processes in existence today. Blood born pathogens, particularly HIV and hepatitis B and C, are dangerous for employees. Preventing exposures to these pathogens is a safety requirement for all healthcare facilities. In addition to the safety component, preventing exposures is also a financial consideration. Employees exposed to harmful pathogens or at risk for any
type of injury create a financial liability for a hospital in terms of cost of care, lost work and potential legal action.

Information on occupational exposures was obtained from the infection control department. The data was reported in an aggregate format reflecting incidents per 1000 patient days for the five-year period.

Both employees and the hospital system can influence occupational exposure rates. The employee's willingness and ability to maintain awareness of and comply with infection control policies is critical. The hospital's ability and willingness to create user-friendly policies, invest in training, invest in safety devices and monitor policy compliance is critical as well.

**Class III Litigation Claims.** Class III litigation claims is defined as lawsuits filed with a court claiming negligence and/or malpractice. Class III claims are reported as a raw number. Class III claims indicates the overall performance of an organization and failure to meet the expectations of patients and their families. Class III claims are influenced by both providers and society. Negligence and/or inadequate communication skills on the part of providers can increase the risk of litigation. However, it should be noted that it is generally accepted that the nature of our society has become increasingly litigious. Class III claims data are available through the organization's internal tracking method within the legal department. Data are not available regarding the nature of Class III claims.

Research Questions
Several questions were derived from the original research question presented in Chapter I. The research questions are grouped according to type of performance indicator. The first five questions pertain to financial indicators and require a descriptive process to answer.

1. Did aggregate direct costs decline following work redesign?
2. Did RN mix decline following work redesign?
3. Did the proportion of unlicensed caregivers rise following work redesign?
4. Did full-time equivalents (FTEs) per adjusted occupied bed decline following work redesign?
5. Did management FTEs decline following work redesign?

The next group of questions pertain to clinical quality and require a descriptive process to answer.

1. Was there a difference in mortality following work redesign?
2. Was there a difference in patient falls following work redesign?
3. Was there a difference in medication errors following work redesign?
4. Was there a difference in nosocomial infection rates following work redesign?

The next group of questions pertain to the work environment and require a descriptive process to answer.

1. Was there a change in employee turnover rates during and following work redesign?
2. Was there a change in employee occupational exposures to blood and
body fluids during and following work redesign?

3. Was there a change in Class III litigation claims during and following work redesign?

The final question relates to the relationship between staffing levels and nursing quality indicators.

1. Was there a decrease in quality of care, as measured by patient falls and medication errors, during the study period that is related to RN mix?

Data Analysis and Considerations

This study was designed to answer questions regarding the effects of work redesign primarily in the areas of cost and quality. All data used for this study were accessed from organizational based tracking systems. All data were reported in table format without access to individual patient or employee records. The data were collected beginning in FY95 and ending in FY99. Permission to access the data was given by the hospital president and chief executive officer.

Work redesign was a major initiative for this hospital organization. It was designed and implemented over a three-year period. Fiscal year 1995 clearly represents pre-work redesign. Fiscal year 1999 clearly represents post-work redesign. The intervening fiscal years represent various stages of design and implementation for the patient care departments.
Portions of the data will be used in a descriptive manner. Limiting the study to one organization prevents comparisons with other hospitals. Patterns of changes in performance indicators will be sought.

Summary

In this Chapter, the research question described in Chapter 1 was operationalized leading to the development of a number of research questions. The research setting was described. An overview of the work redesign process within the research setting was given. An overview of data sources and methods of analysis were presented for each performance indicator. The design of the study and procedures of data collection were also presented. The data analysis process was delineated for each research question. A descriptive process was the method utilized for this study. In the next Chapter, findings from the collected data are presented.
CHAPTER IV

FINDINGS

Introduction

The purpose of this study was to describe the effects of reengineering on hospital performance indicators. In this chapter, each research question will be described and discussed. Data will be presented in table graphic form to further describe the data trend over a five-year period.

Financial Performance Indicators

Five research questions were developed to describe cost related performance indicators. Cost reduction efforts for this organization were to be achieved through four distinct initiatives included in the work redesign process: a) reducing the proportion of RNs to total clinical care providers (i.e., RN Mix), b) reducing overall FTEs through redefinition of jobs and elimination of low value functions, c) de-layering and subsequent elimination of a portion of management positions, d) reduction in nonproductive time for staff through reconfiguration of staff workloads and hours. These components of hospital-based work redesign were expected to
achieve a reduction in direct costs, a reduction in FTEs per occupied bed, a reduction in management FTEs and a reduction in overall RN mix.

Did aggregate direct costs decline following work redesign?

It was expected that aggregate costs would be reduced following work redesign. Due to the cost of consultants and staff education, it was expected that actual costs could rise during the early phases of work redesign. However, costs following implementation of work redesign were expected to be lower than pre-work redesign costs. Since this process was studied over a five-year period, it is important to note the actual rate of inflation during that time period. Consumer Price Index (CPI) is a commonly cited indicator of inflation. It provides a monthly measure of the average change in price of a fixed list of goods and services purchased by urban families and individuals. CPI for the 5-year time period varied and ranged from 2.8% in 1995 to 2.2% in 2000. Actual aggregate costs including projected costs are reflected in Figure 1. Projected costs for FY96 through FY99 reflect FY95 costs adjusted annually according to the actual CPI. Subsequently, the projected costs reflect what would have been expected had work redesign not occurred and had the actual CPI influenced costs consistent with the inflationary rate.

As Table 1 demonstrates, cost per case before work redesign was $4573. It declined in FY96, rose slightly in FY97 and then continued to decline for the next two fiscal years ending at $4197 per case. At no point during or after work redesign did the cost per case rise to the pre-work redesign level. Barring any other cost reduction initiative during the five-year time frame, a rise in cost per case from
$4573 to $5142 would have been expected using the actual CPI as an adjusting factor. Comparing FY95 to FY99 cost per case, an 8.23% reduction was achieved.

Table 1 also demonstrates the actual and projected cost per patient day during the five-year time frame. The actual cost per patient day declined slightly during FY96 and then rose for the remaining three fiscal years. FY97, FY98 and FY99 all demonstrate a cost per patient day in excess of the pre-work redesign costs. Those same fiscal years demonstrate a cost less than projected using the CPI adjustment calculation. Using the actual CPI applied to cost per patient day, the cost per patient day would have been expected to rise during the five year period ending at a level 7.19% greater than the FY95 cost per patient day. The actual rise in cost per patient day comparing FY95 to FY99 is 1.97%.

While aggregate costs were expected to decline, the variability and slight rise in cost per patient day is incongruent with cost per case information. Factors of length of stay (LOS), and acuity are expected to influence costs. As indicated on Table 2, the length of stay during the five-year time frame went from 5.3 to 4.8 days. This could increase patient acuity and subsequently the costs on a daily basis while reducing the overall costs on a case basis. Case Mix Index, a measure of acuity, also rose during the five-year time frame. Actual mortality rate rose while the actual to expected mortality ratio declined or remained relatively stable.
Table 1

Actual and Projected* Cost per Case and Cost per Patient Day

Fiscal Year 1995 to Fiscal Year 1999

<table>
<thead>
<tr>
<th></th>
<th>FY95</th>
<th>FY96</th>
<th>FY97</th>
<th>FY98</th>
<th>FY99</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FY95 to FY99</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost per Patient Day</td>
<td>$862</td>
<td>$837</td>
<td>$912</td>
<td>$871</td>
<td>$879</td>
<td>+1.97%</td>
</tr>
<tr>
<td>Projected Cost per Patient Day</td>
<td>$862</td>
<td>$886</td>
<td>$891</td>
<td>$905</td>
<td>$924</td>
<td>+7.19%</td>
</tr>
<tr>
<td>Cost per Case</td>
<td>$4573</td>
<td>$4365</td>
<td>$4513</td>
<td>$4428</td>
<td>$4197</td>
<td>-8.23%</td>
</tr>
<tr>
<td>Projected Cost per Case</td>
<td>$4701</td>
<td>$4842</td>
<td>$4953</td>
<td>$5032</td>
<td>$5142</td>
<td>+9.38%</td>
</tr>
<tr>
<td>Consumer Price Index (CPI)</td>
<td>2.8%</td>
<td>3.0%</td>
<td>2.3%</td>
<td>1.6%</td>
<td>2.2%</td>
<td>+ 2.38% mean</td>
</tr>
</tbody>
</table>

*Projected costs are based on actual FY95 costs adjusted annually by the CPI
Table 2

Trends in Acuity and Aggregate Outcome Measures

Fiscal Year 1995 to Fiscal Year 1999

<table>
<thead>
<tr>
<th></th>
<th>FY95</th>
<th>FY96</th>
<th>FY97</th>
<th>FY98</th>
<th>FY99</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case Mix Index</td>
<td>1.5807</td>
<td>1.6195</td>
<td>1.6185</td>
<td>1.6484</td>
<td>1.5944</td>
</tr>
<tr>
<td>Length of Stay</td>
<td>5.3</td>
<td>5.2</td>
<td>4.9</td>
<td>4.9</td>
<td>4.8</td>
</tr>
<tr>
<td>Actual Mortality Rate</td>
<td>3.01</td>
<td>3.19</td>
<td>3.15</td>
<td>3.03</td>
<td>3.13</td>
</tr>
<tr>
<td>Actual to Expected Mortality</td>
<td>1.27</td>
<td>1.28</td>
<td>1.22</td>
<td>1.08</td>
<td>1.28</td>
</tr>
</tbody>
</table>

Case Mix Index (CMI) a relative measure of acuity.

Length of Stay as measured in days.

Did RN mix decline following work redesign and did the proportion of unlicensed caregivers rise following work redesign?

To achieve a reduction in labor costs and subsequently, aggregate costs in direct patient care areas, a reduction in RN mix was sought through the work redesign process. Based on a comparison with like institutions, senior management determined that the RN mix was significantly higher than other similar hospital organizations. According to internal documents, work redesign was targeted to
achieve a reduction in RN mix from 88% to 70%. Actual data retrieved from organizational data systems indicated an actual RN mix of 91.3% in FY95. As RN mix declined, it was expected that overall labor costs would decline. There was no organizational goal to reduce the overall number of employees involved in direct patient care. However, to supplement a reduced number of RNs in direct patient care, an increase in the proportion of unlicensed caregivers as well as licensed practical nurses was expected. This increase in non-RN personnel could potentially increase the total number of FTEs and the FTEs per adjusted occupied bed. In some team-based nursing models, registered nurses may be replaced by more than one unlicensed caregiver under the direction of an RN. Therefore, a decrease in RN mix and an increase in unlicensed personnel were expected. FTEs per adjusted occupied bed were expected to hold steady or decline based on other initiatives. However, it would not be surprising if direct caregiver FTEs increased as long as aggregate costs decreased.

Table 3 demonstrates the change in RN mix and proportion of unlicensed personnel. An inverse pattern was expected.

Table 3 demonstrates a gradual decline in RN mix from a pre-work redesign level of 91.3% to a FY99 level of 76.0%. The organization did not at any time reach the 70% RN mix target. It is important to note the RN mix reflected in this data includes RNs in the bedside care model only. RN duties, such as discharge planning and some forms of patient education were delegated to other RN positions within the organization and are not included in the RN mix calculation. A concurrent rise in
unlicensed personnel occurred as expected. Prior to work redesign, unlicensed personnel were not part of the direct patient care delivery model. Subsequently, the proportion rose from zero in FY95 to 12.8 in FY99. The personnel not accounted for in Table 3 are licensed practical nurses (LPNs). LPNs are non-RN-licensed caregivers. Prior to work redesign, LPNs were included in the staff mix. The proportion of LPNs grew slightly during and after work redesign although changes in the proportion of LPNs were minimal.

Table 3
Staff Mix Changes
Fiscal Year 1995 to Fiscal Year 1999

<table>
<thead>
<tr>
<th></th>
<th>FY95</th>
<th>FY96</th>
<th>FY97</th>
<th>FY98</th>
<th>FY99</th>
</tr>
</thead>
<tbody>
<tr>
<td>RN Mix</td>
<td>91.3%</td>
<td>89.7%</td>
<td>76.8%</td>
<td>75.6%</td>
<td>76.0%</td>
</tr>
<tr>
<td>Proportion of Unlicensed Caregivers</td>
<td>0%</td>
<td>0.9%</td>
<td>10.1%</td>
<td>12.3%</td>
<td>12.8%</td>
</tr>
<tr>
<td>FTEs per Adjusted Occupied Bed</td>
<td>5.4</td>
<td>5.2</td>
<td>5.9</td>
<td>5.7</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Did FTEs per adjusted occupied bed decline following work redesign? FTEs per adjusted occupied bed is a standard measure in the hospital industry. The
measure includes all FTEs in an organization and not only those FTEs associated with direct care. Subsequently, predicting changes in FTEs following work redesign is complex. As stated previously, a reduction in RN mix could conceivably lead to an increase in FTEs. However, other initiatives beyond reducing RN mix were included in the overall work redesign project. Delayering and downsizing management in addition to creating more flexible jobs and eliminating low value work were expected to reduce the total number of FTEs. In consideration of the various efforts involved in work redesign, FTEs per occupied bed were expected to initially increase for a short period of time during the design and education phase of work redesign. Then, FTEs were expected to gradually decline to a level less than pre-work redesign.

As demonstrated in Table 3, FTEs per adjusted occupied bed declined slightly in FY96 to 5.2 from FY95 level of 5.4. Based on personal communication, this decline was partly due to the announcement of the work redesign project, which resulted in many voluntary resignations. The surge in FTEs during FY97, from 5.2 to 5.9, was in part, due to time invested in design and employee training. It was expected that FTEs would rapidly decline during FY 97, 98 and 99. A decline did occur in FY 98 and continued in FY99. Although FY99 FTEs per adjusted occupied bed were lower than pre-work redesign levels, FY 96 FTEs were lower than both FY95 and FY99. While the reduction in FTEs per adjusted occupied bed was not dramatic, a slight decrease did occur and would have contributed to the overall reduction in aggregate costs.
Did management FTEs decline following work redesign? Although data was sought, the organization experienced a shift in both job titles and job classifications during the five-year period. Due to the changes in job duties and titles, clear comparative data were unavailable. Positions, which previously existed as staff, were reconfigured to reflect a limited degree of management combined with staff functions. This led to an inability to compare management positions pre-work redesign with similar positions post work redesign. Based on personal communication with sources in the organization, management FTEs declined in patient care areas while concurrently increasing in other areas. This research question was unable to be explored thoroughly.

In summary, the overall performance measures of work redesign on financial indicators for this study include aggregate cost per patient day and cost per case. Total expenses for the organization were not used as a measure because costs associated with new ventures and other non-operational areas could not be excluded from the total. Both cost per patient day and cost per case are questionable indicators due to the influences of acuity and length of stay. However, these measures were constantly available throughout the study and continue to be considered industry standards.

Tactics used to achieve a reduction in cost during redesign included reducing RN mix, reducing FTEs, reducing management and reconfiguring other functions in an effort to reduce low value work. A reduction in RN mix from 91.3% to 76.0% occurred over the five–year period. A slight reduction in FTEs per occupied bed
occurred. According to internal sources, a reduction in management FTEs occurred but could not be substantiated with data. New positions were created resulting in more flexible workers while some highly specialized positions with excessive nonproductive time were eliminated. These changes contributed to the reduction in costs reflected in the reduction of cost per case by 8.23%.

Quality Performance Indicators

Four research questions were developed to explore quality related performance indicators. Although improving quality was not the driving force behind work redesign, administrators expected quality to be maintained throughout the process. They also expected quality to improve post work redesign through an improvement in employee satisfaction, matching resources to patient needs and creating more efficiency within the organization. Quality performance indicators for this study included overall mortality, patient falls, medication errors and nosocomial infections.

Did mortality change during and following work redesign? Mortality was not expected to change as a result of work redesign. To date, no studies reviewed linked a reduction in RN mix or the implementation of reengineering to a change in mortality rates. There were no changes in practice, i.e., policies and procedures involving direct patient care, which were designed to improve or effect mortality. As demonstrated in Table 2, mortality rate, defined as the number of deaths per 1,000
patient days, for the five-year period was lowest in FY95 and highest in FY96. A slight increase in mortality rate after implementation of redesign does not provide an answer to this research question. Significance of the year to year variability cannot be determined since similar patterns of variability are noted in organizational historical data. The actual to predicted mortality rate is a more reliable measure of mortality since the predicted rate considers patient acuity. The actual to predicted mortality rate remained relatively stable during the five-year period excluding a significant decline to 1.08 in FY98. The case mix index was highest during FY98.

Table 4

RN Mix, Patient Falls and Medication Errors

Fiscal Year 1995 to Fiscal Year 1999

<table>
<thead>
<tr>
<th></th>
<th>FY95</th>
<th>FY96</th>
<th>FY97</th>
<th>FY98</th>
<th>FY99</th>
</tr>
</thead>
<tbody>
<tr>
<td>RN Mix</td>
<td>91.3%</td>
<td>89.7%</td>
<td>76.8%</td>
<td>75.6%</td>
<td>76.0%</td>
</tr>
<tr>
<td>Patient Falls</td>
<td>4.2</td>
<td>3.6</td>
<td>3.0</td>
<td>4.2</td>
<td>3.9</td>
</tr>
<tr>
<td>Medication Errors</td>
<td>6.0</td>
<td>3.9</td>
<td>5.2</td>
<td>5.4</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Patient Falls and Medication Errors are measured as incidents per 1,000 patient days.
Did the rate of patient falls change during and following work redesign and did the rate of medication errors change during and following work redesign? Providing a safe environment for patients is a primary function of nursing personnel in a hospital setting. Two measures of patient safety, which fall primarily to nursing, include patient falls and medication errors. Knowing that a primary objective of work redesign was a reduction in RN mix, an unintended outcome could be a compromise in patient safety evidenced by increases in these rates. It was expected that both the medication error rate and the patient fall rate would remain constant or would rise during and after work redesign as a result of a reduction of RNs. Table 4 describes the patient fall rate, the medication error rate and the RN mix over the five-year period.

As previously reported, the RN mix was reduced from 93.1% to 76% over the five-year period. During that same period of time, patient falls per 1,000 patient days decreased from 4.2 falls per 1,000 patient days pre-work redesign to 3.9 in FY99. Rates during the intervening years varied from a high of 4.2 falls per 1,000 patient days in FY98 to a low of 3.0 falls per 1,000 patient days. At no point during or after work redesign did the patient fall rate increase over the baseline rate of 4.2.

Medication errors followed a similar pattern. Pre-work redesign, the medication error rate was 6.0 errors per 1,000 patient days. During the five-year period, the medication error rates varied from a high of 5.4 errors per 1,000 patient days to a low of 3.0 errors per patient day in FY99. As with patient falls, at no point during or after work redesign did the medication error rate increase over the baseline rate of 6.0. It is interesting to note that both the medication error rate and the patient
fall rate were closest to baseline during FY98. This phenomenon cannot be explained.

Although the patient fall rate and the medication error rate demonstrate a reduction from baseline, no conclusions can be drawn from this data. Significance of the year to year variability cannot be determined. The argument that patient care suffers when the RN mix is reduced requires further analysis. In both measures of patient safety, improvements were noted when the RN mix was reduced. This result was unexpected. Since both measures are derived from self-reporting mechanisms, it is conceivable that the reporting of errors declined in concert with the decline of professional nurses. Further study would be required to test the validity of self-reported data.

Was there a difference in nosocomial infections during and following work redesign? Nosocomial infections, otherwise known as hospital acquired infections, are an indicator of patient safety. Appropriate use of aseptic and sterile technique contributes to a patient’s ability to avoid these complications while hospitalized. Two phenomena were expected to negatively impact the nosocomial infection rate. First is the reduction in RN mix. RNs are trained in aseptic and sterile techniques. Substituting RNs with other types of caregivers potentially exposes patients to less trained personnel and subsequently, a higher risk of infection. Second, the addition of non-RN caregivers suggests a team approach to patient care. This team based delivery care model potentially increases the number of people involved in direct care.
of the patient. As more people contact patients, the risks of nosocomial infections increase.

Two different critical care units were studied during the five-year period. In each unit, the RN mix prior to work redesign was 100%. The RN mix was maintained at 100% for FY96. During FY 97, adding respiratory therapists to the delivery care model reduced the RN mix to 81.2%. At no time were unlicensed personnel added to the delivery care model. FY98 and FY99 reported an RN mix of 80.9% and 80.4% respectively. Respiratory therapists were trained in basic patient care skills and were to work in concert with RNs providing direct patient care in addition to respiratory care and ventilator management. Figure 1 describes the nosocomial infection rate for these two units during the five-year period. Data on nosocomial infection were not reported during FY97. Table 5 includes the actual nosocomial rates reported with RN mix data.

Two critical care units were studied for the incidence of nosocomial infections. The baseline infection rate for the Neuro Intensive Care Unit (NCU) was 12.7% in FY95. The infection rate rose sharply in FY96 to 21.9%. No reliable data were available during FY97. FY98 demonstrates a decline in the rate from FY96 ending with a lower than baseline rate in FY99 of 7.36%. The baseline infection rate for the Surgical Trauma Intensive Care Unit (STICU) was 8.08% in FY95. This also rose sharply in FY96 to 15.0%. No reliable data were available in FY97. A decline in the infection rate was reported in FY98. The FY98 and FY99 nosocomial infection rates were 10.5%, which is higher than baseline. In both cases, a rise in the
nosocomial infection rate occurred during FY96 even though no change in RN mix occurred. Based on personal communication with an internal source, FY96 was characterized by a high degree of unrest among the RN staff as there was significant discussion about the pending work redesign initiatives. The change in the nosocomial infection rate does not appear to be associated with a change in the RN mix but may have occurred because of other dynamics within the work group. Reaction to pending changes may have influenced the performance of caregivers.

**Legend.**

NCU: Neuro Intensive Care Unit  
STICU: Surgical Trauma Intensive Care Unit  
Nosocomial Infection Rate: Measured in incidents per 1,000 patient days

Figure 1. Nosocomial Infection Rate for Select Critical Care Units.
Table 5
Nosocomial Infection Rate and RN Mix in Select Critical Care Units
Fiscal Year 1995 to Fiscal Year 1999

<table>
<thead>
<tr>
<th></th>
<th>FY95</th>
<th>FY96</th>
<th>FY97</th>
<th>FY98</th>
<th>FY99</th>
</tr>
</thead>
<tbody>
<tr>
<td>RN Mix</td>
<td>100%</td>
<td>100%</td>
<td>81.2%</td>
<td>80.9%</td>
<td>80.4%</td>
</tr>
<tr>
<td>Nosocomial</td>
<td>12.7</td>
<td>21.9</td>
<td>no data</td>
<td>15.4</td>
<td>7.36</td>
</tr>
<tr>
<td>Infection Rate –</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCU</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nosocomial</td>
<td>8.08</td>
<td>15.0</td>
<td>no data</td>
<td>10.5</td>
<td>10.5</td>
</tr>
<tr>
<td>Infection Rate –</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STICU</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NCU: Neuro Intensive Care Unit
STICU: Surgical Trauma Intensive Care Unit
Nosocomial Infection Rate: Measured in incidents per 1,000 patient days

In summary, four quality performance indicators were monitored over the five-year period. Hospital administrators expected that quality would be maintained throughout the work redesign process. Each quality indicator demonstrated a different pattern throughout the five-year period. Mortality demonstrated year-to-year variability with each annual mortality rate exceeding the pre-work redesign level. The mortality rate peaked during FY96. Actual to predicted mortality rates also varied ending with two of the post reengineering years at rates less than FY95 and two at slightly greater than FY95. Medication errors and patient falls both

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declined during the five-year period ending with rates lower than baseline. The medication error rate was closest to baseline in FY97 while patient falls rate was closest to baseline in FY98. Nosocomial infections dramatically increased during FY97 and then showed a steady decline for FY98 and FY99. In one unit, the FY99 nosocomial infection rate was less than baseline. In the other unit, the FY99 rate was higher than baseline. Various data patterns among the quality indicators make it difficult to draw any conclusions about the relationship between reengineering and quality indicators.

Environmental Performance Indicators

Three research questions were developed to describe environment related performance indicators. Hospital administrators recognize that providing a safe and stable environment for employees contributes to cost reduction and quality improvement. Environmental performance indicators for this study included employee turnover rates, employee occupational exposures to blood and body fluids and Class III litigation claims.

Will employee turnover rates remain constant after work redesign? Employee turnover rates were expected to rise during FY96 as a result of work redesign discussions. The threat of a job loss was expected to initiate voluntary resignations. Based on personal communication with one internal source, the organization planned to offer limited early retirement options to facilitate a reduction in the work force. It
was expected that employee turnover would level off by FY97 and then be 
maintained at pre-work redesign levels for FY98 and FY99. Figure 2 describes the 
employee turnover rate for specific positions over the five-year period.

<table>
<thead>
<tr>
<th>Turnover Rate</th>
<th>RN</th>
<th>LPN</th>
<th>PCA</th>
<th>BA</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 95</td>
<td>0.060</td>
<td>0.086</td>
<td>0.103</td>
<td>0.101</td>
<td>No Data</td>
</tr>
<tr>
<td>FY 96</td>
<td>0.143</td>
<td>0.121</td>
<td>0.169</td>
<td>0.137</td>
<td>0.116</td>
</tr>
<tr>
<td>FY 97</td>
<td>0.215</td>
<td>0.228</td>
<td>0.266</td>
<td>0.253</td>
<td>0.147</td>
</tr>
<tr>
<td>FY 98</td>
<td>0.153</td>
<td>0.085</td>
<td>0.106</td>
<td>0.138</td>
<td>0.085</td>
</tr>
<tr>
<td>FY 99</td>
<td>0.346</td>
<td>0.083</td>
<td>0.103</td>
<td>0.147</td>
<td>0.083</td>
</tr>
</tbody>
</table>

Legend.
RN – Registered Nurse
LPN – Licensed Practical Nurse
PCA – Patient Care Associate
BA – Business Associate
SA – Service Associate

Figure 2. Employee Turnover Rates for Major Classifications of Hospital Employees.

An initial increase in employee turnover was expected. No baseline data were 
available pre-work redesign. Clinical staff members including RNs and LPNs were 
employed by the organization prior to work redesign. Patient Care Associates (PCA) 
were previously employed by the organization but not in a direct care capacity.
Service Associates (SA) and Business Associates (BA) were new positions created through reengineering. Service Associate positions were entry-level positions which combined aspects of patient transport and light housekeeping. Business Associate positions were more complex than Service Associate positions and combined tasks of medical order entry, patient financial counseling, patient registration and document management.

As expected, the RN turnover rate increased initially from 8.6% in FY96 to 12.1% in FY97. The RN turnover rate declined slightly in FY98 to 10.6% and ended the study period at 8.3%, slightly less than baseline. The turnover rate for RNs was the least dramatic among the employee groups. Employee turnover rates have followed a similar albeit more dramatic pattern for the groups including LPNs, PCAs and BAs. In all cases, a sharp increase in turnover occurred in FY97 followed by a decline in FY98. Licensed workers including LPNs and RNs, showed further declines in FY99 ending with lower than baseline turnover rates. BA turnover rates continued to decline after the initial FY97 surge but that rate has not returned to baseline as of FY99. Both PCAs and SAs increased during FY99. For PCAs, the increase was minimal. For SAs, the increase was dramatic.

Based on personal communication with internal sources, SAs and PCAs are entry level positions with wage scales which closely resemble minimum wage levels in the community. An unexpected economic condition which occurred during the project was the continued decline in the unemployment rate for the local market. This affected and continues to affect the organization's ability to attract and retain
entry-level workers. Continued high turnover among Service Associates and Patient Care Associates exists and is expected to remain into the future.

Did employee occupational exposures to blood and body fluids change after work redesign? Exposure to blood and body fluids is an important safety measure for employees in health care settings. Increasing the number of unskilled workers in a hospital can complicate efforts to minimize employee risk. Although occupational exposure rate was not a key indicator tracked purposely during work redesign, it is a quality indicator which was tracked over the five-year period and provides insight into the organizational performance during the study period. With the increase in unlicensed health care workers, an increase in occupational exposures was expected.

Table 6 describes changes in occupational exposure rates during the five-year period. As expected, occupational exposure to blood and body fluids increased from the pre-work redesign rate of 1.75 per 1,000 patient days in FY95 to 1.97 per 1,000 patient days in FY96 peaking at 2.43 per 1,000 patient days in FY97. FY98 showed a decline to 2.15 per 1,000 patient days ending with a FY99 rate of 1.83 per 1,000 patient days. It should be noted that the FY99 rate remains above pre-work redesign baseline. The implementation of a needleless system in 1997 is thought to directly impact the decline in occupational exposures.
Table 6
Environmental Performance Indicators and RN Mix
Fiscal Year 1995 to Fiscal Year 1999

<table>
<thead>
<tr>
<th></th>
<th>FY95</th>
<th>FY96</th>
<th>FY97</th>
<th>FY98</th>
<th>FY99</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupational Exposures</td>
<td>1.75</td>
<td>1.97</td>
<td>2.43</td>
<td>2.15</td>
<td>1.83</td>
</tr>
<tr>
<td>RN Mix</td>
<td>91.3%</td>
<td>89.7%</td>
<td>76.8%</td>
<td>75.6%</td>
<td>76.0%</td>
</tr>
<tr>
<td>Unlicensed Caregiver Mix</td>
<td>0%</td>
<td>0.9%</td>
<td>10.1%</td>
<td>12.3%</td>
<td>12.8%</td>
</tr>
<tr>
<td>Class III Claims</td>
<td>12</td>
<td>15</td>
<td>5</td>
<td>11</td>
<td>10</td>
</tr>
</tbody>
</table>

Occupational Exposures to Blood and Body Fluid measured as incidents per 1,000 patient days.

RN Mix – percent of direct care providers who are licensed registered nurses.

Unlicensed Caregiver Mix – percent of direct care providers who are unlicensed nursing assistants.

Class III Claims – raw number of lawsuits

Did Class III litigation claims rise during and after work redesign? Class III litigation claims are those claims which advance to the litigation level. An increase in Class III claims is expected as an outcome of a rise in employee turnover rates, a reduction in RN mix and a reduction in employee morale.
Table 6 describes changes in the Class III litigation claims during the five-year period. It was expected that claims would rise during work redesign and then remain steady. The inverse occurred which is unexplainable. During the pre-work redesign period, there were 12 Class III claims. That number rose to 15 in FY96 and then sharply declined in FY97 to 5. FY98 showed 11 claims followed by 10 claims in FY99. In calendar year 1994, tort reform was introduced into legislation, which changed the filing requirements for cases among other things. Prior to April, 1994, a plaintiff's attorney was free to file a lawsuit without providing the defendant advanced notice. Tort reform requires a notice of intent to file a lawsuit be provided prior to filing. The advanced notice required under tort reform potentially increases the number of cases settled prior to filing and subsequently, could decrease the number of Class III claims. The sharp decline in Class III claims occurred in FY97. It appears that the trend in Class III claims was not effected by tort reform.

In summary, employee turnover rates were monitored post work redesign for a four-year period. In each of the employee categories studied, turnover rates rose sharply in FY97 and then declined in FY98. Licensed care providers including registered nurses and licensed practical nurses plus business associates demonstrated further reductions in turnover rates for FY99. The two entry-level positions including patient care associates and service associates demonstrated an increase in turnover rate consistent with the timing of the decline in the local unemployment rate. Occupational exposures rose during FY96 and FY97 consistent with the increase in employee turnover and the decline in RN mix. The organization implemented a
needleless system, which is credited with directly reducing the occupational exposure rate. Class III claims peaked in FY96 then declined sharply. Changes in tort reform appear to not have influenced the volume of cases after 1995 although the long-term effects are unclear. In FY97, employee turnover and occupational exposures where highest while Class III litigation claims were lowest.

Relationship Between RN Mix and Quality

The final question relates to the relationship between staffing levels and nursing quality indicators. Specifically, was there a decrease in quality of care, as measured by patient falls and medication errors, during the study period that is related to RN mix and proportion of unlicensed personnel?

The literature suggests that nurses fear a reduction in quality and patient care safety would result from reductions in registered nurses (Rowell, 1998). To determine whether there was a relationship between staffing and medication errors or patient falls, RN mix was studied along with medication errors and patient falls for each year of data collection. Eleven patient care units were reviewed in search of patterns or trends. It was expected that patient falls and medication errors would rise as the RN mix declined. Table 7 reflects the data for the five-year period for the eleven patient care units studied.

All units studied experienced a reduction in RN mix except pediatrics and cardiac critical care. These two units were maintained at 100% RN mix. The average
reduction in RN mix for the eleven patient care units was 15.48% with the greatest reductions noted in general medical surgical areas. Lower reductions were noted in critical care and specialty areas such as obstetrics and cardiology. Seven of the eleven patient care units experienced a reduction in medication errors with one unit experiencing no change. Therefore, eight of the eleven units did not experience a reduction in quality as defined by the measure of medication errors. The units which experienced an increase in medication errors were surgical ICU, rehabilitation and the orthopedic/neurology unit. It is interesting to note that these three units were organizationally structured under a common management service line management team. It is unknown if the implementation of RN mix changes in this service line differed from other service line approaches to change. Eight units experienced a reduction in patient falls with one unit experiencing no change. Therefore, nine of the eleven units did not experience a reduction in quality as measured by patient falls. The units which experienced an increase in patient falls were rehabilitation and pediatrics. These units were organizationally structured in different service lines. It is important to note that the two units which experienced no change in RN mix, pediatrics and cardiac ICU, demonstrated a reduction in medication errors. Pediatrics saw a substantial increase in patient falls while cardiac ICU saw a substantial decline in patient falls. The variability of the data associated with the units lacking RN mix changes creates questions regarding normal variability of these data points.

In summary, the aggregate organizational data demonstrated reductions in patient falls and medication errors as RN mix was reduced over the five-year period.
This trend was supported at the individual patient care unit level. The majority of patient care units which experienced declines in RN mix or no changes in RN mix, tended to reduce their rates of medication errors and patient falls. Based on these findings, a reduction in quality did not result from the reduction in RN mix based on the variables of medication errors and patient falls. There was no obvious pattern regarding the extent to which medication error rate and patient falls rate changed in relationship to the RN mix. Due to the limited scope of this study and the small sample size (N=11), these observations should be regarded cautiously.
Table 7
RN Mix and Nursing Quality Measures
Fiscal Year 1995 to Fiscal Year 1999

<table>
<thead>
<tr>
<th>Patient Unit Type</th>
<th>Change in RN Mix from FY95 to FY99</th>
<th>Change in Medication Errors from FY95 to FY99</th>
<th>Change in Patient Falls from FY95 to FY99</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical</td>
<td>-29.6%</td>
<td>-24.3%</td>
<td>-36.7%</td>
</tr>
<tr>
<td>Surgical</td>
<td>-21.9%</td>
<td>-80.2%</td>
<td>-131%</td>
</tr>
<tr>
<td>Neuro/Ortho</td>
<td>-18.2%</td>
<td>+41%</td>
<td>-&gt;300%</td>
</tr>
<tr>
<td>Rehab</td>
<td>-24.2%</td>
<td>+54%</td>
<td>missing data</td>
</tr>
<tr>
<td>Cardiology</td>
<td>-8.3%</td>
<td>-157%</td>
<td>-46%</td>
</tr>
<tr>
<td>Pediatrics</td>
<td>0</td>
<td>-27%</td>
<td>+156%</td>
</tr>
<tr>
<td>Obstetrics</td>
<td>-9.1%</td>
<td>-22%</td>
<td>-&gt;300%</td>
</tr>
<tr>
<td>Surgical ICU</td>
<td>-19.6%</td>
<td>+265%</td>
<td>-49%</td>
</tr>
<tr>
<td>Cardiac ICU</td>
<td>0</td>
<td>-&gt;300%</td>
<td>-150%</td>
</tr>
<tr>
<td>Psychiatric</td>
<td>-21.2%</td>
<td>0</td>
<td>-59%</td>
</tr>
<tr>
<td>CVL</td>
<td>-18.2%</td>
<td>-&gt;300%</td>
<td>0</td>
</tr>
<tr>
<td>Housewide Data</td>
<td>-15.3%</td>
<td>-50%</td>
<td>-6.8%</td>
</tr>
</tbody>
</table>

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Summary

FY95 was considered the pre-work redesign period. Work redesign was initiated and implemented in varying degrees for the following three years. FY99 was considered the post work redesign period. When examining the many data points reviewed during this study, a pattern emerges among selected indicators. FY96 represents the year when a major organizational change was implemented. That year, RN mix began to decline while the proportion of unlicensed caregivers began to rise, costs increased and indicators of quality, including nosocomial infections, mortality and occupational exposures rose. Indicators that did not fit this negative trend included FTEs per adjusted occupied bed, patient falls, medication errors and Class III litigation claims. FY97 appears to be the year when selected indicators peaked, signaling a high point for the five-year period. FY98 and FY99 demonstrated improvements, ending with many indicators at levels near or below FY95 baseline levels.
CHAPTER V

DISCUSSION, LIMITATIONS, AND RECOMMENDATIONS

Discussion

Work redesign was a management tactic designed to reduce costs and increase efficiencies in the workplace. Quality and service were secondary considerations. Based on cost-related data, work redesign may be considered an effective tool for this hospital organization. Without this intervention, cost per case would be significantly higher than current cost per case. This is substantiated in the literature by various case studies which demonstrated either a reduction in overall costs (Strong, 1997), a reduction in variable cost per case (Bryan, 1998), or a positive change in specific cost indices such as length of stay, proportion of management wages and employee productivity (Harlin, 1996).

Other indicators and predictors of costs such as FTEs per adjusted occupied bed and cost per patient day did not demonstrate the same degree of work redesign success in this study. Both of these indices varied during the years between the beginning and end of work redesign ending with a rate largely similar to baseline as opposed to less than baseline. These indicators are considered weak cost indicators.
since they measure a limited view of costs in the hospital environment. The lack of congruency between these indicators and cost per case is not surprising.

Although reductions in cost per case support the reengineering effort for this institution, it was difficult to determine the hidden costs of errors, employee turnover, litigation and other influences on actual case costs. Those factors are not reflected in the cost per case measure. Based on the inability to create this linkage, relative success of reengineering from a cost perspective cannot be fully determined for this study.

Walston (1999) compared the change in cost position of reengineered hospitals to non-reengineered hospitals. There was no significant difference between the two groups related to cost position. This conclusion may indicate that reengineering reduced costs during a time when cost reductions were achieved within the hospital community through a variety of tactics including, but not limited to, reengineering. The positive effects of reengineering based on cost outcomes should be considered cautiously.

Indicators of quality for this study included medication errors, patient falls, mortality and nosocomial infections. These, in addition to intravenous (IV) related complications, pressure ulcers and patient satisfaction, were typically seen in the literature (Bryan, 1998; Rowell, 1998). Each of the quality indicators included in this study trended differently throughout the five-year period. Medication errors and patient falls varied throughout the five-year period ending slightly below baseline. At no time did the medication error rate or the patient fall rate exceed baseline during or
after redesign. This finding is consistent with one 18-month study (Bryan, 1998). Bryan found that restructuring and reengineering hospital care did not adversely effect quality indicators and patient outcomes. These findings related to quality indicators post reengineering are inconsistent with American Nurses Association funded research (Moore, 1999). Moore found that the trend to reduce RN mix through reengineering had an adverse effect on quality indicators during the study period of 18 months. Both the Moore study and the Bryan study tracked quality indicators over an 18-month period. Neither is able to determine the long-term effect of reengineering on quality indicators.

The source of data for the indicators of patient falls and medication errors in all of these studies is an incident report, a self reporting mechanism commonly used in hospital settings. The decline in both medication error rate and patient fall rate may be due to an actual decline of incidents or may be due to a reduction in RNs who would typically complete the incident reports. Due to the conflicting data presented in these studies and this outstanding question, a conclusion cannot be drawn from this data. Validation of the reliability of this self-reporting measure when RN mix declines is required.

Nosocomial infections and mortality rates varied during the five-year study period. Nosocomial infections initially increased and then declined ending with a rate near or lower than baseline for the two care units studied. Findings related to nosocomial infections were consistent with Bryan’s study (1998), regarding reengineering. Bryan found that nosocomial infection rates decreased after
reengineering and were maintained at a rate lower than baseline for 18-months. This is inconsistent with the findings of Moore (1999). Moore found that the incidence of nosocomial infections rose if RN mix and hours per patient day declined. Bryan's study and this case study demonstrated declines in nosocomial infections even though RN mix declined. This study extended over a five-year period, longer than the 18 months reported by Moore (1999) and Bryan (1998) and may explain the differences in results. Longitudinal research of quality related performance indicators is lacking in the literature.

The review of clinical outcome data concurrent with changes in RN mix is limited in the literature. The only study which drew correlation between these two factors was the American Nurses Association sponsored study (Moore, 1999). Moore concluded that the trend of reducing RN mix as a cost cutting initiative was and continues to be a shortsighted strategy that may harm patients and lower the quality of care provided. This conclusion was not supported by this case study. Declines in RN mix did not result in declines in patient care quality as measured the outcome indicators of patient falls and medication errors, two indices of quality from a nursing perspective. However, the small sample size and the use of a self reporting tool for data collection requires that the findings be interpreted cautiously.

The other indicators tracked in this study included mortality, occupational exposures to blood and body fluids, staff turnover rates and class III litigation claims. There was no evidence that reengineering adversely effected quality or environmental related measures on a long-term basis.
Of the applicable research documented in the literature, no studies extended beyond a short time frame. All studies were conducted within a two-year time frame with most being limited to 18 months. Had the review of performance indicators for this research study been completed within two years of reengineering, the interpretation would have been vastly different. In many cases, performance indicators trended in ways not expected. Costs and FTEs declined during FY96 in concert with declines in RN mix. This would have been largely expected post reengineering. However, mortality, nosocomial infections, staff turnover, occupational exposures and class III litigation claims all rose. The obvious conclusion from this short-term data would be that reengineering successfully reduced costs while creating adverse effects on quality and environmental performance indicators. The longer view of the data suggests that the chaos surrounding a major organizational change may affect hospital performance indicators, but over time performance indicators return to baseline levels.

Limitations

Most documented evidence of the effectiveness of work redesign has been limited to case studies. The limitations of case studies include inconsistent performance measures and an inability to clearly delineate environmental or strategic influences which may have confounded the research results (Leatt, 1997).
In addition to the case study format, a significant limitation of this study is the lack of two common performance indicators found in the literature, patient satisfaction and staff satisfaction. The literature is rich with examples of direct relationships between these two variables and the effects of these variables on select outcome indicators. The inability to include these variables is a significant weakness of this study and limits comparisons to other case studies. Another weakness of the study is the inability to compare similar hospitals, both reengineered and non-reengineered, on performance indicators over an extended period of time. Given Walson's research (1999), the effects of reengineering are seriously questioned due to a lack of documented differences in cost position when comparing reengineered to non-reengineered hospitals. A fourth limitation is the lack of an identified cost related performance indicator which is reflective of costs associated with care and reengineering without confounding factors including costs of low unemployment rates, inflationary adjustments and strategic costs. Lack of an industry-wide cost indicator restricts financial comparisons among hospitals. Finally, a retrospective design limits the variables which can be monitored and controlled during the study period. Episodes of missing data and changing data sources were events which limited research elements in the study.

Recommendations
Comprehensive studies of reengineering in the hospital setting and the effects on cost and quality performance indicators are few. The ability to evaluate the effects of reengineering on hospital performance indicators in the future requires that future research includes both quality and cost indicators. Indicators should be well defined prior to the research period and should be monitored for an extended period of time to ascertain the degree of variability prior to the reengineering intervention. In many organizations, reengineering represents a major change in work and philosophy. Although findings in the literature are inconsistent, some patterns have emerged including significant changes in outcome indicators within the first 18 months post reengineering. Questions remain as to the relationships between these patterns and the effect the redesign process has on outcome indicators both on a short term and long term basis. Reengineering in hospital settings requires longitudinal and comparative research prior to assuming that reengineering is an effective tool for reducing costs while maintaining or improving service and quality. An experimental study including at least one control group would assist in determining the effects of work redesign processes in the hospital environment.

From a nursing perspective, the American Nurses Association has identified a list of ten indicators which should be consistently studied in hospital settings to determine the effects of nursing care on patient outcomes. Three of the ten indicators were noted in this study and included nosocomial infection rate, patient falls rate and RN mix. The other seven indicators supported by the American Nurses Association include patient satisfaction with nursing care, patient satisfaction with pain
management, patient satisfaction with educational information, patient satisfaction with care, maintenance of skin integrity, nurse staff satisfaction, and total nursing care hours provided per patient day. Medication error rate is noticeably absent from the American Nurses Association list of quality indicators and should be added to reflect the role of nursing as it relates to medication safety. Other indicators, which are not listed in the American Nurses Association list of quality indicators but should be included in any performance study in a hospital setting, include occupational exposures to blood and body fluids, predicted to actual mortality rate, and a measure to reflect patient cases which result in legal liability. A move toward common performance indicators with common definitions would facilitate future studies and enable possible comparisons across many hospital organizations.

The use of RN mix as an indicator has many limitations and deserves further exploration. The proportion of RNs caring for patients becomes an invalid measure without including three concurrent measures. These include hours of nursing care per patient day, RN span of care and proportion of unlicensed personnel. Using these three measures plus RN mix creates an accurate picture of nurse staffing in the hospital setting and will enable professional nursing organizations to further study the effects of RNs on patient care and patient outcomes. It is suggested that a flexible RN staffing model is developed which includes the aforementioned parameters of nursing care hours per patient day, RN span of care, proportion of non-RN licensed and unlicensed personnel and RN mix. This comprehensive model should be developed, tested and studied to determine the effects of changes in any of the four
dimensions of the model. The American Nurses Association should abandon the use of RN mix as an indicator and allocate resources to develop a more comprehensive measure of RN staffing.

Hospital organizations are not unlike many industries in the United States. During the past decade, businesses were required to cope with ever changing customer demands, expanding competition and the need to improve quality while reducing costs. Like the various industries noted in Chapter I, hospitals embraced reengineering as a way to remain viable and competitive in the demanding business climate. Anecdotal stories and a multitude of books were published extolling the successes of reengineering. Many consultants used the reengineering craze to create substantial profits in their own businesses. Hospital and business leaders were so desperate to find an organizational panacea that many adopted reengineering without researching the actual outcomes historically achieved through this effort. These same leaders should take note of the promises offered by reengineering consultants and compare those promises to the actual outcomes. Lacking significant research data, they should then challenge their methods of embracing management trends and tactics. Adopting aggressive, creative and innovative practices in an effort to improve performance is a laudable endeavor. However, determining how to proceed when other organizations have gone before them requires in-depth research, critical thinking, and a well-defined approach to change which enables leaders to critically evaluate the success or failure of their endeavor. The need for hospitals to remain competitive and viable in an ever changing and demanding marketplace continues
today. Hospital leaders will undoubtedly seek new and innovative ways to
differentiate services while reducing costs. The lessons learned from reengineering
should influence those same leaders to proceed cautiously when considering the latest
management tactic promoted by consultants and popular management literature.
Appendix

Protocol Clearance From the Human Subjects
Institutional Review Board
Date: 13 July 2000

To: David Cowden, Principal Investigator
   Linda Albery, Student Investigator for dissertation

From: Sylvia Culp, Chair

Re: HSIRB Project Number: 00-04-22

This letter will serve as confirmation that your research project entitled "The Effects of Reengineering on Hospital Performance Indicators" has been approved under the expedited category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may only conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: 8 June 2001
BIBLIOGRAPHY


American Hospital Association. 1996/1997 Survey of Hospital CEOs. Chicago, IL.


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