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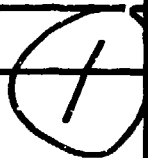
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A STUDY TO DETERMINE IF THE CRITICAL SUCCESS FACTOR CONCEPT IS VIABLY APPLICABLE FOR USE IN DEVELOPING A MANAGEMENT INFORMATION SYSTEM FOR USE IN NUTRITION CARE DIVISIONS

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This study used the critical success factor concept to develop a management information system for use in US Army hospitals' Nutrition Care Divisions. A panel of Nutrition Care chiefs were given a series of questionnaires to identify the critical success factors common to all Nutrition Care Divisions. Eight critical factors were identified. Each was converted to operational terms by identification of standards. The author concluded that the identification of critical success factors is better than the previous system of management by exception.

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NUTRITION CARE DIVISIONS

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I. INTRODUCTION

Development of the Problem

Food service operations are typically managed under the guise of management by exception. Managers respond to some stimulus which threatens homeostasis. These crises are compounded by the frequency of their occurrence. Typical examples include complaints about the food, disgruntled employees, unavailability of essential menu items, pilferage, overspent budgets and equipment failures.

The existing management information system consists of by-products from cost accounting, timekeeping, and whatever surveying is performed to satisfy requirements of the Joint Commission on Accreditation of Hospitals. These by-products are not adequate in supplying the cybernetic needs of the operation. For example, the key by-product of the cost accounting system is rations served. Data are maintained on a daily basis, daily cumulative basis, monthly basis, quarterly basis and fiscal year basis. While its importance as a driving force for resources should not be

diminished, this quantitative measure of performance is of little value in directing the manager to potential crises.

Food service crises represent misapplications of resources, poor quality, and general mismanagement, especially if they could have been avoided. The impetus that has resulted in the focuses on quality assurance, risk management, cost containment, and appropriate use of scarce health care resources mandates that food service operations be managed efficiently and effectively. The real crisis facing food service operations is the lack of information needed to provide management direction.

The problem of information certainly is not new, nor unique to the food service operations. As the president of a banking corporation observed,

I think the problem with management information systems in the past in many companies has been that they're overwhelming as far as the executive is concerned. He has to go through reams of reports and try to determine for himself what are the most critical pieces of information contained in the reports so that he can take the necessary action and correct any problems that have arisen.

Rockart reported the development of a new systems approach of defining managerial information based on critical success factors.²

... A company's information system must be discriminating and selective. It should focus on success factors. In most industries there are usually three to six factors that determine success; these key jobs must be done exceedingly well for a company to be successful.³

Three examples of the use of critical success factors were described.⁴ Styling, an efficient dealer organization, and effective control of production costs have been identified as the industrial critical success factors for the automotive industry. In the food processing industry, initial success factors include the development of new products, the distribution of products, and effective advertisement. Success in the life insurance industry depends on the development of agency management personnel, effective control of clerical personnel, and innovation in creating new types of policies.

Critical success factors thus are, for any business, the limited number of areas in which results, if they are satisfactory, will ensure

successful competitive performance for the organization. They are the few key areas where things must go right for the business to flourish.⁵

While the food service operations of the Army Medical Treatment Facilities are not concerned about the performance of a competitive nature, they are, nonetheless, concerned about satisfactory and successful performance.

The premise of this author was that a management information system for a food service operation could be designed using critical success factors. Such a system could provide the food service manager with a tool to better manage the operation.

Research Question

Is the critical success factor concept viably applicable for use in developing a management information system for use in U.S. Army hospital Nutrition Care Divisions?

Definitions

There are five definitions which are germane to the following discussion:

1. Critical success factors: Those areas in which results must be at least satisfactory for the activity to be successful. Criteria are developed for each factor on which to measure performance.

2. Delphi technique: A method where the iterative use of questionnaires results in group consensus. It will also be referred to as a Delphi process.

3. Management information system: For purposes of this research, a management information system is a formal method of supplying the cybernetic needs of a manager so that better control of the operation is obtained.

4. Participant panel: A selected group of dietitians who will participate in a Delphi process. It will also be referred to as the panel.

5. Prime measures: Those key measures which indicate the status of critical success factors. For example, one prime measure for employee morale might be turnover.

Objectives

There are six major objectives which will be accomplished during the research process.

1. A literature review will be conducted.

2. A participant panel of Army dietitians will be selected to participate in a Delphi process.

3. Using the Delphi technique, critical success factors will be identified.

4. Prime measures for each critical success factor will be determined from comments generated through the Delphi process and the literature review.

5. Methods will be developed to collect data on the prime measures for each critical success factor.

6. The results of this research will be forwarded to the Chief Dietitian, Office of The Surgeon General, with recommendations for implementation.

Criteria

1. Twenty-five dietitians must complete their participation in the Delphi process.

2. Each of the top 5 critical success factors must have been ranked in the top five by at least sixty percent of the Delphi panel.

3. Prime measures must be identified for each critical success factor.

4. There must be identifiable means of collecting data for each prime measure.

5. The prime measures must identify some degree to which the critical success factors have been achieved. The development of standards on which to base success is beyond the scope of this research, but will be identified on the implementation plan.

Assumptions

The author acknowledges the following assumptions:

1. The critical success factors identified through the Delphi process accurately reflect the true indicators of success for a food service operation.
2. The participant panel will maintain a high level of motivation throughout the Delphi process.
3. The participant panel members possess sufficient skills in written communication.

Limitations

The following general limitations of this research are known at this time.

1. The management information system developed by this research may only be applicable to U.S. Army hospital Nutrition Care Divisions located within the continental United States.

2. The research will be limited to the process of developing a management information system using critical success factors. The validation of these factors is beyond the scope of this research.

3. The Delphi process will be limited to four iterations. At the end of the fourth iteration, those factors which have received at least sixty percent consensus will be identified as the critical success factors.

Literature Review

An extensive literature review was made in the several subject areas which have congruence with this topic, including cybernetics, planning and control, information and information systems, quality assurance, and computerization. The literature reviewed ranged from the broad general management area to the specific area of hospital food service.

Cybernetics

As a system, the Nutrition Care Division can be described a "set of interrelated and interdependent parts designed to achieve a set of goals."⁶ Like any other system, it can be conceptualized by the systems model as illustrated in Figure 1.⁷

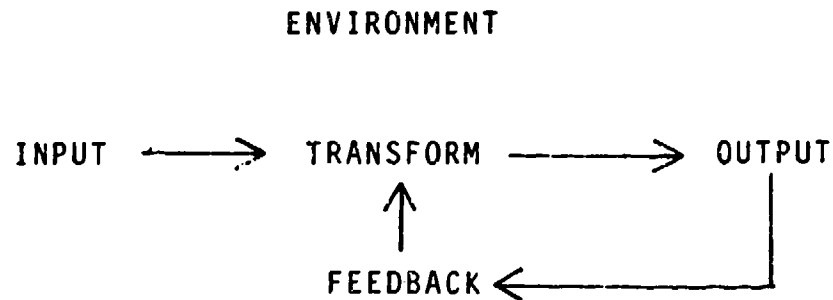


Fig. 1. Systems Model

Examples of inputs include food ingredients, personnel, knowledge of nutrition, equipment, and supplies. The transfer includes food preparation and service, patient assessments, menu writing, and dietary education. Outputs include patient trays, dining hall meals, educated patients (with the desired ultimate outcome of changed dietary behavior), and satisfied employees. In addition to the hospital environment, the system operates within the local military and the broader Army Medical Department environments. The component of concern to this study is the feedback or cybernetic loop.

Janke asserted that although cybernetics could be generalized as the feedback component of a system, it could be more accurately described as a system, in itself, with inputs, outputs, transform, feedback, and environment.⁸

Information systems management introduces the perception of the cybernetic complement to energy systems and some unique context specific techniques for the identification and manipulation of systems variables during the management stages. . . .

Information is the one single source and conduit of management power; the single purpose of information is to reduce uncertainty in the decisions made in managing energy systems. In this respect, information is quite different from data. Information, as opposed to energy, is not consumed when it is used. Finally, information systems (cybernetics) as opposed to data systems (commodity) management is based upon an initial determination of relevant information needs and requirements of the energy system.⁹

Information and Information Systems

Toffler and Naisbitt have brought considerable popular attention to the magnitude of the information explosion.¹⁰ Not everyone has been optimistic about this proliferation. Daniel warned, in 1961, about an information crisis. He described a widening gap between an organization's information needs and its ability to supply that information.¹¹ His study of this problem concluded that while data were generally available throughout organization

structure, it did not naturally flow to the manager. The distinction between data and information has been well described.¹² Advances in information and computer technology have allowed for vast manipulation of data, but has not facilitated an improved flow of real information. Research indicated that despite the use of complex conceptual models, information pitfalls continue to exist primarily due to a failure to determine, properly and accurately, the information needs of an organization.¹³

Four major approaches have previously been used to determine and supply information.¹⁴ The by-product method capitalizes on existing data manipulation systems.¹⁵ The general focus has been on financial/accounting systems, especially those automated functions. The information flowing to the manager consists of reams of computer print-outs and summary reports which are produced as by-products of the functions of payroll, accounts payable, and inventory computer runs. In hospitals where semi-automated nurse call systems have been installed, by-products consist of patient listings, which may contain physician diet orders.

The null approach is generally characterized by the lack of any information system.¹⁶ Premised on the idea that needed information would be supplied as needed through word

of mouth or memorandum, the response characterized by this system can be best described as crisis management. In Nutrition Care Divisions, daily diary notations are an example of a null approach to information.

The key indicator system is the fastest growing management information system of the eighties.¹⁷ A set of key indicators of business health are selected. Periodic written reports provide the status of these indicators. With the use of desk top computer terminals, key indicators can be constantly updated and presented visually with charts, graphs, and figures. The Medical Department Activity's Command Performance Summary Report is an example of a manual key indicator system.

The total study method is usually known by other names, including systems analysis, systems management, and information audits.¹⁸ The benefits of this method are rarely disputed, but the time and expense involved generally prohibit its use for routine information gathering.

Determination of Needs

Mason concurred with Janke in concluding that management information systems should facilitate a manager's ability to make decisions.¹⁹ His research asserted that the

closer an information system is keyed to the manager's needs, the better the decisions would be. Mason proposed the decision-oriented approach for the development of management information systems.²⁰ Decisions are the result of a series of activities which Mason summarized,

1. A source consisting of the physical activities and objects which are relevant to the business.
2. The observation, measurement and recording of data from the source.
3. The drawing of inferences and predictions from the data.
4. The evaluation of inferences with regard to the values (objectives or goals) of the organization and the choosing of a course of action.
5. The taking of a course of action.²¹

These steps are illustrated in Figure 2.

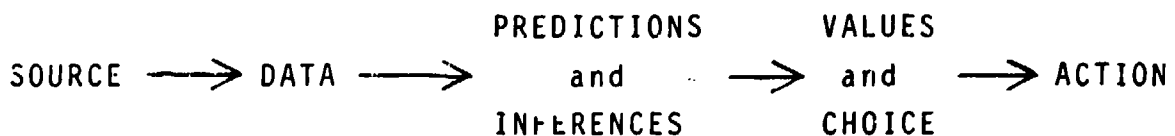


Fig 2. Steps in Decision Making

Mason's research revealed four basic designs for management information systems which are conceptualized in Appendix A. The differences in the designs are the point where the information system interfaces with the decision making system.

Mason further presented a feedback or cybernetic information system formed as combinations of the four basic designs.²² This is conceptually illustrated in Figure 3.

The basic cybernetic model commences with some norm or target being set by a decision-making information system. Then action is taken pursuant to this goal. Subsequently, observations are made to measure the effect that the action has upon the source, and the resulting "feedback" is recorded in a databank. These databank items are then compared with the target to generate a variance, error, or mis-match signal which shows the degree of deviation. The mismatch signal is, in turn, processed through the predictive-inferential and decision making stages. Finally action is taken with the intent of reducing the deviation to zero. This cycle is repeated to maintain the system "on course".²³

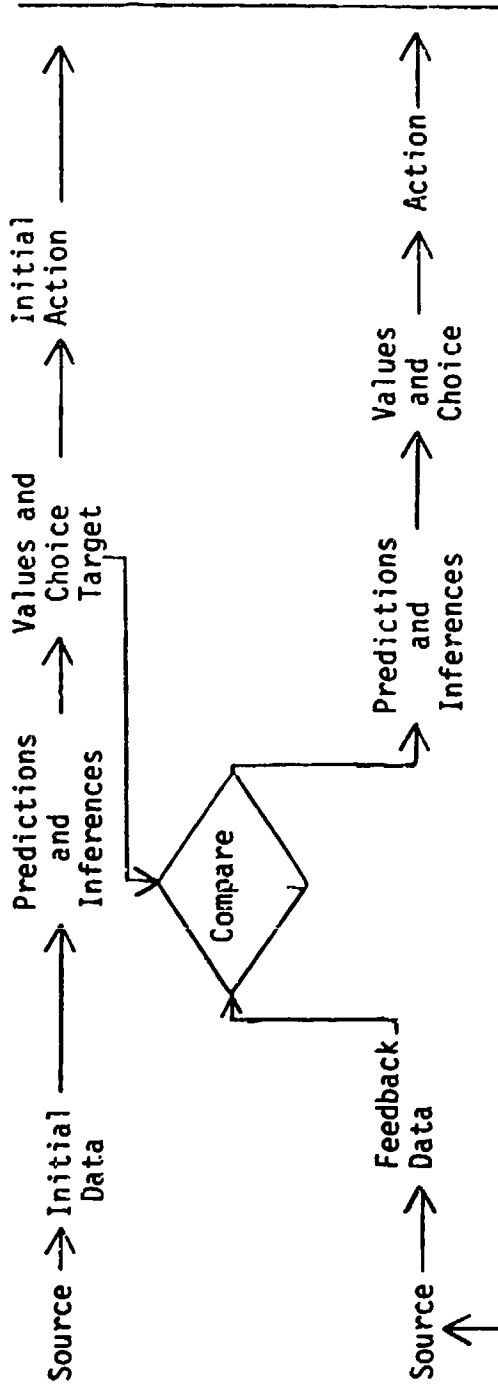


Fig. 3. Cybernetic Decision-Making System

SOURCE: Richard O. Mason, "Basic Concepts for Designing Management Information Systems," cited by Alfred Rappaport Information for Decision Making. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1975.

Shear studied the information needs of hospitals and the several management information systems attempting to provide for those needs.²⁴ He concluded that one of the most important capabilities of a management information system was its ability to evaluate performance, including a measurement of factors that directly contribute to the success of goal (objective) achievement. Shear recommended that management information systems be developed along system (subsystem) lines instead of along departmental (organization) lines.²⁵ His conclusion found congruence with Janke's assertion that cybernetic systems were complements of energy systems.

Sadek et al presented a correlation between having too much information and being misinformed.²⁶ To avoid this Dearden asserted that information must focus on key tasks and decisions.²⁷ Keen concluded that the criteria for design must come from managers as they ask four fundamental questions.²⁸

1. What is the decision or task?
2. How does the manager carry it out?
3. What information does he or she use? In what ways?

4. What would it mean to make this process more effective?

Control and Quality Assurance

Clear distinctions are not always made among the functions of management. Daniel argued that planning and control were the primary functions.²⁹ Organizing and staffing were described as subsets of planning based on clearly defined goals and objectives. Janke stated that directing, actions covering the range of human coordination, was a subset of controlling (maintaining) progress toward objectives.³⁰ The management information system must support the manager in these two tasks.

Merchant stated that once the planning function was accomplished, management's primary task was to take steps to insure plans were carried out or modified.³¹ As tasks are performed, decisions are needed as to the acceptability, appropriateness, and success of the efforts. Merchant reported that the control function consisted of three steps.³²

1. Establish standards

2. Measure performance against standards
3. Correct deviation from standards

Merchant concluded that the key task in control was the ability to measure performance.

Of considerable parallel to this concept of control is the process of quality assurance as it has evolved under the direction of the Joint Commission on Accreditation of Hospitals.

There shall be evidence of a well defined, organized program designed to enhance patient care through the ongoing objective assessment of inpatient aspects of patient care and the correction of identified problems.³³

Shiller and Behm reported the use of audits to control quality and efficiency of all aspects of food service operations.³⁴ Their approach involved four steps.

1. Develop criteria
2. Establish standards
3. Measure performance against criteria
4. Correct deviation from standards.

Snyder studied the application of control and quality assurance in the commercial (non-hospital) environment. He concluded that eighty percent of the problems encountered in food service operations were due to the lack of a management system to monitor and anticipate problems.³⁵

Merchant asserted,

Perfect control, meaning complete assurance that actual accomplishment will proceed according to plan, is never possible because of the likely occurrence of unforeseen events. However, good control should mean that an informed person could be reasonably confident that no major unpleasant surprises will occur.³⁶

Merchant proposed categories of responses when problems could not be avoided through automation, centralization, risk-sharing and elimination.³⁷ These categories of responses are based on the object of the control. That is, controls are exercised over specific actions, results, or personnel.³⁸ Table 1 depicts some common controls classified by Merchant.

TABLE 1

A Control Tool Classification Framework

Object of Control:		
Specific Actions	Results	Personnel
Behavioral Constraint: -Physical (e.g., locks, security guards) -Administrative (e.g., separation of duties)	Results Accountability: -Standards -Budget -Management by Objective (MBO)	Upgrade Capabilities: -Selection -Training -Assignment
Action Accountability: -Work Rules -Policies and Procedures -Codes of Conduct		Improve Communication: -Clarity Expectations -Provide Information for Coordination
Preaction Review -Direct Supervision -Approval Limits -Budget Reviews		Encourage Peer Control: -Work Groups -Share Goals

SOURCE: Kenneth A. Merchant, "The Control Function of Management," Sloan Management Review 23 (Summer 1982), p.45.

Two limiting factors exist which determine the optimal feasible type of control.³⁹ The first is the ability to measure results. In his decision making model (see Figure 2), Mason described this as "Prediction and Inference." The second factor is the knowledge of which specific actions are desirable. This is equated with Mason's "Values and Choices." A matrix structure is presented in Figure 4 to facilitate choice of control.

KEY CONTROL FEASIBILITY DETERMINATION

		Ability to Measure Results On Important Performance Dimensions	
		HIGH	LOW
Knowledge of Which Specific Actions Are Desirable	Excellent	Specific-Action and/or Results Control	Specific Action Control
	Poor	Results Control	Personnel Control

Fig. 4. Key Control Object Feasibility Determinants

SOURCE: Kenneth A. Merchant, "The Control Function of Management," Sloan Management Review 23 (Summer 1982), p.47.

Computerization

Erroneous conclusions are made that management information systems are computerized systems. Gorry and Morton asserted that despite the tremendous growth in the use of computers, few of the resulting systems have significantly impacted management's decision making.⁴⁰ Dearden, McFarlon, and Zani concluded that the important functions of top management were never on the computer.⁴¹ Rockart stated that this resulted from the failure to identify the needs of managers.⁴² The vital concern is not whether computers will be used to facilitate data manipulation but rather the determination of those needs.⁴³

Youngwirth presented a detailed literature review on the evolution of computers in food services.⁴⁴ The literature indicated a variety of computer uses, ranging from forecasting and inventory aids to continuing education.

No specific literature was found which described the identification of information needs of dietitians or food service managers or the development of information systems keyed to identified needs.

Research Methodology

The identification of critical success factors is accomplished through a nominal group process to obtain group consensus. Because of the impracticability of assembling a representative group needed for this study, a Delphi process was used.

It was the decision of this researcher that the population of Army dietitians possessed the expertise to best determine critical success factors for Army Nutrition Care Division operations.

Delbecq, Van de Ven and Gustafson indicated that the sample size for a homogeneous participant panel should be between ten and thirty.⁴⁵ Since Army dietitians have relatively similar educational and experiential backgrounds, they were considered a homogeneous group. One dietitian from each of the thirty-four Nutrition Care activities located in the continental United States was selected to participate in the Delphi panel. The selection of panel members was made jointly by this researcher and the chiefs at each activity.

Telephone interviews were conducted with most of the selected dietitians. Once an individual agreed to participate, the first questionnaire was mailed immediately accompanied by an introductory letter (see Appendix B).

Berdie and Anderson have reported the benefits of personalized correspondence in soliciting responses to questionnaires.⁴⁶ The author used a non-military letter format for the introductory letter. Letters were individually typed using word processing equipment. In addition to the introductory letter, an informal note using Optional Form 41, "Routing and Transmittal Slip," was included to encourage prompt reply. Preadressed envelopes were included with each questionnaire.

Delbecq, Van de Ven and Gustafson recommended that a deadline of two weeks be given for the receipt of the response.⁴⁷

The Delphi process designed for this study consisted of three questionnaires. Questionnaire #1 solicited general success areas (see Appendix C). In Questionnaire #2, participants ranked the critical categories, determined the degree of quality assurance, and indicated how these categories could be measured (see Appendix D). In Questionnaire #3, participants re-ranked the critical categories

(see Appendix E). During the third iteration, panel characteristics were solicited using a separate questionnaire (see Appendix F). If consensus could not have been reached, a fourth questionnaire, identical to the third, would have been developed for a last iteration.

The resultant top categories were used as the critical success factors for the development of a management information system.

A literature search was conducted into the nature of each factor. Information gleaned from the literature search and the comments from the questionnaires were used to identify prime measures for each factor.

Once the critical success factors and their prime measures were identified, on-site research was conducted at the Nutrition Care Division, Winn Army Community Hospital, Fort Stewart, Georgia. This research consisted of the identification and development of collection methods for prime measure data. There was no attempt made to validate the standards developed for the prime measures.

The question as to the applicability of developing a management information system using this critical success factor concept is determined by the attainment of the established criteria.

Footnotes

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¹³Homer H. Schmitz, "Hospital Information Systems: Know What You're Looking For," Hospitals 56 (April 1, 1982): 93-97.

¹⁴Rockart, p.82.

¹⁵Ibid.

¹⁶Ibid, pp.82-83.

¹⁷Ibid, pp 83-84.

¹⁸Ibid, p.84.

¹⁹Richard O. Mason, "Basic Concepts for Designing Management Information Systems," cited by Alfred Rappaport, Information for Decision-Making (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1975), p.3.

²⁰Ibid, p.3.

²¹Ibid.

²²Ibid, p.12.

²³Ibid, p.11.

²⁴Larry E. Shear, "Ability to Measure Performance Should Be Integral Part of Management Information Systems," Hospitals 55 (October 16, 1981): 123-24, 129, 146.

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²⁶Konrad E. Sadek, Ronald W. Hull and Alexander E. Tomeski, "Information Systems Professional's Job Transitions: Its Influence on Information Systems Design," Journal of Systems Management 34 (August 1983), 21-28.

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²⁹Daniel, p.113.

³⁰Janke, p.1.

³¹Kenneth A. Merchant, "The Control Function of Management," Sloan Management Review 23 (Summer 1982), 43.

³²Ibid.

³³Ibid.

³⁴Rosita Shiller and Valerie Behm, "Auditing Dietetic Services: First of a Series," Hospitals 53 (April 16 1979), 122.

³⁵Oscar P. Snyder, Jr., "A Management System for Foodservice Quality Assurance," Food Technology 37 (June 1983), 64.

³⁶Merchant, p.44.

³⁷Ibid.

³⁸Ibid, p.45.

³⁹Ibid, p.46-47.

⁴⁰G. Anthony Gorry and Michael S. Morton, "A Framework for Management Information Systems," cited by Alfred Kappaport, Information for Decision Making (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1975), p. 17.

⁴¹John Dearden, "Will the Computer Change the Job of Top Management?," Sloan Management Review 25 (Fall 1983), 58.

⁴²Rockart, p.82.

⁴³Schmitz, pp.93-97.

⁴⁴Joni Youngwirth, "The Evolution of Computers," Journal of the American Dietetic Association 82 (January 1983), 62-67.

⁴⁵Andre L. Delbecq, Andrew H. Van de Ven and David H. Gustafson, Group Techniques for Program Planning (Glenview, IL: Scott Foresman and Co, 1975) pp. 89-90.

⁴⁶Douglas R. Berdie and John F. Anderson, Questionnaires: Design and Use (Metuchen, NJ: The Scarecrow Press, Inc., 1974), pp.49-69.

⁴⁷Delbecq, Van de Ven, and Gustafson, p.93.

II DISCUSSION

Panel Characteristics

The delphi panel consisted of thirty-four Registered Dietitians. At some hospitals, dietitians worked as a group with the panel member acting as group leader. A majority of panel members were Chiefs of Nutrition Care Divisions. Table 2 depicts the composition of the delphi panel by current position.

TABLE 2
PANEL COMPOSITION BY CURRENT POSITION

CURRENT POSITION	NUMBER	PERCENT
Chief, Nutrition Care Division	26	78.8
Chief, Clinical Dietetic Branch	5	15.1
Chief, Production and Service Branch	0	0.0
Other	2	6.1
TOTAL	33	100.0

Thirty-three, or 97.1 percent, of the thirty-four panel members eventually completed their participation in the delphi process. On the first iteration, twenty-seven responses were received prior to analysis. Eventually, thirty-one replies were received. On the second iteration, twenty-six panel members responded prior to analysis. Eventually, thirty responses were received. On the third iteration, thirty-three of the thirty-four questionnaires were returned in time for the final analysis. Table 3 summarizes panel response.

TABLE 3
PANEL MEMBER RESPONSE

ITERATION	RETURNED ON TIME	PERCENT	EVENTUALLY RETURNED	PERCENT
1	27	79.4	31	91.2
2	26	76.5	30	88.2
3	33	97.1	33	97.1

Panel experience was measured in terms of education level, years of military and dietetic experience, and type of positions held. All of the respondents had baccalaureate degrees and 62.5 percent had postgraduate degrees. Table 4 depicts the education level of the panel.

TABLE 4
EDUCATION LEVEL OF PANEL MEMBERS

HIGHEST DEGREE	NUMBER	PERCENT
Baccalaureate	12	36.36
Masters	19	57.58
Doctoral	2	6.06
TOTAL	33	100.00

The distribution of years of experience in both dietetics and the military is depicted in Table 5. The panel had means of 11.9 and 11.6 for years of dietetic experience and years of military experience, respectively. Actual dietetic experience ranged from 1.5 years to 21.5 years.

TABLE 5
PANEL MEMBER EXPERIENCE

YEARS OF EXPERIENCE	TYPES OF EXPERIENCE			
	Dietetic		Military	
	No.	%	No.	%
0- 4.9	6	18.18	5	15.15
5- 9.9	8	24.24	8	24.24
10-14.9	6	18.18	8	24.24
15-19.9	10	30.30	9	27.27
20+	<u>3</u>	<u>9.10</u>	<u>3</u>	<u>9.10</u>
TOTAL	33	100.00	33	100.00

Table 6 depicts the array of positions experienced by panel members. Over 87 percent of the panel members had experience as Chief of a Nutrition Care Division. Slightly over 75 percent had been in charge of Clinical Dietetic Branches and almost 67 percent had been in charge of Production and Service Branches. The panel had a well-rounded experience base from both branches.

TABLE 6
EXPERIENCES OF PANEL MEMBERS

POSITION	NUMBER	PERCENT
Chief, Nutrition Care Division	29	87.88
Chief, Clinical Dietetic Branch	25	75.76
Chief, Production and Service Branch	22	66.67
Staff Clinical Dietitian*	26	78.79
Staff Production Dietitian	12	36.36
Other	2	6.06

*Includes Clinic Dietitian

When asked if they considered themselves administrative or clinical dietitians, 63.6 percent indicated administrative, 18.2 percent indicated clinical, and 18.2 percent indicated both.

Rank and sex information was solicited to determine if the panel was a representative sample of Army dietitians. Results are illustrated in Figures 5 and 6; and based on Chi square tests, it can be stated that distributions of rank and sex among the panel members did not differ significantly from the distributions of rank and sex among the population of Army dietitians. Tables 7 and 8 depict the results of these tests.

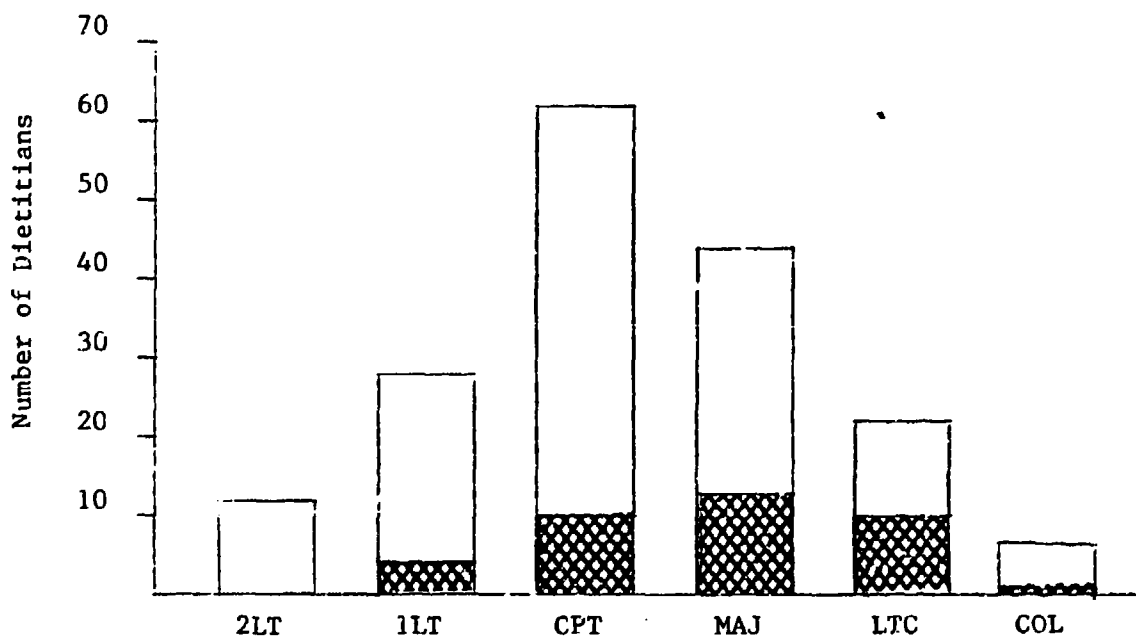


Fig. 5. Distribution of Rank between panel members and population.

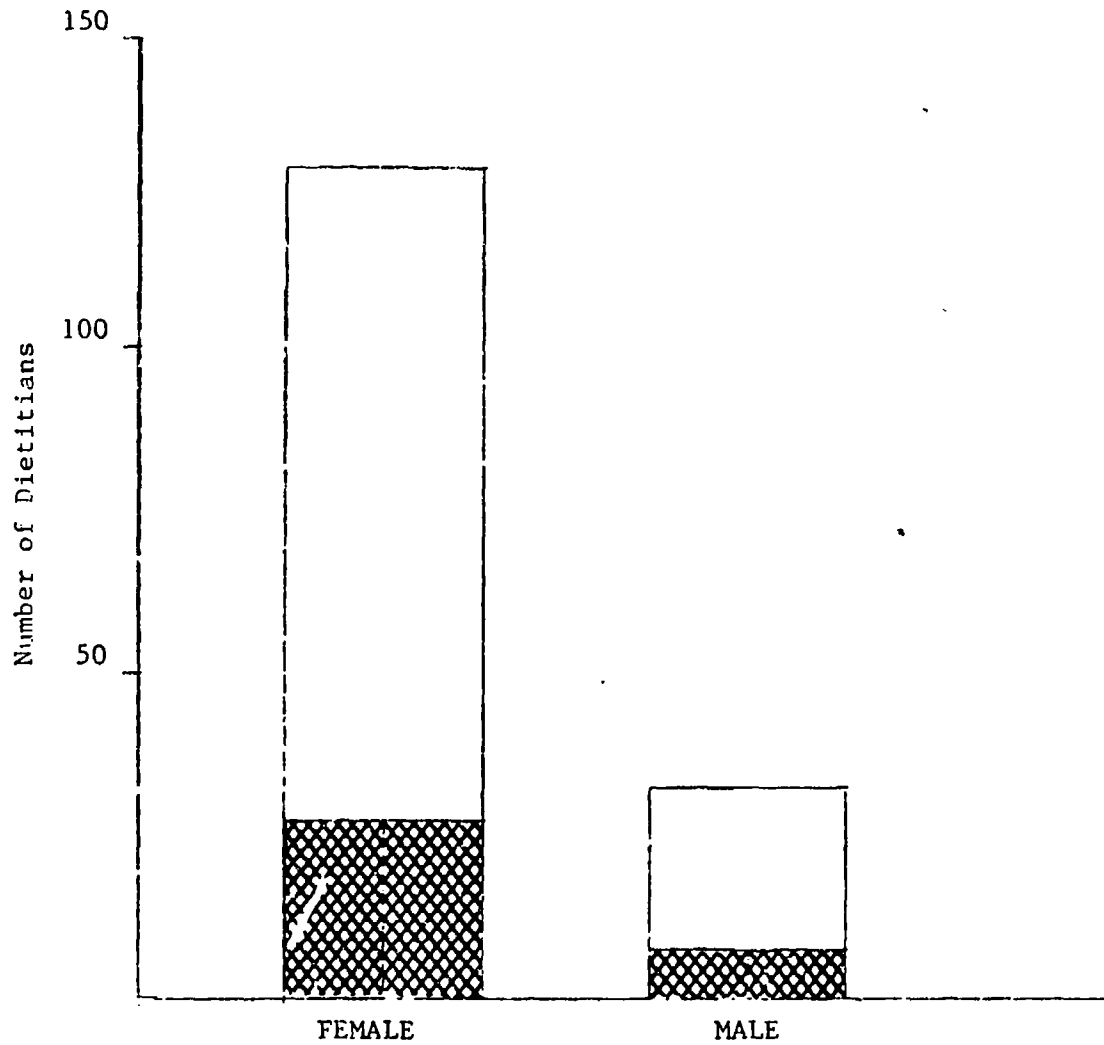


Fig. 6. Comparison of the Distribution of sex between panel members and population.

TABLE 7
CHI SQUARE TEST FOR INDEPENDENCE OF RAI K *

	LT	CPT	MAJ	LTC	COL
POPULATION	39 (35.9)	62 (60.1)	44 (47.6)	16 (17.5)	6 (5.8)
PANEL	4 (7.1)	10 (11.9)	13 (9.4)	5 (3.5)	1 (1.2)

* H_0 : No difference between the two distributions.

H_A : Difference exists between the two distributions.

CRITICAL χ^2 at alpha = .10 and 4 degrees of freedom
= 7.779

CALCULATED $\chi^2 = 4.458$

\therefore Unable to reject H_0

TABLE 8
CHI SQUARE TEST FOR INDEPENDENCE OF SEX *

	FEMALE	MALE
POPULATION	131 (131.1)	36 (35.9)
PANEL	26 (25.9)	7 (7.1)

* H_0 : No difference between the two distributions.

H_A : Difference exists between the two distributions.

CRITICAL χ^2 at alpha = .10 and 1 degree of freedom = 2.706

CALCULATED $\chi^2 = .035$

\therefore Unable to reject H_0

Results/Analysis of Questionnaire # 1

Twenty-seven panel members returned their questionnaires in time for analysis. Responses varied from identification of general areas to specific problem areas. One panel member identified specific policies needed in various areas of the Nutrition Care Division. All responses were given full consideration. The analysis consisted of consolidating like responses into categorical areas of concern. The analysis resulted in 38 areas of concern which are identified in Table 9.

Four other questionnaires received after analysis were analyzed but did not result in the creation of any new areas.

The 38 areas were consolidated from the total of 405 areas identified by 31 panel members. The mean number of areas identified per panel member was 13.1.

TABLE 9

AREAS OF CONCERN IDENTIFIED FROM QUESTIONNAIRE #1

AREA OF CONCERN

1. Fiscal Responsibility (Subsistence)
2. Fiscal Responsibility (Nonfood Supply)
3. Inventory and Subsistence Management
4. Quality of Diet Instructions (Inpatients and Outpatients)
5. Army Weight Control Responsibilities (Includes performing skinfolds)
6. Operation of Diet Clinic (hours, waiting times...)
7. Nutritional Assessments
8. Writing of Modified and Special Diets
9. Inpatient Interviews
10. Documentation of Nutritional Care
11. Sanitation (Includes Personal Hygiene)
12. Equipment Maintenance and Replacement
13. Quality and Accuracy of Patient Trays
14. Quality of Dining Room Meals and Service
15. Appropriate Provision of Nutritional Education
16. Food Preparation (Includes pre-prep and pastry)

TABLE 9 - Continued

AREA OF CONCERN

17. Accuracy of Food Preparation Forecasts
18. Standardization and Maintenance of Recipes
19. Utilization of Leftovers
20. Ingredient Room Operation
21. Menu (Adequacy, Variety)
22. Other Production and Service Branch Operations
23. Other Clinical Dietetic Branch Operations
24. Administrative Requirements (Suspenses, SOP updates, Filing...)
25. Labor - Management Relations
26. Headcount Procedures
27. Availability of Subsistence Items
28. Availability of Personnel
29. Inservice Training
30. Safety Program
31. Employee Morale
32. Personnel Administration (52s, Performance Standards)
33. Personnel Management (Supervision, Counseling)
34. Scheduling and Attendance of Personnel

TABLE 9 - Continued

AREA OF CONCERN
35. Preparation of Tube Feeding and Enteric Nourishments
36. Cost of Nourishments
37. Security
38. Relationships with Other Activities

A review of the 38 areas reveals some areas of concern which seem to overlap. For example, personnel management, personnel administration, labor-management relations and employee morale are considerably interrelated. During analysis, comments from panel members drew clear distinctions. Personnel management represents the relationship between a supervisor and employees and involves management style, motivation, and human relations. Personnel administration involves those administrative tasks associated generally with paperwork, including completion of Standard Form 52 (Request for Personnel Action), Standards of Performance, interviewing, and selecting new personnel. Labor-management relations pertains to the relationships between the labor union and management including contract negotiation and administration. Finally, employee morale, which implicitly results from effective personnel management, was explicitly listed by a sufficient number of respondents to warrant a separate category. Similar overlapping existed in several areas; however, in all areas comments from panel members provided justification for distinct areas.

Results/Analysis of Questionnaire #2

Twenty-six Questionnaires #2 were returned in time for analysis. There were three sets of results obtained from this iteration. First, a preliminary ranking of the 38 areas facilitated the final development of Questionnaire #3. These results are depicted in Table 10.

Second, considerable data were collected on how to measure success. These data were used in the development of management information system elements for the critical success factors. Third, data were collected on the relative importance of the areas regarding quality assurance. Table 11 depicts the quality assurance average weighted scores and resultant ranking. A slight variation is achieved when areas are ranked by percentage as depicted in Table 12.

TABLE 10

PRELIMINARY RANKING OF AREAS OF CONCERN

PRELIMINARY RANK	RAW SCORE	AREA OF CONCERN
1	183	Financial Responsibility (Subsistence)
2	147	Quality and Accuracy of Patient Tray Service
3	105	Quality of Dining Hall Meals and Service
4	104	Inventory/Subsistence Management
5	99	Documentation of Nutrition Care
6	85	Quality of Diet Instruction
7	69	Sanitation
8	65	Personnel Management
9	58	Writing of Special Modified Diets
10	49	Appropriate Provision of Nutritional Education
10	49	Army Weight Control Program Responsibilities
12	43	Fiscal Responsibilities (Nonfood)
13	41	Food Preparation

TABLE 10 - Continued

PRELIMINARY RANK	RAW SCORE	AREA OF CONCERN
14	39	Nutritional Assessments
15	37	Menu
16	34	Equipment Maintenance and Replacement Program
17	32	Availability of Personnel
18	28	Headcount Procedures
19	18	Employee Morale
20	17	Personnel Administration
21	15	Operation of Diet Clinic
22	14	Security
22	14	Administrative Requirements
22	14	Inpatient Interviews
25	11	Inservice Training
26	9	Availability of Subsistence
27	8	Preparation of Tube Feedings/Enteric Feedings
27	8	Labor/Management Relations
27	8	Utilization of Leftovers
30	7	Accuracy of Forecasts

TABLE 10 - Continued

PRELIMINARY RANK	RAW SCORE	AREA OF CONCERN
30	7	Standardization/Maintenance of Recipes
30	7	Scheduling/Attendance of Personnel
33	4	Relationships with Outside Activities
34	1	Safety
35	0	Ingredient Room Operation
35	0	Cost of Nourishments
35	0	Other C.D.B Functions
35	0	Other P & S Functions

TABLE 11

QUALITY ASSURANCE RANKING
Ranked by Average Weighted Score

AREA OF CONCERN	HIGH QA	MEDIUM	LOW QA	NOT QA	AVERAGE
QUAL/ACC OF PT TRAYS	27	1	0	0	3.96428572
DOCUMENTATION OF NUTR CARE	22	1	1	0	3.975
DIET INSTRUCTIONS	18	4	1	0	3.73913044
SANITATION	16	1	3	0	3.65
QUAL OF DH RM MEALS	18	4	2	1	3.56
WRITE DIETS	10	5	2	0	3.47058824
TUBE FEEDINGS	5	7	1	0	3.30769231
NUTRITIONAL ASSESSMENTS	7	5	3	0	3.26666667
NUTRITIONAL EDUCATION	8	5	2	1	3.25
MENU	6	7	3	0	3.1875
INVENTORY/SUBS MGMT	12	5	2	3	3.13181818
INPATIENT INTERVIEWS	4	7	1	1	3.07592308
INSYNC TRNG	6	7	2	2	3
FOOD PREPARATION	5	6	3	1	3
ARMY WT CONTROL	10	4	3	4	2.95238095
FISCAL RESPONSIBILITY (SUB)	11	8	5	5	2.86206897
OPER OF DIET CLINIC	4	4	3	2	2.64285714
FISCAL RESPONSIBILITY (NON)	5	4	8	2	2.63157895
SECURITY	4	5	5	3	2.5882353
SAFETY	2	5	2	3	2.5
HEADCOUNT	4	3	5	4	2.4375
LEFTOVERS	2	4	4	3	2.38461539
ACC OF FORECASTS	2	5	2	4	2.38461539
RECIPES	3	3	4	4	2.35714286
COST/NOURISH	1	5	2	4	2.25
EMP MORALE	3	4	3	6	2.25
AVAIL OF PERS	4	1	2	7	2.14285714
PERS ADMIN	3	3	2	7	2.13333333
PERS MGMT	4	3	4	9	2.1
SCH/ATT PERSONNEL	2	3	2	6	2.07692308
ADMIN RCQ	3	2	5	7	2.05882353
EQUIP MAINT	2	5	4	8	2.05263158
DEPT RELATIONSHIPS	2	3	0	7	2
AVAIL OF SUBS	2	1	4	5	2
ING RM OP	0	3	5	4	1.91666667
OTHER CDB	0	1	1	2	1.75
OTHER P/S	0	1	1	2	1.75
LABOR/MGMT	1	2	3	8	1.71428571

TABLE 12
 QUALITY ASSURANCE RANKING
 Ranked by Percentage of High Responses

AREA OF CONCERN	HIGH QA	MEDIUM	LOW QA	NOT QA	NUMBER OF RESPONSES
QUAL/ACC OF PT TRAYS	96.4	3.5	0	0	28
DOCUMENTATION OF NUTR CARE	91.6	4.1	4.1	0	24
SANITATION	90	5	15	0	20
DIET INSTRUCTIONS	78.2	17.3	4.3	0	23
QUAL OF DN RK MEALS	72	16	8	4	25
WRITE DIETS	58.8	25.4	11.7	0	17
INVENTORY/SUBS MGMT	54.5	22.7	9	13.6	22
NUTRITIONAL EDUCATION	50	31.2	12.5	6.2	16
ARMY WT CONTROL	47.6	19	14.2	19	21
NUTRITIONAL ASSESSMENTS	46.6	33.3	20	0	15
TUBE FEEDINGS	38.4	53.8	7.6	0	13
FISCAL RESPONSIBILITY (SUB)	37.9	27.5	17.2	17.2	29
MEM:	37.5	43.7	18.7	0	16
INSVC TRNG	35.2	41.1	11.7	11.7	17
FOOD PREPARATION	33.3	40	20	6.6	15
INPATIENT INTERVIEWS	30.7	53.8	7.6	7.6	13
OPR OF DIET CLINIC	28.5	28.5	21.4	21.4	14
AVAIL OF PERS	28.5	7.1	14.2	50	14
FISCAL RESPONSIBILITY (NON)	26.3	21	42.1	10.5	10
HEADCOUNT	25	18.7	31.2	25	16
SECURITY	23.5	29.4	29.4	17.6	18
RECIPES	21.4	21.4	28.5	28.5	14
PERS ADMIN	20	20	13.3	46.6	15
PERS MGMT	20	15	20	45	20
EMP MORALE	18.7	25	18.7	37.5	16
ADMIN RED	17.6	11.7	29.4	41.1	18
SAFETY	16.6	41.6	16.6	25	12
DEPT RELATIONSHIPS	16.6	25	0	58.3	12
AVAIL OF SUBS	16.6	8.3	33.3	41.5	12
ACC OF FORECAST:	15.3	38.4	15.3	30.7	13
LEFTOVERS	15.3	30.7	30.7	23	13
SCH/ATT PERSONNEL	15.3	23	15.3	46.1	13
EQUIP MAINT	10.5	26.3	21	42.1	10
COST/NOURISH	8.3	41.6	16.6	33.3	12
LABOR/MGMT	7.1	14.2	21.4	57.1	14
ING RM OP	0	25	41.6	33.3	12
OTHER P/S	0	25	25	50	4
OTHER CDB	0	25	25	50	4

Results/Analysis of Questionnaire #3

On the final iteration, thirty-three panel members responded in time for analysis. A thirty-fourth questionnaire, received after analysis, was discounted because it had not been properly completed. Table 13 depicts the final ranking of the 38 areas.

An analysis of the total raw scores gave credence to a conclusion that there were eight critical success factors instead of five. First, the greatest disparity among the areas existed between the eighth and ninth areas. Second, the top eight areas were all ranked in the top eight by at least sixty percent of the respondents satisfying established criteria. Table 14 depicts the ranking of the eight critical success factors.

TABLE 13

FINAL RANKING OF AREAS OF CONCERN

FINAL RANK	TOTAL SCORE	AREAS OF CONCERN
1	257	Fiscal Responsibility (Subsistence)
2	254	Quality and Accuracy of Patient Trays
3	187	Quality of Dining Hall Meals and Service
4	148	Documentation of Nutritional Care
5	147	Inventory and Subsistence Management
6	115	Personnel Management
7	114	Sanitation
8	112	Quality of Diet Instructions
9	57	Appropriate Provision of Nutrition Education
10	56	Writing Special and Modified Diets
11	54	Army Weight Control Program Responsibilities
12	39	Fiscal Responsibilities (Nonfood)
13	27	Food Preparation
14	26	Menu
15	23	Nutritional Assessments
15	23	Equipment Maintenance/Replacement Program
17	16	Security
18	15	Employee Morale
19	13	Availability of Personnel
19	13	Headcount
21	9	Accuracy of Forecasts
22	7	Inservice Training
23	6	Availability of Subsistence Items
23	6	Personnel Administration
25	5	Operation of Diet Clinic
25	5	Labor-Management Relations
25	5	Standardization and Maintenance of Recipes
28	3	Administrative Requirements
29	1	Utilization of Leftovers
29	1	Relationships with Outside Activities
29	1	Safety
32	0	Scheduling and Attendance of Personnel
32	0	Preparation of Tube Feedings and Enteric Nourishments
32	0	Cost of Nourishments
32	0	Ingredient Room Operation
32	0	Inpatient Interviews
32	0	Other Clinical Dietetic Operations
32	0	Other Production Operations

TABLE 14
CRITICAL SUCCESS FACTORS AS RANKED BY RESPONDENTS

RANK	FACTOR	TIMES RANKED										
		1	2	3	4	5	6	7	8	1-8		
1	Fiscal Responsibility (Subsistence)	22	1	0	1	0	1	0	1	0	1	26
2	Quality and Accuracy of Patient Trays	4	12	4	8	3	0	0	0	0	0	31
3	Quality of Dining Hall Meals and Service	1	2	11	3	6	2	1	1	0	0	26
4	Documentation of Nutrition Care	1	4	2	4	2	5	2	2	3	3	23
5	Inventory and Subsistence Management	1	2	4	5	4	1	4	1	4	1	22
6	Personnel Management	0	1	3	1	4	3	6	2	6	2	20
7	Sanitation	0	0	4	3	3	2	4	4	7	7	23
8	Quality of Diet Instructions	0	0	2	4	3	3	3	3	5	5	20

Correlation of Areas

It was suggested that critical success factors could be used to develop quality assurance programs. To evaluate this suggestion, Spearman rho Rank Correlation tests were performed correlating the final ranking from Questionnaire #3 (see Table 13) with the two Quality Assurance rankings (see Tables 11 and 12). The results are r (rho) = .628 and .377 respectively. Both are significant at alpha = .05. Appendix G contains pertinent information concerning these tests.

Critical Success Factors

Literature review, written comments from panel members, and direct observations within a Nutrition Care Division indicate that all eight critical success factors can be measured and that adequate data collection is achievable.

The most important area identified for success is the proper management of subsistence funds. Army Regulations provide a cost accounting system which outputs a number of completed forms and reports.¹ Adequate data collection is provided. The goal of the cost accounting system is to assist the manager in assessing the ability of

the Nutrition Care Division to afford the menu and serving practices. A standard on which to base measurement would be: At the end of each month (and fiscal year), the Actual Expenditures for Subsistence will not exceed the Monetary Allowance for Subsistence. By comparing performance over several months, the dietitian can determine if correction is needed. A range of discretionary responses is available including modifying the menu, reducing leftovers, altering portion sizes, and modifying the seconds policy. Within the monthly accounting period, this system can be monitored by keeping the required forms up-to-date and by projecting income and expenses. Responses during monthly periods generally involve modifying requisition quantities, but include all responses identified above.

The patient tray system provides diets, both regular and modified, as prescribed by the attending physician. The goals of the system include the following.

1. The patient gets the tray intended for him/her.

2. The tray contains the appropriate items in accordance with dietary restrictions and patient preference.

3. The quality of the food, as measured by appearance, temperature, and taste, meets patient expectations to facilitate consumption.

Several measurements have been identified. Schiller and Behm described the use of administrative audits to measure accuracy and temperature.² One type of administrative audit, using periodic dummy trays, was suggested by a panel member. Satisfaction surveys have been used to measure accuracy, appearance, temperature, and taste. The use of satisfaction surveys has been encouraged by the Joint Commission on Hospital Accreditation.³ Despite the frequent questioning of the validity of results from questionnaires, trends are often discernable from survey data.⁴ Baseline data can be gathered on a more frequent basis when supervisors' daily observations are recorded on checklists. Data can be collected relatively easily with all of these methods.

The dining hall or cafeteria system has a goal of providing patron satisfaction. Classic measurement of this system has been headcount.⁵ Decreasing headcount trends generally indicate diminished quality of food, service, or both. Increasing headcount trends give the opposite indication. Administrative audits, supervisor checklists, and satisfaction surveys can all be used.

Documentation of nutritional care primarily involves documenting patient dietary matters in the inpatients treatment records. This area overlaps with "quality of diet instruction," as the documentation of diet instructions is important as a measure of quality. In both areas, measurement is recommended in the form of record audits. Although the Joint Commission on Accreditation of Hospitals no longer specifically requires audits of patient records, hospitals continue to utilize this method. Many Army Nutrition Care Divisions have adopted nutrition care plans which contain audit criteria.

The inventory and subsistence management area is highly related to fiscal responsibility. However, the distinct goal of this system is to provide needed subsistence items in the quantities needed and at the time

needed. Clearly success is measured by how often the system meets the demands placed on it. This demand satisfaction can be measured by using DA Form 2930, Kitchen Requisition, as a source document.

The personnel management area involves the employee system. Its goal is to have employees who are highly motivated toward the achievement of organization objectives. The use of employee questionnaires results in both data collection and, in theory, increased morale through the Hawthorne effect. More objective data can be drawn from employee complaints and grievances, and from sick leave usage.

The goal of sanitation is to prevent food borne and food transmitted diseases through the proper use of sanitation principles. Data can be drawn from either internal or external inspection checklists. The measure of success is the absence of sanitary deficiencies as noted by satisfactory ratings.

While the development of a management information system was not a stated objective of this study, information concerning the eight critical success factors have been assembled into a management information system as described in Figures 7 - 14.

FISCAL RESPONSIBILITY
(Subsistence)

SYSTEM: Subsistence procurement and cost accounting

SYSTEM GOAL: Ensure financial viability.

SYSTEM STANDARD: At the end of each month (and/or fiscal year) and after adjustment for inventory gain/loss, the actual expenditures for subsistence will not exceed the monetary allowance.

DATA SOURCE: Draw data from DA Form 1836, HSC Report (RCS 114), DD 160, Cost Accountant Projections for DA Forms 3161 and Rations Earned.

MEASUREMENT: Observe trends over several months to determine action for fiscal year close. Observe projections from cost accountant for monthly close.

RESPONSES: Results Control - Range of Actions including modifying menu, portion sizes, and policy on seconds, and improving forecasts to reduce waste and leftovers. Specific Action Control - Range of actions including behavior constraints (disciplinary actions, performance standards), action accountability (policies) and preaction review (improved supervision).

Fig. 7. Overview of Management Information System Element for Fiscal Responsibility.

QUALITY AND ACCURACY OF PATIENT TRAYS

SYSTEM: Patient tray service

SYSTEM GOAL: Patient satisfaction within required nutritional limitations.

SYSTEM STANDARD: 1. Ninety percent of patients will be satisfied with patient tray service regarding appearance, temperature, and taste of food.

2. Ninety-five percent of patients will have accurate trays.

DATA SOURCE: Draw data for patient satisfaction from patient survey conducted at least monthly. Draw data for accuracy from administrative tray audits held at least monthly.

MEASUREMENT: Calculate percentages. Observe trends in percentages.

RESPONSES: 1. Personnel Control - Range of Actions including training, clarifying expectations, providing information, and encouraging peer control.

2. Specific Action Control - Range of Actions including behavior constraints (disciplinary actions, performance standards), action accountability (policies) and preaction review (improved supervision).

Fig. 8. Overview of Management Information System Element for Quality and Accuracy of Patient Trays.

QUALITY OF DINING HALL MEALS AND SERVICE

SYSTEM: Cafeteria Service

SYSTEM GOAL: Patron satisfaction.

SYSTEM STANDARD: Eighty percent of the dining hall patrons are satisfied with appearance, temperature, and taste of food, and with service.

DATA SOURCE: Draw data for patron satisfaction from monthly satisfaction survey.

MEASUREMENT: Calculate percentages. Observe trends in percentages.

RESPONSES: Specific Action Control - Range of Actions including preaction review (improved supervision) and behavioral constraints (performance standards).

Fig. 9. Overview of Management Information System Element for Quality of Dining Hall Meals and Service.

DOCUMENTATION OF NUTRITIONAL CARE

SYSTEM: Nutritional Care of Inpatients

SYSTEM GOAL: Appropriate dietetic information shall be recorded in the patient's medical record.

SYSTEM STANDARD: Ninety percent of the inpatient treatment records (ITRs) will contain appropriate dietetic information as delineated by designated nutrition care plans.

DATA SOURCE: Draw data from audit of ITRs.

MEASUREMENT: NOTE: Consideration must be given to degree of compliance if audit performed is concurrent. Calculate percentage. Observe trends.

RESPONSES: Personnel Control - Range of Actions including training, assignments, and encouragement of peer control.

Fig. 10. Overview of Management Information System Element for Documentation of Nutritional Care.

INVENTORY AND SUBSISTENCE MANAGEMENT

SYSTEM: Subsistence Management.

SYSTEM GOAL: Subsistence items will be available when needed and in the quantity required.

SYSTEM STANDARD: Ninety-five percent of the subsistence items will be available when needed and in the quantity required.

DATA SOURCE: Draw data from DA 2930s or appropriate computer printout if automated (e.g., ingredient room summary).

MEASUREMENT: Calculate demand satisfaction percentage by the formula:

$$\text{Demand Satisfaction} = \frac{\text{Number of Lines Issued}}{\text{Number of Lines Requested}} \times 100$$

Observe trends in data.

RESPONSES: Results Control - Results Accountability.

Fig. 11. Overview of Management Information System Element for Inventory and Subsistence Management.

PERSONNEL MANAGEMENT

SYSTEM: Employee system

SYSTEM GOAL: Employees are highly motivated towards achievement of organization objectives.

SYSTEM STANDARD: Personnel work toward organization objectives without complaint.

DATA SOURCE:

1. Periodic employee questionnaires.
2. Number and Frequency of formal and informal complaints/grievances.
3. Sick leave usage.

MEASUREMENTS: Make subjective review of questionnaire comments. Observe trends in percentage of responses on questionnaires. Observe trends in number of complaints. Observe trends in sick leave usage.

RESPONSES: Personnel Control - Range of Action including Upgrade Capabilities (selection, training and assignment) and improve communications. Other types of control may be appropriate on a case by case basis.

Fig. 12. Overview of Management Information System Element for Personnel Management.

SANITATION

SYSTEM: Sanitation Subsystem

SYSTEM GOAL: Prevent food borne illnesses.

SYSTEM STANDARD: Satisfactory rating will be received on
all Preventive Medicine Service Sanitary
Inspections.

DATA SOURCE: Completed inspection checklist.

MEASUREMENT: Observe results of inspection. Observe trends.

RESPONSES: Both Specific Action and Results - Range of
Action including standards, preaction review
(direct supervision), action accountability (work
rules and policies), and behavioral constraints
(administrative).

Fig. 13. Overview for Management Information System Element
for Sanitation.

QUALITY OF DIET INSTRUCTIONS

SYSTEM: Diet Instruction

SYSTEM GOAL: Patient can verbalize diet principles.

SYSTEM STANDARD: Ninety-five percent of patients receiving diet instructions are able to verbalize principles of diets.

DATA SOURCE: Draw data from patient medical record (both inpatient and outpatient audit).

MEASUREMENT: Calculate percentage. Observe trends.

RESPONSES: Personnel Control - Range of Actions including training, assignment, and encouragement of peer control.

Fig. 14. Overview of Management Information System Element for Quality of Diet Instruction.

Footnotes

¹U.S. Department of Army, "Army Medical Treatment Facilities - General Administration," Army Regulation 40-2, (15 April 1983), pp. 9-1 - 9-10.

²Rosita Shiller and Valerie Behm, "Auditing Dietetic Services: First of a Series," Hospitals 53 (April 16 1979), 122.

³Joint Commission on Accreditation of Hospitals, Accreditation Manual for Hospitals, 1984 ed., (Chicago, IL: Joint Commission on Accreditation of Hospitals, 1983), p. 19.

⁴Henry M. Rosen and William Feigin, Sr., "Quality Assurance and Data Feedback", Health Care Management Review 8 (Winter 1983), 67-68; Gay L. Shick, Loretta W. Hoover, and Aimee N. Moore, "A Computer-Assisted Personnel Data System for a Hospital Department of Dietetics," Journal of The American Dietetic Association 74 (April 1979), 448.

⁵Oscar P. Snyder, Jr., "A Management System for Foodservice Quality Assurance," Food Technology 37 (June 1983): 61-67.

III: CONCLUSION AND RECOMMENDATION

Conclusion

It was concluded that the critical success factor concept was viably applicable for use in developing a management information system for use in U.S. Army hospital Nutrition Care Divisions.

The literature inferred that the failure of most management information systems was due to the improper identification of the manager's real information needs. The literature revealed the weaknesses of the four primary methods of identifying needs and the strength of the critical success factor concept. Literature indicated that management information systems should facilitate a manager's ability to make decisions, evaluate performance towards goal achievement, and be developed along subsystem lines. Literature provided models for development of management information systems and a construct for determining optimal control methods.

Thirty-four dietitians were selected to participate as a Delphi panel. Statistical analysis of rank and sex distributions inferred that the panel was a representative group of Army dietitians. The panel had a well rounded experiential and educational base. Thirty-three, or 97.1 percent, of the respondents completed their participation in the Delphi process.

The panel identified thirty-eight areas of concern for Nutrition Care Division operations. At the conclusion of the Delphi process, eight of these areas were determined to be the critical success factors. The critical success factors, as ranked by at least 60 percent of panel members, were, respectively, fiscal responsibility in the area of subsistence, quality and accuracy of patient tray service, quality of dining hall meals and service, documentation of nutrition care, inventory and subsistence management, personnel management, sanitation, and quality of diet instructions.

Prime measures, data sources, and collection methodology were identified for each critical success factor.

A management information system was developed using the critical success factors, their prime measures, and the collection methodology. The information system measures performance toward goal achievement in the eight critical success areas. While standards were developed for functional and illustrative purposes, standards were not validated and are apt to vary from hospital to hospital. To facilitate the decision making, feasible control responses were identified for each area.

A summary of this research is being forwarded to each panel member. Further, a copy of this paper is being forwarded to the Chief Dietitian, Office of The Surgeon General, Washington, D.C.

As measured by the criteria, the objectives of this research have been fully accomplished. The critical success factor concept was found to be viably applicable in developing a management information system for use in U.S. Army hospital Nutrition Care Divisions.

Recommendations

It is recommended that the critical success factor concept be utilized to develop management information

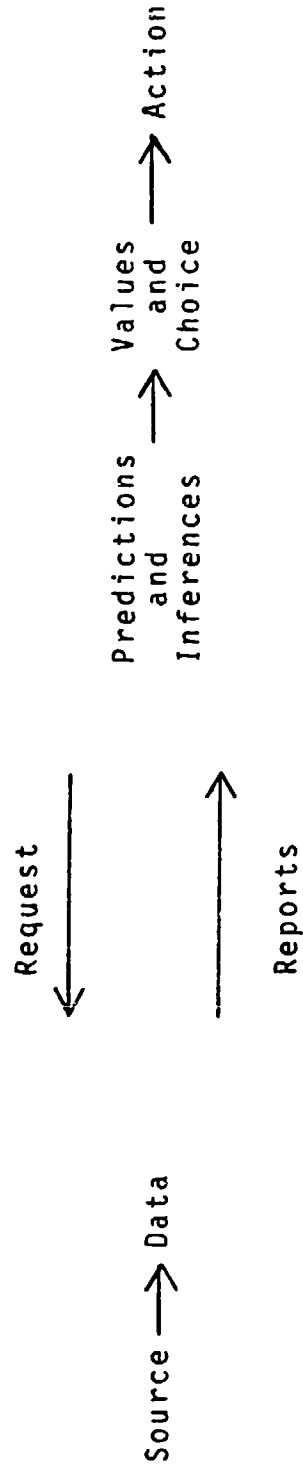
systems for use in Nutrition Care Divisions. It is recommended that further study be performed to validate the critical success factors identified in this research and the standards proposed for those areas. It is recommended that more research be conducted in the correlation between critical success factors and quality assurance.

It is also recommended that dietitians critically evaluate their operations using critical success factors. In this regard, dietitians should evaluate their immediate environments to determine if additional critical success factors exist locally. Consideration should be given to the amount time and effort spent managing (controlling) critical versus non-critical success areas. Greater attention should be given to the critical success areas.

Finally, it is recommended that research be conducted applying the critical success factor concept to other areas within the Army Medical Department.

APPENDIX A

BASIC DESIGNS FOR
MANAGEMENT INFORMATION SYSTEMS



Information System

Decision-Making System

Fig. 15. Databank Design

SOURCE: Richard O. Mason, "Basic Concepts for Designing Management Information Systems," cited by Alfred Rappaport, Information for Decision Making, Englewood Cliffs, NJ: Prentice-Hall, Inc., 1975, p.4.

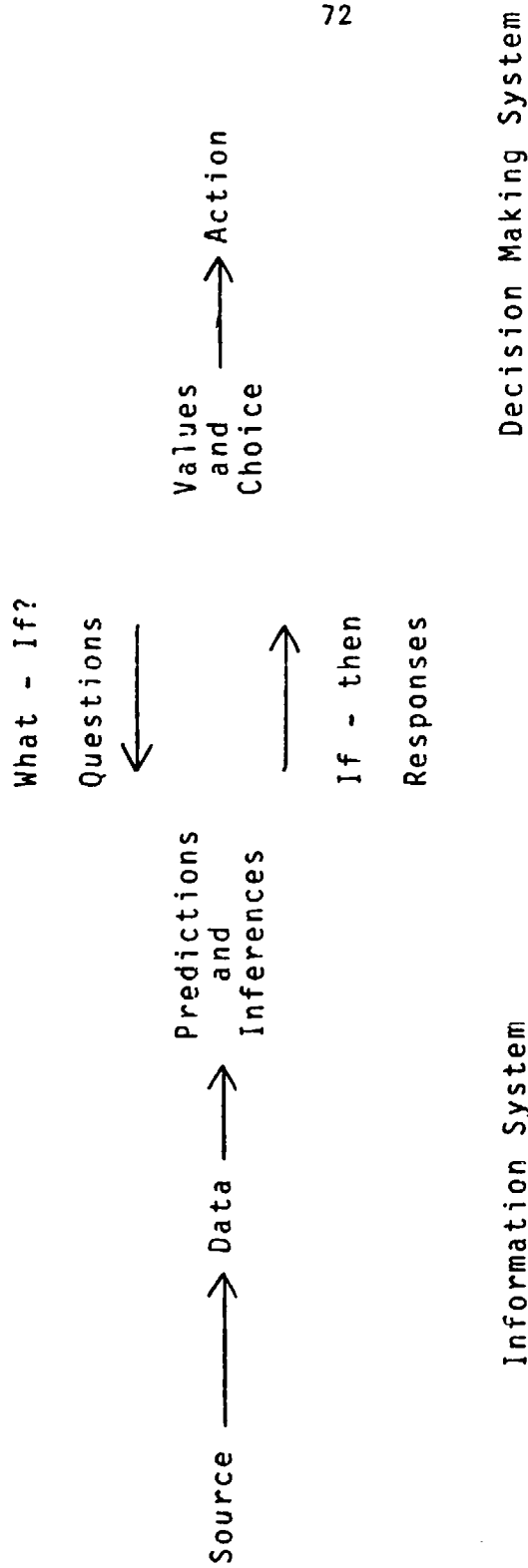


Fig. 16. Predictive Information System Design

SOURCE: Richard O. Mason, "Basic Concepts for Designing Management Information Systems," cited by Alfred Rappaport, Information for Decision Making, Englewood Cliffs, NJ: Prentice-Hall, Inc., 1975, p.6.

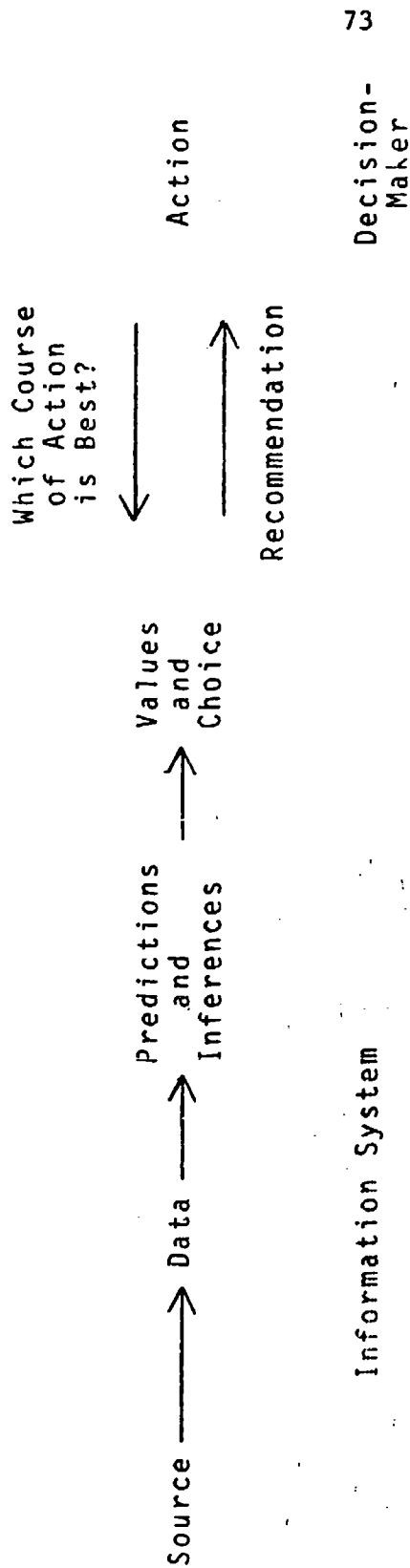
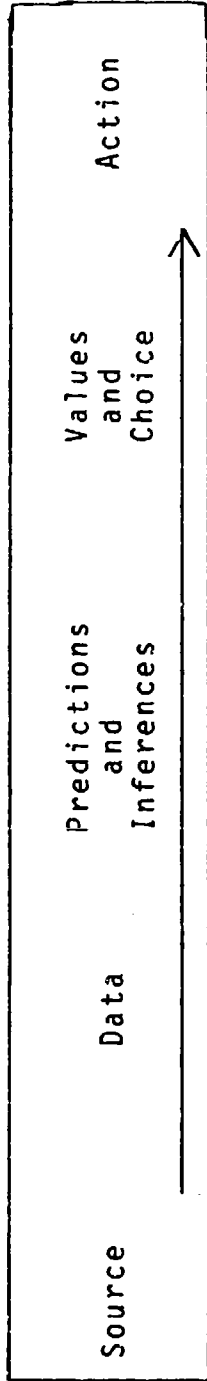


Fig. 17. Decision-Making Information System Design

SOURCE: Richard O. Mason, "Basic Concepts for Designing Management Information Systems," cited by Alfred Rappaport, Information for Decision Making, Englewood Cliffs, NJ: Prentice-Hall, Inc., 1975, p.8.



Information (and Decision Making) System

Fig. 18. Decision-Making Information System Design

SOURCE: Richard O. Mason, "Basic Concepts for Designing Management Information Systems," cited by Alfred Rappaport, Information for Decision Making, Englewood Cliffs, NJ: Prentice-Hall, Inc., 1975, p.10.

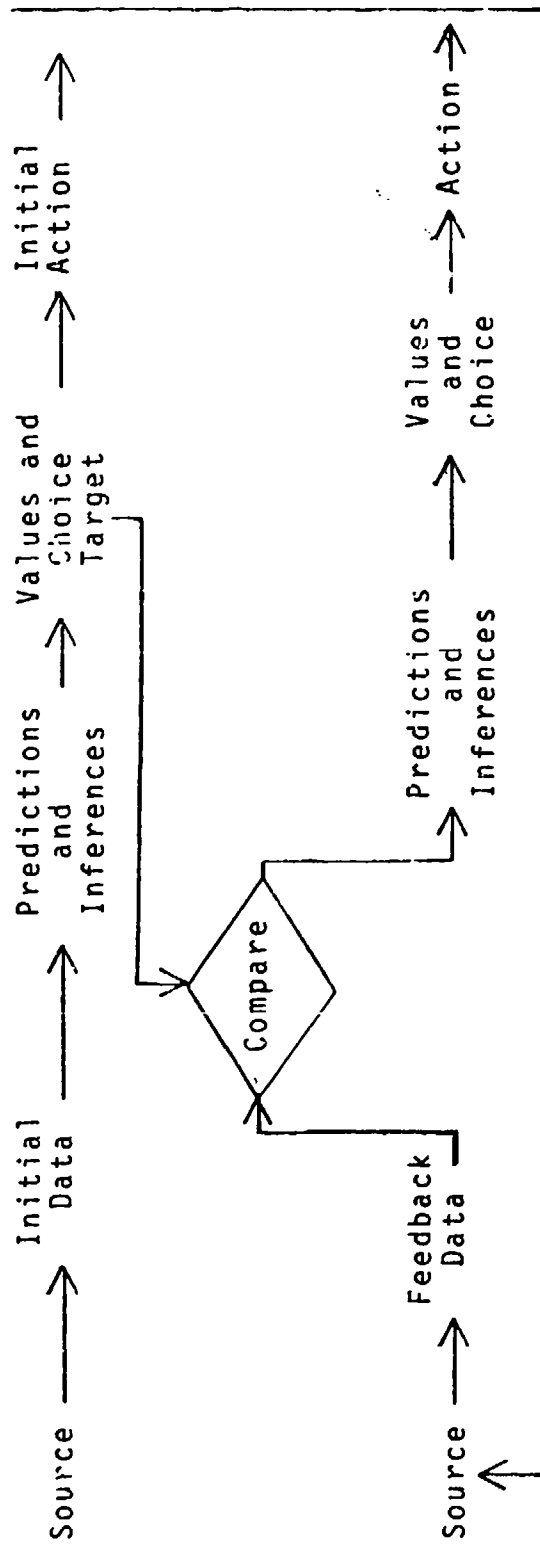


Fig. 19. Feedback (Cybernetics) Information Systems

SOURCE: Richard O. Mason, "Basic Concepts for Designing Management Information Systems," cited by Alfred Rappaport, Information for Decision Making, Englewood Cliffs, NJ: Prentice-Hall, Inc., 1975, p.12.

APPENDIX B

LETTER TO PANEL MEMBERS



HSUB-AG

DEPARTMENT OF THE ARMY
UNITED STATES ARMY MEDICAL DEPARTMENT ACTIVITY
FORT STEWART, GEORGIA 31314

5 January 1984

¶rank¶ ¶first¶ ¶last¶
¶address¶
¶city¶

Dear ¶rank¶ ¶last¶:

Thank you for agreeing to participate in the development of a management information system for use in our nutrition care operations. Your insights will be most helpful in evaluating the areas this system should cover.

Specifically, I need your help to identify major areas which are critical to the success of the operation.

The results will be used to develop a management information system which will aid the dietitian to better control all aspects of the Nutrition Care Division. Additionally, the results of this study will be forwarded to LTC Roy Maize who is coordinating the development of a quality assurance program for our operations.

I am attaching the first in a series of three questionnaires designed to clarify our "critical success areas." Please complete the inclosed questionnaire and return it to me in time for analysis on 27 January. If you need clarification, please call me at AUTOVON: 870-6013/6001 or commercial: (912) 757-6013/6001.

Again, thank you for your help.

Sincerely,

Incl

James L. Rousey, Jr., R.D.
Major, AMSC
Administrative Resident

APPENDIX C

QUESTIONNAIRE #1

QUESTIONNAIRE #1

Think about the Chief, Nutrition Care Division managing the daily activities of the division (both P&S and CDB). What general areas of concern are so critical to the success of the division that the chief needs frequent information? Please list these areas in the appropriate column below. If you desire, you may provide comments on what makes these areas so important. Please be succinct.

Code _____

Date _____

Area of Concern	Comments
Example: Accuracy of Patient Trays	Inaccurate trays may be detrimental to the patient.

Area of Concern	Comments

(Use Back Side)

APPENDIX D

QUESTIONNAIRE #2

CODE _____

QUESTIONNAIRE #2

- Remember 1. Choose only ten areas for ranking.
2. Rank the ten areas as follows. Give a vote of "1" to the most important areas, "2" to the second most important area, and so forth until a vote of "10" is given to the least important of the ten.
3. For each and every area listed, indicate the degree of appropriateness as a Quality Assurance item. Circle the number in accordance with the following scale [4 = high QA item; 3 = medium QA item; 2 = low QA item; 1 = not a QA item].
4. If you know how YOU would measure success in the ten most important areas or in the QA areas, please indicate this measurement in the appropriate column.

VOTE	AREA	INCLUDE IN QA	HOW WOULD YOU MEASURE SUCCESS (Satisfactory accomplishment)
	Fiscal Responsibility (Subsistence)	4 3 2 1	
	Fiscal Responsibility (Nonfood supply)	4 3 2 1	
	Inventory and Subsistence Management	4 3 2 1	

VOTE	AREA	INCLUDE IN QA	HOW WOULD YOU MEASURE SUCCESS
	Standardization and Maintenance of Recipes	4 3 2 1	
	Utilization of Leftovers	4 3 2 1	
	Ingredient Room Operation	4 3 2 1	
	Menu (Adequacy: variety...)	4 3 2 1	
	Other P & S Br Operations (Specify type)	4 3 2 1	
	Other C.D.B. Operations (Specify type)	4 3 2 1	

VOTE	AREA	INCLUDE IN QA	HOW WOULD YOU MEASURE SUCCESS
	Administrative Requirements (Suspenses, SOPs, Files...)	4 3 2 1	
	Labor-Management Relations	4 3 2 1	
	Headcount Procedures	4 3 2 1	
	Availability of Subsistence Items	4 3 2 1	
	Availability of Personnel (Military assigned)	4 3 2 1	
	Inservice Training	4 3 2 1	
	Safety Program	4 3 2 1	

VOTE	AREA	INCLUDE IN QA	HOW WOULD YOU MEASURE SUCCESS
	Diet Instructions Inpatient and Outpatients	4 3 2 1	
	Army Weight Control Responsibilities (Includes skinfolds)	4 3 2 1	
	Operation of Diet Clinic (Hours, waiting times...)	4 3 2 1	
	Nutritional Assessments	4 3 2 1	
	Writing of Modified and Special Diets	4 3 2 1	
	Inpatient Interviews	4 3 2 1	
	Documentation of Nutritional Care	4 3 2 1	

VOTE	AREA	INCLUDE IN QA	HOW WOULD YOU MEASURE SUCCESS
	Sanitation (Personal Hygiene Included)	4 3 2 1	
	Equipment Maintenance and Replacement	4 3 2 1	
	Quality and Accuracy of Patient Trays	4 3 2 1	
	Quality of Dining Room Meals and Service	4 3 2 1	
	Appropriate Provision of Nutrition Education	4 3 2 1	
	Food Preparation (Includes pre-prep and pastry)	4 3 2 1	
	Accuracy of Food Preparation Forecasts	4 3 2 1	

VOTE	AREA	INCLUDE IN QA	HOW WOULD YOU MEASURE SUCCESS
	Employee Morale	4 3 2 1	
	Personnel Administration (52s, Performance Stds)	4 3 2 1	
	Personnel Management (Supervision, counseling)	4 3 2 1	
	Scheduling and Attendance of Personnel	4 3 2 1	
	Preparation of Tube Feeding and Enteric Nourishments	4 3 2 1	
	Cost of Nourishments	4 3 2 1	
	Security	4 3 2 1	
	Relationships with Other Activities	4 3 2 1	
	Add others if you desire.		

COMMENTS:

APPENDIX E

QUESTIONNAIRE #3

INSTRUCTIONS FOR DELPHI
QUESTIONNAIRE #3

Background: Twenty-six of the thirty-four questionnaires were returned in time for analysis. The analysis resulted in an overall ranking of the areas. The ranking was accomplished by assigning weights to each vote. For example, a weight of 10 was given to the area you identified as #1; a weight of 9 was given to the area you identified as #2; and so forth, until a weight of 1 was given to the area you identified as #10. The weights for each area were consolidated giving a total raw score. The overall ranking was achieved by placing the areas in order according to their total raw scores.

Instructions:

1. Review all of the areas, the total raw scores, the ranking, and your initial vote.
2. As before, select the top ten areas. This gives you the opportunity to alter your initial vote.
3. As before, rank the top ten areas. Give a vote of "1" to the most important area; give a "2" to the second most important area, and so forth, until you give a vote of "10" to the least important of the ten.
4. This should be the last questionnaire you receive. If votes are so close in some areas, there may be a need for a fourth questionnaire. You will receive information concerning the overall results of this delphi process.
5. Finally, please complete the "Panel Characteristics" section so that a profile of the respondents can be completed. If several individuals worked in a group, the leader of the group should complete this section.

QUESTIONNAIRE #3

Critical Success Areas	Total Raw Score	Preliminary Ranking	Your Initial Vote	Your Present Vote
Financial Responsibility (Subsistence)	183	1	_____	
Quality and Accuracy of Patient Tray Service	147	2	_____	
Quality of Dining Hall Meals and Service	105	3	_____	
Inventory/Subsistence Management	104	4	_____	
Documentation of Nutrition Care	99	5	_____	
Quality of Diet Instruction	85	6	_____	
Sanitation	69	7	_____	
Personnel Management	65	8	_____	
Writing of Special and Modified Diets	58	9	_____	
Appropriate Provision of Nutritional Education	49	10 tie	_____	
Army Weight Control Program Responsibilities	49	10 tie	_____	
Fiscal Responsibilities (Nonfood)	43	12	_____	
Food Preparation	41	13	_____	
Nutritional Assessments	39	14	_____	
Menu	37	15	_____	
Equipment Maintenance and Replacement Program	34	16	_____	
Availability of Personnel	32	17	_____	

Headcount Procedures	28	18	_____
Employee Morale	18	19	_____
Personnel Administration	17	20	_____
Operation of Diet Clinic	15	21	_____
Security	14	22 tie	_____
Administrative Requirements	14	22 tie	_____
Inpatient Interviews	14	22 tie	_____
Inservice Training	11	25	_____
Availibility of Subsistence	9	26	_____
Preparation of Tube Feedings/ Enteric Feedings	8	27 tie	_____
Labor/Management Relations	8	27 tie	_____
Utilization of Leftovers	8	27 tie	_____
Accuracy of Forecasts	7	30 tie	_____
Standardization/Maintenance of Recipes	7	30 tie	_____
Scheduling/Attendance of Personnel	7	30 tie	_____
Relationships with Outside Activities	4	33	_____
Safety	1	34	_____
Ingredient Room Operation	0	35 tie	_____
Cost of Nourishments	0	35 tie	_____
Other C.D.B Functions	0	35 tie	_____
Other P & S Functions	0	35 tie	_____

APPENDIX F

PANEL CHARACTERISTICS QUESTIONNAIRE

PANEL CHARACTERISTICS

Please indicate your response to the following areas:

RANK _____

SEX _____

EDUCATION LEVEL (highest degree) _____

YEARS OF MILITARY EXPERIENCE _____

YEARS OF DIETETIC EXPERIENCE _____

EXPERIENCES:

(check all experiences which you have had)

Chief, Nutrition Care Division _____

Chief, Production and Service Br _____

Chief, Clinical Dietetic Br _____

Staff Clinical Dietitian _____

Staff Production Dietitian _____

Other (_____) _____

Would you describe yourself as an Administrative or Clinical Dietitian?

(Underline your reply)

What is your current position? _____

APPENDIX G

RANK CORRELATION ANALYSIS

TABLE 15

RANK-DIFFERENCE CORRELATION (SPEARMAN rho)

QA RANKED BY AVERAGE WEIGHTED SCORE

AREA OF CONCERN	CSF RANK	QA RANK	DIF (D)	D ²
FISCAL RESPNS. (SUB)	1	16	-15	225
FISCAL RESPNS. (NON)	12	18	-6	36
INVENTORY/SUBS MGMT	5	11	-6	36
DIET INSTRUCTIONS	8	3	5	25
ARMY WT CONTROL	11	15	-4	16
OPER OF DIET CLINIC	26	17	9	81
NUTRITIONAL ASSESSMENTS	15.5	8	7.5	56.25
WRITE DIETS	10	6	4	16
INPATIENT INTERVIEWS	35	12	23	529
DOCUMENT. OF NUTR CARE	4	2	2	4
SANITATION	7	4	3	9
EQUIP MAINT	15.5	32	-16.5	272.25
QUAL/ACC OF PT TRAYS	2	1	1	1
QUAL OF DN RM MEALS	3	5	-2	4
NUTRITION EDUCATION	9	9	0	0
FOOD PREP	13	13.5	-.5	.25
ACC OF FORECASTS	21	22.5	-1.5	2.25
RECIPES	26	24	2	4
LEFTOVERS	30	22.5	7.5	56.25
ING RM OF MENU	35	35	0	0
OTHER P/S	14	10	4	16
OTHER COB	35	36.5	-1.5	2.25
ADMIN REQ	35	36.5	-1.5	2.25
LABOR/MGMT	28	31	-3	9
HEADCOUNT	26	38	-12	144
AVAIL OF SUBS	19.5	21	-1.5	2.25
AVAIL OF PERS	23.5	33.5	-10	100
INSVC TRNG	19.5	27	-7.5	56.25
SAFETY	22	13.5	8.5	72.25
EMP MORALE	30	20	10	100
PERS MORALE	18	25.5	-7.5	56.25
PERS ADMIN	23.5	28	-4.5	20.25
PERS MGMT	6	29	-23	529
SCH/ATT PERSONNEL	35	30	5	25
TUBE FEEDINGS	35	7	28	784
COST/NOURISH	35	25.5	9.5	90.25
SECURITY	17	19	-2	4
DEPT RELATIONSHIPS	30	33.5	-3.5	12.25
Total			0	3398.5

rho = .628132181

TABLE 15

RANK-DIFFERENCE CORRELATION (SPEARMAN rho)

QA RANKED BY PERCENTAGE OF HIGH RESPONSES

AREA OF CONCERN	CSF RANK	QA RANK	DIF (D)	D ²
FISCAL RESPONB. (SUB)	1	12	-11	121
FISCAL RESPONB. (NON)	12	19	-7	49
INVENTORY/SUBS MGMT	5	7	-2	4
DIET INSTRUCTIONS	8	4	4	16
ARMY INT CONTROL	11	9	2	4
OPER OF DIET CLINIC	26	17	9	81
NUTRITIONAL ASSESSMENTS	15.5	10	5.5	30.25
WRITE DIETS	10	6	4	16
INPATIENT INTERVIEWS	35	16	19	361
DOCUMENT. OF NUTR CARE	4	2	2	4
SANITATION	7	3	4	16
EQUIP MAINT	15.5	33	-17.5	306.25
QUAL/ACC OF PT TRAYS	2	1	1	1
QUAL OF DN RM MEALS	3	5	-2	4
NUTRITION EDUCATION	9	8	1	1
FOOD PREP	13	15	-2	4
ACC OF FORECASTS	21	30	-9	81
RECIPES	26	22	4	16
LEFTOVERS	30	31	-1	1
ING RM OF	35	37	-2	4
MENU	14	13	1	1
OTHER P/S	35	37	-2	4
OTHER CDB	35	37	-2	4
ADMIN REQ	28	26	2	4
LABOR/MGMT	26	35	-9	81
HEADCOUNT	19.5	20	-.5	.25
AVAIL OF SUBS	23.5	29	-5.5	30.25
AVAIL OF PERS	19.5	18	1.5	2.25
INSVC TRNG	22	14	8	64
SAFETY	30	27	3	9
EMP MORALE	18	25	-7	49
PERS ADMIN	23.5	23	.5	.25
PERS MGMT	6	24	-18	324
SCH/ATT PERSONNEL	35	32	3	9
TUBE FEEDINGS	35	11	24	576
COST/NOURISH	35	34	1	1
SECURITY	17	21	-4	16
DEPT RELATIONSHIPS	30	28	2	4
Total			0	5698

rho = .376518219

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