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Productivity, Quality, and Cost Relationships in a Healthcare Foodservice System

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To the Graduate Council:

I am submitting herewith a thesis written by Roberta J. Buchan entitled "Productivity, Quality, and Cost Relationships in a Healthcare Foodservice System." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Food Science and Technology.

Jeannie Sneed, Major Professor

We have read this thesis and recommend its acceptance:

Jean D. Skinner, Betty R. Carruth

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Productivity, Quality, and Cost Relationships in a Healthcare Foodservice System

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Degree

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Roberta Buchan

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ABSTRACT

A pilot study was conducted in a 165-bed combination hospital-nursing home with a conventional food production system to develop a system to measure productivity, quality, and cost of meals and service and to determine the relationship among those variables. Measurement of these variables was made from December, 1988 to September, 1989. Historical productivity and cost data were obtained from departmental records for the time period from January, 1986 through November, 1988.

The mean productivity was 14.4 ± 1.5 labor minutes paid per meal equivalent. The mean total cost per meal was $1.59 ± .23. The mean overall percent quality index was 88 ± 5. Major quality problems related to temperature control of food at point of service and delivery and cleanliness and orderliness of equipment and work areas.

Simple linear regression analysis showed no significant relationship between Quality Index and Productivity Indexes, between Productivity Indexes and Cost per meal Index, and between Quality Index and Cost per meal Index. Multiple linear regression showed that Productivity Index and Quality Index do not predict Cost per meal Index.

This provides a comprehensive system that could be used by other dietitians to set standards for productivity, cost, and quality variables and to monitor performance related to these variables in their operations.

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CHAPTER 1

INTRODUCTION

Today's healthcare foodservice managers are faced with the cost containment mandate resulting from the Tax Equity and Fiscal Responsibility Act (TEFRA) of 1982. Under this legislation, medicare payments to hospitals are made on a prospective basis guided by a case-classification system called diagnosis related groups (DRGs). Since October 1983, a four year phase-in of the prospective payment system to hospitals occurred on the basis of diagnostic groups of all medicare patients admitted (Halling, Lafferty, and Feller, 1986).

These changes in reimbursement ended unrestrained affluence for hospitals and made the healthcare industry financially driven. No longer is the goal of hospitals just healing the sick, but doing so as quickly as possible. Emphasis on finding ways to reduce costs of operation permeates the industry (Stephenson, 1988).

These changes came about because the overall healthcare expenditures in the United States rose from $12.7 billion in 1950 to $322.4 billion in 1980, an ascent from 4.4% to 10.5% of the gross national product. The government tried to pressure hospitals to restrain their rising costs voluntarily, but when that did not work the DRG system of reimbursement was implemented (Stephenson, 1988).

Occupancy rates have declined in hospitals in the past five years. Because of this decline, major changes have taken place in hospitals including decreasing number of employees and combining departments to improve efficiency (Stephenson, 1988). These changes have had major impact on the hospital foodservice departments as they, too, have had budget reductions.

Foodservice directors need to be exceptionally clear as to the goals of their institutions and to develop their department's goals to be congruent with the attainment of the institution's overall goals. Foodservice directors must determine current departmental performance, establish goals, and determine how to achieve those goals. There are many options to improving performance including changes in the operating system and personnel. Managers must deal with change and be flexible. The incentive to control cost is urgent (Stokes, 1989).

The current economic environment provides an opportunity to improve productivity of healthcare foodservices. However, certain quality standards must be maintained in order to qualify for reimbursement. Thus, there is a challenge to provide quality services at a minimum cost. Since labor represents 60% to 70% of the total hospital budget, the relationship of cost and quality of service to productivity are topics of interest.

According to Sink (1985), there are seven measures of organizational system performance: effectiveness, efficiency, quality, profitability, productivity, quality of work life, and innovation. These criteria are interrelated as they impact organizational performance. In a service industry, such as healthcare foodservice, effective delivery of quality service is important (Adam et al., 1981).

One important job of a manager is to determine how to operationally measure these performance criteria and how to link the measurement system to improvement. The purpose of performance measurement is to assist the foodservice operation with assessment, evaluation, and control and with improvement of its effectiveness, efficiency, quality, productivity, quality of work life, innovation, and profitability.

While Sink (1985) recommends seven performance measures, most studies related to foodservice operations have considered only productivity data, such as number of meals served, as an appropriate measure of output without evaluation of the quality of service or the quality of food and its acceptability to the consumer (Ruf and David, 1975). When changes in productivity are measured, basic changes in effectiveness, resource consumption, and quality of outputs are also monitored (Bowman and Gift, 1989). Productivity measurement and evaluation can tell foodservice managers when they are ineffective, inefficient, and when there is a potential quality problem (Bowman and Gift, 1988).

Considering only quantitative data as an appropriate measure of output without an evaluation of the quality of meals served leads to biases in the conventional measures of productivity. Productivity must include a quality dimension, for if an operation increases quantity at the cost of lowering the quality, it gains, little, if any, overall productivity (McDougall, Covert, and Melton, 1989).

At some point, increased productivity may be achieved only by sacrificing the quality of food and service. The foodservice manager must be cognizant of the quality/productivity relationship and optimize all facets of productivity (McDougall et al., 1989). Both qualitative and quantitative standards have been lacking for foodservice systems (David, 1978). Each operation should set its own standards based on past performance and on the resources and constraints of the system (Matthews, 1975). Quality should always be a consideration (Koska, 1989), and management may not choose to sacrifice quality to increase productivity (Schuster, 1989). Standards for quality of the food and service should be determined, and the quality of meals served should be evaluated continuously (Lieux and Winkler,

1989). Using resources effectively, palatable, appealing, and nutritious food can be produced to achieve the goals of the institution for maximum quality patient care.

It is important to relate quality assurance and productivity and to develop a means of quantifying that relationship. Accuracy of such a program requires careful, step-by-step implementation. Of equal importance is the continual monitoring of the system to insure proper accounting that clearly shows the cost savings that results from changes (McDougall et al., 1989).

Purpose of the Research

The purpose of this research was to develop a system to measure the productivity, quality, and cost of meals produced and served in a 165-bed combination hospital-nursing home that uses a conventional food production system. This study also determined the relationship among the variables of productivity, quality, and cost per meal, provided information on how effectively resources were being utilized, and facilitated in the development of standards of performance for this dietary department.

Research Questions

The following research questions were addressed in this study:

1. How can quality and productivity be measured in a hospital-nursing home foodservice system?
2. What is the relationship among measures of quality, productivity, and cost of meals produced?
3. Should productivity measures include quality measures?

Research Hypotheses

The following research hypotheses were tested to determine the relationship among the variables of quality, productivity, and cost in a healthcare foodservice operation.

Hypothesis 1: There is no relationship between the Quality Index and the Productivity Indexes for meal production and service.

Hypothesis 2: There is no relationship between the Productivity Indexes and the total Cost per meal Index.

Hypothesis 3: There is no relationship between the Quality Index and the Cost per meal Index.

Hypothesis 4: As Productivity Index and Quality Index improve, the Cost per meal Index will increase.

Limitation of the Study

This study provides information about the 165-bed combination hospital-nursing home studied and can not be generalized to other hospitals. However, the system, which was developed to measure the productivity and quality of meals produced and served in this facility, could provide a model to help dietitians in other foodservice operations to set standards for productivity, cost, and quality variables and to monitor performance related to these variables.

Definitions of Terms

The following terms define service recipients, measures of cost, productivity, and quality, and bases for reimbursement of services provided to patients/consumers.

Consumer: patients receiving regular diets in the hospital or nursing home; employees and guests eating in the cafeteria or at a catered special function.

Cost index: direct expense (labor, food, and other expenses) per meal equivalent.

Diagnosis-related groups (DRGs): case-classification system upon which prospective payments are based.

Dietary services: provision of foodservices to patients, personnel, and guests in compliance with public health regulations and physicians's orders.

Effectiveness: ability to use inputs to achieve desired goals, objectives, and standards; meeting the needs of the consumers (Sink, 1985).

Efficiency: relative benefit recognized from converting inputs into outputs.

Equivalent meal cost: average selling price of a meal based on the average selling price of an entree, starch, vegetable, salad, dessert, bread, butter, and beverage at the noon meal in the cafeteria. The equivalent meal cost is used to determine the number of cafeteria meals served by dividing total sales by the cost of an equivalent meal (American Hospital Association, 1988).

Inputs: resources (i.e., materials, labor, money, energy, facilities, etc.) that enter the system.

Meal equivalents: sum of the 1) total number of patient meals, 2) total revenue from the cafeteria divided by equivalent meal cost, 3) total number

of nonpaid and catered meals, and 4) total number of nourishment counts divided by eighteen (Johnson, Matthews, Allington, and Johnson, 1980).

Outputs: goods and services produced by the system.

Productivity: ratio of outputs to labor inputs. The ratio is a measure that indicates the efficiency of the use of labor in the production of goods and services.

Productivity index: two productivity indexes were calculated; labor minutes paid divided by meal equivalents per day and labor minutes worked divided by meal equivalents per day.

Prospective payment: fixed price paid for a hospital service regardless of the procedure performed and length of stay.

Quality: degree to which a product or service conforms to a set of predetermined standards related to the characteristics that determine its value in the organization and its performance of the function for which it was designed (American Hospital Association, 1975).

Quality Index: numerical score based on the product, service, and sanitation of the foodservice operation. Product measures included the characteristics of appearance, taste, and temperature of the final product as determined in assembly. Service measures include appearance, taste, and accuracy of the tray when it reaches the consumer. Sanitation measures include cleanliness, orderliness of equipment area, and personnel.

Standards: predetermined quality level expected of a product or service.

CHAPTER II

REVIEW OF LITERATURE

A quiet change is underway in American industry - a change which increasingly involves healthcare foodservice. Increased productivity and profits are needed in order to survive in today's competitive environment (Stokes, 1989). It is more important than ever to use human resources more effectively and efficiently. Reducing costs, while maintaining high quality, is a challenge facing all hospital foodservice operations. In today's competitive, dynamic business environment the foodservice manager has become increasingly aware of and concerned with productivity, cost containment, and service quality (Stephenson, 1988).

This review of literature includes findings about the relationship between productivity and quality. In addition, current terminology is defined, measurement methodologies reported, and causal variables examined. This information was synthesized and integrated and used to develop a methodology to measure productivity, quality, and cost of meals in a small healthcare facility, in order to facilitate the development of standards of performance for the dietary department.

Productivity

Definitions of Productivity

Many definitions of productivity exist. The myths and realities, the assumptions and expectations surrounding productivity are all part of an intense search into this important issue that has affected institutional foodservice (Allington, Matthews, and Johnson, 1981). In its broadest sense, productivity refers to the

efficient utilization of resources, including people, machines, and money. These resources are necessary not only for the day-to-day operation, but for the organization to grow and prosper (Sink, 1985).

Pickworth (1987) defined productivity from an economic, management, and behavioral perspective. Economists define productivity as output per employee, exhorting employees to work harder and smarter (Pickworth, 1987). Management scientists define productivity as how well an operation converts inputs into outputs, paying the most attention to measurement issues (Pickworth, 1987). Behavioral scientists generally define productivity in the broadest of terms. They pay less attention to measurement issues and put more emphasis on assessing significance of the various factors that influence productivity, such as employee morale. According to Pickworth's (1987) definition productivity should be broadened beyond solely economic concerns; productivity should be thought of as a multidisciplinary concept that focuses on optimizing social and economic inputs and outputs.

Several authors (Price and Mueller, 1986; Rose, 1984; Ross, 1978; Sink, 1985) defined productivity as simply the relationship between the outputs generated from a system and the inputs provided to create those outputs. Inputs in the general form of resources such as labor, capital, energy, materials, and data are brought into a system and transformed into outputs. Productivity is the relationship between the amount produced by a given system during a given period of time and the quantity of resources consumed to create or produce those outputs. The more output that can be produced with a given level of input, the greater the productivity; similarly, the less input needed to produce a designated level of output, the greater the productivity (Price and Mueller, 1986).

Halling et al. (1986) defined productivity as an efficiency measurement related to production. Production can be conceptually defined as the relationship between inputs, the conversion process, and outputs. In hospital-based nutrition care operations, outputs of the production system are generally considered to be meals and nutrition services. Inputs are typically defined as labor, materials, facilities, money, and energy. The conversion process is determined by both inputs and outputs. Products and services to be produced and resources available dictate requirements of the conversion process. Managers are responsible for planning, organizing, and controlling this conversion process.

A foodservice department is highly productive if it achieves its goals at the lowest possible cost (Stokes, 1985). Productivity of a foodservice system is often defined as the amount of labor hours used divided by the number of meals served, yielding the number of labor hours required to serve one meal. Ruf and David (1975) and Yung, et al. (1980) defined productivity in their studies as the number of meals prepared and served per labor hour. Ruf and David (1975) and Yung et al's. (1980) definition differ from Stokes's (1985). The latter allows for high and low productivity. Stokes's (1985) definition defines productive versus not productive foodservice systems.

McDougall, Covert, and Melton (1989) defined productivity as the quality, timeliness, and cost-effectiveness by which an organization achieves its mission. This definition implies that productivity improves as the quality of services is improved, even though the quantity of services remains the same.

Productivity Measurement

Productivity measurement is the process by which inputs and outputs are selected to develop ratios and, eventually, standards. Productivity measurements provide managers with a quantitative value for evaluating efficiency of the production process. Without a quantitative value, efficiency evaluation is subjective. The effectiveness of a change in the system intended to increase productivity is difficult to measure and evaluate without a quantitative value for comparison (Halling et al., 1986).

In most foodservice operations, productivity is measured as minutes of labor time (input) used per meal served (output), output per labor hours used, or output per full-time equivalent worker. In some operations, the input is measured in relation to dollar volume of sales as the output (David, 1978).

Activity analysis, predetermined motion time, and work sampling are measurement techniques that have been used to measure productivity in foodservice operations. These techniques will be described, giving examples of how the techniques have been used in research and how the findings have been applied.

Activity Analysis

Activity analysis involves continuous observations for a chronological record of the nature of activities performed (Mundel, 1970). Data for an activity analysis may be obtained by an observer who records chronologically the elements of the job being done by the employee and the time required to do each element, from the records of an employee who records his own activities and times, or a technical

estimate from an individual who is experienced with the work activity. The information can be recorded on a form that lists the sequence of steps in a job, a brief description of the work activity, and the time required to do the work. The time required for each work activity can then be determined from the information collected (Matthews, 1975).

Activity analysis through the use of continuous time study, the application of time and motion study techniques, and combined with work sampling, has been used to determine the total labor time, the amount of labor time used in the preparation of some menu items, and the time equipment was used. Emphasis in some studies was on the tasks involved (David, 1978).

To investigate the feasibility of using productivity measurement techniques to control labor time in food production, data during the production of seventeen menu items in two hospitals were recorded using a continuous time technique (Stumpf, 1957). The tasks were classified as skilled or unskilled; this made it possible to reassign some to the less skilled employees and ultimately reduce labor costs of production.

To determine the need for and location of power mixers, the time of use, mixer capacity, time of day used, and percentage of total production time the mixers were used was recorded in eight foodservice units using continuous stop watch time study (Price, 1960). The data provided information which eliminated duplication of equipment and avoided production delays. The need for classifying skills for better job specifications was indicated so that skilled personnel were involved in tasks requiring only the special skills for which they were being hired, which improved productivity.

During an observation period of nine months, a continuous time study of 100 employees in a hospital was conducted. The activities were classified into eight general areas. The high percentage of nonproductive time was the major concern (Coffey, Spragg, McCune, and Gordon, 1964).

Using time and motion techniques, the tasks involved in quantity production of roast beef sandwiches were analyzed by dividing the tasks into work elements (Smith, 1972). Standard times were determined for each element and each task. These elemental times were used to evaluate present and proposed work methods, standardize procedures and techniques, predict production times, and give a quantitative basis for more productive scheduling of personnel and equipment.

In another study, labor time estimates were established for the performance of fifty-four food production tasks involved in the preparation of four menu items (Lebeau, 1974). Estimates were derived from a repetitive stop watch time study and conceptual estimate procedure. The time required to prepare twenty-one different salads and to service a salad bar in a residence hall foodservice was analyzed to provide basic data for developing a model for salad department activities (Hauge, 1975). The main increase in food production time was not directly related to an increase in the quantity prepared.

The Enhanced Productivity Program (Campbell, 1985) was based on an organizational audit of a dietary department by a foodservice consultant. The objective of the program was to enhance departmental productivity by increasing personnel efficiency through work simplification and work organization principles while maintaining quality standards. The program was structured by a task-oriented program schedule that identified tasks to be completed. A comprehensive work plan

was developed for each task. Time and motion studies carried out before and after implementation of program changes demonstrated a savings of 9.27 labor hours per day. Trayline speed increased from 1.7 trays to 3 trays per minute. Improved personnel efficiency allowed an 11 percent growth in meal volume in six months, thus improving departmental productivity.

In a recent study, researchers outlined the procedures for utilizing the servings produced per labor hour measure to determine actual labor needs when operating under the "offer versus serve" concept in forty elementary and secondary schools (Mayo and Olsen, 1987). The food-servings-produced-per-labor-hour measure can be used as a productivity standard, since it can reflect adequately the "offer versus serve" concept. Therefore, the food-serving-produced-per-labor-hour measure can be utilized to forecast basic labor needs.

Predetermined Motion Time Techniques

Activity analyses provide basic data and methodology for further studies using predetermined motion time techniques. Predetermined motion time is a technique in which tasks are broken down into basic motions for which normal time values have been determined. The purpose of this system is to establish cycle time for a specific operation without physically performing the task (David, 1978). These systems contain a series of tables that identify the basic motions used to do work, describe the specific nature of the motions and the conditions under which they occur, and provide a standard time value required for the normal performance of each motion. Methods-Time-Measurement (MTM), a type of predetermined motion time, is widely used in industry but is time consuming and usually not

applicable to long-cycle work and work with limited repetition such as that found in foodservice operations. Crossan and Nance (1972) developed an alternate predetermined motion time technique, Master Standard Data (MSD), as an economic approach to productivity measurement. A basic feature of this technique is the development of an alpha-mnemonic code which combines seven basic elements of work into larger, more condensed elements identified by the code.

Montag et al. (1964) applied the MSD system to small-scale food production and suggested the method was applicable for developing coded standard data elements with universal application in foodservice operations. Since it is necessary to resort to time study to determine process time, MSD needs to be used in conjunction with time study until standard data for process times have been developed (Montag et al., 1964). Methods-Time-Measurement also was applied to develop normal entree service times compared with stop watch time study (Beach and Ostenso, 1969). Application of predetermined motion time systems forces careful analysis of the tasks with emphasis on method; therefore, methods improvement is more likely to occur using one of those systems rather than stop watch studies to determine normal production or service time. Using similar methodology, processing times of selected quantity food production formulas were studied to develop standard times for variables including number of servings, pan size, and personnel (Connelly, 1972). The time required to prepare the processing steps varied with the number of servings and cooks. Specific standard times for the variables were established. Success in setting time standards for recipe processing steps was found to be dependent on standardized recipes and correct work methods which are defined and practiced.

Basic labor productivity measures for popular breakfast menu items have been developed using the Universal Standard Data system developed by H.B. Maynard (David, 1978, p. 9). The time values in the study were based on the best method found to produce a specific menu item at a well-designed and equipped work station. This was done by analyzing and selecting the best production method (Freshwater, 1975).

Waldvogal and Ostenso (1977a) used MSD to develop a structural framework for a standard code based on activities in producing single-item entrées where preparation required individual handling of each portion. The code was developed and verified by a stop-watch time study. Three formulas for entrées were analyzed and divided into basic elements of production. From the time required for each basic element in the recipe, the production time required for preparation of 100 portions of each entrée was synthesized. Differences between synthesized time of entrées determined by applying MSD and stop watch techniques were within acceptable limits. The MSD quantity food production code was considered valid and reliable and was suggested for use as a structural framework for establishing a universal data code applicable to all aspects of quantity food production. Further studies are needed to determine and optimize the relationship between time per motion and total volume produced for each menu item (Waldvogel and Ostenso, 1977b).

Zemel and Matthews (1982) used MSD times to simulate the effect of increased production volumes on labor time required for production. The MSD times were developed during a 15-year period of research. If continued cooperative research on the application of MSD to develop universal codes for the foodservice

industry were done, it could make a major contribution toward increasing productivity through the use of standard procedures and times (Zemel and Matthews, 1982). Managers could use the information developed to determine the amount of time it would take to prepare every item on a menu.

Work Sampling

Work sampling provides a simple and effective way to measure working and nonworking time of people employed in direct and indirect activities and to measure operating time and down time of equipment. The technique is based upon the law of probability which states that the characteristics of random samples of a group tend to resemble the characteristics of the whole group if the sample is large enough (Mundel, 1970). The method usually involves making randomly spaced, instantaneous observations over a specified period, such as seven days of full-time operation.

The method used and the approach to work sampling in foodservice operations vary according to the objectives of the analysis. Work sampling has been done to obtain productivity data about the utilization of scheduled labor time in different types of foodservice systems (David, 1978). The sample can include all dietary personnel, either the professional or support staff, groups in one area of activity, or individual positions. For productivity studies, the classification of activities has progressed through the years from three major functions to twenty or more subdivisions of direct labor, indirect labor, and delay time. For each of these major groups of activities, specific tasks have been defined and coded (Institution Management Lab, 1967).

Early work sampling studies analyzed the time individual personnel in specific positions spent in certain classified activities. One of the first reported studies used random ratio-delay to survey activities of student personnel in two similar residence halls and to determine why the labor time differed for similar tasks (Wilson, 1956). Activities were divided into five homogenous task groups and a re-evaluation of the job assignments was recommended. Equipment, layout, and degree of training were believed to have influenced the difference in labor time.

Using a combination of survey and in-depth analysis, Tuthill and Donaldson (1956) measured productivity of hospital foodservice workers in 10 Wisconsin hospitals. Hospitals were grouped according to the number of beds based on the premise that hospital foodservices of similar size would experience similar problems. Tasks performed by employees were classified as production, service, cleaning, or miscellaneous. The percent of time spent in each type of task was calculated. On an average, less than one-third of total labor time was spent in food distribution and patient services and one-fifth of total labor time for food production.

Halter and Donaldson (1957) analyzed per meal labor time for 838 short-term care hospitals in the East North Central region of the United States. Hospitals were classified according to bed capacity or type of ownership. A survey was used to collect the required data. Total labor time and direct labor time were calculated. Labor time was the input variable and the daily average meal count was the output variable. Labor time and direct labor time per meal were determined. The direct labor time per meal ranged from 3.5 to 29.6 minutes for the various classifications of hospitals. Analysis of variance showed no significant differences in labor

minutes per meal among the hospitals on the basis of bed capacity, type of ownerships or total meals served daily.

Kroener and Donaldson (1958) analyzed the labor time per meal for Type A school lunch programs in Wisconsin. A survey was conducted to collect data on the number of hours worked by each employee in school lunch production. The time required to produce a meal ranged from 2.69 to 16.52 minutes with a mean of 7.16 minutes. Thirty percent of the foodservices produced meals in less than the mean minus one standard deviation while 16.4% needed more than the mean plus one standard deviation.

The activities of management personnel have been analyzed using work sampling. Johnson (1960) developed a work sampling technique for classifying and analyzing the management activities of dietitians and food production personnel who performed at the middle management level. Activities were classified as planning, organizing, controlling, procurement, conference, and evaluation. During the study, time spent in direct labor, personal time, and delays also were recorded. Individuals were observed at intervals for one month; this was considered a representative cycle time for management personnel. The distribution of tasks for each of the activities varied according to the type of foodservice operation. Statistical evaluation of the findings in relation to the experimental design and procedure indicated work sampling to be a feasible technique for analyzing management activities.

Activities of three managers in a college foodservice were classified from more than 1,000 observations made over a 28-day period (Sanford, 1964). Managers differed in their emphasis on various categories of work. Later this study was repeated in the same unit to identify changes in managerial activities (Rojas,

1968). Some changes were attributed to changes in job description and reassignment of tasks for better personnel utilization.

In 1961, a work sampling study was initiated to classify functional areas and operations in hospital dietary departments, to measure the productivity of personnel, and to establish and define normal performance standards (Ostenso and Donaldson, 1966). Twenty hospitals in Wisconsin with similar organizational characteristics were included in the sample. After a pilot study using continuous time observation, all activities involved in the production and distribution of food were classified into twenty functions. A methodology manual for work sampling was developed and has been used as the basis for several subsequent studies in hospitals and modified for use in other foodservice operations (Institution Management Lab, 1967). A unique feature of this methodology was group observations using the Greds theory to assure random sampling of personnel working in departments with large areas and with more than twenty personnel (Halsey, 1960). Gred is a term used to describe geographically variable sized areas with a uniform number of workers. The manual also includes the definition of twenty work activities, for each activity, coded tasks for recording observations to determine how time for each activity is described.

Williams and Donaldson (1969) used a management evaluation system to determine the utilization efficiency of resources within a foodservice department. Work sampling was used to determine the percent of time in which dietary employees were involved in direct, indirect, and nonproductive activities. Performance ratings were used in combination with work sampling data to produce a performance index. Employees were rated in work groups for speed, tempo, and pace. Individual and group scores were calculated. Performance was expressed as

a percent of the standard expectancy. Work sampling and performance rating data were correlated with number of meals served, hours worked per day, labor and food costs, and food quality factors found in nine Wisconsin hospitals. The relationships were statistically significant ($p < .05$) for productive and non-productive work time, scheduled personnel hours, and number of meals served. Work sampling correlated with performance ratings revealed that as the number of meals served increased the percent of time required for direct labor increased proportionately.

Salad preparation activities were analyzed by Hague and Knickrehm (1979) in a residence hall foodservice. Over a three-month period, direct observation of one salad preparation employee was conducted during the preparation of eight types of salads. Only the time involved in direct salad preparation was included in the analysis. A linear regression model was used to determine the relationship between time needed for preparation and volume of salads produced. The results showed the more salads that needed to be prepared, the more preparation time required.

Yung et al. (1980) conducted a study of 14 nursing homes in Wisconsin to measure and to correlate variables identified as affecting the time required to produce a meal. Work sampling was used to collect data on minutes per meal equivalent served. Data from the 14 nursing homes were analyzed statistically. Mean total minutes per meal equivalent for three days of study in each home facility from 7.13 to 18.95; the mean was 11.25 minutes, with a standard deviation of 2.94. Based on analysis of variance, significant differences ($p < .01$) were found in total minutes per meal equivalent for direct work, indirect work, and delay time among foodservice systems. The ranges in labor minutes per meal equivalent

obtained from this study could serve as guides for comparing productivity in nursing homes with similar characteristics.

Regression analysis was used by Mayo and co-workers (1984) to analyze productivity of foodservice workers from 44 public schools in Richmond, Virginia. Six dependent variables and 12 independent variables were studied by stepwise multiple regression analysis. Significant findings indicated that the number of employees producing meals should be kept to a minimum; contingencies inherent in each operating unit affect the total amount of labor time used to produce meals; managers should have at least a two-year certificate of training; menu steps should be kept to a minimum, and the use of disposable ware may aid in keeping payroll cost at a controlled level.

The labor time each year (1973 through 1984) spent in foodservice activities in one hospital was analyzed by Matthews and co-workers (1986). Work sampling was used to determine the percent of time spent in direct work, indirect work, delays, and minutes of labor time per meal. Results showed that on the average 10 minutes were spent in direct work per meal, one minute for indirect work, and two minutes for delays. This was slightly different from the studies done in the 1960s showing that 11 minutes were spent in direct work per meal (Donaldson, 1967). Further analysis of the data showed that 10% of the time was spent in preparation, 14% in service, 29% in transportation, 15% in cleaning, and 10% in clerical activities.

Summary

To reduce the variables influencing work sampling data in the various sectors of the foodservice industry, more in-depth studies are needed to standardize similar work activities so that labor can be forecast for proposed alternate foodservice systems and evaluated before a new system is implemented.

Current literature indicates that the traditional concept of productivity is changing. Cromwell (1974) identified determination of a quality-constant definition of output as the major practical difficulty in measuring hospital productivity by departments. He indicated that more thought should be given to the definition of department output as well as the measurement of nonlabor inputs so that a total productivity index can be devised.

All foodservice operations have some similarities; but many within each type have unique differences. Each should establish its own standard of productivity based on past performance, ideal performance, and the current needs of the system. It is not possible to construct a general measure of productivity, since the outputs of organizations vary so greatly (Price, 1986).

Productivity measurement should continue in order to determine the level at which objectives are achieved (Ruf et al., 1975). Quantitative productivity standards, however, should not be the only index for measuring effectiveness of a foodservice operation (McDougall et al., 1989). At some point, increased productivity can be achieved only by sacrificing the quality of food and service. The foodservice manager needs to be cognizant of the productivity-quality relationship and optimize all aspects of productivity (Ruf and David, 1975).

Variables Affecting Productivity

Researchers reporting analyses of labor time expended per meal served in various types of foodservice operations have indicated that numerous factors influence the results obtained. Part of the reason why it is not possible to construct a general measure of productivity is that there are so many different variables affecting productivity. Tuthill and Donaldson (1956) compared data from 10 hospitals for the following factors that influence labor time in a dietary department: actual bed capacity, average census, number of employees, length of the work week, number of split shifts, type of service, use of selective menus, average number of therapeutic diets, and formula room service. No conclusions were drawn from these comparisons.

Halter and Donaldson (1957) reported results of a survey conducted by mailed questionnaires to a random sample of general short-term hospitals in the East North Central region of the United States. Data from 175 institutions were analyzed to determine whether there were significant differences in scheduled per meal labor time in the dietary departments. Several factors were found to influence labor time including percent of beds occupied, percent of patients on modified diets, length of work week and use of split shifts, service of coffee to personnel and guests, training of employees, and yearly turnover rate of employees. Based on these data, it was not possible to formulate conclusive statements regarding the effect of any one factor in increasing or decreasing total labor time per meal.

Returns of dietary department survey questionnaires from 225 hospitals were analyzed in a study conducted by Donaldson (1957). The reported range in total labor time per meal was 4.1 to 34.3 minutes. Certain assumptions about possible reasons for variation in labor time required for efficient management of the dietary department were tested by comparing the hospitals with high labor time to these with low labor time. A greater percentage of hospitals with high labor time reported a percentage occupancy lower than the 83% median of the 225 hospitals surveyed. A greater percentage of hospitals with high labor time used selective menus for all patients, served more than the median percent of modified diets of the hospitals surveyed, scheduled a 40-hour work week for a majority of personnel, provided coffee service for personnel and guests as well as formula room service, and conducted in-service training programs. In more hospitals with low labor time, straight shifts were scheduled for personnel, turnover rates were higher than the median, and tray service and some housekeeping duties were provided by nondietary personnel.

Dayton and Hitchcock (1965) identified some of the factors which determine the number of employees needed and the use of labor time in a school foodservice. These factors included type of menu, relationship of volume of food to time and place needed, training, supervision, scheduling, capabilities of personnel, selection and purchasing of food and food products to be used, adequacy of equipment as to size and placement for use, and design and layout of the foodservice.

Kotschevar, Owens, and Saylor (1971) suggested that differences in labor minutes per meal served or the number of meals served per labor-hour for

different types of foodservices are primarily the result of the amount of service given with each meal. The number of meals served, operational conditions, and the time of service were suggested to be contributing factors.

Brown (1972) identified the following variables as initially having a direct influence on the labor time expended in a nursing home foodservice department: use of labor-saving equipment, efficiency of kitchen layout for food production activities, work methods used by personnel in performing repetitive tasks, pace at which selected tasks were performed, labor demand of the menu served to patients on regular diets, scheduling of work and of personnel within the foodservice department, and use of the time scheduled in the foodservice department.

On the basis of work sampling observations about the distribution of labor time among various categories of food service activities in three nursing homes, other variables were added to the initial list of input variables affecting labor cost per day: policies, procedures, and expectations imposed by management; regulations imposed by external forces; and motivation of the worker. Examples of policies, procedures, and expectations of management would include the definition of duties and responsibilities for providing food and services within the nursing home, specific guidelines to follow relative to how certain foodservice activities are to be performed, and expectations for quantity of output of food and services reflected in the work schedule and policies related to overtime work. Policies and procedures would be expected to affect the flexibility of the foodservice department in adapting to change. Examples of rules and regulations imposed by external forces would include the length of time that is permitted to elapse between meal periods, particularly between the last period of foodservice in

the evening and the first in the morning. These regulations place certain constraints upon the foodservice system that may or may not be subject to individual choice of compliance, as an example, the regulations applying to those nursing homes participating in specific healthcare programs (Brown, 1972).

Initially Brown (1972) selected variables for analysis which were considered to reflect conditions or situations present in a nursing home. For example, it was assumed that work methods or pace of the worker would reflect skills of the worker, training, and supervision. In this study, no attempt was made to measure the motivation of workers. It seemed apparent to Brown (1972) that to work efficiently, some incentive was needed. When the time allotted to perform assigned tasks is generous, there is little incentive to perform the task in a manner that will take less than the allotted time. It is possible that by increasing productivity, a reduction in labor time could be initiated which permits greater remuneration to employees and at the same time results in a reduced labor cost per meal. Brown (1972) felt that too specialized assignments might contribute to an unwillingness to assist others when assistance is needed, because one does not feel it should be expected. A desirable attitude would be that of a team working toward common objectives, so there is a willingness to assist others in the performance of tasks as needed to accomplish these objectives. When conditions affecting the foodservice department cannot be controlled within the department and departmental activities depend upon close cooperation with other departments in the nursing home, the incentive to work efficiently must extend to the cooperating groups. For example, when delivery of meals is a task assigned to non-foodservice personnel, efficient serving procedures in the foodservice

department will be promoted by an efficient system for distribution of meals by the other personnel. Otherwise, delays, interruptions, and slow pace resulting from a lack of coordination will defeat efforts to improve the work methods used and to increase the performance speed of foodservice personnel in serving meals. When effective arrangements cannot be devised because of conditions existing in the nursing home, this situation must be recognized by management and expectations for the foodservice department adjusted accordingly.

Ruf and David (1975), through a review of the literature, identified 27 variables assumed to influence the direction and extent of productivity in hospital foodservice systems. These factors were classified as human resources, operational decisions, facilities, materials, and policy decisions.

Human resource variables included age, race, and sex of personnel; tenure; percentage of full-time employees; turnover and absenteeism rates; home responsibilities; supervisory type; group cohesiveness; and customer satisfaction. Operational decisions included food costs, wages, and fringe benefits. Facility variables included transportation distance and size of unit. The only variable measure for materials was the form of food purchased. Policy decision variables included the non-patient meal ratio, modified meal ratio, number of menu items, number of diet modifications, hours of service, number of functions performed, degree of routinization, degree of delegation, span of control, training, and perceived promotion opportunities (Ruf and David, 1975). Correlation analysis provided confirmation of a linear relationship between the variables quantity of meals, quality of meals, employee satisfaction, and productivity in 25 hospital foodservice systems.

Increases in three of the human resource variables, percentage of full-time employees, tenure under one year, and customer satisfaction, were associated with decreased quantities of meals served. The influence of the percentage of full-time employees might have been a reflection of a more highly educated secondary or part-time labor force in this study. Most hospitals recruited from nearby colleges for part-time employees. A greater flexibility in scheduling also might be responsible for this trend, because part-time employees could be scheduled to meet increasing or decreasing patient census more readily than primary workers, who work at least 35 hours per week. The effect of the ratio of employees with less than one year's tenure might reflect the amount of training and orientation required for new employees, thus decreasing meal output. The effect of consumer satisfaction might be caused by personnel taking time to socialize with customers, increased hours of service, or more individualized service provided to the customer (Ruf and David, 1975).

Three operation decision variables affected the quantity of meals served. Increased food costs were associated with a decrease in meals per labor-hour. As starting wage and mode wage rates increased, meals per labor-hour increased. When more ready-to-serve foods were used, an increase in the meals per labor-hour was significant ($p < .05$) (Ruf and David, 1975).

Two policy decision variables affected the quantity of meals served. An increase in the routinization index, meaning a greater degree of routinization, cause a decrease in meals per labor-hour. Most management philosophies imply that routinization or standardization will result in more effective utilization of time. Two factors might account for this discrepancy: routinization of substandard

practices would not decrease labor time, and, although an institution had specified that tasks noted on the questionnaire were standardized, varying degrees of routinization were noted by the researchers. A more sophisticated measure of these differences would be required to determine relationships (Ruf and David, 1975).

As the number of diet modifications increased, quantitative output increased as a possible by-product of necessity. As more diet modifications were made, menus were adapted so that they were applicable for as many special diets as possible; with fewer modifications, more individual attention was given to each modification.

Johnson et al. (1980) conducted a study of fourteen nursing homes in Wisconsin which involved identification, measurement, and correlation of variables assumed to affect labor minutes per meal equivalent served in each facility. The following variables caused productivity to increase as the value of the variable increased: ratio of number of residents to full-time equivalent positions, turnover, and meal equivalents. This relationship is influenced by staffing and scheduling policies used in nursing homes, type of menus offered, market form of food purchased, and responsibilities of foodservice employees. The number of residents served by a full-time equivalent worker ranged from 10 to 21 with a mean of 14.

Turnover increased labor productivity in that new employees were more motivated. Traditionally, turnover of employees has been regarded as an adverse factor affecting productivity. Yet, continual changes in the social, economical, political, and technological structure of society have made turnover of foodservice employees inevitable. Semi-annual turnover rates for all employees ranged from 0

percent to 64% with a mean of 28%. The higher turnover ratio of part-time employees (31.32%) compared with full-time employees (18.14%) was expected and supports the commonly held assumption that part-time employees have a shorter tenure.

The assumption that labor productivity increases as the number of meal equivalents served increases was supported in the 14 facilities. Since foodservice offered to employee and guests was minimal, total meal equivalents represented meals served mainly to residents. Mean total meal equivalents for the three days of the study was 922 with a range of 714 to 1,131.

The ratio of the number of employees to one full-time equivalent position and labor hours caused productivity to decrease as the value of the variable increased. As the number of employees required to fill one full-time position increased, labor productivity decreased. Thus, when more part-time workers were employed in the facilities, labor productivity was adversely affected. Most part-time workers were high school students who may have been less motivated and have had less skill than full-time employees. Scheduling part-time employees to attend in-service education sessions was difficult because high school students usually worked during late afternoon and evening hours. Since foodservice supervisors usually worked morning and early afternoon hours, these part-time employees received less supervision than did full-time employees.

The number of employees to full-time equivalent position ratio ranged from 1.06 to 1.50 because nursing homes used different policies for employing part-time workers. The mean percentage showed that, on the average, the number of employees was 25% more than the number of full-time equivalent positions in the

14 homes. For example, some combination of ten full- and part-time employees was necessary to staff eight full-time equivalent positions.

A significant relationship ($p < .01$) was found between labor hours and productivity. Total labor hours for the three days of study ranged from about 110 to 225 with a mean of 169 hours. Number of labor hours worked was dependent upon employees' training and efficiency, staffing and scheduling policies used in facilities, number of meal equivalents served, market form of food purchased, and type of menu offered to residents.

The wide ranges found in variables assumed to affect operations indicate that unique and individual differences existed among foodservice in nursing homes although organizational characteristics were similar. Productivity appears to be related more to management policies and procedures in individual homes such as method of scheduling personnel; standards of practice set by management; volume of meals produced and served by foodservice employees; and amount of training and work methods of employees, rather than to other variables in the operation.

Mayo et al. (1984) conducted a study to estimate the relative degree of importance selected variables had for various measures of productivity. The authors hypothesized that the following variables would affect productivity: adequacy of equipment capacities, facility layout and design, number of menu items, extent of menu preparations, employees' skills, educational level achieved by employees, rate of absenteeism, time constraints inherent in each operating unit, number of employees available to produce meals, managerial performance, education or training of managers, and the use of reusable ware versus the use of disposable ware.

A model was developed to empirically test the hypothesized impact of each of the aforementioned variables on six measures of productivity: meals produced per labor hour, meals served per labor hour, servings produced per labor hour, payroll cost per meal produced, payroll cost per meal served, and payroll cost per serving produced. Servings produced per labor hour emerged as the best criterion for productivity measurement. The predictive variables that yielded higher servings produced per labor hour values were: lower labor hour percentages, fewer menu steps, more menu items, fewer employees, lower educational level achieved by employees, lower managerial performance, lower employee skill scores, and use of disposable ware.

Four variables significantly ($p < .05$) influenced all of the productivity ratios. They were lower labor hour percentages, fewer menu steps, high managerial training scores, and increased use of disposable ware. Three predictors influenced five of the six productivity measures, i.e. number of employees, managerial performance, and employee skills. The variables which had little effect on productivity included: use of reusable ware, rate of absenteeism, and equipment capacity. Mayo et al. (1984) felt that many of the variables identified as influencing productivity in this research environment influence productivity in other environments as well, in different degrees. Thus, the variables and the techniques used to measure them have applicability beyond the sample studied.

Matthews, Zardain, and Mahaffey (1986) studied labor time spent in foodservice activities in one hospital over a 12-year period. On the basis of observations in the foodservice department and variables determined by other investigators, major factors affecting time workers spent in different activities were

identified. The following factors, in descending order, were thought to have the greatest effect on the labor minutes per meal equivalent in the hospital studied:

1. Methods of scheduling work for foodservice employees. Fewer patients require fewer hospital employees. Reducing labor hours when patient census is low was found to be a good practice.
2. Number of menu items offered, prepared, and served per meal. The more variety in the menu, the more labor minutes required for the meal.
3. Policies, procedures, and standards of practice established by management. The more formal training employees had the greater the productivity.
4. Types of foodservice provided (patients, cafeteria, and catering). The more services provided, the more labor hours required.

Additionally, the number and type of functions performed by the foodservice operation have an impact on labor minutes per meal equivalent. For example, when the foodservice department is responsible for purchasing and receiving; accounting; cleaning and sanitation; personnel processing; food preparation, production, assembly, and distribution; patient and non-patient meal services; research; and education and training of foodservice employees, inpatients, and outpatients, then the number of employees needed in the foodservice increases.

Murray and Upton (1988) studied the relationship between quantitative labor productivity and variations in such factors as number of beds, staff turnover, and use of convenience foods. Thirty factors were tested in a sample of ten public general hospitals in Ontario. Outputs of the hospital foodservice departments were

separated into two components: goods and services, which were evaluated against the labor required to produce them, given the variations in selected factors. Four of the thirty variables tested against the output of goods collectively explained forty-eight percent of the variation in meals per day produced per labor hour. The four variables were: unionized staff, number of beds, percent patient meals per day of total meals per day, and percent part-time hours of total hours worked.

Lieux and Winkler (1989) observed foodservice activities for three days in three senior centers. These researchers found that productivity varied with the number of meals served. Average productivity ranged from 12.95 to 19.30 labor minutes per meal.

Summary

There were several factors consistently found to influence productivity across all the studies reviewed in this section. Variables consistently reported as positively affecting productivity were: percent of full-time employees, number of modified diets, use of selective menu, volume of meals produced, training of employees, and the use of ready-to-serve foods.

Knowledge of factors affecting time that foodservice employees spend in work activities would allow dietitians and foodservice directors to understand fluctuations in productivity better. With such information, and on the basis of organizational objectives, available resources, and operating constraints, managers should be able to establish more realistic performance standards for labor time in hospital foodservice departments.

Quality

Definitions of Quality

Competition among healthcare institutions continues to minimize price differentiation. Quality is now becoming the differentiating factor when one chooses where to obtain services (Baker, 1988). The question is how to provide the highest quality service at the lowest possible cost. To answer that question, the term quality must be defined.

Food Quality

After completing a survey among dietitians to obtain a definition of quality food, McCune (1960) reported that she was convinced that everyone has a somewhat different standard. McCune (1960) listed four criteria used by individuals in judging quality food: grade of ingredients, appearance, taste, and texture. Ingredients of high quality must be the starting point. Quality food should look and taste good.

Ellis (1961) defined quality as an aspect, attribute, characteristic, or fundamental dimension of experience, which involves variation in kind rather than degree. It is the composite of those characteristics that differentiates among individual factors of the product and has significance in determining the degree of acceptability of that factor by the user.

Miller (1964) defined quality food as superior food with a top degree of excellence. She reported that the attainment of a quality product is dependent on the following:

1. a systematic production plan, in which quality is controlled during the production process.

2. quality people, who are well trained and well informed on quality, standards, procedures, and methods.

3. quality management which assumes the responsibility of a total quality program of training, organizing, climatizing, deciding, leading, and controlling.

Many individuals and groups have attempted to define quality food and the conditions necessary to attain high quality (Deisenroth, 1967). Food quality has been described in terms of food production, that is, the attitude of the worker, the manner of preparation of each food item, and the manner to which the food is served to the patron. It has likewise been defined in terms of specific characteristics, such as flavor and tenderness, which can be assessed by sensory evaluation (Deisenroth, 1967).

The American Hospital Association (A.H.A.) (1975) defined quality as the extent to which important characteristics of a product or service conform to specified standards. A desired level of quality is achieved by identifying characteristics that determine quality and performing activities in such a way that units of product or service conform to standards established for these characteristics. Clearly defined and understandable standards of quality should be put in writing and made available to those who are expected to accomplish them. Two considerations are very important in defining quality standards. First, the characteristics selected must be important in relation to quality. Second, it must be possible to make consistent decisions as to whether or not a unit of product or service actually meets the standards. If these requirements are not met, an

inspection program can be a source of discontent rather than an aid to improvement.

Thorner and Manning, (1976) defined quality as the standard to which all steps of the foodservice operation must, of necessity, conform in order to ensure that changes in a food's characteristics do not take place. The word "quality", with reference to foodservice, has many significant meanings and interpretations. The average consumer associates quality with personal preferences, as something that is liked, disliked, excellent, superior, great, or good. These descriptions are both subjective and abstract. Many factors influence the consumer's decision, such as habit, locality, ethnic characteristics, advertising "gimmicked" sales promotions, and price. In addition to these psychological factors, positive sensory stimulation plays an important role in establishing quality parameters. These include an appealing flavor, a pleasing mouthfeel or texture, an attractive natural color or appearance, general palatability, product consistency, and, to many consumers, the nutritional value of the food. Additional factors that determine consumer quality preferences are the ambience or character of the foodservice operation, the type and efficiency of the service, plating methods, and cleanliness. These contribute to mood appeal and have a decided effect on the consumer's final determination of quality.

From a scientific standpoint, quality can be defined as an orderly classification of a product's chemical and physical characteristics. Flavor, texture, appearance, consistency, palatability, nutritional value, safety, ease of handling, convenience, storage, stability, and packaging are the essential elements that must be evaluated in establishing a product's quality.

It is interesting to note the dictionary definition of quality as a characteristic, an attribute of something, a property or feature, or the degree of excellence or a product or thing (Webster's Ninth New Collegiate Dictionary, 1986). Regardless of the exact definition, there are two dominant factors in the evaluation of quality: the actual physical measurements of the product, and the acceptance of the product by consumers based on whether it will fulfill their "wants" with complete satisfaction.

Crosby (1979) defined quality as, conformance to requirements. When all criteria are defined and explained, then the measurement of quality is possible and practical. Requirements must be clearly stated so that they cannot be misunderstood. Measurements are then taken continually to determine conformance to those requirements. The nonconformance detected is considered the absence of quality. Quality problems become nonconformance problems, and quality becomes definable.

Service Quality

There are two elements relative to the quality of service: customer reactions and human relations (Traynham, 1966). Farrell (1963) stated that customer satisfaction was the most important objective of interpersonal communications in foodservice establishments. Interpersonal communications determine customer satisfaction and directly affect profitability, and that the ultimate point for measuring effectiveness of communications in table service establishments is the customer.

Farrell (1963) conducted a study over a period of two years at Michigan State University. He surveyed, observed, and interviewed 1300 customers, 130

supervisors, and 215 waiters in 35 hotel dining rooms and coffee shops and in 50 restaurants in the midwest and east coast area. All of the customers in his study were asked to indicate desirable service characteristics, 99% of the responses indicated neatness; 94%, attentiveness; 93%, promptness; 87%, interest; 76%, friendliness; and 75%, competence. His study suggested that customers evaluated foodservice establishments by the service people rather than by the food. The direction and degree of satisfaction by the customers were generally uniform in most establishments. Farrell (1963) concluded that improvements in communications and customer satisfaction could be achieved only when servers had a clear perception of their role.

Adam, Hershauer, and Ruch, (1981) defined quality as the degree to which a product or service conforms to a set of predetermined standards related to the characteristics that determine its value in the marketplace and its performance of the function for which it was designed. Quality is measured primarily by consumer complaints, the attitudes of consumers, observation, or the subjective assessment of the producer.

Townsend (1986) stated that there are two distinct types of quality: quality in fact and quality in perception. The provider of goods or services who performs up to its own specifications achieves quality in fact. Quality in perception is the subjective quality as the consumer sees it. For sustained success, close attention must be paid to achieving both aspects of quality.

Martin (1986) explained four basic factors which apply to the customer's judgment of a foodservice operation: product quality, price-value relationship, surroundings, and service. These factors are interdependent in producing customer

satisfaction. Service has two distinct components: procedure and conviviality. Procedure encompasses the systems and mechanisms for selling and distributing products to customers. Conviviality embodies attitudes, behaviors, and verbal skills that the service person and other employees display in their interaction with customers. Conviviality is provided when employees show a genuine personal interest in customers. Such interest is displayed when employees are friendly, courteous, and enthusiastic; they show they appreciate their customer's patronage; they are knowledgeable about the products they are selling; they use sales techniques tactfully and effectively; and they strive to meet each customer's unique expectations for quality service.

Pickworth (1987) believes quality should be defined in terms of customer expectations. If a customer expects immediate service and he receives it, he will perceive the quality of service to be good. Also quality control should focus on prevention rather than inspection. Most traditional quality-control activities have emphasized inspection - rejecting poorly prepared foods after cooking. This type of quality control produces a waste of materials and supervisor's and cook's time. A preventive approach would emphasize the creation of standardized recipes that increase the likelihood of the food being cooked properly each time. In short, quality should be built in, not an afterthought.

It is important to determine the customer's expectations before new programs or services are developed (McDougall, et al. 1989). Customer's perceptions of service quality result from comparisons of their expectations before they receive the service to their actual experience with a service. Service quality is judged on the basis of whether or not it met expectations.

Quality requires commitment from upper level management. Quality involves more than developing and implementing a quality-improvement program or building quality standards into the delivery of service. Quality involves a lasting commitment and a company-wide effort, a far-reaching approach that has been called "total quality control" (Crosby, 1979).

Quality shows during the service encounter. A successful service encounter requires customer-oriented employees who are aware of customer's needs and can satisfy them. Such employees are able to seize opportunities to enhance the customer's perceptions of the service. Customer-oriented employees are committed to the customer and the organization, not just themselves. The way the service is performed can be a crucial component of the service from the consumer's point of view (McDougall et al., 1989). Quality assurance programs need to be supplemented by an assurance of quality behavior (Martin, 1986).

Summary

Because the dietary department of a healthcare facility produces and serves many different types of menu items daily, often in very small quantities for the special diets of patients, a quality control program should be implemented by managers in every healthcare facility. Scientific data on the quality of menu items prepared and served in health care foodservice systems are limited. In general, little attention has been given to developing and implementing food quality management programs in healthcare foodservice facilities. Most hospitals in the United States are small, with fewer than 200 beds and are not staffed to do research. In many of the studies about the operation of foodservice departments researchers have

considered only quantitative data, such as number of meals served, as an appropriate measure of output without an evaluation of the quality of food and service, or acceptability to the consumer. Costs of operation are related both to the quantity and quality of goods and services purchased as inputs and to the quantity and quality of goods and services provided as outputs. To evaluate the effectiveness of a foodservice system, consideration should be given to the determination of costs, the number of meals, and the standard of quality of goods and services.

Foodservice managers are responsible for the quality of food and service their facility provides. In order to operate effectively and produce quality food and service, measurements must be taken on a consistent basis.

Quality Measurement

There are many techniques available for measuring the quality of food and service in foodservice operations. By comparing actual performance against predetermined objectives, management establishes control over departmental operations and identifies weak areas (Matthews, 1982).

Service Quality Measurement

Glover (1987) reported that departments concerned with personnel and service management are generally those where measurement is particularly lacking. This is a result of the low priority management often assigned to measurement in these areas, the absence of clearly developed goals, and inability to delegate responsibilities. In particular, many managers dismiss the idea of measuring quality by reporting the commonly shared idea that "you can't measure service because it's

intangible" (Glover, 1987, p. 16). Service is a real social event between the employee and the customer. Its quality can be observed and documented through guest focus groups and guest feedback. In a healthcare environment, service means that patients should receive their meals on time, regardless of diet changes, transfers, or new admissions. Department phones should be answered promptly and courteously. Cafeteria workers should be polite and attentive (Burns, 1987).

Martenay and Ohlsen (1964) developed appropriate questionnaires to measure the extent to which the dietary department staff met its responsibility of satisfying both patients and house staff. One hundred patients were selected randomly for interviews from those who had been served a minimum of two meals in the hospital and who were eating a regular diet. Data on age, sex, length of hospital stay, diagnosis, and diet were obtained from the patient's chart before the interview. Interviews were scheduled before 11 o'clock in the morning and were made by an experienced clerk. Questionnaires were sent to the medical staff by U.S. mail with an explanatory letter and self-addressed stamped envelope. Identification, except for department and whether the person completing the questionnaire was staff, resident, or intern, was not requested. The questionnaire was sent to the medical staff of 302.

Patients' responses during the interviews were generally those expected by the researchers: more male than female patients felt the portions were too small; however, over half the patients thought the portions were just right. One-third of the patients complained about the temperature of food when served to their bedside. New food carts and small packages for individual items were tested to help solve the temperature problem.

Fifty-six percent of the medical staff responded. The responses of the doctors was generally what was expected by the researchers. Some (two percent) physicians who felt the patient's food was tasteless, of poor variety, and sometimes served unattractively.

In regard to hospital cafeteria service, the medical staff responses were those generally expected in a foodservice with mass production. The majority responded favorably about temperature of food, seasoning, and service. The most negative responses concerned variety.

In general, patients and the medical staff accepted and appeared to enjoy the food. For this study, a measure of what was good could only be inferred from patient and doctor contacts; however, the department frequently received comments from returning patients regarding the continued improvement of the food served.

Traynham (1966) developed an evaluation instrument to assess the quality of service in restaurants to give a quantitative score to service in a particular establishment. Throughout the study, it was assumed that service should reflect practices indicative of acceptable standards of public health, interests of restaurant management, and desires of the patron. Three aspects of service were studied: customer enjoyment, sanitation, and speed of service. Forty-five items, selected from three aspects of service, were combined to form one evaluation instrument. The results of the evaluation supported the hypothesis that the quality of restaurant service varies from one time to another.

Ruf and David (1975) measured quality of the foodservice in 25 hospitals for the characteristics, appearance, taste, texture, and temperature of the final product evaluated in assembly and in service lines. Service measures included appearance

and accuracy of the tray when it reached the patient. Housekeeping and sanitation were measured by evaluating cleanliness, operational status, orderliness of equipment area, and personnel. The total quality score possible was 100. There was extensive variance in quality among hospitals in the study. The mean was considerably lower than the range of 90-100 recommended as the control limits for quality standards. Major problems noted were temperature control, missed items on trays, and delay in service from nurses' stations to the patient.

Allington, Matthews, and Johnson, (1981) developed quality measures for food preparation, foodservice, sanitation, and safety. Methods for quality assessment involved evaluating ten characteristics of quality in food and service provided in 14 nursing homes. Food preparation encompassed the appearance, taste, texture, and temperature of food. The characteristics in service were meal appearance, meal accuracy, delivery or service times, and sanitation and safety. The assessment involved an evaluation of equipment, kitchen areas, and foodservice personnel. In the evaluation process each of the ten characteristics were rated as satisfactory or unsatisfactory according to predefined criteria. The number of satisfactory ratings was calculated as a percentage of the total number of ratings given the characteristic. Each percentage satisfactory rating was weighted using an index conversion chart. Then, conversion numbers for all ten characteristics were summed to yield an overall quality index. This index was used to assess the quality of the foodservice operation over a period of time or to compare the quality of meals from one foodservice operation to another.

A range of 32 to 42 menu items were evaluated in each nursing home for appearance, flavor, texture, and between 45 and 77 menu items were evaluated for

temperatures. The number of unsatisfactory ratings for appearance, flavor, and texture of menu items was minor when compared to the number of ratings for inadequate temperatures of menu items during assembly of meals and at point of consumption. Reasons for inadequate temperatures included: food was not heated to proper temperatures before service, hot-holding tables were not preheated; serving dishes were not preheated; heated delivery carts were not used; and serving and delivery periods were longer than scheduled.

The number of satisfactory evaluations for delivery times of meal carts ranged from nine to 48 in the 14 nursing homes. None of the facilities received satisfactory ratings of 100% for actually meeting the scheduled delivery time of meals to resident areas and to dining rooms. Problems in meal delivery included shortage of personnel to deliver carts and unforeseen delays in meal preparation.

The majority of unsatisfactory ratings for preparation equipment was to due to grease, dust, dirt, and crumbs in and on ovens, ranges, griddles, and counters. Unsatisfactory ratings for transportation equipment were recorded because of soiled trays and meal carts. Storage equipment was rated as unsatisfactory because of food stains, crumbs, grease and dust on cabinets, shelves, and in refrigerators and freezers. Reasons for unsatisfactory ratings of sanitation equipment included lime deposits and dirt on dishmachine or dishmachine counters and uncovered trash containers. The most frequent reasons for unsatisfactory personal appearance ratings of employees were lack of hairnets or headcovers; employees wearing jewelry, and employees with long or polished fingernails.

Monitoring and improving the quality of meals should be implemented in every foodservice operation. Sensory quality of menu items should be evaluated by

foodservice personnel prior to service of the meal. Quality of meals, as demonstrated in this study, can affect the palatability of menu items that are prepared, transported, and served to customers.

Puckett, Boe, and Medved (1987) developed a systematic approach for monitoring and controlling the timeliness of late tray distribution and unreported distribution changes. This resulted in the reduction of disputes with nursing personnel regarding "lost" trays. Unreported patient meal distribution changes were researched for each patient unit as meals were served. The outcomes of this effort were a redesigned patient meal distribution system, improved communication with nursing services and administration, and reduced distribution problems.

Dowling and Cotner (1988) designed a monitoring system of tray assembly error rates to evaluate patient tray accuracy and to identify types of assembly errors. Data were collected during two morning, five noon, and five evening meals. Errors were classified according to type: omission, addition, or substitution. They were also classified by severity: error of convenience (not critical with respect to diet) or error of compliance (contradictory to diet order). Error rates were determined and compared by meal, weekday vs. weekend, and first half of assembly period vs. second half. An average error rate of 12.9% was calculated from the 6,553 trays studied, with error rates of 12.5%, 10.9%, and 15.1% for breakfast, lunch, and dinner, respectively. Evaluation of data revealed no significant difference in error rate by type of error, among meals, or between weekday and weekend. Only 2.7% of the trays had errors contradictory to the diet order. The error rate was significantly higher during the second half of the assembly period, and the highest error rates were observed for the evening meal. The methodology used in this

study serves as the basis for quality control monitoring and as a motivational tool to stimulate improved performance by trayline employees since customer's complaints about food temperatures are common concerns of foodservice managers.

Coop and Darling (1988) evaluated meals provided by a home-delivered meal program for five consecutive days in each of six years. In the evaluations, meals were compared with federal guidelines for meal pattern. In addition, serving size, temperature of hot food, and quality were evaluated. Meal pattern and serving size guidelines were not always met by the meals. Problems included no delivery of milk with the meals and variations in serving sizes for meat or meat alternate, fruit, vegetable, and dessert. Temperatures of hot foods were often much lower than the 140° to 150°F specified in food safety guidelines. Food preferences were fairly well satisfied.

Wong, Graff, and Hagan (1989) designed a study to identify and rank the quality indicators most important to hospital patients in providing meal satisfaction. The population studied were patients from the medical and surgical units at a state teaching hospital. The survey listed 15 quality indicators selected from the literature or of interest to the Foodservice Department. Patients were asked to rate each quality indicator from "extremely unimportant" to "extremely important" using an itemized rating scale. "Taste of food", "temperature of food", "opportunity to select foods from menu", "tenderness of meats", "receiving food as ordered", and "enough time allowed to eat" were the six most important indicators. "Use of disposable dishes and eating utensils", "attractiveness of dishes", and "bread with each meal" were the least important. Appearance and attractiveness of food were found to be less important than quality of food.

Product Quality Measurement

The nature of any system, including a foodservice system, is that every component is connected to every other. A change in any part of the system will have a "ripple effect" because that change will affect other parts of the system (Matthews, 1982). Loss of control of food quality in one subsystem of foodservice may result in a loss of control in other subsystems. Thus, control of the quality of menu items throughout the subsystems of production, assembly, distribution, and service is a primary objective of managers. Because the dietary department of a hospital produces and serves many different types of menu items daily, often in very small quantities for the special diets of patients, a food quality control program needs to be implemented by managers in every hospital facility.

Cardello (1982) described the major factors determining the affective response to food. These include its appearance, flavor, texture, and temperature. Appearance refers to those aspects of the food that are appreciated by the sense of sight. These include the color, light reflectance, size, and shape of the food. Flavor refers to the combined sensations of taste and smell, where taste is defined as the sensations resulting from stimulation of receptors on the tongue, palate, and pharynx - which results in the salty, sweet, sour, and bitter qualities - and where smell is defined as the sensations resulting from volatile compounds stimulating the receptors in the olfactory mucosa. Texture refers to the oral tactile sense and the perception of the mechanical, geometrical, and moisture properties of food in the mouth.

Lastly, temperature refers to oral-thermal sensations resulting from food that differs in temperature from the oral mucosa. All of these factors interact in complex ways to determine the acceptability of a particular product.

Deisenroth (1967) developed an evaluation instrument to assess the edibility and appearance of food. The instrument was designed for use in different types of foodservices and for a fixed or a selective menu. The food items chosen for evaluation were entrees, salads, and desserts, because it was observed that these food items were most likely to be chosen for a meal by a large number of people. Selection was made of quality characteristics which would be the basis for evaluating the chosen food items. A seven-point scale was selected to provide a sufficient range to reflect various levels of the characteristics scored. The evaluation instruments were used in two tests at 11 establishments. The general acceptability scores for the two tests were correlated with the total two scores based on three food items and their specific quality characteristics. The main correlation coefficient indicated that either the general acceptability score or total score may be used to determine the rating of food quality for a given food establishment. This quantitative score could be used as a quality indicator.

Bobeng and David (1977), as part of the Hazard Analysis Critical Control Point model, developed time-temperature standards to control food quality at critical process steps in conventional, cook-chill, and cook-freeze foodservice systems. These standards minimize the time that the temperature of entrees are in the zone of growth for microorganisms, 45°-140°F. These researchers recommended establishing time-temperature standards as a practical method for monitoring entree production in

hospital foodservice systems. If continuous time-temperature surveillance is implemented, data are available for immediate corrective action.

Johnson et al. (1980) measured the quality of food preparation, food service, food sanitation, and safety in 14 nursing homes in Wisconsin. Quality characteristics of one meal were evaluated at both dinner and supper meals in each nursing home for three days. Under three categories of food preparation, food service, and sanitation and safety, ten components of quality were rated. At the end of the three-day period in each nursing home, percent satisfactory ratings were calculated and a quality index was assigned to each of the ten characteristics.

Food preparation was evaluated by rating as satisfactory or unsatisfactory, the appearance, taste, texture, and temperature of meals. Temperature of food was recorded at assembly lines and at points of service to residents; actual temperatures were compared to recommended temperatures for different categories of food and then rated as satisfactory or unsatisfactory.

Food service was measured by evaluating the appearance and accuracy of meals served on trays to five residents in their living areas or meals served at five place settings in dining rooms. Delivery times for meal carts from kitchen to resident areas were rated satisfactory or unsatisfactory in accordance with meal delivery times established by the foodservice supervisor in each nursing home.

Sanitation and safety observations included: evaluating equipment for cleanliness, orderliness, and operating conditions; evaluating areas for cleanliness, and evaluating foodservice personnel for uniforms, caps or hairnets, aprons, hands, nails, skin, and hygiene. Each factor was rated satisfactory or unsatisfactory.

The range in the Quality Index for the fourteen nursing homes in this study was 69 to 90 with a median value of 84. The median of 84 is lower than the 90 to 100 range recommended as being the control limits for quality standards in hospital foodservices.

The median Quality Index for nursing homes in the low productivity group was seven points higher than the median for high productivity groups. In contrast, four facilities that obtained the lowest quality scores were in the high productivity group. Thus, facilities with higher scores for quality of meals tended to require more labor time for meal preparation and service. Data from this study emphasized the need for foodservice directors to evaluate labor productivity in relation to quality standards for meals produced and served in foodservice.

Brown, McKinley, Baltzer, and Opurum (1985) conducted a series of research studies to determine the temperature preferences of three age groups for a specific entree, ground beef in tomato sauce, at point of consumption and to measure the ability of each group to judge relative temperature accurately and to assign the same response consistently to a given temperature.

Data were collected from two sets of participants 20 to 59 years old. Product temperatures were tasted at 120°, 130°, and 140°F in Experiment A; and 130°, 140°, and 150° in Experiment B. The younger adults preferred temperatures ranging between 140° to 145°F. Older adults preferred temperatures ranging from 145° to 150°F. These findings imply that many people do not have well-defined reference points for responding to food temperatures.

Food cools rapidly once it has been placed on a plate for delivery to the customer. The appropriate serving temperature to assure that food is eaten within

the preferred temperature range varies with each situation. Serving temperature needs to be well above 140° to satisfy the temperature preferences of adults for hot entrees.

Dahl (1982) recommended developing a checklist for use by foodservice personnel which includes:

1. Food appearance
    a. Does the food item have satisfying color?
    b. Is there pleasant eye appeal in the variety of color and texture?
    c. Is the portion of uniform size and shape?
    d. Is there a right texture for a particular food item?
2. Food taste
    a. Are there any strong or undesirable flavors?
    b. Is the taste what is expected of the product?
    c. Is there any ingredient that produces an undesirable flavor or aftertaste?
    d. Is the seasoning adequate?
3. Food texture
    a. Is the product over- or undercooked?
    b. Does the moisture content make the texture suitable to the particular food product?
    c. Is the proper texture identifiable in the product?
    d. Is the product too tough or stringy?
    e. Is the product too soft or mushy?

Summary

Many different methods have been used to measure quality. Foodservice managers are responsible for the quality of food and service their operations provide. To ensure that quality is satisfactory, standards must be established and criteria by which they can be evaluated developed. If quality can be measured, then it can also be managed more effectively. Many variables which affect quality will be discussed.

The objectives of quality measurement are to provide a measure that indicates the level of quality of service rendered; to provide such measures on a continuing basis as a vital, ongoing management control; to provide the necessary feedback of information to allow corrective action to be taken; and to provide a means of establishing staffing patterns based on optimum utilization of personnel and assured quality of service.

Variables Affecting Quality

A feeding establishment, regardless of size, is a complex manufacturing center. From the time the food is delivered until it is served, a myriad of steps and handling operations are involved. The following are the prime factors responsible for significant quality changes:

(1) spoilage due to microbiological, biochemical, physical, or chemical factors

(2) adverse water conditions

(3) poor sanitation and ineffective warewashing

(4) improper and incorrect pre-cooking, cooking, and post-cooking methods

(5) incorrect temperatures

(6) incorrect timing

(7) wrong formulations

(8) poor machine maintenance program

(9) presence of vermin and pesticides

(10) poor packaging

Any of these factors, either alone or in combination, will contribute to poor quality, and effect changes that will be evident in the food's flavor, texture, appearance, and consistency.

Ruf and David (1975) described a method to determine the optimal range of quality in 25 hospital foodservice systems. Variables correlating significantly with quality of output were the type of supervision, employee tenure of three to nine years, moderate wage rate, less ready-to-serve foods used, routinization, delegation, and promotional opportunities. As supervisors became more structured in their approach to subordinates the qualitative productivity decreased. The structured approach may have developed a dependency upon the supervisor for enforcement of standards of quality. Job boredom may have caused the deterioration of qualitative productivity between the third and ninth year of employment. As wages increased, quality decreased. This may be an indication that foodservice directors have not made employees as aware of quality standards and measures as they have of labor standards. Also foodservice managers may not be rewarding quality and communicating that to employees. Use of ready-to-serve foods had a negative correlation with qualitative productivity, indicating that as a foodservice department

increased usage of ready-to-serve foods, the quality of the product decreased. Factors within routinization accounting for increased quality output were utilization of standard recipes, cafeteria cycle menus, shorter patient menu cycles, and written specifications for perishable and staple food purchases. Increased delegation of duties reflected a trend for permanent sharing of responsibilities with supportive personnel. This, in turn, demanded a teamwork approach to management and a specification of goals and standards.

Thorner and Manning (1976) described many factors responsible for poor food quality. Most of them can be traced to poor sanitation, faulty handling of food, malfunctioning equipment, incorrect preparation, and carelessness. The properties of food considered when making a quality evaluation are: flavor, nutritional content, texture, appearance, consistency, shelf-life, convenience, packaging, and price.

Cardello (1982) described the problems inherent in different foodservice systems which are reflected in judgments of the quality of the food. Although the ingredients, preparation, and delivery of food to patients may result in menu items of excellent quality, the particular items placed on the menu, the frequency of serving them, and the opportunity of the consumer to select among a variety of items are all important variables affecting consumer satisfaction.

Variety and choice in a menu will only increase satisfaction if the entrees for the menu items are unambiguous and descriptive. The use of nondescriptive adjectives in food item names should be avoided and consideration should be given to providing short descriptions of the actual ingredients and preparation methods for items that may be ambiguous (Cordello, 1982).

In addition to the above menu factors; the combination of items in a meal is also important. Although frankfurters and sauerkraut might make an acceptable meal for most people, frankfurters and cauliflower may not. The entree is the primary determinant of the acceptability of the meal; and the salad is the least important of its components.

Portion size is an important factor in patient's satisfaction with hospital foodservice. However, portion size may be more likely to be perceived as a problem in the hospital cafeteria. Patients have lower mean appetites and their inactivity produces less discontent with portion size than does the greater activity level of people eating in the cafeteria.

Arrival time of meals is a complaint frequently heard from hospitalized patients. The demeanor of people serving trays is also important. Cheerful personnel can improve the patient's general attitude at meal time, and this will affect perceived satisfaction with the meal.

The appearance of the food tray and the cleanliness of the dishes and silverware can have a significant impact on patient perceptions of meal acceptability. The appearance and aroma of the food are the most important factors contributing to meal acceptability. The temperature of cold food items, the attractiveness of dishes, silverware, and tray, and the tenderness of meat are also important factors.

An evaluation of the quality of food and service should reflect the viewpoint of the patient. Patients' food likes and dislikes influence their attitudes about the acceptability of any particular meal. Patients' service likes and dislikes may be influenced by a desire to participate in activities which the health of the individual does not make possible. An assessment of these factors might be difficult in

situations where the patients are senile and are not coherent or consistent in their thinking.

Sanitation affects the quality of food and service not only from an aesthetic standpoint but from the standpoint of chemical and biological safety of food as well. Adequacy of tableware and kitchenware washing procedures, proper handling and storage of clean equipment and utensils, personal habits of the foodservice personnel, and food handling and holding practices affect quality.

Management's expectation regarding quality of food and service provides standards or goals for foodservice personnel. Unless management desires to meet high standards of quality of food and service, it is unlikely that high standards will be achieved, regardless of the level of food and labor costs.

Brown (1972) suggested that the following variables affect the quality of food and service in a nursing home foodservice operation: menu, nutritional adequacy of food, patient's likes and dislikes, quality of food ingredients, food handling, standardized production and service methods, sanitation, and management expectations.

Summary

Many of the researchers have found that nutritional adequacy, food handling, and standardized production and service procedures can be expected to influence the quality of food as well as the cost of food. The aesthetic appeal of the menu in terms of variety in color, shapes, textures, flavors, and consistency can be expected to influence the acceptance of a meal and consequently be reflected in a quality rating.

The Relationship Between Productivity and Quality

Foodservice managers recognize the need to measure and improve quality, and they also realize that they must measure and improve productivity. It has long been accepted that increases in productivity are likely to come at the expense of quality, and that improvements in quality will increase operating costs. Caught in this apparent dilemma, managers often concentrate on either quality or productivity, but rarely both.

It is important, therefore, that quality and productivity measurement be incorporated into a systems approach to management of an operation (David, 1972). In order for decisions to be made about the management of an operation, there must be a statement of objectives in relation to the needs of the larger organization, for example the hospital. Foodservice is one of many subsystems whose functions must be integrated with the objectives of the hospital. For example, the objective of foodservice may be to provide high-quality food and service to patients, employees, and guests and to realize a sense of attainment and satisfaction on the part of foodservice personnel. However, if the hospital is committed to additional community healthcare because of changes in the social, political, and economic environment the objective may have to be expanded to include service to outpatients and other members of the community. Figure 1 depicts a systems concept of foodservice operations (Sneed and Kresse, 1989). In addition to productivity, an evaluation of the quality of meal components and service can help determine how well the objectives of the system are being achieved. Feedback is based on the

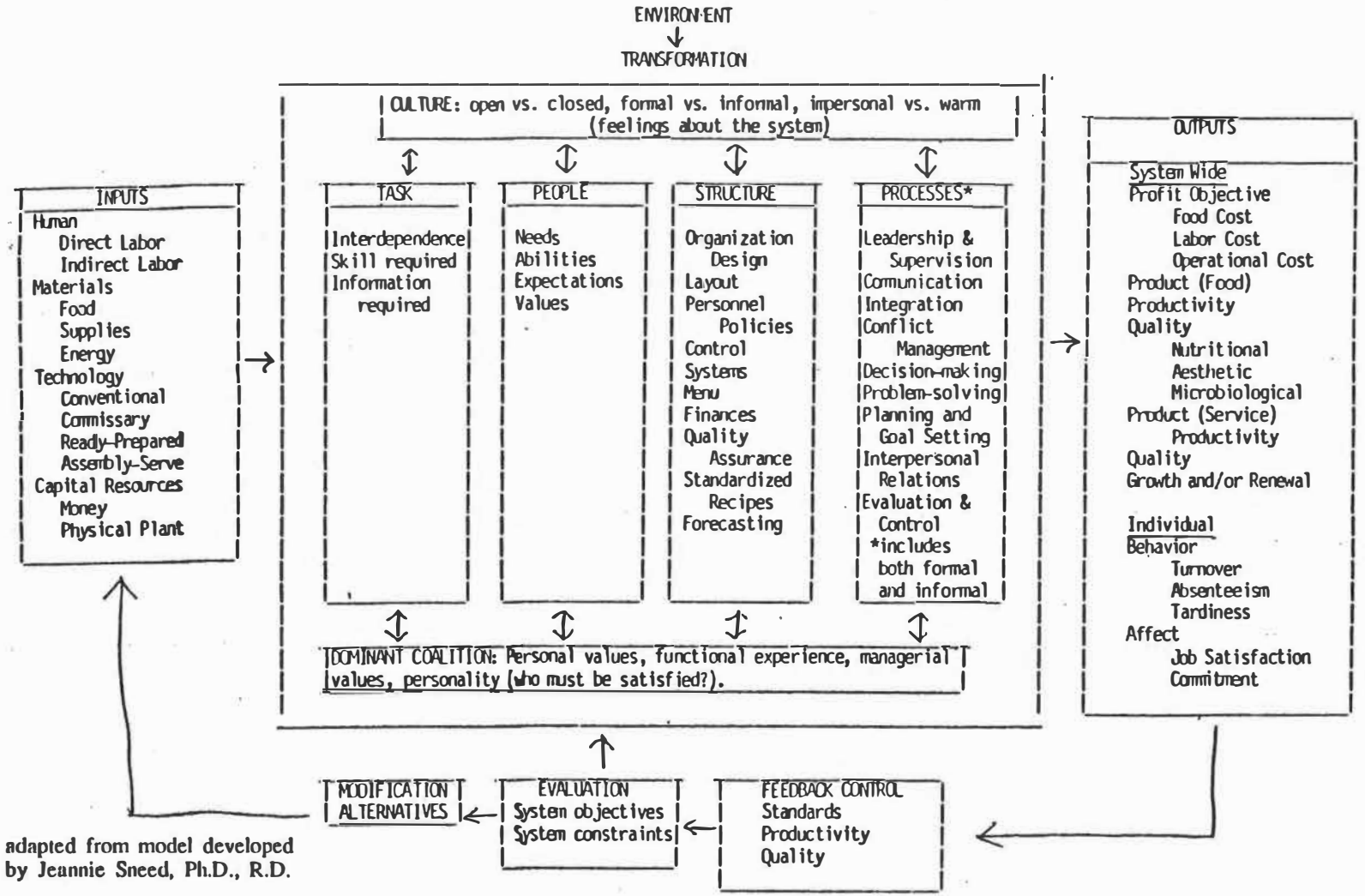

Figure 1. Systems Approach to Foodservice Operations.

objectives and standards sought rather than on the means for achieving the specific goals of each system function.

Standards, both for productivity and quality, must be developed for systematic evaluation and decision making. Valid and reliable measures of food quality and consumer satisfaction have been difficult to establish. Each foodservice operation must set its own standards and methods of measurement based on past performance and on the resources and constraints of the system, and each one must develop innovative methods to achieve objectives with new and changing resources and functions.

When standards are set and outputs are measured in relation to them, one can determine whether the ultimate objectives have been reached, or if not, why. For example, if patient evaluation of the food shows dissatisfaction, a review of the qualitative measures might show that the food quality desired has not been achieved because of system constraints. Perhaps the number of meals to be served has increased without a proportionate increase in preparation equipment, time, money, or labor.

At this point, analyses should be conducted to determine whether the system is operating as effectively as possible with the resources available. If so, constraints may have to be modified or certain functions changed so that standards can be met. What are the alternatives to determine the ideal, feasible system? Will a change in inputs, such as an increase in number of meals served, require a change in the market form of food, cost of food, quality of food, methods of purchasing, methods of service, or a decision to lower quality standards of food and service? Any modification will require decisions to determine alternatives for change.

The systems approach for decision making emphasizes productivity and quality measurement as techniques for planning and analysis, and control of resource utilization. With feedback control of productivity and quality; and with evaluation, the foodservice system can keep pace with and meet the needs of the organization and the changing environment.

Quality-productivity ratios for service functions can be developed by following a short, simple, robust procedure for gathering, shaping, and combining the basic knowledge of managers. Drawing from theories and experiences in operations management, sociotechnical systems, structured group processes, quality control, and productivity measurement, a procedure has been developed, tested, revised, and successfully implemented that provides quality-productivity ratios for any service group (Adam et al., 1981).

$$\text{Quality-Productivity Ratio} = \frac{\text{number of units acceptable and free of errors}}{\begin{array}{l}\text{processing cost per unit x number of units processed +} \\ \text{cost per unit of correction processing x number of units subjected to correction procedures.}\end{array}}$$

Productivity of services should be measured principally by quality-productivity ratios. The process quality-productivity ratio is based on the user's concern for costs to produce acceptable output units. Many of the functions of services are basically avoidance or prevention activities to maintain good employees, customers, or community relations. Quality-productivity measures put these concerns into a form whereby the marginal benefits of added resources can be evaluated. Rather than enumerating activities carried out by service staff and comparing this list with currently recommended practices, the quality-productivity

ratios allow yearly evaluations to concentrate on resources consumed to provide services that meet user quality standards.

Quality has become a potent means of product differentiation. Competition among healthcare institutions and organizations continues to minimize price differentiation. Quality is becoming the differentiating factor when one chooses services. Productivity is likewise important in the current environment of labor shortages.

The quality emphasis stresses the idea of value, while productivity stresses the concept of money spent. Efforts to raise quality should result in heightened productivity. Efforts to raise productivity usually pay off in better quality, but only if managers establish a new relationship between quality and costs (Leonard and Sasser, 1982).

Productivity should be linked with quality (Pickworth, 1987). There is always a quantity and quality dimension to consumer expectations. Customers are eating meals, but they have expectations; workers take home paychecks, but they come to work with expectations. Productivity and quality are inseparable in this framework. Rather than consider them as mutually exclusive propositions, it is more helpful to view them as forming a grid based on the customers' and workers' priorities.

The potency of the relationship between quality and productivity becomes more apparent as an organization begins an improvement program. In quality assurance, quality improvement merges into value enhancement. As ideas to improve quality surface, suggestions are made also to reduce costs and thereby increase value. Employee-involvement groups frequently come up with ideas to

improve quality. At the same time, these ideas increase job satisfaction by reducing workplace hassles that impede productivity (Pickworth, 1987).

Management must never sacrifice quality in efforts to increase productivity (Bowman and Gift, 1989). The quality of food served should be evaluated continuously (Schuster, 1989). If productivity measurement and quality measurement of a foodservice operation are linked then management decisions can be made more effectively. The foodservice manager must determine at what level, if at all, quality can be reduced for quantitative efficiency (Bowman and Gift, 1988).

CHAPTER III

METHODOLOGY

Sample

The LaFollette Medical Center Dietary Department (LMC) served as a pilot study site 1) to develop a system to measure the productivity, quality, and cost of meals produced and served and 2) to test the relationship among those variables. LMC is a 165-bed hospital (98 beds in a nursing home-type unit) located in a rural community in East Tennessee (A.H.A., 1988).

National and Tennessee statistics are presented to show the comparability of the study hospital with other hospitals. In the United States, there are 6,821 hospitals; the average community hospital bed-size is 170; 1,950 hospitals have 100-199 beds; and the average occupancy rate for hospitals with 100-199 beds is 59.1% (A.H.A., 1989). LMC is similar in size to 19% of the hospitals in the U.S. and has an 82.4% occupancy rate, a higher rate than the national average (A.H.A., 1989).

In Tennessee, there are 160 hospitals; 50 hospitals have 100-199 beds, and the average hospital occupancy rate in Tennessee is 66.9% (A.H.A., 1989). LMC is similar in size to 30% of the hospitals in Tennessee.

Because this research involved human subjects, review and approval of the protocol by the University of Tennessee Human Subjects Research Review Committee (Appendix A) was obtained prior to data collection. In addition, the

research was approved by the Quality Assurance Coordinator of LMC (Appendix B).

Data Collection and Calculation of Indexes

This section describes procedures and forms used for data collection and calculation of the Productivity Indexes, Quality Index, and Cost per meal Index. Data on productivity, quality, and cost were collected for ten consecutive months on four randomly selected days each month. Dates for data collection, food items, meals, patients, equipment, facility maintenance, personnel, and time of day for quality inspections were randomly selected using a table of random numbers before data collection began. Specific procedures for randomization are described fully in Appendix C.

Historical productivity and cost data from the Monthly Statistical Report (Appendix D) were used from January, 1986 through November, 1988 to determine the relationship between the Productivity Index A (labor minutes paid per meal equivalent) and the Cost Per Meal Index.

Productivity

Because LMC is a small facility, distinguishing among functional units or groupings of job positions with similar purposes was not feasible. Therefore, Productivity Management for Nutrition Care Systems' (Halling et al., 1986) procedures for hospitals with fewer than 100 beds were adapted and used to collect data for the Productivity Indexes.

Labor hours (both paid and worked) were allocated by employee classification into three service areas (patient, cafeteria, and catering) based on

percentage of time spent in each area. Payroll data were recorded and calculations were completed by the researcher. Forms used for recording and calculating the Productivity Indexes are presented in Appendix E.

Recording and Calculating Labor Data

The following procedure was used to collect and calculate labor data using Form I:

1. Employee classification heading (line 1) and date (line 2) were completed for each Form I. The following classification of positions by employee function recommended by Halling et al. (1986, p. 15) was used:
    I. Dietitian
    II. Food Service Supervisor
    III. Diet Clerk
    IV. Cooks/Bakers
    V. Foodservice Workers
2. For each employee classification, the following information was recorded:
    a. Each position in the employee classification (column A).
    b. The names of the incumbent employees (column B).
    c. Record 100% of time in hours (column C).
3. Percentage of time shown in column C was divided according to the percentage of time assigned to each service area: patient (column D), nonpatient cafeteria (column E), nonpatient catering (column F). Thus, C = D + E + F.

4. Hours paid and hours worked were recorded according to the classification listed in Figure 2 (Halling et al., 1986, p. 16).
    a. Total hours paid from payroll data and hours paid but not worked, according to the classification in Figure 2, were recorded in column G for each position.
    b. Total hours paid but not worked for each position were recorded in column H.
    c. Hours paid but not worked were subtracted from hours worked to calculate net hours worked for each position. These data were recorded in column I. If hours paid but not worked were greater than the hours worked, then column I was a negative number.
5. Hours paid for each service area were calculated using the following formulas:

    Patient hours paid (J) = G x D

    Nonpatient cafeteria hours paid (K) = G x E

    Nonpatient catering hours paid (L) = G x F
6. Hours worked for each service area were calculated using the following formulas:

    Patient hours worked (M) = I x D

    Nonpatient cafeteria hours worked (N) = I x E

    Nonpatient catering hours worked (O) = I x F
7. Columns J through O were added to determine the total hours worked and hours paid for each employee classification by service area.

1) Hours paid/worked
   - Scheduled hours worked
   - Overtime

2) Hours paid/not worked
   - Sick leave (SL)
   - Vacation (VA)
   - Holiday (H)
   - Compassionate leave (CL)
   - Administrative leave (AL)
   - Military leave (ML)
   - Jury Duty (JD)
   - Work Injury (WI)

3) Schedule days off (SDO)

4) Exclude the following:
   - Tardiness
   - Absent without leave
   - Excused unpaid absence
   - No sick leave available
   - Unpaid mealtime

Figure 2. Classification of Employees Hours Worked and Hours Paid (Halling et al., 1986, p. 16).

Form II, Hours Worked and Hours Paid Distributed by Employee Classification for Identified Service Area (Appendix E), was completed using the following method:

1. Heading information including the service area (line 1) and time period of data collection (line 2) were recorded.
2. Table 1 summarizes the service areas, input units, output units, and source of output values used for completing this form. The output description (meal equivalents for patients, sales ÷ cost per meal equivalent for cafeteria, or number of meals for catering) was recorded on line 3. The output unit (the actual number of meal equivalents or meals) for each service area was recorded on line 4.
3. For each employee classification, the total hours paid were reported (column Q) for each corresponding service area. The total hours paid was the sum appearing on Form I at the bottom of column J + K + L.
4. Step 3 was repeated for hours worked transferring the total of columns M + N + O on Form I to column R.
5. For each employee classification, the hours paid for each output unit were determined and recorded (column S). Therefore column S = column Q ÷ line 4. Column S is the labor hours paid per output unit (productivity ratio).
6. For each employee classification, the hours worked for each output unit were determined and recorded (column T). Therefore column T = column R ÷ line 4. Column T is the labor hours worked per output unit (productivity ratio).

Table 1

Output Values Used in Productivity Reporting

Service Areas	Input Unit	Output Unit	Source of Output Values
Patient	Labor hours	Meal equivalents	Patient meal census
Nonpatient cafeteria	Labor hours	Sales ÷ Cost of meal equivalent	Total income from cafeteria
catering	Labor hours	Number of meals	Number of catered meals

Summarizing the Productivity Indexes

The summary of Total Labor Hours Paid and Worked and Total Meal Equivalents Used to Calculate the Productivity Indexes (Form III, Appendix E) was completed as follows:

1. Service areas were recorded on lines (1), (2) and (3).
2. For each service area, the total hours paid for each output unit was transferred from column Q, Form II to column AA, Form III.
3. For each service area, the total hours worked for each output unit was transferred from column R, Form II to column BB, Form III.
4. For each service area, the Output unit was transferred from line 4, Form II to column CC, Form III.
5. Total Hours Paid in column AA were added and recorded as a Grand Total (line 4).
6. Total Hours Worked in column BB were added and recorded as a Grand Total (line 4).
7. Total Meal Equivalents in column CC were added and recorded as a Grand Total (line 4).
8. Productivity Index A was calculated by dividing the total paid labor hours by the total meal equivalents. This was recorded in line 5.
9. Productivity Index B was calculated by dividing the total labor hours worked by the total meal equivalents. This was recorded in line 6.
10. Lines 5 and 6 were multiplied by 60 minutes and recorded on Form XIV.

Summarizing Service Area Productivity

Form IV, the Summary of Service Area Productivity (Appendix E), was completed as follows:

1. Dates were recorded in appropriate columns.
2. For each service area, the total hours paid for each output unit (from column S, Form II) were recorded on each column U.
3. For each service area, the total hours worked for each output unit (from column T, Form II) were recorded in column V.
4. For each service area, the comparison productivity ratios (from the previous productivity record) were entered in columns W and X.
5. Year-to-date productivity mean for hours paid was calculated by adding the values in column U for the current time period and the time periods previously recorded. This sum was divided by the number of time periods to date in the study. Year-to-date productivity mean for hours paid for each service area was recorded in column Y.
6. Year-to-date productivity mean for hours worked was recorded in column Z.

Quality

Methods and forms for determining quality indexes were adapted from Improving Work Methods in Small Hospitals (American Hospital Association, 1975). The forms used for collection and calculation of quality indexes (Forms V, VI, VII, VIII, IX, X, XI, and XII) are presented in Appendix F.

Forms V through VIII were completed by the researcher. Food production (Form V) was assessed based on appearance of menu items, taste of menu items, texture of menu items, and temperature of food at time of service and delivery. The temperature of food was not measured on each patient floor because trays were always immediately delivered to patients. Patient foodservice was evaluated (Form VI) based on tray appearance, tray accuracy, delivery time, and percent of the meal eaten. The measurement of the percent of the meal eaten was added to the protocol by the researcher because it is now a requirement of government regulatory agencies. Sanitation of equipment, facility, and personnel were assessed (Form VII). The equipment list was modified to include only equipment used in this facility. The researcher developed Form VIII to evaluate cafeteria service because this important area was not included in previous quality inspections. Criteria for assessing cafeteria service included color, texture, and flavor of foods served; variety of food offered; pan placement on the line; size of pans; neatness/cleanliness of serving line; overall appearance of cafeteria; and overall quality of preparation.

Forms IX through XI, developed by the researcher, were completed by randomly selected consumers. Patient tray service (Form IX), cafeteria customer service (Form X), and catering-guest service (Form XI) were evaluated using opinion surveys. Yes/no responses were used to ensure that consumers would respond.

A total Quality Index was determined by assigning a numerical score to each of seven areas: 1) food production, 2) patient foodservice, 3) sanitation, 4) cafeteria service, 5) patient tray service, 6) cafeteria customer service, and 7) catering and

guest service. The procedure for conducting quality inspections and calculating the Quality Indexes follows.

Conducting Quality Inspections and Calculating Quality Indexes

1. Inspection times were selected at random during the day that data were collected for each of the eight areas according to the random procedure previously described (Appendex C).
2. Each factor on the inspection sheets was observed and rated as each pertained to the selected meal, service, or area. Each factor was observed and rated by the researcher with respect to the immediate, existing condition. All factors were checked satisfactory/yes or unsatisfactory/no at the time of observation, using the appropriate criteria (Figures 3 and 4) as a guide for interpreting observations. The patient opinion survey was given to patients on regular diets only. Cafeteria and catering consumers were selected randomly.
3. For each unsatisfactory/no rating, comments about the reason for the low rating were written in the space provided at the bottom of the inspection sheet. If additional space was required, the reverse side of the sheet was used.
4. All the satisfactory/yes and unsatisfactory/no ratings for every area inspected were totalled on Form XII (Summary of Quality Inspections). The percent of acceptable ratings was calculated. The Index Conversion Table (Figure 5) was used to determine quality index conversion numbers corresponding to the percent of acceptable ratings for each service area.

1. Food appearance
   a. Food item has satisfactory color.
   b. Food has eye appeal.
   c. Food item is uniform in size and shape.

2. Food taste
   a. There is no strong or undesirable flavor.
   b. Taste has desirable relationship to food product.
   c. No aftertaste.
   d. Aroma is pleasing.
   e. Variety of flavors.

3. Food texture
   a. Food product is not overcooked or undercooked.
   b. Texture is suitable to the particular food product.
   c. Not too tough and/or stringy.
   d. The menu has a variety of textures.
   e. Not too soft and/or mushy.

4. Tray appearance
   a. Dishes or utensils are not cracked or bent.
   b. Tray has a variety of colors and/or shapes.
   c. Food is neatly served.
   d. There are no spills.
   e. Side dishes are used for foods that are juicy.

5. Tray accuracy
   a. All specified items on menu are present on tray.
   b. Utensils needed are provided on tray.
   c. Proper condiments are used.
   d. Food on tray is allowed on patient's diet.
   e. No unnecessary items on tray.

Figure 3. Inspection Criteria for Food Production and Service.

Adapted from A.H.A., 1975, p. 46

1. Employee's uniform
    a. Free of soil, pressed, and in good repair
    b. Fits properly
    c. White, soft sole, clean, polished shoes are worn
    d. Uniform conforms to regulations of foodservice department
2. Employee's cap
    a. Clean and worn properly
    b. Worn in all areas of food production
3. Employee's hairnet
    a. Covers head completely
    b. Hairnet in good repair, with no holes
    c. Tight enough to hold hair in place.
    d. Worn in all areas of food productions

Figure 4. Inspection Criteria for Personnel.

Adapted from A.H.A., 1975, p. 47

% Acceptable	Food Production					Patient Foodservice				Sanitation			Cafeteria	Surveys		
	Appearance	Taste	Texture	Serv. Temp.	Deliv. Temp.	Appearance	Accuracy	Deliv.	% of Meal Eaten	Equip.	Fac.	Per.		Pt.	Cafe.	Cat.
100	6	6	6	7	7	6	7	6	6	7	6	5	6	7	6	6
95	5	6	6	6	6	6	6	6	6	6	6	5	6	7	6	6
90	5	5	5	5	6	6	5	5	6	6	6	5	6	7	6	6
85	5	5	5	5	6	6	5	5	6	5	6	5	5	6	5	5
80	4	4	4	5	5	6	4	5	6	5	6	5	5	6	5	5
75	4	4	4	4	4	6	3	5	6	4	5	5	5	6	5	5
70	4	4	4	3	3	6	3	4	6	4	5	5	5	5	4	5
65	4	4	4	3	3	5	2	4	6	3	4	5	4	5	4	5
60	4	3	3	2	2	5	1	4	6	3	4	5	4	5	4	5
55	4	3	3	1	1	4	0	4	6	3	3	5	4	5	4	5
50	4	3	3	1	1	4	0	4	6	3	3	4	3	4	3	4
45	3	2	2	1	1	3	0	3	6	3	3	4		4	3	4
40	3	2	2	0	0	3	0	2	5	3	2	4	3	4	3	4
35	3	2	2	0	0	3	0	2	5	3	2	3	2	3	2	3
30	2	1	1	0	0	2	0	1	5	3	2	3	2	3	2	3
25	2	1	1	0	0	2	0	1	5	3	2	2	1	2	1	2
20	1	0	0	0	0	1	0	1	4	3	2	2	1	2	1	2
15	1	0	0	0	0	1	0	1	4	3	2	1	0	1	0	1
10	0	0	0	0	0	0	0	0	3	2	2	1	0	1	0	1
5	0	0	0	0	0	0	0	0	2	1	1	0	0	0	0	1

Adapted from A.H.A., 1975, p. 51.

Figure 5. Index Conversions.

Food temperature, tray accuracy, equipment sanitation, and patients' opinions were considered more important by the researcher than other criteria and thus, were weighted for calculating the index conversion numbers. The total of the index conversion numbers was the quality index for the day. The sum of the index conversion numbers yielded a percentage between 0 and 100.

The final Quality Index score was recorded on the Quality Performance Summary (Form XII). The possible range in Quality Indexes was 0-100 percent. As quality ratings of meals increased, the percent Quality Index increased.

Cost

Form XIII (Appendix G) was used to calculate the number of meal equivalents and the Cost per meal Index.

Calculating Meal Equivalents

The method used to quantify output was the number of meals served. The following steps were used for the calculations:

1. For all regular and modified diets, the total number of patient meals was derived from the daily census diet order sheet and the telephone order sheet.
2. The total number of nonpatient meals was calculated using the following meal equivalent formula: meal equivalents = sales ÷ equivalent meal cost.

3. The total number of other meals was taken from the daily count for guests and the census for catered functions.
4. A nourishment was defined as being equivalent to one-eighteenth of a meal. Since the nourishments served were usually ready-made items such as ice cream, crackers, milk, and juices, the time necessary for preparation was minimal. Foodservice employees were only responsible for supplying the items; nurses aides usually served the nourishments. Three such nourishments were equivalent to one nourishment count. The total number of nourishment counts divided by eighteen and rounded off to the nearest whole number equaled the meal equivalents for nourishments.
5. The total meal equivalents were then determined using the following formula:

   total meal equivalents = total number patient meals + (total revenue from cafeteria ÷ equivalent meal cost) + total number of nonpaid and catered meals + (total number of nourishment counts ÷ 18).

Calculating Cost of Food and Supplies

Food and supply costs were calculated by adding the period's beginning inventory (food or supply) to the purchases for the period and then subtracting the ending inventory. This amount was divided by the number of days in the month to get a mean food and supply cost per day. The mean was divided by the number of total meal equivalents for the day to get the food and supply cost per meal.

Calculating Labor Cost

Labor cost came from the Dietary Department time cards. The salaries paid for productive labor and overtime were calculated. This total was divided by the number of days in the month to get an average labor cost per day and by the number of meal equivalents for the day to get the labor cost per meal equivalent.

Calculating Cost per Meal Index

The Cost per meal Index was calculated by adding the food cost per meal equivalent plus the supply costs per meal equivalent plus the labor cost per meal equivalent. No calculations (or forms) were used for labor cost per meal.

Summary

Form XIV (Appendix H) summarized Productivity Index A, Productivity Index B, Quality Index, and Cost per meal Index.

Analysis of Data

Descriptive statistics and tests of the research hypotheses were determined using the Statistical Analysis System (SAS, 1986). For all tests of significance, a .05 probability level was used. Means with standard deviations were determined for all productivity data, cost data, quality data, and historical data.

Hypotheses testing used the following procedures:

Hypothesis 1 - There is no relationship between the Quality Index and the Productivity Indexes for meal production and service.

Hypothesis 2 - There is no relationship between the Productivity Indexes and Cost per meal Index.

Hypothesis 3 - There is no relationship between the Quality Index and the Cost per meal Index.

Simple linear regression analysis was used to test Hypotheses 1, 2, and 3.

Hypothesis 4 - As Productivity Index and Quality Index improve, Cost per meal Index will increase.

Hypothesis 4 was tested using multiple linear regression, with Productivity and Quality Indexes being used to predict Cost per meal Index.

CHAPTER IV

RESULTS AND DISCUSSION

This pilot study was conducted in the Dietary Department of the LaFollette Medical Center (LMC), LaFollette, TN to develop a model for the ongoing measurement of productivity, quality, and cost of meals and to determine the relationship among these variables. Measurement of these variables was made from December, 1988 through September, 1989. Historical data on productivity and cost were obtained from departmental records for the time period from January, 1986 through November, 1988. Descriptive statistics for volume, productivity, cost, and quality variables will be presented followed by the results of testing the research hypotheses.

Volume

For this 10-month time period, the mean patient meal equivalents per day was 426 $\pm$ 26; mean cafeteria meal equivalents per day was 103 $\pm$ 20; and mean catered meal equivalents per day was 3 $\pm$ 6. Mean meal equivalents for patient, cafeteria, and catered meals provide an estimate for volume that may serve as the basis for labor planning and budgeting.

Productivity

Means and standard deviations for each of the productivity variables are presented in Table 2. These means, based on 46 randomly selected days over a ten-month period, provide standards for this operation that serves as the basis for

Table 2.

Productivity Measures for a 165-bed Combination Hospital/Nursing Home for Patient, Cafeteria, and Catered Meal Services

Productivity Measure	Mean ± Standard Deviation
Labor hours per day[a]	
Total labor hours paid	132.1 ± 13.5
Total labor hours worked	121.6 ± 13.1
Labor hours paid for patient service	103.9 ± 11.1
Labor hours worked for patient service	94.9 ± 10.8
Labor hours paid for cafeteria service	26.8 ± 3.8
Labor hours worked for cafeteria service	25.3 ± 3.8
Labor hours paid for catered service	1.4 ± 3.1
Labor hours worked for catered service	1.4 ± 3.1
Labor minutes per meal	
Productivity Index A[b]	14.4 ± 1.5
Productivity Index B[c]	13.7 ± 1.4
Labor minutes paid per patient meal equivalent	14.5 ± 1.5
Labor minutes worked per patient meal equivalent	13.7 ± 1.3
Labor minutes paid per cafeteria meal equivalent	16.1 ± 1.3
Labor minutes worked per cafeteria meal equivalent	15.2 ± 1.3
Labor minutes paid per catered meal equivalent	6.8 ± 3.3
Labor minutes worked per catered meal equivalent	6.0 ± 3.1

[a]n=46 days.
[b]Labor minutes paid per meal equivalent for 81 days (includes 46 days plus 35 days of historical data) minimum 9.5 and maximum 18.
[c]Labor minutes worked per meal equivalent.

labor planning, staffing, and scheduling. In addition, the labor minutes paid per meal equivalent, based on 81 days, serves as an overall standard for productivity for this operation. It is interesting to note that the mean labor minutes paid per cafeteria meal equivalent was 16.1 compared with 14.5 for patient service, thus representing higher labor costs per meal equivalent for that service. To decrease the number of minutes paid per cafeteria meal equivalent, the volume served in the cafeteria could be increased or the labor hours decreased; given the same meal equivalents as currently exists.

Success of foodservice management is usually measured by labor productivity defined as the ratio of outputs to inputs. In this study, productivity was defined as labor minutes per meal equivalent served, where a high number indicated low efficiency and a low number indicated high efficiency in the use of labor time. LMC's level of productivity was within the guideline of 9-15 labor minutes per meal equivalent for nursing homes used by Johnson et al. (1980). Labor minutes paid per meal equivalent were 14.4 ± 1.5 and labor minutes worked per meal equivalent were 13.7 ± 1.4 (Table 2). Labor productivity ranged from 9.5 minutes per meal equivalent to 18.0 minutes per meal equivalent. LMC did not have as high a level of efficiency as the 11.2 ± 2.9 minutes per meal equivalent reported by Johnson et al. (1980), perhaps, because more services were provided to patients, employees and guests in the cafeteria, and guests of catered functions. Matthews et al. (1986) found that as more services were provided, more labor hours were required. Also more menu items are offered, prepared, and served per meal in a hospital because of the modified diets, special test procedures involving diets, and

late trays. Matthews et al. (1986) also showed that more variety in the menu required more labor minutes per meal.

The number of labor hours worked and paid at LMC are affected by staffing and scheduling policies of the institution. Productivity appears to be related more to management policies and procedures, such as methods of scheduling personnel, standards set by management, and the amount of training and work methods of employees, than to the number of meals served.

The majority of the labor time at LMC was spent in patient service. Labor minutes paid per patient meal equivalent were 14.5 ± 1.5 and the labor minutes worked per meal equivalent were 13.7 ± 1.3. This is still within the guidelines previously mentioned by other researchers. However, the labor minutes paid and worked for each cafeteria meal equivalent were 16.1 ± 1.3 and 15.2 ± 1.3, respectively. Part of the reason for this higher labor cost may be that several employees work on the cafeteria line serving customers even though there may be periods of ten minutes without customers, resulting in nonproductive time. In contrast, employees who served patient meals were productive throughout the service period. The labor minutes paid and worked for catered meal equivalents were much lower than calculated values for either patient service or cafeteria service. LMC does limited catering, usually three catered dinners a month served by supervisory staff.

Cost

Means and standard deviations for cost variables are presented in Table 3. Mean total cost, categorized as food, labor, and supply, provides standards for the budgeting process.

For this study costs for food, supplies, and labor were calculated as a percentage of total cost. Sneed and Kresse (1989) recommended a goal of 35% average food cost whereas LMC had a food cost of 32%. Labor was the largest cost, at 67%, of the total meal cost. Labor cost per meal did not include the cost of benefits paid to employees, because the LMC Personnel Manager provided only information on the amount of productive time paid. Thus, actual labor cost and total cost would be higher than reported in this study.

Supply costs, the lowest cost category, included disposables, cleaning supplies, and office supplies. Supply cost accounted for approximately one percent of the total meal cost. The mean total cost per meal at LMC was \$1.59 ± 0.23, well below the goal of \$2.50 per meal set six years ago. Since that time, several programs have been initiated including participation in the USDA Commodities Program and membership in the Coordinated Hospital Services Group Purchasing Plan. Both programs made food available at a discount.

Quality

The total Quality Index was 88% ± 5%, based on a possible 100%. The mean percentage acceptable ratings for each quality characteristic evaluated are

Table 3

Cost Variables Per Day for the 165-bed Combination Hospital/Nursing Home

Variables	Mean ± Standard Deviation
Food cost per meal[a]	$ .51 ± $.14
Supply cost per meal[a]	$ .02 ± $.01
Labor cost per meal[a]	$1.06 ± $.20
Cost per meal index[b]	$1.59 ± $.23

[a] n=46 days

[b]n=81 days (includes historical data).

presented in Table 4. Ideally, all ratings should have been 100%. A range from 90 to 100 for the Quality Index is recommended as the control limit by the American Hospital Association (1975). In this study the Quality Index ranged from 75% to 97% with a mean of 88% ± 5%, a value less than the goal of 90% for the Dietary Department.

Food Production

The weakest rating in the area of food production was for temperature of food at time of service and the strongest ratings were given to the appearance and texture of foods served (Table 4). The number of unsatisfactory ratings for appearance, taste, and texture of menu items, although indicating a need for improvement, was minor when compared to the number of inadequate temperatures of menu items during assembly of meals and at point of consumption of meals. The mean percentage acceptable rating for serving temperature was 69% ± 25% with a range from 20 to 100. Of the hot foods checked for temperature during tray assembly, 44% were below recommended minimum temperatures. Of the cold foods checked at tray assembly, 76% were above recommended temperatures.

The mean percentage acceptable rating for delivered temperature was 79% ± 24%, with a range from 15% to 100%. Of the hot foods checked at point of meal consumption, 15% were below desired minimum temperatures. Of the cold food items checked at point of meal consumption, 62% were above desired temperatures. The reason that delivered temperatures were often more acceptable then serving temperatures could have been because the serving temperature standard did not need to be 160°F for vegetables or 180°F for soups but 145°F would still be acceptable.

Table 4

Mean Acceptable Percentages for the Quality Variables in a 165-bed Combination Hospital/Nursing Home.

Variables	Mean % ± Standard Deviation (n=46 days)
A. Food Production[1]	
1. Appearance	99 ± 4
2. Taste	99 ± 5
3. Texture	99 ± 4
4. Serving temperature	69 ± 25
5. Delivered temperature	79 ± 24
B. Patient Foodservice[1]	
1. Tray appearance	98 ± 5
2. Tray accuracy	88 ± 15
3. Delivery	100 ± 0
4. Percent of meal eaten	71 ± 18
C. Sanitation[1]	
1. Equipment	88 ± 12
2. Facility maintenance	67 ± 22
3. Personnel	97 ± 5
D. Cafeteria service[1]	94 ± 11
E. Surveys[2]	
1. Patient opinion	87 ± 8
2. Cafeteria customers	89 ± 11
3. Catered or guests	98 ± 4

[1]Measured by the researcher.
[2]Measured by five randomly selected customers from each service area.

Possible reasons that temperature of hot food items were lower than recommended include: food was not heated to proper temperature before service; steam tables were not preheated properly; serving dishes were not preheated properly; or disposable dishes, which do not retain heat well, had to be used. Potential reasons that cold foods were warmer than recommended include: milk coolers and refrigerators were operating above 45°F; menu items were at room temperature too long before meal service began; or foods such as canned fruit were not chilled before service. Temperature was the most critical quality control problem identified in this study.

Patient Foodservice

In the patient service area, a very strong rating (100%) was given to delivery time indicating that patient trays are always delivered to the nursing units on time. Patients did not consume a high percentage of their meals (71%) which may result from several factors other than quality, such as their illness. Tray accuracy was below the established 90% standard.

In this study, delivery times of meals from the kitchen to the patient received satisfactory ratings of 100% for meeting the scheduled delivery time of meals to the patients. Thus, this is an area where employees should be given positive feedback.

Some problems in accuracy of trays were noted. The mean percentage acceptable rating for tray accuracy was 88% ± 16%, ranging from 40% to 100%. The main problems were with diabetic diets. Food items selected would be left off or food items not selected would be placed on trays. Also modified diets without a

selective menu, because of being new admissions, occasionally had foods not allowed. These inaccuracies could result from a number of factors, including worker fatigue, tray assembly speed, diet order changes during operation of the trayline, and telephone interruptions during service.

Percent of meal consumed by patients had a low mean percentage acceptable rating: 71% ± 18% ranging from 40% to 100%. Reasons given by patients who did not consume 75% of a meal included: poor appetite because of illness or drug reaction; short time period from last meal due to eating a late tray or food brought from home; or dislike of food served, in which case the patient was served a substitution. Of the patients surveyed, 20% did not eat more than 75% of their meal.

Sanitation

The lowest acceptable rating for sanitation was facility maintenance with a mean of 68% ± 22% ranging from 25% to 100% (Table 4). Unsatisfactory ratings for cleanliness of foodservice areas pertained mainly to hoods, vents, walls, lights, and lavatories. Racks for hanging pots and pans over the food production counters were often covered with dust, because they are difficult to clean without getting dust in the food being prepared.

The mean percentage acceptable rating for equipment sanitation was 88% ± 12%, ranging from 60% to 100%. The majority of unsatisfactory ratings for production equipment was related to grease, dust, dirt, and crumbs in and on ovens, ranges, counters, and other equipment. There were food stains, crumbs, grease, and

dust on shelves and in refrigerators and freezers. Fans also harbored grease and dirt, thus, decreasing acceptable ratings.

In regard to employee appearance, satisfactory ratings ranged from 85% to 100% with a mean of 97% ± 5%. The most common nonconformity to a personal hygiene rule was found in male employees who were not clean shaven; employees were required to shave before continuing work.

Cafeteria Service

The mean percentage acceptable rating for cafeteria service was 94% ± 11%, ranging from 50 to 100. Reasons for unacceptable ratings in the cafeteria were most often because food items were not popular or the item was held too long on the steam table resulting in undesirable texture and color changes. One solution to these changes would be to batch cook foods in smaller pans so that a food not selected after one hour could be replaced with a fresh item.

Surveys

The mean percentage acceptable rating for the patient opinion survey was 87% ± 8%, ranging from 65% to 100% (Table 4). Reasons for most unsatisfactory ratings were that hot foods were not hot; patients did not get something they wanted; or patients did not get a menu for selecting their own items.

The mean cafeteria opinion rating was 89% ± 11%, ranging from 55% to 100%. The majority of unsatisfactory ratings were because the customer did not like the menu; hot food was not hot; or customers did not like what they selected. Most of the cafeteria customers were hospital employees who eat in the cafeteria

every day. Therefore, variety in the menu was important to them. Employees rated food service lower than did guests. Overall, catered-meal guests reported a mean acceptable rating of 98% ± 4%, ranging from 80% to 100% and rarely reported unsatisfactory comments.

Discussion of the Research Hypotheses

Four research hypotheses were tested using simple and multiple linear regression. The results of each hypothesis will be presented.

Hypothesis 1

Hypothesis 1 stated that there is no relationship between the Quality Index and the Productivity Indexes for meal production and service. Two Productivity Indexes were used: labor minutes paid per meal equivalent and labor minutes worked per meal equivalent. Two separate simple linear regression analyses were done, one for each Productivity Index. The null hypotheses for both Productivity Indexes were not rejected because no relationship was shown. Intercorrelations among the variables (Table 5) showed a weak relationship between Quality and Productivity Indexes.

Hypothesis 2

Hypothesis 2 stated that there is no relationship between the Productivity Indexes and the Cost per meal Index. Again, two simple linear regression models, one for each Productivity Index, were run to test the hypotheses. The models was not significant and the hypotheses were not rejected.

Table 5

Intercorrelations Among Quality, Cost, and Productivity Variables in a 165-bed Combination Hospital/Nursing Home

	Quality Index	Cost/Meal Index	Productivity Index A
Cost per meal Index	.13[a] (.39)[b]		
Productivity Index A	.13 (.37)	-.06 (.67)	
Productivity Index B	.03 (.86)	.002 (.90)	.54* (.0001)

[a]Pearson product moment correlation.
[b]Probability.
*Statistically significant ($p < 0.05$).

Hypothesis 3

Hypothesis 3 stated that there is no relationship between the Quality Index and the Cost per meal Index. Simple linear regression analysis showed that there was no relationship and the hypothesis was not rejected.

Hypothesis 4

Hypothesis 4 stated that as Productivity Index and Quality Index increase, Cost per meal Index will increase. A multiple linear regression analysis was done using cost per meal index as the dependent variable and productivity index and quality index as independent variables. No relationship existed ($F = .71$, $p = <.57$) and the hypothesis was rejected.

Many researchers (Adam et al., 1981; David, 1978; Fuchs, 1969; Kent and Ostenso, 1965; McDougall et al., 1989; and Williams, 1966) have suggested there is a significant relationship between productivity, quality, and cost. Johnson et al. (1980), in a study of fourteen Wisconsin nursing homes, found that facilities with higher scores for quality of meals tended to require more labor time for meal preparation and service. This seemed to imply a relationship between labor productivity and quality standards for meals produced and served in foodservice. Also the American Hospital Association (1975) noted that quality normally can be increased by improving productivity or by increasing cost. Improved productivity can be applied to raising the quality level and/or reducing cost. This also implied that there is a relationship between productivity, quality, and cost.

Ruf (1975) stated that at some point, increased productivity could be achieved only by sacrificing the quality of food and service. This again assumed a relationship between productivity and quality. Olsen and Meyer (1987) suggested that further study was needed to determine the affect of quality on productivity. Pickworth (1987) wrote that productivity and quality had a subtle relationship, they reinforced each other.

This study found no significant relationship among the variables productivity, quality, and cost and thus, productivity and quality cannot be used to predict cost. To the author's knowledge no published research had been done to test the relationship between productivity, quality, and cost.

Even though no significant relationship was shown among productivity, quality, and cost; the measurement of productivity still might include some measurement of quality. For example, one way to improve productivity would be to offer fewer items on the menu (Brown, 1972). Customer satisfaction may depend on the variety offered in the menu (Cardello, 1982).

Since productivity in this study did not have a significant relationship to quality it seems to imply that employees did not change any of their work habits when the meal census was low. This is evident from the quality measurement which showed that the cleanliness of equipment and the facility needed attention.

Temperature of foods served was a problem. If the meal census were lower and the employee finished his/her assigned task early, the food was put in the steam table too early, resulting in temperature and food quality problems.

In this study, most of the employees were full-time, therefore the total labor hours each day had little variance. If institutional policies permit limiting full-time

employees and increasing part-time employees, employees could be scheduled to meet demands of a fluctuating patient census. Managers need to reduce labor hours when patient census is low, if the situation permits it.

CHAPTER V

SUMMARY AND RECOMMENDATIONS

The purpose of this research was to develop a system to measure productivity, quality, and cost of meals produced and served in a 165-bed combination hospital-nursing home that uses a conventional foodservice production system. The relationship among the variables of productivity, quality, and cost per meal was determined. Results of this study provided information on how effectively resources were being utilized and the results, also, facilitated the development of standards of performance for the dietary department at LMC.

The mean level of productivity in this study was 14.4 ± 1.5 labor minutes paid per meal equivalent. Labor productivity ranged from 9.5 to 18 minutes per meal equivalent. According to Johnson, et al. (1980) nine to 15 labor minutes per meal equivalent is a reasonable guideline for planning staffing needs in nursing homes. In contrast to Johnson's study, lower mean productivity value was found in this study because LMC includes a cafeteria and a hospital, which has more modified diets than a nursing home.

The mean total cost per meal in this study was $1.59 ± $0.23. Comparability to other institutions is limited because of differences in menus, purchasing practices, employee skill levels, and other characteristics that impact cost. The goal set by LMC in 1983 was to keep the total meal cost under $2.50; current costs are well under that value.

The mean percent Quality Index for this study was 88% ± 5%, ranging from 75% to 97%. The goal of the Dietary Department was 90%, so there was

need for improvement in this area. Major problems noted during data collection in this study were: temperature control of food during assembly of meals; temperature control of food at point of service to patients; and cleanliness and orderliness of equipment and work areas in the kitchen.

Simple linear regression, used to test Hypotheses 1, 2, and 3, showed there was no significant relationship between quality and productivity, between productivity and cost; and between quality and cost. Multiple linear regression used to test hypothesis 4 showed that productivity and quality do not predict cost.

Research Questions

The following research questions were answered in this study:

1. How can quality and productivity be measured in a hospital-nursing home foodservice system? Quality and productivity were successfully measured using methods described in Chapter III. The methods were practical and could be implemented during usual work routines.
2. What is the relationship among measures of quality, productivity, and cost of meals produced? There was no significant relationship among quality, productivity, and cost.
3. Should productivity measures include quality measures? Since productivity measures were found to have no relationship to quality measures, combining measures can not be justified based on the impact of these variables on each other. Both are important variables in the operation but are independent of each other and measurement can be approached independently as well.

Productivity is one of management's top priorities and can be increased through technical innovations in equipment and through ready-to-serve forms of food, but quality may also need to be considered. Management benefits from an ongoing program for evaluating meal quality.

Limitations of the Study

This study provides information about the 165-bed combination hospital-nursing home studied. The mean productivity, quality, and cost values at LMC can not be compared to other institutions since these values depend on bed size, occupancy rates, total business volume in cafeteria and catering services, managerial policies, staff qualifications, and many other factors. At LMC most meals were served to patients (80%), with only 19% and 1% of total meal equivalents served in cafeteria and catering, respectively.

Significance of the Study to the LaFollette Medical Center

This integrated system, developed to measure productivity, quality, and cost per meal at LMC, resulted in development of standards for the dietary department. The mean for productivity was 14.4 $\pm$ 1.5 minutes per meal equivalent and that established a standard for the future. The cost per meal can range from $1.36 to $1.82 based on the standard which was already in effect.

The estimated total number of meals produced per day (patient, cafeteria, and catered) was determined to be 529$\pm$46. This value was used as the basis for making personnel-related changes, particularly related to labor planning, staffing,

and scheduling. Managers at LMC reduced the total number of part-time labor hours by 13%. Managers also analyzed labor time to determine whether it was being controlled effectively. As a result, some employees were trained in more than one job in order to improve productivity; for example, the cook assistant was trained to work also in the diet office or as a cashier, as needed.

Based on opinion surveys, unpopular items were eliminated from the menu and labor-saving menu items were incorporated into the menu cycle. Initially all cookies were made from scratch, but now a variety of high quality preprepared bakery items are used. Stocking prepackaged, portion-controlled condiments and purchasing pulled chicken cubes for casseroles created major time savings. The use of convenience foods allowed the expansion of menu variety without sacrificing quality. Pizza, tacos, and soft-serve ice cream were added to the menu. Cafeteria sales increased by approximately $600 per month.

Supervisors now spend more time supervising activities of support personnel to assure the maintenance of food production and service standards. Managers direct employees to clean during idle time. A foodservice employee is now scheduled to do heavy cleaning after all food production is completed for the day. Increased supervision of employees yields improved sanitation practices.

A system of inspection analysis and corrective action was developed by managers to solve the problem of inadequate food temperatures. Supervisors conducted routine observations in the food production area to determine if the steam tables were being preheated or if food were set out too far ahead of serving time. Also, temperatures of menu items are routinely checked throughout

production and service. Refrigerators are also maintained at appropriate temperatures.

Foodservice workers are given more training and supervision in checking the accuracy of each tray before it is sent to the patient. One employee, not on the tray line, is designated to answer the telephone to help prevent interruptions during service.

The registered dietitian works closely with nursing to identify patients who do not eat adequately. Routine patient opinion surveys increases the dietitian's awareness of patients' needs.

An on-going system of quality control and quality assurance is now being used to measure productivity, quality, and cost. These measures document whether or not standards are being met. By utilizing the information obtained from this system of measurement, optimal dietary services are assured. Identified foodservice problems are resolved as efficiently and effectively as possible.

Recommendations

The present research involved a pilot study site to develop a system to measure the productivity, quality, and cost of meals produced and served and to determine the relationship among those variables. Findings in this research suggest some recommendations:

1. Every organization has unique needs and system constraints. Therefore, managers should establish standards for their system based on their unique resources and constraints.

2. There is a need for workshops to train foodservice supervisors and dietitians on how to improve their management skills.
3. Quality needs to become ingrained as a core value of foodservice operations.
4. A multiple point scale should be developed to provide more useful information. In this study, a dichotomous scale, satisfactory and unsatisfactory, was used for measuring quality of food production, patient foodservice, sanitation, cafeteria service, patient tray service, cafeteria customer service, and catering and guest service.

In addition, the following recommendations for future research are apparent from this study.

1. Studies are needed to obtain information on productivity, quality, and cost in a larger sample of foodservice systems with comparable characteristics to the sample used in this study.
2. Studies of productivity, quality, and cost in foodservice systems with more than 200 beds (i.e. larger than the sample used in this study) should be conducted to establish relationships among these variables.
3. Studies are needed to determine other factors affecting productivity, quality, and cost per meal, such as quality of working life, organizational policies, organizational culture, and mission and objectives.

To remain competitive, foodservice managers in healthcare are required to provide quality food and services within tight budgetary constraints. To meet that goal, standards for productivity, quality, and cost per meal should be established

and procedures for measurement of these variables should be implemented in order to have necessary data for the decision making process. The system described in this study provides a comprehensive procedure for establishing and monitoring these variables in a healthcare setting.

REFERENCES

REFERENCES

Adam, E., Hershauer, J., and Ruch, W. (1981). Productivity and Quality Measurement as a Basis for Improvement. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Allington, J., Matthews, E., and Johnson, N. (1981). Methods for evaluating quality of meals and implications for school foodservice. School Food Service Research Review, 5(2), 68-73.

American Hospital Association. (1989). American Hospital Association Guide to the Health Care Field, Chicago, IL: American Hospital Association.

American Hospital Association. (1975). Food Service. In Improving Work Methods in Small Hospitals, (pp. 43-52). Chicago, IL.: American Hospital Association.

American Hospital Association. (1988). Healthcare Administration Services Monitrend System. Chicago, IL: American Hospital Association.

American Hospital Association. (1988). Hospital Statistics. Chicago, IL; American Hospital Association.

Asp, E., and Darling, M. (1988). Home-delivered meals: Food quality, nutrient content, and characteristics of recipients. Journal of the American Dietetic Association, 88(1), 55-59.

Baker, M. (1988). Meeting the challenge in foodservice management: Enhanced quality at less cost. Journal of the American Dietetic Association, 88(4), 441-442.

Beach, B.L., and Ostenso, G.L. (1969). Entree serving times. Relationship of serving time to system capacity. Journal of the American Dietetic Association, 54, 290.

Bell, L.S., and Fairchild, M.M. (1989). Development of a productivity index to increase accountability of ambulatory nutrition services. Journal of the American Dietetic Association, 89(4), 517-519.

Bobeng, B., and David, B. (1977). HACCP models for quality control of entree production in foodservice systems. Journal of Food Production, 40(9), 632-638.

Bowman, J. and Gift, R. (1988). Knowing how well you're doing. Food Management, 23(6), 134-146.

Bowman, J., and Gift, R. (1989). Continuing to do well. Food Management, 24(3), 136-144.

Brown, N.E., (1972). A conceptual framework for analysis of a nursing home foodservice system and procedures for measurement of selected variables related to labor time. Unpublished doctoral dissertation, Department of Institution Management, Iowa State University, Ames.

Brown, N., McKinley, M., Baltzer, L., and Opurum, C. (1985). Temperature preferences for a single entree. Journal of the American Dietetic Association, 85(10), 1339-1341.

Burns, R. (1987, December). A commitment to customer service. Food Management, pp. 57-58.

Campbell, C.A. (1985). The enhanced productivity program. Journal of the American Dietetic Association, 85(11), 1479-1482.

Cardello, A. (1982). Patients' perceptions of meal acceptability. In Advisory Board on Military Personnel Supplies Commission on Engineering and Technical Systems National Research Council (Ed.) Hospital Patient Feeding Systems (pp. 31-84). Washington, DC: National Academy Press.

Coffey, C.A., Spragg, D., McCune, E., and Gordon, G. (1964). Continuous time study shows how scheduled time is spent. Hospitals, 38(2), 98.

Connelly, V.S. (1972). Analysis of processing times of selected quantity food production formulas. Unpub. M.S. thesis, University of Tennessee, Knoxville.

Cromwell, J. (1974, Sept.). Hospital productivity trends in short-term general nonteaching hospitals. Inquiry, 11, p. 181.

Crosby, P. (1979). Quality Is Free. New York: Nal Penguin, Inc.

Crosson, R.M., and Nance, H.W. (1972). Master Standard Data. The Economic Approach to Work Measurement. New York: McGraw-Hill Book Co.

Dahl, C. (1982). Effect of meal assembly, meal distribution, and meal service on sensory quality of food. In Advisory Board on Military Personnel Supplies Commission on Engineering and Technical Systems National Research Council (Ed.) Hospital Patient Feeding Systems (pp. 193-235). Washington, DC: National Academy Press.

David, B. (1972, August). A model for decision making. Journal of the American Hospital Association, 46, 51-55.

David, B.D. (1978). Work measurement in foodservice operations. School Foodservice Research Review, 2(1), 5-11.

Dayton, M., and Hitchcock, M. (1965). A study of labor time in a centralized school foodservice unit. Journal of Home Economics. 57(3), 192-196.

Deisenroth, M. (1967). Development of an instrument to assess quality of food in foodservice establishments. Unpublished M.S. thesis, Iowa State University, Ames.

Donaldson, B. (1957). Labor hours in the dietary department. Journal of the American Dietetic Association. 33(12), 1239-1243.

Donaldson, B. (1967). Effective utilization of hospital dietary personnel. Terminal Report, PHS Grant No. HM 00198. University of Wisconsin, Madison.

Dowling, R., and Cotner, C. (1988). Monitor of tray error rates for quality control. Journal of the American Dietetic Association, 88(4), 450-453.

Ellis, B.H., (1961). A Guide Book for Sensory Testing. Chicago, IL.: Continental Can Co.

Farrell, T. (1963). Communications in the foodservice industry. Cornell Hotel and Restaurant Administration Quarterly, 4(3), 20-28.

Freshwater, J.F. (1975). Basic Labor Productivity Measures for Popular Breakfast Menu Items. U.S. Dept. of Agriculture, Agriculture Res. Serv., Mkt. Res. Report No. 1044.

Glover, W. (1987). The cult of ineffectiveness. Cornell Hotel and Restaurant Administration Quarterly, 27(4), 16-18.

Hague, A., and Knickrehm, M. (1979). Salad preparation activities in a residence hall foodservice. Journal of the American Dietetic Association, 74, 459.

Halling, J., Lafferty, L., and Feller, K. (Eds.). (1986). Productivity Management for Nutrition Care. Chicago, IL: The American Dietetic Association.

Halsey, J.J. (1960). A new model for work sampling - the Greds theory. Journal of Industrial Engineering, 11, 503.

Halter, E., and Donaldson, B. (1957). Labor in the dietary department. Journal of the American Dietetic Association, 33, 581.

Hauge, A.J., (1975). An analysis of production and service activities in the salad department of an institutional foodservice facility. Unpub. M.S. thesis, University of Nebraska, Lincoln.

Ho, A.F. (1976). Activity sampling in two nursing home foodservice systems. Unpublished M.S. Thesis, University of Wisconsin, Madison, WI.

Institution Management Lab. (1967). Methodology Manual for Work Sampling. Madison, WI: University of Wis.

Johnson, V.K. (1960). Responsibilities of food production managers performing at the middle management level. Unpub. Ph.D. thesis, University of Wisconsin, Madison.

Johnson, N.E., Matthews, M.E., Allington, J.K., and Johnson, U.K. (1980). Quality of Food, Nutrition, and Foodservice in Wisconsin Nursing Homes. Publication of Faye McBeath Institute on Aging and Adult Life. Madison, WI: University of Wisconsin.

Koska, M.T. (1989, February 5). Quality-thy name is nursing care, CEO say. Hospitals, 63, 32.

Kotschevar, L. Owens, L., and Saylor, J. (1971). Dietary operation in state mental hospitals. American Hospital Association Journal, 45(20), 81-83.

Kroener, V., and Donaldson, B. (1958). Labor time in type A school lunch programs in Wisconsin. Journal of Home Economics, 50, 451.

Lebeau, J.N. (1974). Comparison of labor time estimates for the performance of specific food production tasks. Unpub. M.S. thesis, Iowa State University, Ames.

Leonard, F., and Sasser, W. (1982). The incline of quality. Harvard Business Review, p. 168.

Lieux, E.M., and Winkler, L.L. (1989). Assessing productivity of foodservice systems in nutrition programs for the elderly. Journal of the American Dietetic Association, 89(6):826-829.

Marteney, A., and Ohlsen, M. (1964) Work sampling of a dietary staff. Journal of the American Dietetic Association, 45, 212-217.

Martin, W. (1986). Quality Service: The Restaurant Manager's Bible. Ithaca, NY: Cornell University.

Matthews, M. (1982). Overview. In Advisory Board on Military Personnel Supplies Commission on Engineering and Technical Systems National Research Council (Ed.) Hospital Patient Feeding Systems (pp. 1-10). Washington, DC: National Academy Press.

Matthews, M.E. (1975). Productivity studies reviewed, trends analyzed. Journal of the American Hospital Association, 49, 81-84.

Matthews, M.E., Zardain, M.V., and Mahaffey, M.J. (1986). Labor time spent in foodservice activities in one hospital: A 12-year profile. Journal of the American Dietetic Association, 86, 636.

Mayo, C.R., and Olsen, M.D. (1987). Food servings per labor hour: An alternative productivity measure. School Food Service Research Review, 11(1), 48-51.

Mayo, C., Olsen, M. and Frary, R. (1984). Variables that affect productivity in school foodservice. Journal of the American Dietetic Association, 84, 187.

McCune, E. (1960). Food preference survey: Guide to better menus. Hospitals, 34, 70-74.

McDougall, M.D., Covert, R.P., and Melton, V.B. (1989). Productivity and Performance Management in Health Care Institutions. Chicago, IL: American Hospital Publishing, Inc.

Meyer, M.K. and Olsen, M.S. (1989). Productivity of the clinical dietitian: measurement by a regression model. Journal of the American Dietetic Association, 89(4), 490-493.

Miller, E.J. (1964). Quality - a magic formula? Journal of the American Dietetic Association, 45, 347-349.

Montag, G.M., McKinley, M.M., and Klinschmidt, A.C. (1964). Predetermined motion times: A tool in food production management. Journal of the American Dietetic Association, 45, 206.

Mundel, M.E. (1970). Motion and Time Study: Principles and Practices. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Murray, I.P. and Upton, E.M. (1988). Labor productivity in hospital foodservice. Journal of the Canadian Dietetic Association, 49, 178.

Ostenso, G.L., and Donaldson, B. (1966). Effective use of hospital dietary labor resources. Hospitals, 40(14), 127.

Pickworth, J.R. (1987). Minding the Ps and Qs: Linking quality and productivity. The Cornell Hotel and Restaurant Administration Quarterly, 28(5), 40-47.

Price, H.E. (1960). The utilization of mixers in eight quantity food service units. Unpub. M.S. thesis, University of Wisconsin, Madison.

Price, J.L., and Mueller, C.W. (1986). Handbook of Organizational Measurement. Marshfield, MA: Pitman Publishing, Inc.

Puckett, R., Boe, D., and Medved, C. (1987). Management engineering principles applied to foodservice operations. Journal of the American Dietetic Association, 87(6), 770-774.

Rojas, I.C. (1968). Analysis of activities by work sampling of foodservice managers in a university cafeteria and comparison results with a 1962 study. Unpub. M.S. thesis, Cornell University, Ithaca, NY

Rose, J.C. (1984). Handbook for Healthcare Foodservice Management. Rockville, MD: Aspen Systems Corp.

Ross, J. (1978). Managing Productivity. Reston, VA: Reston Publishing.

Ruf, K.L., and David, B.D. (1975, December 16). How to attain optimal productivity. Journal of the American Hospital Association, 49, 77-81.

Sanford, J., and Cutlar, K. (1964). Work sampling of activities of foodservice managers. Journal of the American Dietetic Association, 44, 182.

SAS Institute. (1986). Statistical Analysis System, Cary, NC: SAS Institute, Inc.

Schuster, K. (1989). Crosby's quality is free. Food Management, 24(4), 212.

Sink, D.S. (1985). Productivity Management: Planning, Measurement, and Evaluation, Control and Improvement. New York: John Wiley and Sons, Inc.

Smith, N. (1972). Development of standard times for work modules used in quantity food production. Unpub. M.S. thesis, University of Tennessee, Knoxville.

Sneed, J., and Kresse, K. (1989). Understanding Foodservice Financial Management. Rockville, MD: Aspen Publishers, Inc.

Stephenson, S. (1988). Hospitals forge the future. Restaurants and Institutions, 98(6), 42-66.

Stokes, J.F. (1985). Cost Effective Quality Food Service, An Institutional Guide. Maryland: Aspen Systems Corporation.

Stokes, J.F. (1989). Revenue from Foodservice? You Bet! Provider, 15(7), 9.

Stumpf, G.L., and Donaldson, B. (1957). Better management by control of direct expenses. Journal of the American Dietetic Association, 33, 117.

Thorner, M., and Manning, P. (1976). Quality Control in Food Service. Westport, CT: The AVI Publishing Company, Inc.

Townsend, P.L. (1986). Commit to Quality. New York: John Wiley and Sons.

Traynham, J. (1966). Development of an instrument to assess quality of service in restaurants. Unpub. M.S. Thesis, Iowa State University, Ames.

Tuthill, B., and Donaldson, B. (1956). Labor in the dietary department: A study of ten hospitals. Journal of the American Dietetic Association, 32, 541.

Waldvogel, C.F., and Ostenso, G.L. (1977a). Quantity food production labor time. Master Standard Data Code. Journal of the American Dietetic Association, 70, 172.

Waldvogel, C.F., and Ostenso, G.L. (1977b). Labor time per portion and volume in foodservice. Journal of the American Dietetic Association, 70, 178.

Webster's Ninth New Collegiate Dictionary. (1986). Springfield, MA: G. & C. Merriam Company.

Williams, J., and Donaldson, B. (1969). SCORE: A management evaluation program for dietary departments. Journal of the American Dietetic Association, 54, 283.

Wilson, M. (1956). Determining work loads by random ratio-delay sampling. Journal of the American Dietetic Association, 32, 719.

Wong, E.Y., Graff, N.B., and Hagan, D.W. (1989). Ranking quality indicators of patient meal satisfaction: which ones are most important to patients? A Supplement to the Journal of the American Dietetic Association. 89(9):A-79.

Yung, L.S., Matthews, M.E., Johnson, V.K., and Johnson, N.E. (1980). Productivity in foodservice systems in fourteen nursing homes. Journal of the American Dietetic Association, 77, 159-164.

Zemel, P., and Matthews, M.E. (1982). Determining labor productivity time for roast entrees in hospital foodservice. Journal of the American Dietetic Association, 82, 709.

APPENDIXES

Appendix A

Approval from the University of Tennessee Human Subjects Research Review Committee

THE UNIVERSITY OF TENNESSEE
KNOXVILLE

Office of the
Vice Provost
for Research

CRP #: 2867 A DATE: 12/12/88

Productivity, Quality, and Cost Relationships in a Healthcare Foodservice Operation

Buchan, Roberta
801 E. Hemlock St
LaFollette, TN 37766

Sneed, Jeannie
229 Jessie Harris Bldg.
Campus

The project listed above has been certified exempt from review by the Committee on Research Participation.

This certification is for a period ending one year from the date of this letter. Please make timely submission of renewal or prompt notification of project termination (see item #2 below).

The responsibilities of the project director includes the following:

1. Prior approval from the Vice Provost for Research must be obtained before any changes in the project are instituted.

2. Submission of a Form D at 12-month intervals attesting to the current status of the project (protocol is still in effect, project is terminated, etc.).

We wish you success in your research endeavors.

Sincerely,

Thomas C. Collins

Thomas C. Collins
Vice Provost for Research

cc: Department Head
CRP file

404 Andy Holt Tower / Knoxville, Tennessee 37996-0140 / (615) 974-3466

THE UNIVERSITY OF TENNESSEE
KNOXVILLE

Office of the
Vice Provost
for Research

CRP #: 2867 A DATE: 01/16/90

Title: Productivity, Quality, and Cost Relationships in a Healthcare Foodservice Operation

Buchan, Roberta
Nutrition and Food Sciences
801 E. Hemlock St
LaFollette, TN 37766

Sneed, Dr. Jeannie
Nutrition and Food Sciences
229 Jessie Harris Bldg.
Campus

This is to notify you that your request for renewal with no change in protocol of the above-captioned project has been approved.

This approval is for a period ending one year from the date of this letter. Please make timely submission of renewal or prompt notification of project termination (see item #3 below).

Responsibilities of the investigator during the conduct of this project include the following:

1. To retain signed consent forms from subjects for at least three years following completion of the project.

2. To obtain prior approval from the Committee before instituting any changes in the project (Form D).

3. To submit a Form D at 12-month or less intervals attesting to the current status of the project (protocol is still in effect, changes have been made, project is terminated, etc.)

We wish you continued success in your research endeavor.

Sincerely yours,

Edith M. Szathmary
Coordinator of Compliances

cc: Dr. Jim Moran
229 Jessie Harris Bldg.

404 Andy Holt Tower / Knoxville, Tennessee 37996-0140 / (615) 974-3466

Appendix B

Approval from the Quality Assurance Coordinator of the LaFollette Medical Center

TO WHOM IT MAY CONCERN:

The Patient Opinion Survey, Form IX, has been approved by the Quality Assurance Coordinator as part of the ongoing quality assurance program at the LaFollette Medical Center.

Eugenia B. Branam

Eugenia B. Branam, A.R.T.
Director, Quality Assurance

Nov. 23, 1988
Date Approved

Appendix C

Procedure for Ensuring Randomness of Quality Inspections

Procedure for Ensuring Randomness of Quality Inspections

A large enough sample, taken at random, tends to have the same pattern of characteristics as the total situation (A.H.A., 1975). Therefore, a plan that provides for inspection of a sample of the units of product/service, designed in such a way that each unit has an equal opportunity of being selected for inspection, provides reliable information concerning all units of a product/service. Random sampling of inspection locations and times is essential to ensure unbiased results and complete coverage of activities (A.H.A., 1975).

A table of random numbers was used to ensure randomness in scheduling the observations for the quality inspections. Selections were made to designate the day, meal, and area for each inspection. The following procedure was used:

1. The starting point was any one of the two-digit numbers appearing at any place in the table of random numbers.
2. Numbers were selected in sequence. The direction of the sequence of numbers was constant (up, down, diagonal, left to right, right to left) for any one inspection.
3. The day of the week was designated by the next random number in sequence according to the following:

Numbers from Table of Random Numbers	Day
00-13	Sunday
14-27	Monday
28-41	Tuesday
42-55	Wednesday
56-69	Thursday
70-83	Friday
84-97	Saturday

4. The meal or time was designated by the next random number in sequence according to the following:

Number from Table of Random Numbers	Meal time
00-32	Breakfast(6-9am)
33-65	Dinner (10am- 2pm)
66-99	Supper (3pm-6pm)

5. The equipment was designated by the next random number in sequence according to the following:

Numbers from Table of Random Numbers	Equipment
00-06	Utility carts
07-13	Tables/Counters
14-20	Sinks
21-27	Refrigerators
28-34	Freezers
35-41	Stoves/Ovens
42-48	Steamer
49-55	Coffeemaker
56-62	Dishwasher
63-69	Garbage Disposal
70-76	Pots and Pans
77-83	Trash Containers
84-90	Meat Slicer
91-97	Mixers
98-99	Can Opener

2. The area for facility maintenance was designated by the next random number in sequence according to the following:

Numbers from Table of Random Numbers	Area
00-17	Doors
18-35	Floors
36-53	Walls
54-71	Lights
72-89	Hoods, Ventilators
90-99	Lavatory

7. The personnel to be inspected was designated by the next random number in sequence, according to the following:

Numbers from Table of Random Numbers	Personnel
00-13	Cook
14-27	Assistant Cook
28-31	Salad preparation
32-45	Baker
46-59	Dishmachine operator
60-73	Diet Clerk
74-87	Porter
88-99	Foodservice Supervisor

8. The time to be inspected in the cafeteria was designated by the next random number in sequence, according to the following:

Numbers from Table of Random Numbers	Time
00-15	11:00 am
16-31	11:30 am
32-57	12:00 pm
58-73	12:30 pm
74-89	1:00 pm
90-95	4:00 pm
96-99	4:30 pm

9. The patient was designated by the next random number in sequence, according to the following:

Numbers from Table of Random Numbers	Room No.	Bed
00	102	A
01	102	B
02	103	A
03	103	B
04	104	A
05	104	B

and so forth...

If the patient designated was absent when the observation was made, the next higher room and bed numbers were used for observation.

10. The menu items to be inspected were selected by numbering each item on the menu for the day and following the Table of Random Numbers

to pick out which item would be observed. This was done for both the regular diet and the cafeteria menu.

11. The next random number was used to determine the next scheduled observation day.

12. The following is an example of the procedure for determining scheduled days, meals, times, and areas for inspection:

Step	Line	Number	Column	Comment
1	6	79	1	Starting point
2				Direction: up
3	5	27	1	Monday
4	4	93	1	Supper (3pm-6pm)
5	3	51	1	Coffeemaker

13. The following outline was followed in planning the study:

(1) Randomly selected the dates.

(2) Form V - Food production.
   (a) Randomly selected the foods.
   (b) Randomly selected the meal.

(3) Form VI - Patient Foodservice.
   (a) Randomly selected the meal.
   (b) Randomly selected the patient by room and bed number.

(4) Form VII - Sanitation.
   (a) Randomly selected equipment.
   (b) Randomly selected facility maintenance.
   (c) Randomly selected personnel.
   (d) Randomly selected time.

(5) Form VIII - Cafeteria Service.
   (a) Randomly selected a food.
   (b) Randomly selected the meal.

(6) Form IX - Patient Opinion Survey.
   (a) Randomly selected the meal.
   (b) Randomly selected the patient by room and bed number.

Appendix D

LaFollette Medical Center Dietary Statistical Report

LaFollette Medical Center
LaFollette, Tennessee

DIETARY STATISTICAL REPORT DATE _____
Month and year

MEALS SERVED:

	A-Hospital	B-Nursing Home	
A. Patients			
1. Regular diets	_____	_____	
2. Modified diets	_____	_____	
TOTAL PATIENTS	_____	_____	_____ Total A + B

B. Non-Patient Meals
1. Total revenue (cafeteria) _____
2. Equivalent meal cost _____ _____ #1/#2
(Entree, Starch, Vegetable, Salad, Bread, Beverage)

C. Other meals - nonpaid and catered _____

D. Total nourishment counts/18: _____

TOTAL EQUIVALENT MEALS: _____
Total A + B + C + D

COST:	A-MONTHLY	B-PER MEAL
A. Food	_____	_____
B. Supplies	_____	_____
C. Labor	_____	_____
TOTAL COST	A-PER MONTH	B-PER MEAL
	_____	_____

LABOR PRODUCTIVITY:

A. Number of hours paid labor _____

B. Paid labor minutes per meal equivalent _____
(number of hours paid labor/total equivalent meals)X(60)

DIETARY PATIENT EDUCATION:

A. Number of visits to patients by dietary personnel _____

B. Number of patients received diet instructions _____

C. Number of nutrition notes written in the medical records progress notes. _____

_____
Director of Dietetic Services

Appendix E

Productivity Index Forms

Form 1 - Report of Labor Data by Employee Classification

Employee Classification: _____(1) Date: _____(2)

(A) Position Title	(B) Employee Name	(C) % Time (hrs)	Service Area (D) Pat. %	(E) Cafe. %	(F) Cater. %	(G) Total Hrs Paid	(H) Hrs. Paid not worked	(I) Net hours worked (G-H)	Hours Paid (J) Pat.	(K) Cafe.	(L) Cater.	Hours Worked (M) Pat.	(N) Cafe.	(O) Cater.
								Total Hours						
									Hours Paid Total J+K+L			Hours Worked Total M+N+O		

adapted from (Halling et al., 1986, p. 17).

Form II

Hours Worked and Hours Paid Distributed by Employee Classification for Identified Service Area

Service area: _____(1) Time period: _____(2)

Output unit: _____(3) Output No.: _____(4)

Employee Classification	(Q) Hours	(R) Hours	(S) $\frac{\text{Labor hours paid}}{\text{Output}}$	(T) $\frac{\text{Labor hours worked}}{\text{Output}}$
1.				
2.				
3.				
4.				
5.				
Total for service area				

adapted from (Halling et al., 1986, p. 19).

Form III

Summary of Total Labor Hours Paid and Worked
and Total Meal Equivalents Used to Calculate
The Productivity Indexes

Date_____

Service Area	(AA) Total Hours Paid	(BB) Total Hours Worked	(CC) Total Meal Equivalents
1.			
2.			
3.			
4. Grand Total			

Productivity Index A = Paid Labor Hours / Total Output Number.

Productivity Index B = Labor Hours Worked / Total Output Number.

Productivity Index A = _____ = X 60 = (5) _____.

Productivity Index B = _____ = X 60 = (6)_____.

Form IV

Summary of Service Area Productivity

Service Area	(U) Current ratio Date:		(W) Comparison ratio Date:		(Y) Year-to-date productivity average	
	Hours paid	Hours worked	Hours paid	Hours worked	Hours paid	Hours worked
A. Patient (hours/meal equivalent)						
B. Non-Patient 1. Cafeteria (hours/sales) (cost of meal equivalent) 2. Catering (hours/number of transactions)						

Adapted from (Halling et al., 1986, p. 20)

Appendix F

Quality Index Forms

Form V - Quality Inspection for Food Production

Breakfast____ Dinner____ Supper_____ Date_____

Foods (select 5)	Appearance S	Appearance U	Taste S	Taste U	Texture S	Texture U	Food Temperatures Serving Line STD	ACT	S	U	Delivered STD	ACT	S	U
1.														
2.														
3.														
4.														
5.														
Totals														

Comments for unsatisfactory ratings:

Reviewed by:

Temperature Standards:

Food item	Serving Temperature °F	Delivery Temperature °F
Hot Liquids	185	150
Hot Cereals	175	150
Soups	180	130
Meats	150	110
Eggs	145	110
Vegetables	160	110
Cold liquids	36	50
Cold Foods	50	65

Adapted from : (American Hospital Association, Improving Work Methods in Small Hospitals, 1975, p.43).

Inspection Criteria for Satisfactory Ratings:

1. Appearance: satisfactory color; food item is uniform in size and shape.
2. Taste: no strong or undesirable flavors; desirable relationship to product; seasoned adequately and pleasing aroma.
3. Texture: not overcooked or undercooked; moisture content makes texture suitable; not tough or stringy; not too soft or mushy.

Adapted from (A.H.A., 1975, p. 46).

Form VI- Quality Inspection for Patient Foodservice

Breakfast _____ Dinner_____ Supper_____ Date_____

Patient Name Room No. (Randomly select 5)	Trays: Appearance S	Trays: Appearance U	Trays: Accuracy S	Trays: Accuracy U	Leave Kitchen Time	Delivery: Arrive Bed Time	Standard ½hr		% of meal eaten: S >75%	% of meal eaten: U <75%
1.										
2.										
3.										
4.										
5.										
Totals										

Comments for unsatisfactory ratings:

Reviewed by:

Appearance standard: Variety of pleasant color combinations

Accuracy standard: 100% correct.

Adapted from(A.D.A. , 1975, p. 47).

Form VII Quality Inspection for Sanitation

Date_____ Time_____ Reviewed by_____

Equipment (Randomly select 5)	Clean S	Clean U	Good Operating Condition S	Good Operating Condition U	Comments for Unsatisfactory Ratings
Utility Carts					
Tables/Counters					
Sinks					
Refrigerators					
Freezers					
Stoves/Ovens					
Steamer					
Coffeemaker					
Dishwasher					
Garbage Disp.					
Pots and Pans					
Trash Containers					
Meat Slicer					
Mixers					
Can Opener					
Total					Grand Total: _____ for equipment

Facility Maintenance (Randomly select 4)	Clean S	Clean U	Comments for unsatisfactory ratings
Doors			
Floors			
Walls			
Lights			
Hoods, Ventilators			
Lavatory			
Total			

Personnel (select 2)	Uniform S	Uniform U	Cap or Hairnet S	Cap or Hairnet U	Hands S	Hands U	Personal Hygiene S	Personal Hygiene U
1.								
2.								
Totals								

Grand Total: _____ for personnel

Adapted from: (A.H.A., 1975, p. 48).

Form VIII- Quality Inspection for Cafeteria Service

Dinner____ Supper____ Date_____ Time_____

Randomly select a food product on the steam table Food item:	S	U
Color		
Texture		
Flavor		
All Foods: Variety of food		
Pan Placement		
Size of Pans		
Neatness/Cleanliness		
Overall appearance of serving line		
Overall quality of preparation		
Total		

Comments for unsatisfactory ratings:

Form IX - Patient Opinion Survey

Breakfast_____ Dinner_____ Supper_____ Date_____

	Yes	No
1. Did you get the food you wanted?		
2. Did you like what you ate?		
3. Did your tray look nice?		
4. Were hot foods hot?		
5. Were cold foods cold?		
6. Has anyone from the Dietary Department visited you?		
7. Did you get enough to eat?		
8. Were your dishes clean?		
9. Did you get a menu to make your own food choices?		
10. Did the food taste good?		
Total		

Comments:

Form X - Cafeteria Opinion Survey

	Yes	No
1. Did you like what you ate?		
2. Was the hot food hot?		
3. Was the cold food cold?		
4. Did you like the menu?		
5. Were the foodservice workers who served your food friendly?		
6. Did you get enough to eat?		
7. Were your dishes clean?		
8. Did the food taste good?		
9. Are the meal hours acceptable?		
10. Did your food look nice?		
Total		

Comments:

Form XI - Catering-Guest Survey

	Yes	No
1. Did you like what you ate?		
2. Was the hot food hot?		
3. Was the cold food cold?		
4. Was your beverage temperature acceptable?		
5. Did your food look nice?		
6. Were the food portions adequate?		
7. Was the quality of food acceptable?		
8. Were the hours of meal service acceptable?		
9. Were your dishes clean?		
10. Was there enough variety given in the meal?		
Total		

Form XII - Summary of Quality Inspections Date_____

Category	Total Ratings Satisfactory	Unsatisfactory	Total	% acceptable	Quality Index
A. Food Production					
1. Appearance					
2. Taste					
3. Texture					
4. Serv. Temp.					
5. Deliv. Temp.					
B. Patient Foodservice					
1. Tray Appearance					
2. Tray Accuracy					
3. Delivery					
4. % of meal eaten					
C. Sanitation					
1. Equipment					
2. Facility maintenance					
3. Personnel					
D. Cafeteria Service					
E. Surveys					
1. Patient Opinion					
2. Cafeteria Customers					
3. Catered or Guests					

Quality Index= _____

Appendix G

Cost Index Forms

Form XIII - Summary of Meal Equivalents and Cost

Date: _____

Meals Served:

A. Patients: _____

B. Non-Patients:
   1. Total revenue _____
   2. Equivalent meal cost _____ _____ #1/#2
      (Entree, Starch, Vegetable, Salad, Bread, Beverage)

C. Other Meals: _____
   nonpaid and catered

D. Total number of nourishment counts/18: _____

E. Total meal equivalents: _____
   (A + B + C + D)

Cost:		A-month	B-day	C-meal
A. Food.....	Beginning inventory _____			
	+			
	Purchases _____			
	=			
	Total food available for use			
	_____			
	-	= _____	____	____
	Ending inventory _____			
B. Supplies.....	Beginning inventory _____			
	+			
	Purchases _____			
	=			
	Total supplies available for use			
	_____			
	-	= _____	____	____
	Ending inventory _____			
C. Labor.....	Productive _____			
	+	= _____	____	____
	Overtime _____			
	TOTAL COST	_____	____	____

Cost Index:

$$\frac{\text{Total Cost of Food + Supplies + Labor}}{\text{Total Meal Equivalents}} = \_\_\_\_\_$$

Appendix H

Summary Form

Form XIV

Summary of Productivity Index, Quality Index, and Cost Index
for
Date_____

Productivity Index A
(paid labor minutes/total meal equivalents) _____

Productivity Index B
(labor minutes worked/total meal equivalents) _____

Quality Index _____

Cost Index
(Total cost/total meal equivalents) _____

VITA

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