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A MODEL FOR MEASURING THE DIFFICULTY OF REGISTERED NURSE ASSIGNMENTS

by

Louis Edward Freund

A dissertation submitted in partial fulfillment
of the requirements for the degree of
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Doctoral Committee:

Associate Professor Richard C. Jelinek, Chairman
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ABSTRACT

A MODEL FOR MEASURING THE DIFFICULTY
OF REGISTERED NURSE ASSIGNMENTS

by

Louis Edward Freund

Chairman: Richard C. Jelinek

The purpose of this research is to develop a model for measuring the difficulty of Registered Nurse (RN) assignments. The model is validated by investigating the relationship between difficulty and performance in an experimental setting. The measures of performance selected are (1) the proportion of time spent by RN's in various kinds of activities and (2) the proportion of a predefined set of activities which are successfully accomplished.

It is hypothesized, for example, that as the difficulty of the RN's assignment increases:

1. The proportion of time she spends in Direct Patient Care (bedside) activities will increase, but non-linearly with a decreasing rate.
2. The proportion of time she spends in Non-Patient Care activities will decrease, but non-linearly with a decreasing rate.
3. The proportion of non-patient oriented (i.e., unit oriented) activities completed will decrease.

4. The proportion of patient oriented activities completed will decrease.

Other hypotheses of this type are also proposed and tested.

In order to test these hypotheses, the parameters of the model were estimated on four patient units at a large university hosptial. Both medical and surgical units were used. Observations were made only on weekdays during the day shift.

During the estimation portion of the research, actual RN assignments were characterized according to the format required by the model. Using a scale of difficulty derived from a questionnaire administered to RN's on the four units, a difficulty value for each observed assignment was obtained. Work sampling observations were grouped according to difficulty of assignment, while the average difficulty of assignments on a unit over a short period was associated with the proportion of activities from the check list which was completed.

The results support the hypothesis that the computed measure of RN assignment difficulty is significantly related to both the proportion of time spent in activity groups and the proportion of non-patient oriented activities accomplished.

Furthermore, there was significant indication that the average assignment difficulty reflects certain workload measures such as the number of RN hours per patient day and the number of RN hours per weighted patient day. There is an indication that the measure of assignment difficulty reflects the effects of using additional personnel on patient units with comparatively heavy work-loads. These results imply

the ability of the measure of assignment difficulty to be useful for characterizing the staff and workload situation on a patient unit in terms of a single variable, the average difficulty of RN assignments.

Implied by the data obtained, but not statistically verified, is the potential usefulness of the difficulty measure of nursing assignments as an indicator of "overload" situations, i.e., periods when more staff is needed on a unit in order to maintain a high rate of activity completion. Conversely, it appears that the measure of assignment difficulty will allow recognition of those RN's who have "room" in their assignment for additional responsibility.

Finally, by the measure of assignment difficulty, we have gained new understanding of the relationship between nursing assignments and nursing performance which, it is hoped, will prove useful in the management of nursing organizations.

PREFACE

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TABLE OF CONTENTS

	Page
PREFACE	ii
LIST OF TABLES	v
LIST OF ILLUSTRATIONS	vii
CHAPTER	
I. INTRODUCTION	1
1.1 Purpose	4
1.2 Scope of this Research	6
II. BACKGROUND	9
2.1 Qualitative Approaches	9
2.2 Quantitative Approaches	12
III. THE NURSING ASSIGNMENT MODEL	16
3.1 On Models	16
3.2 Analysis of Nursing Assignments	17
3.3 The Theoretical Model	25
3.4 Hypotheses	37
IV. PRETEST OF MODEL STRUCTURE AND ASSIGNMENT QUESTIONNAIRES	45
4.1 Study Setting	45
4.2 Pretest of Component Structure	49
4.3 Establishing the Difficulty of Assignment Elements	64
4.4 Determining the Difficulty of an Assignment	71
V. DESIGN FOR DATA COLLECTION	82
5.1 The Difficulty of Observed RN Assignments	82
5.2 Proportion of Time in Activities	87
5.3 Quality Index	95

CHAPTER Page

VI. RESULTS 97

6.1 Description of 6th and 7th Floor Subjects 97
6.2 Measuring Assignment Difficulty 98
6.3 Difficulty of Assignments and Proportion of Time Spent in Activity Groups 111
6.4 Difficulty of Assignments and the Quality Index 115
6.5 Assignment Difficulty and Workload Factors 124

VII. ANALYSIS AND INTERPRETATION OF THE RESULTS 126

7.1 Analysis of Results 126
7.2 Implications of Results - Staffing 132
7.3 Implications of Results - Individual Assignments 142

VIII. SUMMARY AND CONCLUSIONS 150

8.1 Areas for Future Research 151

APPENDICES

1. Patient Classification and RN Assignment Form 154
2. Back-up Sheets for Quality Checklist 156
3. Quality Checklist 178
4. Instructions and Definitions for Part I Questionnaire 191
5. Part I Questionnaire 201
6. Instructions for Part II Questionnaire 210
7. Part II Questionnaire 211
8. Data Analysis Procedure - Constant Sum Questionnaire 226
9. Data Analysis Procedure - Categorical Judgment 228
10. Work Sampling Observation Sheet 230

BIBLIOGRAPHY 231

LIST OF TABLES

TABLE		Page
1.	Assignment Components Suggested by the Literature	20
2.	Assignment Elements Suggested by the Literature	23
3.	Characteristics of Difficult Assignments	32
4.	Most Frequently Performed Assignment Associated Activities	51
5.	Agreement on Activities in Medication Group	53
6.	Agreement on Activities in Treatment Group	53
7.	Agreement on Activities in Day Care Group	54
8.	Frequency of Component Appearance in RN and HN Assignments by Unit	58
9.	Number of Patients per Functional Component	60
10.	Assignment Elements Used on Study Units as Determined by Validation Study	62
11.	Codes for Work Sampling Observations	92
12.	Example of Analysis of Work Sampling Data	93
13.	Example of Analysis of Work Sampling Data (Continued)..	94
14.	Subject Background	97
15.	Coefficients - Part I Questionnaire	102
16.	Coefficients - Part II Questionnaire	105
17.	Regression Coefficients for Judged vs. Calculated Difficulty	106
18.	Difficulty Scale Values for Assignment Elements (6I-7I)	110
19.	Difficulty Levels for Work Sampling Analysis	111
20.	Work Sampling Observations	113

TABLE

Page

21. Linear vs. Quadratic Standard Errors of the Estimate for Proportion of Time Spent in Activities .. 115

22. Accepted Work Sampling Equations 116

23. Assignment Difficulty and Workload Factors 125

24. Example of Use of Difficulty Scale for Evaluating Patterns of Assignment 147

25. Example of Assignment Element Difficulty Structure 148

LIST OF ILLUSTRATIONS

FIGURE		Page
1.	The Assignment Model	27
2.	Hypothesized Relationship - Time in Direct Patient Care vs. Assignment Difficulty	39
3.	Relationship Between the Jelinek Result and this Research	40
4.	Hypothesized Relationship - Time in Personal Activity vs. Assignment Difficulty	41
5.	Hypothesized Relationship - Time in Non-Patient Care Activity vs. Difficulty of Assignment	41
6.	Hypothesized Relationship - Patient Oriented Quality Index vs. Average Assignment Difficulty	42
7.	Hypothesized Relationship - Non-Patient Oriented Quality Index vs. Average Assignment Difficulty	42
8.	Hypothesized Relationship Between Hours of RN Staff Available and Average Assignment Difficulty ..	44
9.	Hypothesized Relationship Between the Ratio (Hours of RN Staff Available/WPD) and Average Assignment Difficulty	44
10.	Definition of Medication, Treatment, and Day Care Components in Terms of Included Activities	56
11.	Pretest Difficulty Scale - Assignment Elements	68
12.	Judged vs. Calculated Difficulty - 87 Hypothetical Assignments	74
13.	Hypothetical Assignments Used in Part II	77
14.	Pretest Scale for Hypothetical Assignments (Pretest)..	78
15.	Pretest - Judged vs. Calculated Difficulty of 15 Hypothetical Assignments	79

FIGURE Page

16. A Comparison of the Judged Difficulty of Nine Hypothetical Assignments Obtained by Sorting and Comery Methods 80

17. Difficulty Scale for Assignment Elements (6I) 99

18. Difficulty Scale for Assignment Elements (7I) 100

19. Difficulty Scale for Assignment Elements (6I-7I) 101

20. Difficulty Scale for Hypothetical Assignments (6II and 7II)..... 103

21. Difficulty Scale for Hypothetical Assignment (6II-7II) 104

22. Judged vs. Calculated Difficulty of 15 Hypothetical Assignments (6II) 107

23. Judged vs. Calculated Difficulty of 15 Hypothetical Assignments (7II) 108

24. Judged vs. Calculated Difficulty of 15 Hypothetical Assignments (6II-7II) 109

25. Difficulty of Assignments and Proportion of Time Spent in Activities 114

26. Average Assignment Difficulty vs. the Proportion of Non-Patient Oriented Activities Accomplished 118

27. Average Assignment Difficulty vs. the Proportion of Patient Oriented Activities Accomplished 120

28. Average Assignment Difficulty vs. the Proportion of Marginal Patient Oriented Activities Accomplished 122

29. Proportion of Patient Oriented Activities Accomplished vs. the Proportion of Non-Patient Oriented Activities Accomplished 123

30. Assignment Difficulty and the Proportion of Time Spent in Non-Patient Care Activities 134

31. Assignment Difficulty and the Proportion of Non-Patient Oriented Activities Accomplished 134

FIGURE Page

32. Average Assignment Difficulty vs. the Proportion of Marginal Patient Oriented Activities Accomplished 136

33. Assignment Difficulty and the Proportion of Time Spent in Patient Care Activities 139

34. Assignment Difficulty and the Proportion of Marginal Patient Oriented Activities Accomplished 139

CHAPTER I

INTRODUCTION

In the production of any product or service, the organization of effort and the assignment of responsibility among available personnel are of primary importance to the manager. The manager realizes that personnel requirements and organizational capacity cannot be stated specifically without having in mind the particular responsibilities to be assumed by each organizational member. In many organizations, this question comes into consideration only at the point of inception or at points of major organizational changes. In other cases, however, such as the hospital inpatient nursing unit, the question of organization and assignment of responsibility is one which must be faced daily.

The changing nature of the nursing unit organization is probably due to several factors. Among these is the changing population of patients: not only do new patients arrive on the patient unit replacing discharged patients, but the condition of patients carried over from the previous day may change (improve or worsen) to the extent that a significant change of the total nursing load occurs. Also contributing to the need for organizational flexibility are the variety and number of personnel available to contribute to the provision of nursing care. Individuals differ not only with regard to such factors as their experience, training, age, sex, intelligence, and skill, but also in

their ability to get along with certain patients and in their preferences for certain kinds of patients or activities.

These factors are among those that contribute to the need for organizational flexibility on the nursing unit. While the presence of this need has long been recognized,[1,2,3] surprisingly little research has been reported which would formulate a methodology for a general answer to the question: What is the relationship between Registered Nurse (RN) assignments and RN performance?[4]

The Head Nurse, in making daily assignments to professional personnel, hypothesizes some answer to this question. Yet her answer is, at best, an estimate based primarily on her past experience and judgment (for a full discussion of suggested factors that the Head Nurse should take into account when making individual assignments, see Barrett).[5] This rather undefined process of evaluation is forced onto

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[1]Barabas, Mary H., Contemporary Head Nursing, The Macmillan Company, New York, 1962, p. 51.

[2]Johnson, Betty S., and Campbell, Emily B., "It's Time to Be Realistic About the Workload," American Journal of Nursing, Vol. 66, No. 6, June, 1966.

[3]New, P. K., et al., Nursing Service and Patient Care: A Staffing Experiment, Community Studies Inc., Kansas City, Mo., Publication #119, November, 1959.

[4]The term "Registered Nurse (RN) assignment" will refer to the patient care responsibility of a single RN.
As will be discussed later, the term "RN performance" refers to the "kind" and "amount" of patient care provided by RN's who have assignments.

[5]Barrett, Jean, The Head Nurse, Appleton-Century-Crofts, New York, 1967.

the Head Nurse due to the lack of specific data on the relation between nursing assignments and nursing performance.

In an effort to provide more methodological guidelines for the problem of making assignments, several writers have discussed the benefits to be derived from certain "patterns" of assignments. In general, three patterns have been defined: the Functional pattern, the Case pattern, and the Team pattern. (A general discussion of these patterns of assignments can be found in Barabas).[6] The Functional pattern is suggested for times when high productivity is required, the Case pattern when individualized care is possible, while the Team pattern provides a means of combining aspects of both the Functional and Case pattern. "Teams" are assigned to specific groups of patients while members of teams may have functional responsibility for patients that the team is caring for. While these patterns provide an overall scheme for making individual assignments, they fail to indicate specifically how much responsibility each RN should be asked to assume. In fact, those research efforts concerned with methodologies for staffing the patient unit consider only the overall size and composition of the group of personnel required and not the myriad of possible ways that the ability of this group might be allocated among the existing patient demands. Clearly, without specification of responsibility, the number of people required on the unit has little meaning. The assignments

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[6]Barabas, Mary H., op. cit., p. 51.

of individuals is the key factor in specifying the organizational structure.

What is lacking in this important area of decision-making responsibility, then, is a means for evaluating the differences between alternative personnel assignments in a manner somewhat beyond the conceptual stage. Also lacking is an ability to relate specific assignment alternatives to the expected performance of individual RN's.

1.1 Purpose

The purpose of this research is to measure the effects of nursing assignments. In order to achieve this purpose, a model of the assignment process is developed and a method of representing Registered Nurse assignments defined. Next, a technique for measuring the difficulty of Registered Nurse assignments based on the assignment structure is specified.

If the nursing assignment model is representative of the "real world" relationships, then certain hypotheses regarding the relation between the difficulty of assignments and the associated levels of nursing performance must be investigated and supported. After specification of the model, several such hypotheses are made. In order to test the hypotheses, estimation of the parameters of the model in an experimental setting is required. This aspect of the research will evaluate actual RN assignments and observed levels of associated RN performance. Two measures will be used to reflect nursing performance in the structuring and testing of the hypotheses. The first measure

will be the proportion of time RN's spend in Direct Patient Care, Indirect Patient Care, Personnel Centered, Unit Centered, and Personal or Unoccupied activities. The second measure will be an index of the quality of nursing care as indicated by the proportion of an established list of activities which are successfully completed for the patients.

The model for describing nursing assignments has certain similarities to the model underlying the predetermined elemental time systems currently being used in the industrial setting.[7] The objectives of both models are basically to evaluate job content or to establish job standards of performance. This is accomplished by the employment of pre-established activity groups called "elements". Present industrial predetermined time systems have associated with each element an estimate of the working time required in order to accomplish that element. Summing these elemental times over all elements used to describe a task yields a predicted time for the entire task. All that such systems require is that the motion or activity sequence be known.

Our approach to the characterization of RN assignments will be similar to the approach taken in describing industrial jobs by predetermined elemental time systems in that we will propose a system of pre-established activity groups in which each activity group has an associated value of difficulty. Due to the preliminary nature of this

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[7]Barnes, R. M., Motion and Time Study, Wiley, New York, 1963.

research, only the activity group approach to the problem is considered generally applicable. Until more is known about the nature of nursing assignment activity groups and the difficulty values associated with them, application of the results of this research must be preceded by investigations tailored to each situation by the methodology described in this research.

The overall pattern of assignment is not considered in this research, since it is recognized that the pattern only presents broad guidelines for the assignment of individuals.

The successful development of such a model of nursing assignments would be in itself a significant step toward the understanding of the nursing system. Registered Nurse assignments could be compared to one another in a quantitative fashion for purposes of equal distribution of the patient unit load. Such a measure would also allow us to evaluate the extent to which an assignment has been "increased" or "decreased" by some change in the responsibility of the nurse. The model would also be useful for training RN's in the "art" of making assignments and to researchers who wish to "characterize" the nursing unit "situation" so as to appropriately weight other data.

1.2 Scope of this Research

While the relation to be derived between the difficulty of RN assignments and the performance of the RN will be useful in solving the staffing requirements problems and the problem of "optimally" assigning available staff to patients on the unit, this study will be restricted

to demonstrating a methodology which might be applied in order to obtain the data suitable for the solution of such problems. The scope of this study will further be restricted to considering only the assignments of Registered Nurses on the nursing units, excluding all non-professional personnel.

These restrictions seem to be justified on the basis of discussions by several nursing authors.

In recommending a procedure for Head Nurses to follow in establishing the daily assignment, Barrett states:

> In deciding how assignments shall be made the best method is, first, to consider the needs of individual patients and the person qualified to care for him, without regard to the needs of other patients. Thereafter, if the nursing load for the various staff members is not balanced (and seldom will it be), the nursing requirements of all patients are weighed and the best possible assignment made . . . .
>
> When the requirements of all patients have been assessed and the competency of available staff members determined, sometimes it will be discovered that there are not enough professional nurses. On these occasions a practical nurse or aide must be assigned to patients.[8]

In other words, the procedure of establishing assignments recommended by Barrett is to assign the available RN's first and then fill in with Licensed Practical Nurses and Aides. This procedure is also recommended by Lambertson in discussing assignment within the nursing team.

> In planning the assignment the procedure is one of first identifying those patients or those phases of the nursing care plans which require professional judgment and skill. Following the professional nurse's . . . assignment . . . a similar procedure is carried out for the practical nurses and auxiliary personnel.[9]

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[8]Barrett, Jean, op. cit., p. 212.

[9]Lambertson, Eleanor C., Nursing Team Organization and Functioning, Bureau of Publications, Teachers College, Columbia University, New York, 1953.

The process recommended by both authors emphasizes the determination of each RN's assignment prior to considering the specific responsibilities of auxiliary personnel. Implied here is the belief that certain aspects of patient care must be attended to by the professional staff and that these activities should be assigned first.

For this reason, it does not seem inappropriate to limit the scope of this research to RN assignments only. RN assignments are considered separately from the assignments of auxiliary personnel and they are considered first in the process of determining the assignments of the unit personnel. Hence, this research investigates only the RN assignment not to propose the answer to the question of personnel assignment but to establish some quantitative relationships regarding the first step of the assignment process.

In deciding to limit the model to only the patient care aspect of the RN's assignment, we are again pursuing the guidelines for establishing assignments as stated by Lambertson and Barrett. Although these writers do not neglect the eventual assignment of supervisory, staff teaching, or ward record duties to RN's, we note that again the first consideration is their patient care responsibility. Hence, in the process of constructing assignments, establishing the patient care responsibility of the RN precedes deciding upon other duties.

The omission of these aspects of the RN's assignment will not affect the estimation of the model unless the time spent in patient care activities is increased due to the inclusion of these non-patient care responsibilities.

CHAPTER II

BACKGROUND

While no attention has been given specifically to the relation of individual assignments to individual performance for Registered Nurses, there is a good deal of discussion, both qualitative and quantitative, of "patterns of assignment" and associated nursing performance. By the term "pattern of assignment," we refer to the overall guiding design for the scope of responsibility for individual assignments. Since the pattern of assignment is thus indirectly related to individual assignment, let us consider for a moment how the pattern has been described and what relation between pattern and performance has been observed.

2.1 Qualitative Approaches

There have been three traditional approaches toward organizing the personnel on the nursing unit. Under the Functional approach, each individual is assigned to a specific task or group of tasks which she performs for all patients on the patient unit. Under the Case Study approach, personnel are assigned to individual patients. They perform all activities which are required for the care of these patients. Under the Team approach, a mixture of the Functional and Case Study approaches is observed. "Teams," consisting of one team leader, perhaps another RN and several non-professional personnel, are assigned to some subset of the patients on the nursing unit. The team has responsibility for

providing all of the care to this subset of patients, but a Functional approach within the team might, or might not, be employed.

The Functional pattern is generally accepted to accomplish more tasks than the other two patterns. Intuitively this seems appropriate since the Functional pattern parallels the production line concept of organization. In the nursing context, this pattern is employed under conditions of low staffing relative to the patient demands, i.e., when there is an extreme amount of work to be performed. This pattern has the significant drawback that it does not permit the nurse to become fully involved in the overall care plan of any patient.

The Case Study pattern, on the other hand, is thought to provide the opportunity for the nurse-patient relationship to develop. This is reflected in the following statement by the American Hospital Association (AHA) and the National League for Nursing Education (NLNE):

> It is obvious that the patient (case) method of assignment provides for more individualized care of the patient, less adjustment of patients to personnel, and more incentive of personnel to improve the quality of their care. It does, however, require more personnel than the functional method.[1]

The Team method of assignment is an attempt to glean the most desirable parts of both of the previous patterns while minimizing the deficiencies. By subdividing personnel into teams and assigning these teams to subgroups of patients, the chances for the development of the nurse-patient relationship remains, while there is also the possibility of employing aspects of Functional care when needed.

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[1]Lorentz, Mildred I., et al., Hospital Nursing Service Manual, National League for Nursing Education, New York, 1950, pp. 41-42.

Which pattern is to be selected? Calendar[2] states that patient assignment (pattern) should depend on:

1. Condition of patients
2. Ability of personnel
3. Number of personnel assigned to the unit

Calendar goes on to point out:

> . . . the number of personnel assigned to a unit affects that patient assignment. If the number is not sufficient to give good nursing care, the head nurse should notify the nursing service department.[3]

Johnson and Campbell[4] have proposed a rather unique methodology for determining the appropriate pattern. Their technique involves the use of a "situation thermometer." When the situation gets bad (high temperature), we move to the Functional pattern. As the temperature drops to "cold," we move back to Case Study nursing. Presumably we can use combination patterns when we are "warm" to "cool."

Yet, the selection of the appropriate pattern, based on considerations of staff capability and patient needs, only provides a guide for individual assignments. If the Case pattern has been selected, we know that each RN is to have a case load assignment, but how are the patients to be divided among the RN's? If the Functional pattern has been selected, which tasks are assigned to which RN's? These questions are not answered in any detail in the qualitative literature. However,

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[2]Calendar, Tiny M., Unit Administration, W. B. Saunders Company, London, 1962, p. 109.

[3]Ibid., p. 110.

[4]Johnson, Betty S., and Campbell, Emily B., op. cit.

guidelines for assignments of personnel to patients (or tasks) are presented in many nursing texts.[5,6] For example, the AHA-NLNE[7] states that assignments should take into account:

1. The degree of illness of the patient and the time necessary for his adequate nursing care and treatments.
2. The personality of the patient and his emotional condition.
3. The degree of activity allowed the patient.
4. The teaching or rehabilitation necessary.
5. The experience and preparation of the professional nurse or of each member of the team.
6. The number of patients to whom one nurse or a team can give adequate care.
7. The proximity of patients assigned to the same nurse or team.

2.2 Quantitative Approaches

Relevant to the interests of the present investigation, there have been studies in the past attempting to quantitatively relate characteristics of the nursing unit organization and/or the patient load to nursing performance. The objectives of these studies have been primarily prescriptive.

George and Kuehn[8] investigated the question of "just what groupings of nursing service personnel can care most effectively for what numbers of patients?" Experimental personnel patterns were set up on a medical-surgical ward unit and the number of minutes and proportion of time

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[5]Calendar, op. cit., p. 109.

[6]Barrett, Jean, op. cit., p. 201-216.

[7]George, Francis L., and Kuehn, Ruth P., Patterns of Patient Care, Macmillan Company, New York, 1955, p. 42.

[8]George, Francis L., and Kuehn, Ruth P., ibid.

spent by various categories of personnel in "nursing care activities" were observed. It was concluded that one professional nurse, one senior nurse aide and one junior nurse aide "provided adequate nursing service for from twelve to sixteen patients on the day tour of duty."[9] Other conclusions related to other tours of duty. Again, a discussion of the specific responsibility of each RN was not included.

A study comparing alternative patterns of assignment on the basis of the rate of omissions of nursing care tasks concluded that the quality (rate of omissions) was "directly related to the combination of nursing personnel employed and the type of nursing employee."[10]

Both of the above studies considered the pattern, specified by the number and mix of staff available, to be unique. Yet, for each pattern tested in these studies, there are many different ways in which the individual assignments could be structured. The results, indicating differences between patterns, while not specifying organization, leave many unanswered questions regarding the relation between nursing organization and patient care. While important, they tell us only that organizations of different size and composition accomplish different amounts.

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[9] Ibid., p. 124.

[10] Miller, Stephen J., and Bryant, W. D., A Division of Nursing Labor: Experiments in Staffing a Municipal Hospital, Community Studies, Inc., 1965.

The feasibility of viewing the patient unit as a complete system was demonstrated by Jelinek.[11] Assignments and pattern of organization were not incorporated in this study, although the size and composition of the staff was reflected by a staff-hours to patient-day-hours ratio. This ratio was a significant contributor to the reduction of the variance of the model (which estimated the proportion of time spent by personnel in various categories of activity). Although Jelinek did not investigate individual assignments, his work indicates that changes in the ratio of RN hours per patient day (and, hypothetically, in RN "work load") are accompanied by associated differences in performance measures.

While the above studies were concerned primarily with aspects of the organization for providing patient care on the nursing unit,[12] Connor[13] demonstrated that the time spent in direct (bedside) patient care was related to the patient's need for care, which in turn could be reflected by the patient's self sufficiency. For our purposes, Connor showed that regardless of the size, mix, or assignment of staff, patients tended to receive an amount of direct patient care which was related to their condition, as established by independent criteria.

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[11] Jelinek, R., Nursing: the Development of an Activity Model, Doctoral Dissertation, Department of Industrial Engineering, The University of Michigan, 1964.

[12] Jelinek included data related to the patient's need for nursing care. This variable also turned up significant in estimation of the model for professional (RN, LPN) personnel.

[13] Connor, R. J., A Hospital Inpatient Classification System, Doctoral Dissertation, Johns Hopkins University, Industrial Engineering Department, 1960.

Thus, prior investigations indicate that the performance of the organization is related to both the size and composition of staff relative to the number of patients and to the patient's need for nursing care. Any characterization of the RN's assignment which we might develop then should indicate--for each patient she is assigned to--both the scope of her responsibility and the patient's need for nursing care. In the next chapter, we will discuss a theoretical model of Registered Nurse assignments based upon the previous discussion.

CHAPTER III

THE NURSING ASSIGNMENT MODEL

3.1 On Models

A model is an abstraction which is constructed in order to simplify investigation of the characteristics or behavioral aspects of objects or systems. A model aids an investigator by focusing his concentration on those aspects of the situation which are most important to the analysis. Churchman[1] distinguishes between three types of models:

1. An iconic model pictorally or visually represents certain aspects of a system,
2. An analogue model employs one set of properties to represent some other set of properties, and
3. A symbolic model is one which employs symbols to designate properties of the system under study.

The model itself forms the heart of a process of investigation. The process begins with "asking questions" and proceeds to the modeling stage after passing through such stages as system identification and identification of the aspects of interest within the identified system. At this stage, the model represents an overall hypotheses regarding the operation of the actual system. In order to validate a proposed

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[1]Churchman, C. W., Ackoff, R. L., and Arnoff, E. L., Introduction to Operations Research, John Wiley and Sons, New York, 1957, p. 155-168.

model, and because of the difficulty of testing a general theory, it is usually necessary to formulate a set of specific hypotheses which are deduced from the general model. Testing these specific hypotheses is accomplished by estimating the parameters of the model using data from the actual system. If the data supports the specific hypotheses, the general theory or model from which they are derived is accepted.

The formulation of specific hypotheses and subsequent estimation of the parameters of the model comprise model validation. Finally, based upon the validation results, the original model can be adjusted (and re-evaluated) if necessary and the entire process repeated.

3.2 Analysis of Nursing Assignments

In this research we will attempt to describe a meaningful relationship between some parameter of RN assignments and (1) the time spent in nursing activities and (2) the overall "quality" of patient care. Past research has either neglected the question of assignments altogether or approached it from the standpoint of the size and composition of staff complements. In this chapter, we will derive the structure by means of which we will represent RN assignments. We will then see how this structure is to be related to nursing performance. Finally, we will indicate the specific hypotheses to be investigated in this research.

Prior research has demonstrated that staff size and composition are factors associated with the time an RN devotes to various activities.

This implies that, first, the scope of responsibility[2] for each patient in the RN's assignment and, second, the number of patients in her assignment, are meaningful assignment descriptors. As the composition of the staff changes, the individual's assignment and hence her scope of responsibility with respect to each patient changes. The third aspect of the RN's assignment apparently associated with the time she spends in activities is the degree to which each patient in her assignment is self sufficient. This corresponds basically to the patient's classification by the Connor scheme.[3] In the next section, a structure for describing RN assignments on the basis of the above three characteristics will be presented.

3.2.1 Scope of Responsibility

Our previous discussion has indicated that nursing responsibilities are assigned on a patient basis (Case pattern) or on a task basis (Functional pattern). If assigned on a patient basis, some subset of tasks associated with a single patient have been grouped and included in an RN's assignment. If assigned on a task basis, a single task or group of tasks, required by many patients, have been included in the RN's assignment. The basis of the assignment is these task groups, where each task group is associated with a single patient or with a group of patients.

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[2]The term "scope of responsibility" will be used to refer to the patient care activities which are included in an RN's assignment.

[3]Connor, R. J., ibid.

Common task groups can be deduced from the literature. The Case Study pattern suggests a task group which we might call "total care for a single patient"; the nurse in the Case Study pattern is responsible for "all" of the care demands of each patient in her assignment. For each patient in any assignment in this pattern, the associated task group is "total care."

In describing the nature of the Functional pattern, it is frequently suggested that the two most suitable functional assignments for RN's are "medications for n patients" and "treatments for n patients." These represent the groupings of all tasks related to medications for some subset of patients or all tasks related to treatments for some subset of patients. This task grouping is then included in the RN's assignment.

The Team pattern provides for a third type of task grouping which we might term "partial care" or "total care except for . . ." In this type of grouping we reflect the situation which must arise in the Team situation where all of the patient's needs "except for medications" or "except for treatments" (which are to be taken care of by the medication nurse or the treatment nurse) are grouped and included in the RN's assignment.

Hence, we can deduce from the literature that the following set of task groupings are likely to appear in an RN's assignment (Table 1).

TABLE 1

Assignment Components Suggested
by the Literature

1. Total Care of a single patient
2. Medications for n patients
3. Treatments for n patients
4. Medications and Treatments for n patients
5. Total Care except Medications for a single patient
6. Total Care except Treatments for a single patient
7. Total Care except Medications and Treatments for a single patient

The above seven task groupings will be termed "assignment components" from this point on. It is perhaps easiest to summarize the significance of the component structure by stating that the components represent the broad ways in which patient care tasks are grouped and included in an RN's assignment; hence they represent, in a real sense, the RN's scope of responsibility with respect to each patient or each group of patients in her assignment. Table 1 is not intended to be a unique list of assignment components. As we will see later, the components suitable for a particular nursing unit are determined by the ways in which activities are grouped and included in RN's assignments on that unit. Some of the components in Table 1 may be omitted; it is possible that other components might be added.

Before proceeding with an example of the use of the component structure, let us further note that components 2, 3 and 4 in Table 1 are "function" oriented. That is, they refer to a single task or group of

tasks assigned to an RN for n patients. Let us (arbitrarily) assign the value "5" to n in these three components. Hence, for purposes of demonstration, the component list will be re-written as follows:

1. Total Care for a single patient
2. Medications for 5 patients
3. Treatments for 5 patients
4. Medications and Treatments for 5 patients
5. Total Care except Medications for a single patient
6. Total Care except Treatments for a single patient
7. Total Care except Medications and Treatments for a single patient

We now note that all components refer to some specific number of patients. This is to be important, since the number of patients included in an RN's medication responsibility, for example, will determine the number of times the medication component is repeated in her assignment. We will say that if an RN is assigned to give medications to 10 patients, the medication component will be considered to be repeated 10/5 = 2 times in her assignment, since the component is defined for 5-patient groups.

Components 1, 5, 6 and 7, which all are defined for single patients (i.e., "patient" oriented) are, of course, repeated once for each patient included in an assignment under one of those kinds of responsibility.

Let us indicate how the component structure might be used to describe an assignment. We select that subset of components which describes the scope of responsibility one RN has with respect to each patient in her assignment. For example, if Nurse Smith has responsibility for all of the RN level care for 5 patients, except that Patient A and Patient B receive their medications from Nurse Jones, the following components would appear in describing Nurse Smith's assignment:

Component	Number of Times Repeated
Total care single patient	3
Total care except meds, single patient	2

and included in Nurse Jones' assignment would be the following component:

Meds only for 5 patients	0.4 (= 2/5)

If, in addition, Nurse Smith was responsible for treatments only for 10 patients, other than the 5 already mentioned, her total assignment would appear as follows:

Total care single patient	3
Total care except meds, single patient	2
Treatments only for 5 patients	2 (= 10/5)

Hence, it is suggested that the aspect of nursing assignments dealing with scope of responsibility can be represented by the above component scheme.

3.2.2 Patient Condition

It was noted above that the Connor study indicated that the amount of bedside care time that a patient received was dependent on his degree of self sufficiency. Connor specified three levels of self sufficiency in terms of independent criteria. While the distributions of bedside care time provided to patients at each level were overlapping and of differing variances, the ability of the method to usefully classify patients was substantiated.

The three levels of self sufficiency will be termed: Class I (self care), Class II (intermediate care), and Class III (intensive care). Since the patient(s) associated with each component included in in RN's assignment might be either self care, intermediate care, or intensive care, our next step is to expand each assignment component into three assignment "elements." Each of the assignment elements will represent a type of responsibility for a particular Class patient. Thus we derive from the seven components the following 21 assignment elements (Table 2).

TABLE 2

Assignment Elements Suggested
by the Literature

1. Total Care for 1 Class I patient
2. Total Care for 1 Class II patient
3. Total Care for 1 Class III patient
4. Total Care except Meds for 1 Class I patient
5. Total Care except Meds for 1 Class II patient
6. Total Care except Meds for 1 Class III patient
7. Total Care except Treatments for 1 Class I patient
8. Total Care except Treatments for 1 Class II patient
9. Total Care except Treatments for 1 Class III patient
10. Total Care except Med and Treatments for 1 Class I patient
11. Total Care except Meds and Treatments for 1 Class II patient
12. Total Care except Meds and Treatments for 1 Class III patient
13. Meds only for 5 Class I patients
14. Meds only for 5 Class II patients
15. Meds only for 5 Class III patients
16. Treatments only for 5 Class I patients
17. Treatments only for 5 Class II patients
18. Treatments only for 5 Class III patients
19. Meds and Treatments only for 5 Class I patients
20. Meds and Treatments only for 5 Class II patients
21. Meds and Treatments only for 5 Class III patients

The particular subset of 21 assignment elements used to describe an RN's assignment reflects both the scope of the RN's responsibility and the condition (self sufficiency) of the patient(s) associated with each type of responsibility for each patient in her assignment. Hence it is proposed that the above structure reflects those aspects of the RN's assignment which are primarily related to her performance within that assignment as indicated by past research and by the literature.

To demonstrate how the expansion of the components into elements affects the way in which we will characterize the RN's assignment, let us return for a moment to the characterization of Nurse Smith's assignment discussed above. We recall that in terms of components, her assignment was described as follows:

Component	Number of Times Repeated
Total Care of a single patient	3
Total Care except Meds of a single patient	2
Treatments only for 5 patients	2

Let us suppose that of the three "Total Care" patients in Nurse Smith's assignment, two were Class I and one was Class III. Further, let us suppose that one of the "Total Care except Meds" patients was Class II, the other Class III. Finally, suppose that five of the "Treatments only" patients were Class I, the other five Class II. In terms of elements, we would describe Nurse Smith's assignment as follows:

Elements	Number of Times Repeated
1. Total Care of 1 Class I patient	2
3. Total Care of 1 Class III patient	1
5. Total Care except Meds of 1 Class II patient	1
6. Total Care except Meds of 1 Class III patient	1
16. Treatments only, 5 Class I patients	1
17. Treatments only, 5 Class II patients	1

3.2.3 Other Factors

It is not to be forgotten that several other factors, beside scope of responsibility and patient condition, concerning both the individual RN, the patients, and the medical staff may also affect the RN's time in patient care activity or the quality of the care she provides. None of these factors, however, are to be further considered as possible expandors of the above element structure. The reason for this is that the great majority of these factors relate to characteristics of individuals (i.e., experience, skill, personality, etc.) rather than the characteristics of RN assignments. These factors will be expected to influence the relationships observed in Chapter V but will not be considered separately.

Other factors, which we might term "unit" oriented, will be experimentally controlled in estimating the model. This will be discussed further in Chapter IV.

3.3 The Theoretical Model

This dissertation began with the objective of describing the relationship between nursing assignments and two aspects of nursing performance: the time spent in various nursing activities and the quality of patient care. Prior research in nursing organizations has shown that three factors (size and composition of staff, number of patients, and patient self sufficiency) are associated with the time in direct patient care activities. Based on these results, a structure has been proposed for describing the RN's assignment in terms of the

scope of her responsibility for each patient or patient group in her assignment and in terms of the self sufficiency of each patient or patient group in her assignment.

It is suggested as a theoretical model that the particular elements in the RN's assignment strongly influence her performance. That is, an RN having many total care - Class III patients, will have a different level of performance than an RN having a single, total care Class I patient. This is not to say, however, that one RN is doing a "better job" than the other, for not included in our description of assignments are other significant aspects of her job, i.e., teaching, supervising, assisting, etc. Hence, in our theoretical model, we expect to be able to distinguish quantitatively between the patient care responsibilities of RN assignments.

Let us note also that the particular set of assignment elements used is determined by the ongoing process of assignment-making in the hospital being studied. The seven components discussed above were only those derived from the literature on nursing assignments. In fact, each hospital, perhaps each patient unit, has its own way of dividing activities into components. It is necessary to first establish the basic set of components for the particular units being investigated. Hence, the model is not only adaptable to the wide variety of nursing units in existence today, but also for future changes in nursing practice.

The nature of this model can be presented pictorially. Let us first assume that a parameter, D, used to "measure" the assignment

elements has been defined (this will actually be discussed in the following section). The model implies that the measure Sj associated with the individual elements included in an assignment is functionally related to D.

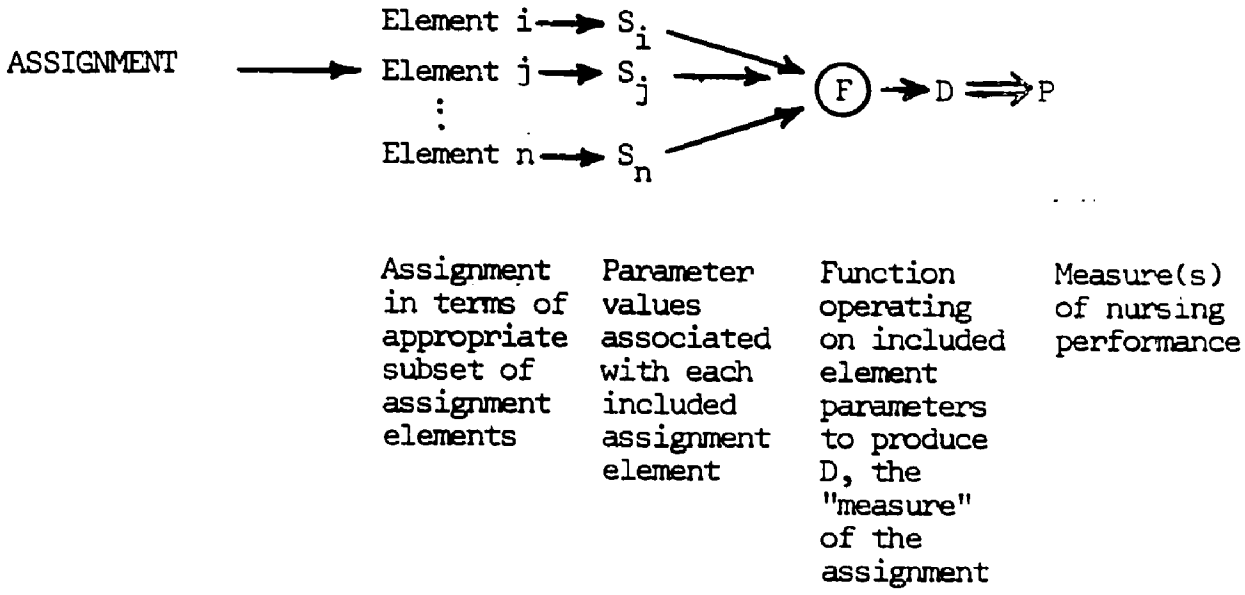


Fig. 1.--The Assignment Model

Let us consider the output of this model, the proportion of time spent on various nursing activities and nursing quality, to be dependent on the level of D. Hence let us call the output variables the dependent variables, and consider D to be the independent variable. In the discussion below, we define the independent and dependent variables specifically.

3.3.1 Specification of the Independent Variable

We have proposed to characterize nursing assignments in terms of the presence of individual assignment elements and in terms of the number of times each assignment element is repeated; we now wish to provide a means of quantifying this characterization, so that some basis of measurement can be applied to establish the degree of similarity or difference between any two nursing assignments which we encounter. We note initially that the value we place on the assignment should have some relation hypothesized with respect to nursing performance.

Mackworth and Mackworth[4] faced a similar question in dealing with various instrument panel designs. They questioned the relationship between characteristics of a display and operator performance. They determined that the two characteristics of display monitoring which were most closely associated with operator performance were the variety (in terms of type and/or number) of stimuli presented and the rate at which stimuli were presented. The product, variety X rate, was found to be linearly related to operator performance (% errors in monitoring).

If we think of a particular assignment element as a stimulus for the RN's activities, and the performance of the activities themselves as responses, we can draw a ready analogy between our characterization of nursing assignments and the Mackworth and Mackworth characterization

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[4]Mackworth, J. F., and Mackworth, N. H., "Visual Search for Successive Decisions," British Journal of Psychology, Vol. 49, 1958. Reported in McCormick, E. J., Human Factors Engineering, McGraw-Hill Book Company, New York, 1964, p. 97-100.

of the display panel monitoring task. We immediately hypothesize that the variety of elements present in an assignment (in terms of number and type) will be associated with performance as will the number of patients associated with each element, reflecting the rate at which the activities must be performed. While Mackworth and Mackworth could quantify the factors of variety and rate directly, we can only quantify one of them: that dealing with the rate--the number of patients associated with each included element. The other component, the variety present in the assignment, cannot be directly obtained in our case.

What is needed is a measure which will reflect the presence or absence of variety in nursing assignments in such a way that an association can be drawn between the measure and RN performance. How does presence or absence of variety (in terms of types and number of assignment elements) affect the RN's job? The answer which comes immediately to mind is that variety in this sense makes the job clinically easier or more difficult.

That is, Total Care of a single Class III patient should be clinically more difficult (in terms of types of orders, intensity of care demanded, interaction required with the physician, intricacy of nursing judgment, skill, and care plans required, etc.) than Total Care to a single Class I patient. Similarly, Total Care to a single Class III patient should be clinically more difficult than Total Care except Treatments to a single Class III patient. The variety of elements present in an RN's assignment (in terms of the types and

number) should be reflected by degree of clinical difficulty associated with that assignment.

The difficulty of the RN's assignment is thus proposed as the parameter upon which to base the measure D. Not only is this parameter suggested by analogy to the Mackworth and Mackworth experiments, but it is frequently referred to by RN's themselves.

Let us go back for a moment to the discussion from Barrett presented in Chapter I in which we noted, ". . .Thereafter if the nursing work load for the various staff members is not balanced (and seldom will it be). . . ." We note here a reference to what might be considered an objective of nursing assignments, balancing the work load. But balancing in terms of what? It is possible that the reference is to balancing the work load in terms of the difficulty of the various assignments, where difficulty refers to the variety factor proposed by Mackworth and Mackworth. In any case, it is difficult to believe that the reference was to balance with respect to the time required for Direct Patient Care or the skill required for treatments or the number of physician interactions required by the various assignments. It is probable that a combination of all of these factors was in Miss Barrett's mind in suggesting the balancing of assignments. We take this as supporting a difficulty parameter which could be derived by individual RN's subjectivity weighting all of these factors at once.

Finally, we have support for using difficulty as a measure of the assignment from the comments of RN's. It is not unusual to hear an RN describe "her day" as being difficult. If the word "difficult"

itself is not used as a descriptor (and the writer has heard it used frequently), some similar terms such as good, bad, hard, easy, or "OK" will be. It is suggested that this type of assignment characterization has real meaning when considered in terms of the specific elements in the RN's assignment and the number of times these elements are repeated.

Of course, in using the term "difficult" in this way, RN's may simply be referring to the time aspects of their assignment, i.e., the time required in bedside activities, charting, treatment preparation, and so on. If that were the case, an appropriate measure, D, of assignments would simply be the time required to complete the activities expected to be associated with the elements included in the assignment. If, on the other hand, time aspects and other aspects of the assignment are being referred to in the use of the term "difficult," the single measure of time would not be so desirable.

In order to investigate the meaning of the term "difficult" when used to describe RN assignments, six RN's were asked, in a structured interview, to think of a recent assignment of theirs which they considered "difficult." They were then instructed to list five or six characteristics of difference between these two assignments. These listed characteristics were taken to represent possible aspects of difference between easy and difficult assignments, or more precisely, contributors to the difficulty of an assignment. Reviewing the reported characteristics of difference, we group the influences on assignment difficulty into two groups (Table 3).

TABLE 3

Characteristics of Difficult Assignments

Group 1	Group 2
Patient condition	More involved orders perhaps requiring interpretation
Frequency of treatments	No. of patients in pain
Time required at bedside	Attention required
No. of medications required	Experience of ward clerk
Frequency of tracheotomy care	Familiarity with patients
No. of patients	Monotony of assignment
No. of intravenous fluids running	Amount of ganging of medications or treatments at one time
No. of critical patients	No. of interruptions or requests
No. of post operative patients	
No. of supplementary staff	
Emergency admission requiring stat. care	

All of the above characteristics of assignments were elicited from the six respondents in their attempt to describe the differences between easy and difficult assignments. We note that there is a difference between the characteristics placed into Group 1 and those placed into Group 2 (the groups were formed by the researcher, not by the respondents). Group 1 characteristics relate to the number of patients, the specific medication and treatment activities and their numbers, and the patients' conditions for the patients included in an RN's assignment. Group 2 characteristics are concerned with something other than the predictable aspects of a particular assignment based on the "content" of the assignment. Hence, it appears that at least two dimensions should be considered when attempting to measure nursing

assignments, one dimension associated with the number and kinds of activities required by the particular patients in the assignment, and another dimension, reflecting perhaps the "intensity" of the assignment, or the "stress" of the assignment beyond that caused by the activities likely to be required.

Yet, both of these dimensions are apparently associated with the conceptual dimension of "difficulty." Hence, rather than attempting to measure only part of the assignment characteristics (by using time as a measure, for example), we propose to measure assignments by using a pre-established scale of assignment difficulty. Such a measure should relate to both the time aspects and the stress aspects of an observed assignment.

3.3.2 Specification of the Dependent Variables

The model for this research suggests that nursing assignments affect the level of nursing performance. It becomes necessary at this point to specify what aspects of nursing performance will be measured to validate the model. The previous use of the term performance now requires clarification. The responsibility and objective of the nursing organization has been stated to be to:

> . . . provide for each patient the kind and amount of care required . . .[5]

A suitable measure of nursing performance would then be the extent to which the kind and amount of care required was, in fact, provided.

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[5]George, Francis L., and Kuehn, Ruth P., op. cit., p. 10-11.

On an individual care basis, this is extremely difficult to judge. Experience has indicated, however, that successful completion of a particular subset of nursing tasks for all patients indicates that the patients are receiving a certain kind of care. It has also been asserted that the proportion of time spent in the so-called bedside or "direct patient care" activities reflected the extent to which the patient was receiving the proper amount of care. In this research, we will not attempt to "measure" nursing performance. Rather, we will measure aspects of the kind and amount of care provided and assume that these measures in some way reflect nursing performance.

The Quality Index: As a measure of the kind of care provided, it has been suggested above that the proportion of a particular set of tasks that have been completed for the patients on the unit can be used as a measure. This proportion will be termed the "Quality Index." Several research efforts have been directed toward establishing such a set of tasks, and for purposes of this research, a listing developed by the Veterans Administration[6] and adapted by Jelinek will be employed. The instrument and the backup sheets which accompany it are presented in Appendices 2 and 3 (adapted to the form used in this research).

We see that the total list of activities is broken down into nine basic categories. These categories and the number of activities included in each category are as follows:

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[6] "Nursing Care Quality Control Plan," Veterans Administration, Department of Medicine and Surgery, Washington, D. C.

Category	V.A. Quality Checklist No. of Activities Included
1. General (long term)	6
2. Patient's Welfare and Safety	14
3. Patient's Comfort	12
4. Patient's Room	7
5. Patient's Chart	17
6. Nursing Care Plan	19
7. Nursing Unit (Excluding Pt.'s Rm.)	15
8. Ward Medical Administration	9
9. Ward Building Management	13

Some of these activities are related directly to the nurses assignment, others are not. In a later section we will specify exactly which activities are to be considered in establishing the value of the Quality Index in this research. These nine categories can be grouped into two basic groups as follows:

	Group Name
Categories 1, 7, 8, 9	Non-Patient Oriented
Categories 2, 3, 4, 5, 6	Patient Oriented

The methodology for establishing the Quality Index is basically a sampling methodology and proceeds as follows: patients are selected at random from those being treated by RN's on the patient unit. A trained observer then goes through the entire list of items for each patient, checking yes, no, or not applicable for each item. When a sufficient number of patients have been observed, Patient Oriented and Non-Patient Oriented Quality Indices are computed by establishing the proportion of yes checks to the total number of yes and no checks for each of the category groups.

The Proportion of Time Spent in Activity Categories: We have reported several previous studies which attempted to measure the relationship between an organizational parameter and the amount of patient care. In all but one of these studies, the proportion of time spent in direct patient care activities was taken to reflect the amount of patient care. Direct patient care activities are those which take place at the patient's bedside. Certainly, it is easy to suggest that the more that is happening at the patient's bedside, the greater the amount of care he is receiving. Such an argument, however, neglects those activities which must occur away from the patient's bedside which also contribute to his care. Hence, it is of interest to measure the time spent in indirect care activities in order to gain a total picture of the time devoted to a patient's care.

In this research, as a measure of the amount of care provided, we intend to measure the proportion of time spent by RN's in four basic activity categories:

I.	Patient Care	
	a. Patient Present (Direct Patient Care)	The sum of Ia and Ib will be termed Patient Oriented Activities
	b. Patient Not Present (Indirect Patient Care)	
II.	Personnel Centered Activities	The sum of II, III and IV will be termed Non-Patient Oriented Activities
III.	Unit Centered Activities	
IV.	Personal and Unoccupied and Standby	

Our observations will be made on RN personnel only, and will follow the general methodology described for this type of study in Arnstein.[7]

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[7] Arnstein, M. G., How to Study Nursing Activities in a Patient Unit, U. S. Department of Health, Education and Welfare, P.H.S. Pub. #370.

3.4 Hypotheses

Having specified the independent variable and the dependent variables associated with the assignment model, we now propose specific hypotheses regarding the expected relationships between these variables. Testing of these hypotheses constitutes a portion of the procedure necessary to validate the model.

In investigating the question posed early in this research, we wish to test hypotheses related to two aspects of the potential use of the measure, assignment difficulty. First, we must demonstrate that the measure is in fact related to nursing performance in predicted ways. Substantiating this claim will justify recommending that a measure of assignment difficulty be used for purposes of evaluating, balancing, and comparing nursing assignments. Hence,one group of hypotheses relates to the level of assignment difficulty and the associated levels of the performance variables.

It has also been mentioned that nursing assignments are made after considering the number and condition of patients, the size and composition of staff, and other unit factors. If this is so, then the average value of the assignment difficulty on any day should reflect the Head Nurse's best guess as to how to balance these factors through assignments. If the situation is bad, we would expect to find high difficulty assignments and vice versa. Hence, the average difficulty of RN assignments on a given day should reflect the unit situation. If so, then the second use of the assignment difficulty could be affirmed; it would be possible to substitute the single parameter of average daily

assignment difficulty for the many parameters now used to reflect the patient unit situation.

Hypothesis 1 — As the difficulty of Registered Nurse (RN) assignments increases, RN's will tend to devote progressively smaller increments of their time to Direct Patient Care activities.

Hypothesis 2 — As the difficulty of RN assignments increases, RN's will tend to devote progressively smaller increments of their time to Patient Oriented activities (Direct + Indirect).

Hypothesis 3 — As the difficulty of RN assignments increases, RN's will tend to devote less time to Non-Patient Oriented activities (Personnel + Housekeeping + Personal).

Hypothesis 4 — As the average difficulty of RN assignments increases, RN's will tend to accomplish a smaller proportion of:

a. Non-patient oriented and
b. Patient oriented

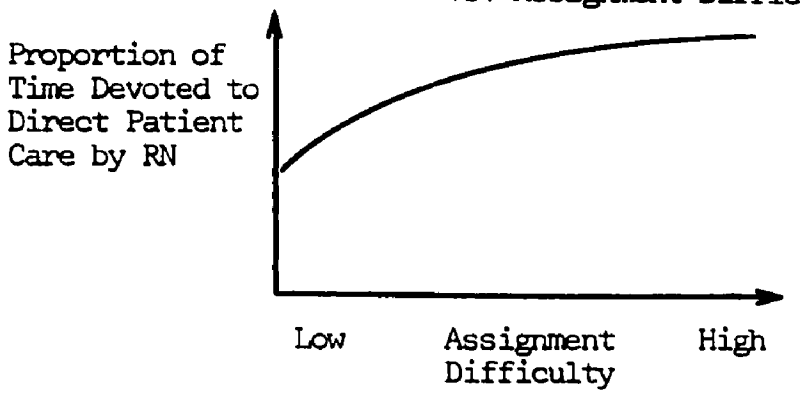
activities.

Hypothesis 5 — The average difficulty of RN assignments will tend to be greater on days when the ratio (RN hours available)/(Hours of Direct Patient Care to be provided) is small.

3.4.1 Discussion of Hypotheses

Hypothesis 1 follows simply from the fact that increasing difficulty generally means that more and more activities are being added to the assignment. Hence, more time in patient care activities will be required if the demands of the assignment are to be satisfied. It is expected, however, that beyond a certain limit, no more activities can be attended to. Hence, there is some saturation point for nursing assignments which would be reflected by the tendency for this curve to level off at high D values. The form of the expected relationship is presented in Figure 2.

Fig. 2--Hypothesized Relationship - Time in Direct Patient Care vs. Assignment Difficulty



The curve is hypothesized to be non-linear in accordance with the results of the Jelinek[8] study. We can construct the relationship between the Jelinek results and this study as follows. (Refer to Figures 2 and 3.)

Let us assume a constant number of patients on the nursing unit. When the number of RN's available is relatively low, assignments are at a high difficulty level. Each RN devotes the maximum possible time to direct patient care activities. The total hours of direct patient care, however, is relatively low also due to the small number of staff available.

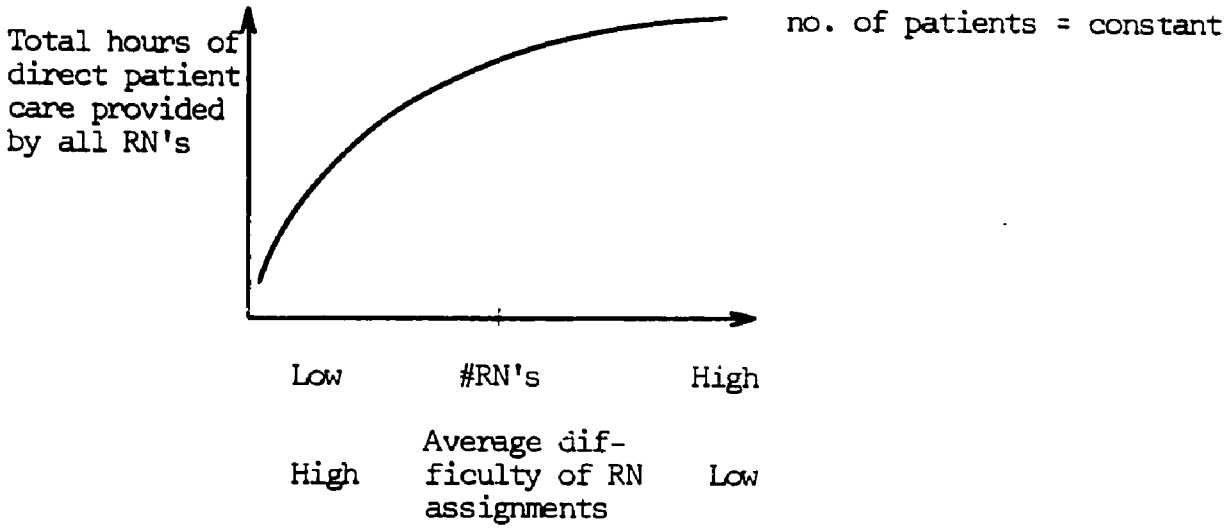
If, on the other hand, the number of RN's available is large, the difficulty of RN assignments should tend to be relatively low. Each RN spends less than her maximum possible proportion of time in direct patient care activities. The total amount of direct patient care time provided is, however, relatively high due to a larger number of staff available.

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[8]Jelinek, R. C., op. cit.

Jelinek showed that the number of hours per patient day devoted to direct patient care is non-linearly related to the ratio RN hours per patient day. On the basis of the discussion above, we should also assume that the relation between assignment difficulty and the proportion of time spent in direct patient care activities is non-linear. In more general terms, Jelinek's study showed that the patient unit situation was non-linear with respect to normalized RN performance. This implies that the difficulty of an individual RN's assignment should be non-linear with respect to her performance.

Fig. 3.--Relationship Between Jelinek Result and this Research



Similarly, it is expected that as the difficulty of assignments increase, proportionally less time will be devoted to personal time activities and to the non-patient care activities (personal, unit-centered, and personnel centered). These expected relationships are demonstrated in Figures 4 and 5. The non-linear form of these curves is, again, hypothesized in concurrence with the Jelinek results.

Fig. 4.--Hypothesized Relationship - Proportion of Time in Personal Activity vs. Assignment Difficulty

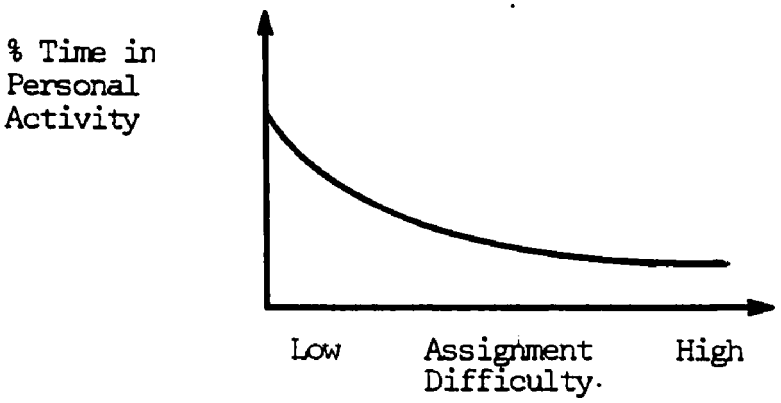
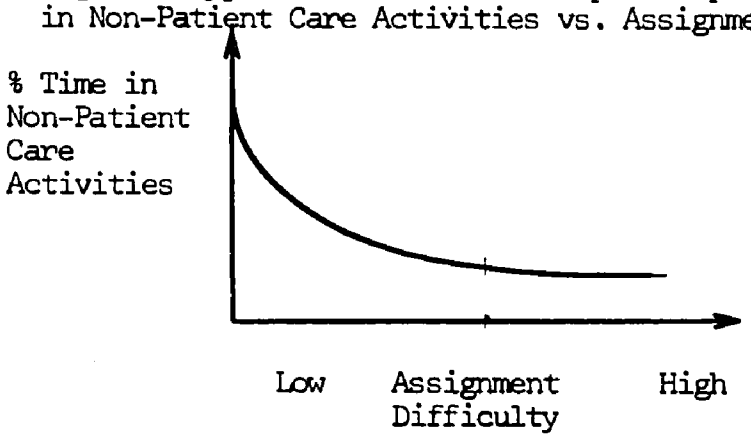


Fig. 5.--Hypothesized Relationship - Proportion of Time in Non-Patient Care Activities vs. Assignment Difficulty



The expected form of the relationships for both the patient oriented Quality Index and non-patient oriented Quality Index are shown in Figures 6 and 7. Note that the initial portion of these curves is flat, corresponding to the increasing slope of the curve in Figure 3 and the decreasing slope of the curve in Figure 5. As Figures 3 and 5 tend to level off, it is expected that the proportion of activities accomplished will begin to drop.

Fig. 6.--Hypothesized Relationship - Patient Oriented Quality Index vs. Average Assignment Difficulty

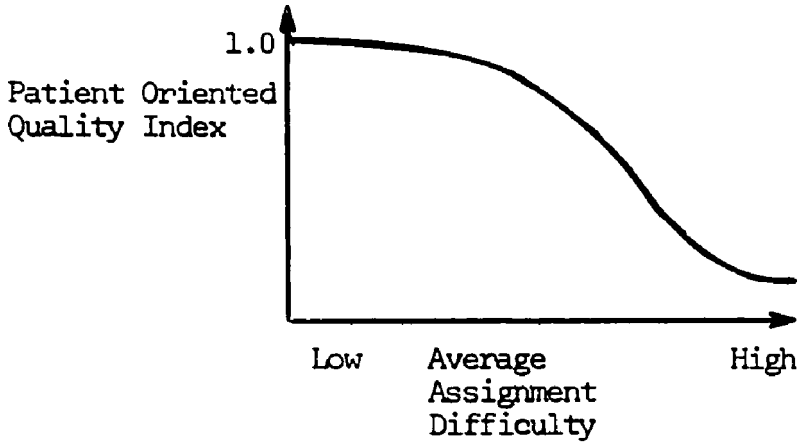
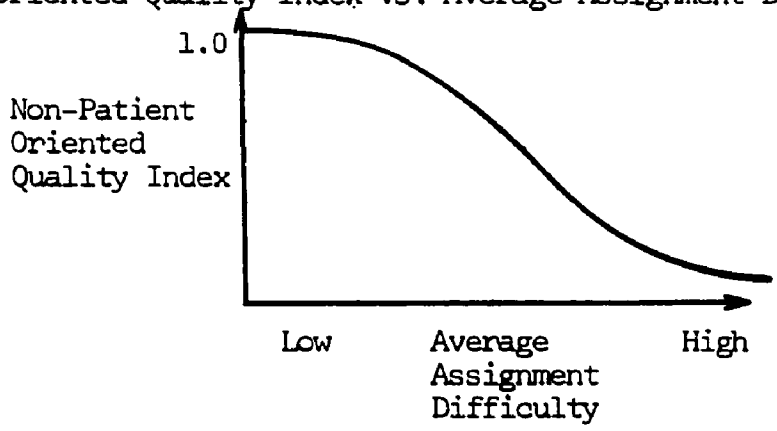


Fig. 7.--Hypothesized Relationship - Non-Patient Oriented Quality Index vs. Average Assignment Difficulty



It should be pointed out here that the curves obtained in estimating the Quality Index on different nursing units are not expected to be exactly the same. The curves should be expected to differ between hospitals, and probably between units within the same hospital. Also, the patient oriented and non-patient oriented Quality Indices are not expected to be equal at various levels of assignment difficulty. Only the general shape of the curves in Figures 6 and 7 is being referred to in this research.

Hypothesis 5 suggests that the ratio of RN hours available to hours of care required (as computed by the Connors formula) should be related to the average assignment index. Connor[8] suggests that the RN hours of direct patient care to be provided to all patients on the nursing unit can be computed by:

$$\text{Hours} = .5N_1 + 1.0\ N_2 + 2.5\ N_3$$

where N_1 = number of self care patients (Class I)

N_2 = number of intermediate care patients (Class II)

N_3 = number of intensive care patients (Class III)

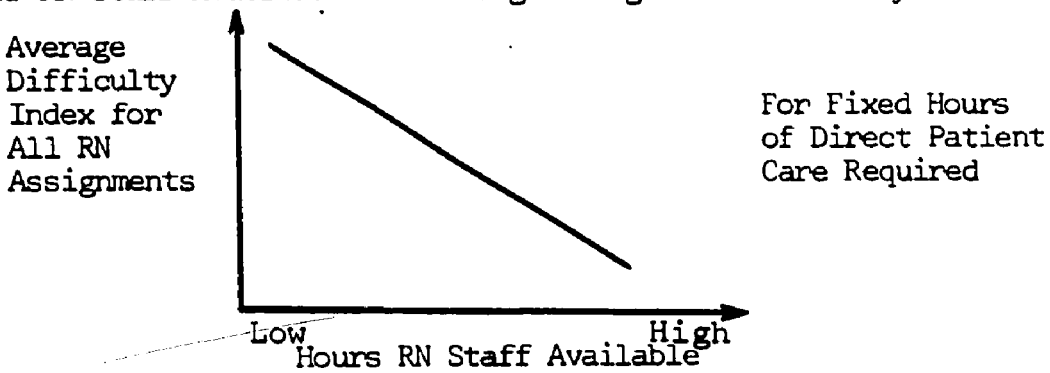
Since the equation is directed toward weighting patient demand by the classification criteria, this variable will be termed WPD. For a fixed number of hours of care required, a high level of staff hours available would suggest relatively lower assignment indices. A low level of staff hours available would suggest a higher level of assignment

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[8]Connor, R. J., op. cit.

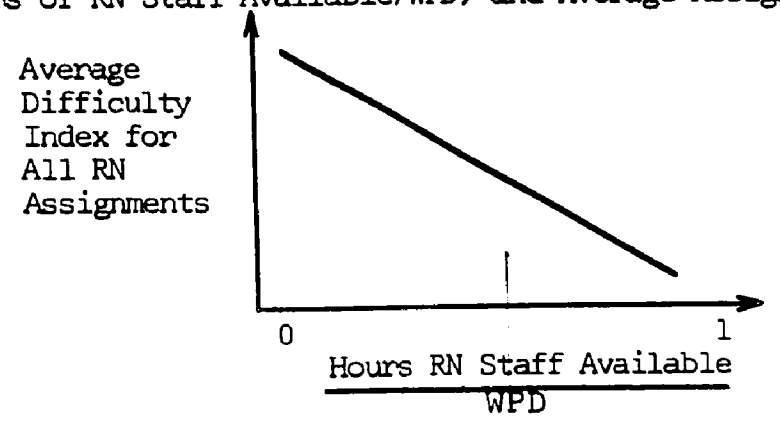
indices. A possible relation for these factors might be as shown in the Figure below:

Fig. 8.--Hypothesized Relationship Between Hours of RN Staff Available and Average Assignment Difficulty



The ratio of staff hours available to WPD should appear as follows when related to the average difficulty index value of RN assignments.

Fig. 9.--Hypothesized Relationship Between the Ratio (Hours of RN Staff Available/WPD) and Average Assignment Difficulty



This concludes the description of the nursing assignment model and the specification and discussion of hypotheses to be tested in this research.

CHAPTER IV

PRETEST OF MODEL STRUCTURE AND ASSIGNMENT QUESTIONNAIRES

The proposed model asserts that the level of performance of a Registered Nurse is dependent on the difficulty of her assignment. In turn, the model proposes that the difficulty of an assignment is determined by the assignment elements included in the assignment and the number of times each assignment element is repeated. Several hypotheses have been proposed which must be supported if the proposed model is in fact a representative description of the "real world" relationships of interest.

In order to test these hypotheses, it was necessary to estimate the parameters of the model on actual patient units. Before proceeding with this phase, however, it was necessary to confirm the existence of assignment elements on actual patient units and to develop a methodology for estimating the difficulty of observed RN assignments. These two requirements were treated in a pre-test fashion in this research and are discussed in this chapter.

4.1 Study Setting

Both the pretest and data collection phases of this study were conducted at The University of Michigan Hospital, Ann Arbor, Michigan. The University Hospital is a nonprofit hospital, owned and operated by the Regents of The University of Michigan. Serving over 65,000 persons annually in the Michigan community, the hospital acts both as

a university medical referral center and as a community hospital.

In a study of this type, it is important to note any differences between the study units which might interfere with our ability to draw conclusions based on the data analysis. Such differences, although not considered specifically in the model, can nevertheless act on the model parameters. It is desirable, then, to attempt to minimize or control for these differences by an appropriate selection of the study setting. In the present research, it was intuitively deemed desirable to attempt to control for the layout of the nursing unit, the overall methods, procedures, and policies governing nursing activity and the experience and education of the RN staff.

Four nursing units were selected for the data collection phase of this research. These four units will be termed "study units" from this point on. Two of the study units (designated 6E and 6W) were on the sixth floor of the hospital's main building. The other two study units (designated 7E and 7W) were on the seventh floor of the same building.

All four patient units have the same basic physical layout. The design can be best thought of as a "Y", where the "arms" are a Male and a Female ward, and the "stem" consists of private rooms, treatment rooms, conference rooms, and supply rooms. The Nursing Station, which serves all three extensions, is located in the center of the "Y".

Organizationally, the pairs of units differ considerably. As a result of an experimental investigation of patient unit organization conducted prior to this research, the two units on the sixth level

(6E and 6W) do not have a "Head Nurse" position. The staff on each of these two units is divided into two permanent teams. While the teams remain approximately constant with respect to size and composition, the size and location of the team's patient load changes daily. Each team is supervised by a "team leader." Hence, 6E and 6W have two team leaders each in charge, rather than one "Head Nurse" each. These four permanent teams are designated 6EY, 6EB, 6WG, and 6WR. The other two patient units to be studied, designated 7E and 7W, have a more traditional organizational structure. The Head Nurse on each of these units usually serves as leader of one team, with RN's serving as leaders of other teams which may be used.

In terms of the types of patients cared for, the study units also differ. The two 6th floor nursing units generally treat only "medical" patients. The two 7th floor units generally treat only surgical patients.

As will be discussed in the following chapter, each pair of units is to serve as a basis for data collection and analysis in this study. Hence, any differences which may exist due to the differences in organizational format or types of patients served will not be confounded in the results of this research. There are several reasons for wanting to proceed with this design. First, the two pairs of units provide the opportunity to examine intensively the meaningfulness of the theory underlying this research. One pair cares for "medical" patients, the other "surgical." One pair employs a rather traditional Head Nurse-team organizational format, the other pair uses no Head Nurse, but uses the team format of organization. One pair (the one with the Head Nurse) generally assigns the teams to wards, or to large groups of patients;

the other pair of units also assigns patients to teams, but generally mixes the teams' responsibility among male and female patients.

These wide divisions in the approach to the organization for nursing care are expected to be reflected in the RN's assignments and attitudes toward their work. It is highly desirable for the methodology proposed in the previous chapters to be validated under these conditions.

Secondly, it is of interest to compare some aspects of RN assignments and perceived difficulty of assignments between the two pairs of units on the basis that one pair is "medical," the other "surgical." What differences exist in the composition of assignments, in the difficulty of assignments, in the number of patients attended to, in the condition of patients in the assignment, or in the use made of auxiliary and non-professional personnel?

Thirdly, it is desirable to test the hypotheses proposed under two distinct data collection efforts. Such replication in support or non-support of the type of model proposed here adds to our understanding of the situation we are attempting to investigate.

It should be noted, however, that the separate analysis of the two pairs of nursing units depends upon the confirmation of differences in the assignment components used in structuring RN assignments or large differences in the ranking of elements in terms of their difficulty. If the units all use the same assignment components and if RN's from the sixth and seventh floors agree on the difficulty of the associated assignment elements, all the data from all four nursing units will be combined.

4.2 Pretest of Component Structure

Estimation of the parameters of the assignment model is first dependent on the ability to represent actual assignments in terms of assignment components. The literature suggests that components should exist, but the first step in estimation must be to verify that they do and to specify their composition in terms of nursing activities. Nursing activities have been classified into different types; for example, Direct Nursing Care, Indirect Nursing Care, Record Keeping, Care and Procurement of Equipment, etc. We note that some activities in these categories are performed by an RN primarily due to her specific patient assignment; others are performed because she has responsibility for supervising, because she has responsibility for unit records, or because she happens to be at a particular place at a particular time. Examining one such listing[1] of types of nursing activities suggests that the following types of activities are primarily assignment associated:

Direct Nursing Care
  Medication and Treatment
  Hygiene, Safety, and Comfort
Indirect Nursing Care
  Indirect Care by Nurse
Record Keeping
  Patient Records
Care and Procurement of Equipment
  By Nurse
Conference and Consultations

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[1]Stewart, D. D., and Needham, C. C., The General Duty Nurse, University of Arkansas Editorial Service, University of Arkansas, Fayetteville (Distributed through the Arkansas State Nurse's Association), no date of publication given.

The remaining categories of activities are engaged in for reasons other than the RN's patient assignment; these categories are:

Indirect Nursing Care
  Direction of Others in Nursing Care
Record Keeping
  Administrative Records
Care and Procurement of Equipment
  Directing Others in Care and Procurement of Equipment
Care of Environment
Procurement and Care of Supplies
Public Relations
Personal

Let us now consider the most frequently performed activities within each of the categories of the first group listed above. It is on the basis of these activities that we expect to be able to define the assignment components used on these units. A list of these activities is presented in Table 4. The time spent in the five categories of assignment activities accounts for approximately 50% of the RN's productive time. The 50 selected activities, listed on the following page, represent 44.51% or 9/10 of this productive time spent in assignment associated activities.

The procedure to be described below has two objectives:

1. to determine how the 50 assignment associated activities are commonly grouped into components on the units to be studied, and

2. to determine the components most frequently used in establishing RN assignments.

As indicated above, the literature mentions components called Medications, Treatments, Total Care, and Partial Care. The question which we must answer before proceeding is: Are these the same components which are used to construct assignments on the units to be studied, and, if so,

is there generally agreement as to which activities are included in the components used most frequently? If such agreement exists, then we can continue to talk in terms of assignment components. If such agreement is lacking, then the discussion must be in terms of individual activities.

TABLE 4

Most Frequently Performed Assignment Associated Activities[2]

give oral
orient & instruct pt.
make rounds
examine pt.
asst. Dr. w/ exam
asst. Dr. w/ trtmt.
check term. &/or asst. in IV med.
give hypo. med.
give &/or remove bedpan
give drinking water
catheterize pt.
give intramusc. med.
take TPR
take blood pressure
dress &/or undress pt.
transport pt.
answer pt. call sig.
asst. pt. in/out of bed
adj. pts. pstn. in bed
give blood transfusion
check, term. &/or asst. in blood transf.
give gavage
apply sterile dress.
care for anes. rec. pt.
check O_2 tent therapy
start, check &/or term. suction

make occupied bed
give compl/part bed bath
feed patient
adjust bed
asst. pt. walking w/wo cr.
fill &/or apply ice pack
adj. heat, light, ventltn.
prepare oral med.
prepare hypo., IM, IDerm
prep. unsterile drssng.
put on mask, gown &/or scrub hands
prep. IV &/or Hypoderm-oclysis med.
prep. &/or ck. med. card/Lst
chart nurse's notes
chart graphic sheets
trnscrbe &/or ck. Dr. orders
consult nurse's notes
prepare diet list
prepare charge slips
clean equipment
prep. equip. for steriztn.
procure equip. from other sctn. of nsg. unit
make mtnce. inspctn. of eqpmt.
conferences and consultatns.

[2]Drawn from Stewart and Needham, op. cit.

Certainly, the most desirable situation that could be encountered would be for the Head Nurses on 7E and 7W and for the Team Leaders on 6E and 6W (from this point on, these six people, with whom we will be dealing frequently, will be referred to as HN's) to independently group the same nursing activities into the same assignment components. High agreement both as to components and activities included in components would indicate that we need investigate no further in establishing the component structure actually used on the study units.

In order to determine the degree of component and activity agreement on the units studied, each HN was asked independently to describe her own and one other RN's assignment on the day of the interview. Each respondent mentioned the same three activity groupings in describing these two assignments: Medications (Mx), Treatments (Tx), and Day (or AM or Morning) Care (AMC). Each respondent indicated that she considered these components to be function oriented rather than patient oriented. Each HN was then asked to indicate which activities from the list (Table 4) they would include in each of these three activity groups.

Analysis verified that all of the HN's were including approximately the same activities in the three activity groups they had mentioned. All six HN's, in describing the Mx group, agreed on the inclusion or exclusion of 86% of the activities. The inclusion or exclusion of an additional 6% of the activities was agreed on by five of the six RN's. The Pearsonian product-moment correlation coefficients, (r), between pairs of HN respondents are presented in Table 5

Noting that all correlations are positive, and that most are greater than 0.70, we conclude that agreement on the existence and composition of the medication component exists among HN's on the units to be studied.

TABLE 5

Agreement on Activities in Medication Group (or Component)

HN UNIT	6EY	6EB	6WG	6WR	7E	7W
6EY	1.0	.82	.69	.82	.94	.82
6EB		1.0	.74	.87	.77	1.0
6WG			1.0	.85	.66	.74
6WR				1.0	.78	.87
7E					1.0	.77
7W						1.0

In describing the Tx component in terms of activities from the list in Figure 1, the six respondents agreed on the inclusion or exclusion of 52% of the activities. The correlation between the HN's responses for the Tx component activities is shown in Table 6.

TABLE 6

Agreement on Activities in Treatment Group (or Component)

HN Unit	6EY	6EB	6WG	6WR	7E	7W
6EY	1.0	.68	.49	.63	.63	.57
6EB		1.0	.51	.67	.76	.62
6WG			1.0	.61	.48	.34
6WR				1.0	.58	.61
7E					1.0	.61
7W						1.0

It is apparent that while all correlations in Table 6 are positive and most in the range 0.5 to 0.7, there is somewhat less agreement on which activities from the list are in the Tx component than there was regarding the Mx component. Nevertheless, the responses clearly indicate that the Tx activity group actually does exist in the minds of the HN's. With regard to the specific activities which should be included in the Tx group, the HN's responses suggested that a distinction exists between the treatment activities themselves and the charting, cleaning, note making, and fetching types of activities usually associated with, but not distinguished from, the treatment activities. Hence, some of the HN's responded by checking only the treatment activities. Other HN's also checked various associated activities.

There was agreement on the inclusion or exclusion of 56% of the activities between all six HN's in considering the AMC group. Five of the six HN's agreed on the inclusion or exclusion of an additional 18% of the activities. The correlation between the respondent's selections for the activities to be included in the AMC group is shown in Table 7.

TABLE 7

Agreement on Activities in Day Care Group (or Component)

HN Unit	6EY	6EB	6WG	6WR	7E	7W
6EY	1.0	.65	.63	.59	.63	.51
6EB		1.0	.79	.46	.79	.63
6WG			1.0	.49	.90	.62
6WR				1.0	.47	.54
7E					1.0	.62
7W						1.0

The above analysis, then, indicates rather strongly that at least three well-defined components are used in constructing RN assignments. These three components, in addition, are classed as functional rather than patient oriented; that is, in referring to these components, the HN's spoke in terms of medications for a group of patients, treatments for a group of patients, and day care activities for a group of patients. Figure 10 presents the activity make-up of each of these three components. Only activities for which four or more of the respondents agreed that the activity should be included are shown.

Our objective is to determine those components which form the basis for the structuring of RN assignments on the units to be studied. Up to this point, three such components, all functional in nature, have been observed and defined in terms of activities. The question which must be answered next is: are there more components than the three already observed and, if so, what are they and how can they be best defined? As a methodology for answering this question, the component structure of the assignment of each RN and HN on the four patient units was determined for five days. The information was obtained by means of HN interviews. During each interview, the HN was asked to describe her own patient care responsibilities and the patient care responsibilities of each RN under her supervision. Generally one such interview was held each day, during which descriptions of both the AM and PM assignments (if different) were recorded. On HN days-off, the information was obtained from the person in charge.

Fig. 10.--Definition of Mx, Tx, and AMC Components in Terms of Included Activities

Mx	Tx	AMC
Give oral medication	Assist Dr. with exam	Give &/or remove bedpan
Check, terminate &/or assist in IV medication	Assist Dr. with treatment	Give drinking water
Give hypo medication	Catheterize patient	Dress &/or undress patient
Give intramuscular medication	Take TPR	Answer patient call signal
Check, terminate &/or assist in blood transfusion	Take blood pressure	Assist patient in/out of bed
Prepare oral medication	Give gavage	Adjust patient's position in bed
Prepare hypo, IM, IDermal	Apply sterile dressing	Make occupied bed
Prepare IV &/or Hypodermoclysis medication	Check O_2 tent therapy	Give complete/partial bed bath
Prepare &/or check medication card &/or list	Start, check &/or terminate suction	Feed patient
	Assist patient walking with/without crutches	Adjust bed
	Fill &/or apply ice pack	Adjust heat, light, ventilation
	Prepare unsterile dressing	
	Chart nurse's notes	

In all, five different components were used to describe RN and HN assignments on the four patient units during the five-day study period. The five components were:

1. Treatments for n patients
2. Medications for n patients
3. AM or Morning care for n patients
4. Working with (or helping) the aides with AM or Morning care for n patients.
5. Total care for a single patient

The activities and descriptions appropriate to the first three components have been discussed above. The fourth component, although observed infrequently, does exist in the structuring of assignments. Essentially, when this component is present in an assignment, the HN or RN and an aide work together in the completion of the AMC tasks. They may divide the activities to be performed between them, or they may actually work together (such as in making beds) toward the completion of single tasks. In any case, the responsibility of the RN or HN is somewhat different if component 4 is included in her assignment than if component 3 is included.

Component 5 is the total care component, and its meaning is essentially the same as the total care component described in the literature. In terms of activities, total care represents medications, treatments, and AM care as described above. Hence, we might just as easily describe it in terms of these three, already established components. The reason we don't is simply that the RN or HN doesn't. In describing assignments, the HN's indicated total care components 87 times. When asked what they meant by total care, they replied in terms such as medications, treatments and AMC. Yet, for reasons of

their own, they thought of these assignments not as three separate activity groups, but as a single activity group of a different kind. Hence, the total care component does exist in the structure of RN and HN assignments, and must be included in our component structure. Table 8 presents the frequency with which each of the above five components was used in structuring an RN or HN assignment on the four patient units during the one-week observational period.

TABLE 8

Frequency of Component Appearance in RN and HN Assignments by Unit

Component	Total	Mx	Tx	AMC	AMC with Aide	
Unit						
6EY	29	8	10	3	0	50
6EB	3	16	16	7	0	42
6WG	17	11	8	0	3	39
6WR	18	14	14	7	3	56
7E	0	15	1	3	3	22
7W	20	13	7	6	8	54
	87	77	56	26	17	263

We note in the above table some interesting characteristics of the study units which might be mentioned here as an aside. First, there are characteristic differences between units on the ways assignments are composed. 6EY relies heavily on the total care component while 7E does not use it at all. 7E uses students and Practical Nurses for treatments while 6EB and 6WR use RN's and HN's for these activities.

In terms of proportions, 83% of the components observed were either Total, Mx, or Tx. AMC accounted for another 10% of the components observed.

One other aspect of the AMC component should be discussed prior to finally selecting the components which will be used in the subsequent parts of this study. The AMC component changes from morning to afternoon due to the completion of two activities that need be done only once a day. These two activities are: (1) make occupied (or unoccupied) bed and (2) give complete/partial bed bath. In the one week of data collection, the proper distinction between AMC and what we now might call PMC was not made. All PMC and PMC with Aide components were recorded as AMC or AMC with Aide. It was not until later in the study week that the difference between the morning and afternoon task composition of these components became clear. There are apparently no such differences with regard to the Total, Mx, or Tx components.

4.2.1 Selection of Study Components and Elements

As a result of the one-week preliminary data collection procedure, it is apparent that the following five components will adequately describe RN and HN assignments for purposes of this study:

1. Total care for one patient
2. Mx for n patients
3. Tx for n patients
4. AMC for n patients
5. PMC for n patients

The above five components account for 92.5% of the components used to describe assignments during the one-week study period. These five

components also account for approximately 90% of the ways in which patient care activities are included in RN and HN assignments. The AMC with Aide and PMC with Aide components are not included for the following reasons:

1. These two components appeared least frequently (total 7.5%) in the assignment descriptions during the one-week study period. Each additional component complicates later procedures.

2. These components are extremely difficult to define in terms of specific activities due to the many ways in which the AMC and PMC activities could be divided or shared between the RN and Aide concerned

In accordance with the selection of the five components, there will be fifteen assignment elements used in the remainder of the study. To finally specify these fifteen elements, it is necessary to consider assigning a value to n in the functional components and elements. The value of n should reflect the functional nature of the component and should not be larger than the number of patients generally assigned to an RN or HN for each type of component. Also, it appears initially that it would be desirable to keep n the same size for all function oriented components. During the one-week component analysis, the number of patients associated with each reported component was also reported. This data is shown in Table 9.

TABLE 9

Number of Patients per Functional Component

Component	Total Number of Components Observed	Average Number of Patients per Component
Mx	77	8.84
Tx	56	6.13
AMC (and PMC)	26	4.68

Hence, the value of n will be set at 5, approximately the number of patients in the AMC and PMC components which were observed.

Finally, before specification of the study elements, the meaning of the terms: Class I, Class II, and Class III must be discussed.

The system for patient classification to be used in the estimation of the model follows the format of the system developed by Connor and discussed above. Some adjustments will be made, however, to the Connor methodology and criteria. These adjustments have the objectives of making the instrument representative of the particular activities which are time consuming on the study units, speeding up the data collection process, and making the determination of patient condition, given a set of factor observations, more defined. Changes of this type have been adopted in other[3, 4] research projects with apparently no loss in the ability to distinguish between patients on the basis of their demands on nursing time.

The same three categories (Self, Intermediate, and Intensive) will be used to identify the three patient classes (Class I, II, and III respectively). In the following discussion, the use of these terms refers to the adjusted Connor scheme. The format of the instrument to be used for data collection is presented in Appendix 1.

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[3] Jelinek, R. C., "Service Unit Management Project," currently under investigation, Bureau of Hospital Administration, The University of Michigan.

[4] Haussmann, R. K. D., A Queueing Theory Approach to Measuring Quality of Nursing Care: Application in a Burn Unit, Ph.D. Dissertation, Department of Industrial Engineering, The University of Michigan, 1968.

The fifteen assignment elements to be used in the remainder of this research are listed in Table 10.

TABLE 10

Assignment Elements Used on Study Units
as Determined by Validation Study

1. Total Care for one Class I Patient
2. Total Care for one Class II Patient
3. Total Care for one Class III Patient
4. Medications for 5 Class I Patients
5. Medications for 5 Class II Patients
6. Medications for 5 Class III Patients
7. Treatments for 5 Class I Patients
8. Treatments for 5 Class II Patients
9. Treatments for 5 Class III Patients
10. AMC for 5 Class I Patients
11. AMC for 5 Class II Patients
12. AMC for 5 Class III Patients
13. PMC for 5 Class I Patients
14. PMC for 5 Class II Patients
15. PMC for 5 Class III Patients

4.2.2 Differences Between Observed and Theoretical Components

We note immediately that there are some major differences between the assignment components suggested by the literature and the assignment components actually observed on the study units. The differences are:

1. There are no partial care components in the observed structure.
2. There is no medication and treatment component in the observed structure.
3. There is no AMC or PMC component in the theoretical structure.

Differences 1 and 2 result apparently from the fact that the RN's and HN's on the patient units to be studied view their assignments as task oriented rather than patient oriented. This is not a criticism of their approach, but an observation of the affects of staffing levels, personal preferences, and educational experiences. First, it is easier to group activities of a particular class, such as medications, and perform as many of these activities as possible at the same time. Hence, we do not find the nurse doing medications and treatments for patient 1, then medications and treatments for patient 2, and so on; but rather, she will give medications to patients 1 and 2 and then give treatments to patients 1 and 2. She functionally organizes her work around the components included in her assignment. In reality, then, the medication and treatment component does not exist. Even though the nurse may be responsible for medications and for treatments for the same group of patients, the organization of her work is no different than if the medication responsibility had been for one group of patients and the treatment responsibility for another group of patients.

On the study units, it appears that once some portion of a patient's care requirements are included in an RN's or HN's assignment as part of a functional component, the other requirements for his care are also included in functional components of the same, or other, unit personnel. The partial care situation, indicated in the literature, never really exists in the assignments of the HN's or RN's on the study units. As above, this is not to say that the

activities comprising what we might call partial care are not there; frequently, they are. But again, the functional view of, and organization for work, renders the partial care component extinct.

Now, finally, why do we find HN's and RN's doing AMC and PMC on the study units; why aren't these activity groupings mentioned in the literature regarding nursing assignments? The activities in this group do not require the skill of an RN or HN; in fact, these activities are generally referred to by the HN's as "aides work." RN's and HN's get involved in these activities for several reasons:

1. On some units, sometimes, there is a severe "shortage" of well trained aides. The RN or HN gets involved in order to help get done what otherwise would be neglected.

2. Most activities in this group require the presence of the attending person at the patient's bedside. Hence, the HN or RN may assume the responsibility for these activities in order to gain a chance to converse with, observe, or examine the patient while still accomplishing some required activity.

3. On one patient unit, where most of the aides were relatively inexperienced, the HN commented that it was easier to do the AMC herself at this point than to attempt to explain to an aide what had to be done and then supervise her work.

In the literature, it is assumed that these activities will be assigned to Aides or Practical Nurses. Hence, the possibility of an RN emptying bedpans or making beds is almost zero according to nursing authors. In reality, on the other hand, it is extremely likely.

4.3 Establishing the Difficulty of Assignment Elements

Thus far in the development of the independent variable, we have determined a set of fifteen assignment elements by means of which

we can characterize the scope of responsibility and the patient condition for each patient in an RN's assignment on the study units. We have decided to measure assignments by establishing a scale of difficulty and applying this scale to assignments observed.

The method for estimating the difficulty, D, of an observed assignment will be obtained in two steps. The first step will be to find difficulty scale values, S_j, for each of the fifteen assignment elements. The second step will be to establish the transfer function to convert the individual scale values associated with the particular elements in an assignment into an index, D, reflecting the difficulty of the assignment taken as a whole. The first step is essentially a problem in psychometric scaling, and it is suggested here that the desired result (a set of 15 scale values) can be obtained by a method of scaling known as the subjective estimate approach. This method has many variations, and is described in detail in Torgerson's Theory and Methods of Scaling.[5]

In this technique, we assume that we have fifteen stimuli which are to be scaled with respect to the attribute "difficulty." A list of pairs is presented to the subjects, constructed so that each assignment element appears once paired with every other assignment element. The subject task, for each pair in the list, is to "divide 100 points between the stimuli in the pair in accordance with the absolute ratio of the greater to the lesser."[6] This method has come

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[5]Torgerson, W. S., Theory and Methods of Scaling, John Wiley and Sons, New York, 1965.

[6]Comery, A. L., "A Proposed Method for Absolute Ratio Scaling," Psychometrika, 15, 1950, p. 217.

to be called the constant-sum method. Torgerson explains that, for example, the "assignment of 80 of the 100 points to one member and the remaining 20 to the other is to indicate that the former is four times as large as the latter. A split of 60-40 would, in a like manner, indicate a ratio of three to two; 50-50, that the stimuli are of the same difficulty."[7]

Hence, it is proposed to obtain "sense ratios" between assignment elements by constructing and administering a questionnaire consisting of 105 paired items to all RN's and HN's on the study units. The result of this procedure will be a ratio scale of difficulty of each of the assignment elements. The term "ratio scale" is used here although a natural origin or zero point is generally implied by this term. Prior application of the constant-sum method has indicated, however, that addition and multiplication can be expected to be consistent within the system derived. Since this is the extent to which we intend to use the scale of difficulty of assignment elements, the constant-sum method is expected to be adequate. Appendices 4 and 5 present the definitions and instructions and the questionnaire used to obtain estimates of the difficulty of assignment elements. This questionnaire was named "Part I."

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[7]Torgerson, W. S., op. cit.

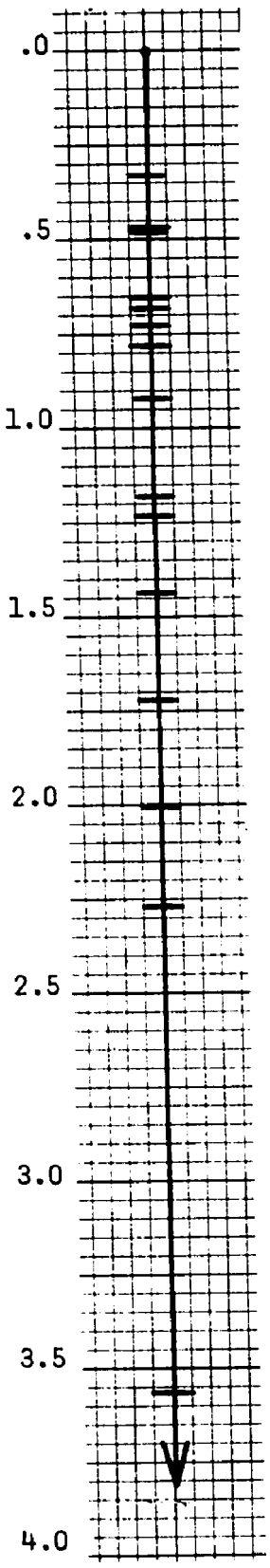
4.3.1 Pretest of Constant Sum Questionaire - Assignment Elements

Six Registered Nurses from patient units other than the four study units, volunteered to participate in the pretest. These subjects were paid for their time and participated either before or after their regular shift. Three one-hour sessions were required from each pretest subject.

At the first session, the subjects were asked to complete a Background Questionnaire. They then read, at their own pace, the Definitions and Instructions for Part I (Appendix 4) and proceeded to the Part I Questionnaire (Appendix 5). Approximately 20 minutes were required for the reading of the Definitions and Instructions and 20 minutes for completion of the Part I Questionnaire.

The six Part I Questionnaires were used to derive an assignment element difficulty scale for the pretest subjects. This scale is presented in Figure 11. (A summary of the data analysis procedure is presented in Appendix 8.) We note that the self care-intermediate care-intensive care ordering is maintained for each of the five components. Of course, such a scale has little meaning if subjects are not consistent in their judgments or if there is little agreement between subjects. By treating each pair as a simple comparative judgment (more than or less than 50 points assigned to the a. and b. parts), we can make use of some pre-established statistics of comparative judgments.

Fig. 11.--Pretest Difficulty Scale - 6 Subjects



Scale Value (S_j)	Element
.3433	Total care for one self care patient
.4842	Afternoon care for 5 self care patients
.4883	Medications for 5 self care patients
.6642	Morning care for 5 self care patients
.6829	Treatments for 5 self care patients
.7435	Total care for one intermediate care patient
.7592	Medications for 5 intermediate care patients
.9373	Afternoon care for 5 intermediate care patients
1.1585	Medications for 5 intensive care patients
1.2422	Treatments for 5 intermediate care patients
1.4407	Morning care for 5 intermediate care patients
1.5224	Total care for one intensive care patient
2.0094	Afternoon care for 5 intensive care patients
2.2733	Treatments for 5 intensive care patients
3.5505	Morning care for 5 intensive care patients

Edwards states:

> In making paired comparison judgments, a subject may sometimes be inconsistent. An inconsistency in judgments occurs whenever there is a circular triad present in the n(n-1)/2 judgments.[8]

As an illustration of what is meant by a circular triad, consider three assignment elements, i, j, and k, included in the set of fifteen assignment elements. If element i is judged more difficult than element j, and element j is judged more difficult than element k, then, to be consistent, the subject should also judge element i to be more difficult than element k. If he judges element k to be more difficult than element i, these three judgments would constitute a circular triad. "The greater the number of circular triads occurring in a set of n(n - 1)/2 comparative judgments of a given subject, the more inconsistent the subject may be said to be."[9]

It is possible to determine the maximum number of circular triads possible in a set of n(n - 1)/2 pairs constructed from a stimuli set (elements).[10] The coefficient of consistency represents the proportion of the maximum number of triads which are found in a subject's responses. If a subject makes the maximum number, then the coefficient of consistency would be 0. If the subject does not have a single circular triad, the coefficient of consistency will be 1.00. We can test the

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[8]Edwards, A. L., Techniques of Attitude Scale Construction, Appleton-Century-Crofts, Ltd., New York, 1957, p. 66-67.

[9]Edwards, ibid., p. 67.

[10]Kendall, M. G., Rank Correlation Methods, Griffin, London, 1948.

probability of obtaining a given value of the coefficient of consistency under the hypothesis that a subject's judgments were made at random by a Chi-Square test devised by Kendall.[11]

For the six pretest subjects, the coefficients of consistency ranged between 0.76 - 0.97. The mean value of the coefficient for the six subjects was 0.87. The null hypothesis of random judgments was rejected for all subjects at the $\alpha = .01$ level of confidence.

Of course, several subjects can have extremely high coefficients of consistency and yet not agree in the judgments they have made. Kendall's u statistic[12] is a means of determining the extent to which a group of subjects agree in their comparative judgments. The value of u can be 1.00 only if there is perfect agreement. "The greater the departure from perfect agreement, the smaller the value of u."[13] Since the value of u can be negative, any positive value whatsoever suggests a certain amount of agreement between the subjects. The coefficient of agreement for the six pretest subjects on the Part I Questionnaire was 0.7346. Kendall has devised a Chi-Square test to test the null-hypotheses that a particular value of u could be obtained if the subjects had been judging at random. The test indicates that the probability of a value of u as great as 0.7346 is much less than .01 if all of the subject's comparative judgments were made at random.

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[11] Kendall, M. G., ibid.

[12] Kendall, M. G., ibid.

[13] Edwards, A. L., op. cit., p. 78.

Finally, the test-retest reliability coefficients for the six pretest subjects were determined. Fifteen of the Part I pairs were randomly selected and presented at the second one-hour pretest session. The Personian correlation coefficient (r) between the original and retest responses was determined for each subject. These coefficients ranged between .55 and .90 with a mean of .77. Since these coefficients were significantly different from zero at the $\alpha = .05$ level, it was concluded that the session one judgments on the subjects could be considered dependable.

4.4 Determining the Difficulty of an Assignment

Having obtained the scale values of perceived difficulty for each of the fifteen assignment elements, the next step in the pretest was to investigate how these elements could be combined into an overall index of assignment difficulty. An assignment can be made up of any combination of assignment elements, with each element repeated a sufficient number of times to represent all of the patients associated with that element. To be determined is how the difficulty of each assignment element in an assignment, and how the number of patients associated with each element in an assignment, are related to the difficulty of the total assignment. Having this information, we could then construct an index for any observed assignment based on the included assignment elements and number of times each element is repeated.

In order to investigate these questions, the nurse respondents were asked to complete a second task. In the second task, respondents

were asked to judge the difficulty of each of many hypothetical assignments. The method used to obtain this data is known as "categorical judgment." The procedure was as follows:

A deck of 87 cards was presented to each subject. On each card, a hypothetical assignment was described in terms of the included assignment elements and the number of times each included element was repeated.[14] The subject was asked to separate the 87 cards into nine categories of approximately equal difficulty. This was done by first separating the 87 hypothetical assignments into three levels: high, medium, and low difficulty. Each of these levels was then broken down into three additional levels. Subjects were allowed to re-judge and to shift cards from one pile to another until they were satisfied with their categorization. By analyzing the categorizations of the respondents, an estimate of the difficulty of each of the hypothetical assignments was obtained. A general discussion of the data analysis procedure for the categorical judgment data is presented in Appendix 9.

Analysis of the sorting task provided a value of the judged difficulty of each of 87 hypothetical assignments for the pretest group. These assignments represented various combinations of kinds of elements, numbers, and conditions of patients. The question then asked is whether the judged difficulty of a hypothetical assignment

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[14] In order to avoid complexity, the elements were presented as, for example, "Medications for 15 self care patients" rather than as the element "Medications for 5 self care patients" repeated three times.

could be shown to be related to the difficulty of the assignment elements (S_j) which comprise that assignment. A second value, D, was calculated for each hypothetical assignment where

$$D = \sum_{i=1}^{12} (n_i/5)S_i + \sum_{i=13}^{15} n_i S_i$$

and

n_i = number of patients associated with the ith assignment element.

S_i = scale value (from Part I) of the ith assignment element.

Note that since the first twelve assignment elements are functional in nature and deal with patients in groups of 5, the number of times an element is repeated (corresponding to the number of patients) is computed by taking $n_i/5$. Hence if there were 10 Self-Care patients receiving Medications, the scale value for the element "Medications for 5 Self-Care patients" would be added in 10/5 or 2 times. Since the total care elements (numbers 13, 14 and 15) each deal with a single patient, the number of times an individual element is repeated corresponds exactly to the number of patients.

A graph showing the judged difficulty and the computed D for each of the 87 hypothetical assignments is shown in Figure 12.

The Pearsonian correlation between D and judged difficulty in Figure 12 is 0.85. This coefficient is significantly different from zero at the $\alpha = .01$ level of confidence, and suggests the appropriateness of the linear function to compute D. On the basis of this pretest result,

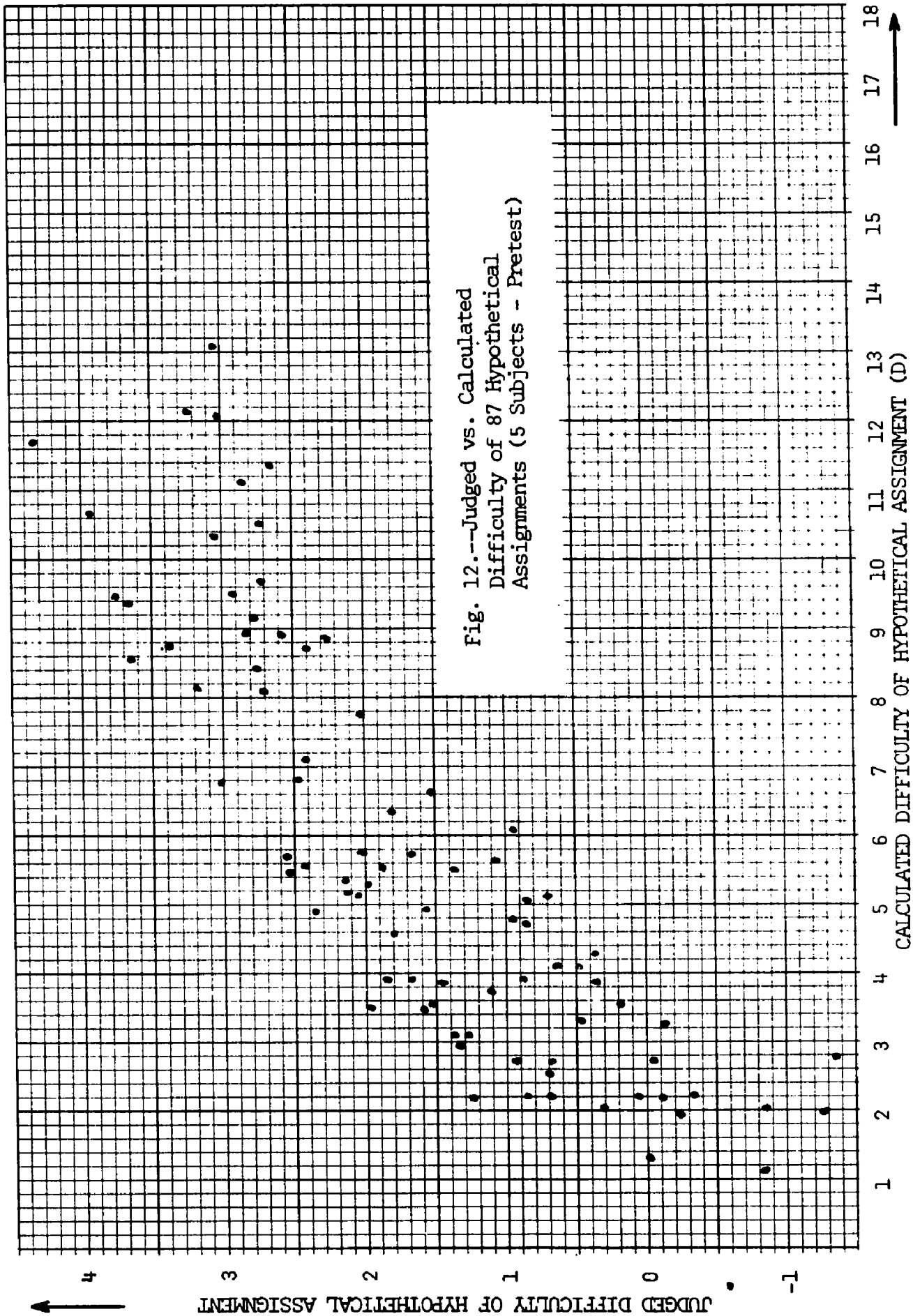


Fig. 12.--Judged vs. Calculated Difficulty of 87 Hypothetical Assignments (5 Subjects - Pretest)

it appears that it will be possible to estimate the difficulty of RN assignments based on a linear combination of the S_j's associated with each included assignment element.

The linear form indicates that no distortion of the computed D should be expected at high or low levels of judged assignment difficulty. Further validation of the appropriateness of the linear form to compute D will be undertaken in the data collection phase of the study.

4.4.1 Pretest of Constant Sum Questionnaire - 15 Hypothetical Assignments

While the sorting task appeared to be satisfactory with regard to the results it provided, it had several problems. First, since only 10-12 RN's from each study floor were to be participating, there was some question as to the reliability of the scale derived. In general, many more subjects are usually reported in studies utilizing the categorical judgment technique. Secondly, the preparation of 5 to 10 additional decks of hypothetical assignment cards loomed as a monumental task with the reproduction facilities available. Third, the coding of the subject's sorted decks was an extremely tedious job subject to many different kinds of coding errors. These problems, and the apparent success of the Part I constant sum questionnaire, prompted the construction of a second constant sum questionnaire (named Part II). Part II consisted of all possible pairs of 15 chosen hypothetical assignments. Nine of the 15 assignments were drawn from the 87 assignments in the sorting task. The remaining 6

assignments were constructed so as to provide breadth of representation with respect to combinations of components and numbers and types of patients. The 15 hypothetical assignments used are presented in Figure 13. The scale derived from the responses of the six pretest subjects is presented in Figure 14. The complete Part II questionnaire and the instructions for its completion are presented in Appendices 6 and 7.

As before, the judged difficulty of the 15 assignments as derived from analysis of Part II was compared with the computed difficulty D where, again,

$$D = \sum_{i=1}^{12} (n_i/5)S_i + \sum_{i=13}^{15} n_i S_i$$

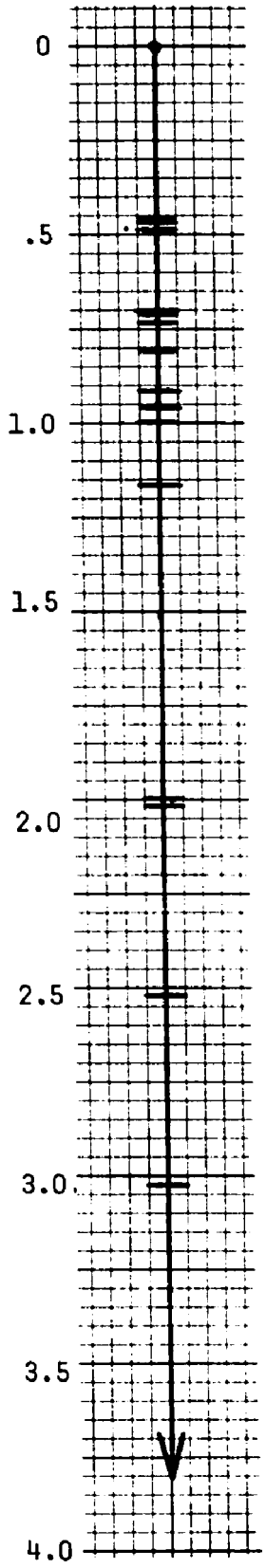
The resulting plot is presented in Figure 15. The plot again indicates the appropriateness of the linear function. As a final check, there were 9 assignments judged in both the sorting task and in Part II. Figure 16 presents the plot of the scale values derived for each assignment from each of the judgment methods. This plot indicates that both methods are measuring approximately the same dimension.

One difficulty appears to be at the extreme levels of judgment, where both Figure 12 and Figure 16 indicate some tendency for distortion. This is attributed to the constraint which the sorting task places on the subjects. An assignment cannot be judged "more difficult" than level 9 or "less difficult" than level 1. While correction procedures are available, this problem was viewed as an additional deficiency of the sorting procedure.

Fig. 13.--Hypothetical Assignments Used in Part II

ASSIGN. NO.	ASSIGNMENT
1.	Treatments for 15 self care patients
2.	Medications for 5 self care patients Medications for 10 intermediate care patients
3.	Morning care for 5 self care patients Morning care for 5 intermediate care patients
4.	Total care for three self care patients Total care for one intensive care patient
5.	Medications for 10 self care patients Treatments for 5 self care patients Total care for one intensive care patient
6.	Medications for 15 intermediate care patients
7.	Medications for 15 intermediate care patients Afternoon care for 10 intermediate care patients
8.	Medications for 10 intermediate care patients Total care for 5 intensive care patients
9.	Treatments for 10 intermediate care patients Morning care for 10 intermediate care patients
10.	Medications for 5 intermediate care patients Medications for 10 intensive care patients
11.	Medications for 5 intensive care patients Treatments for 5 intensive care patients Morning care for 5 intensive care patients
12.	Afternoon care for 10 intermediate care patients Total care for 5 intermediate care patients
13.	Total care for three intensive care patients
14.	Medications for 15 intensive care patients Morning care for 10 intensive care patients Total care for one intensive care patient
15.	Morning care for 5 self care patients Morning care for 15 intermediate care patients Morning care for 5 intensive care patients

Fig. 14.--Difficulty Scale for Hypothetical Assignments (Pretest) - 6 Subjects



Judged Difficulty Scale Value	Assignment No. (See Figure 13)
.4609	6
.4620	1
.4894	2
.7042	4
.7150	3
.7325	10
.8030	7
.9202	12
.9633	5
1.0039	13
1.1688	9
2.0057	11
2.0209	8
2.5233	15
3.0367	14

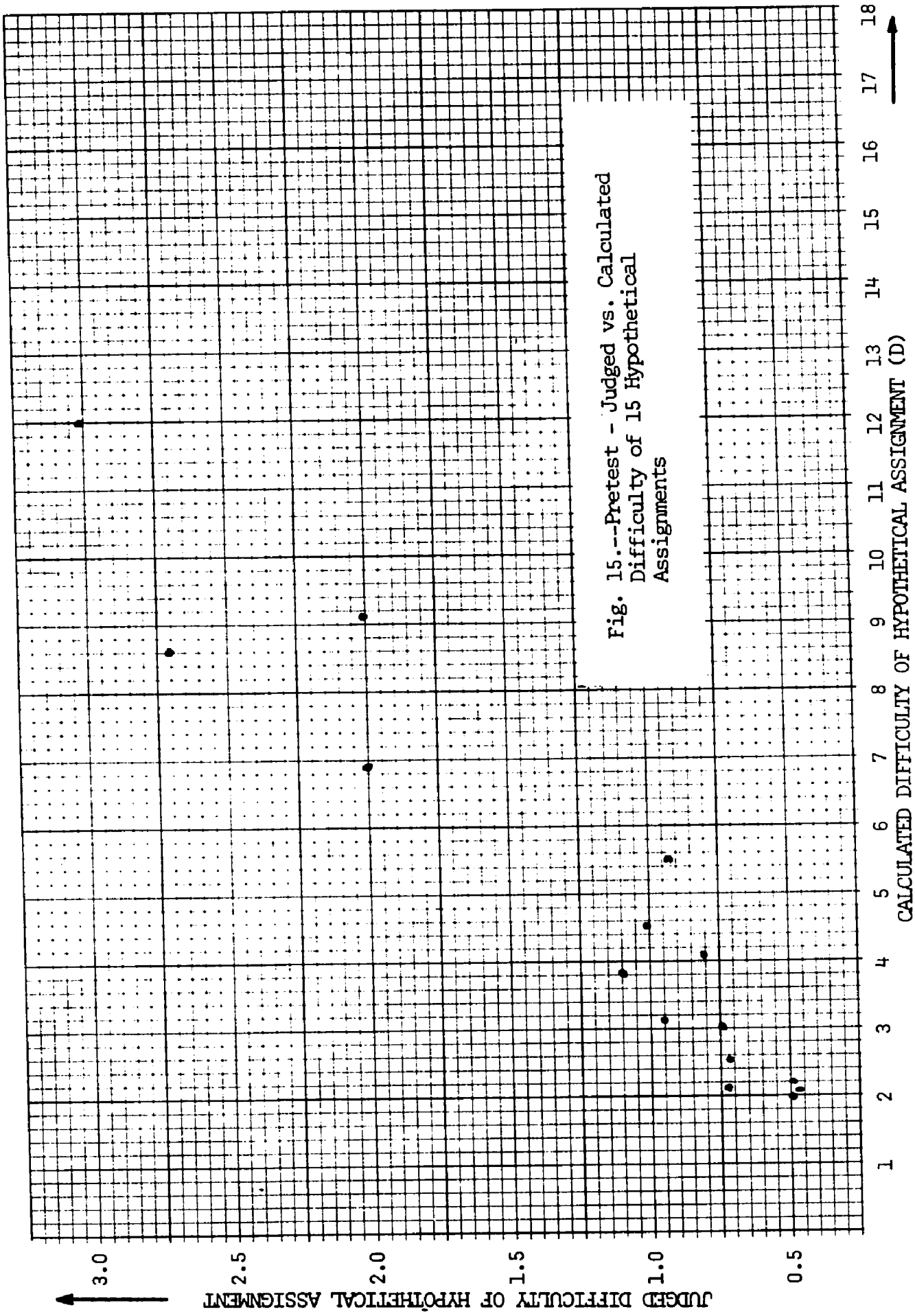


Fig. 15.--Pretest - Judged vs. Calculated Difficulty of 15 Hypothetical Assignments

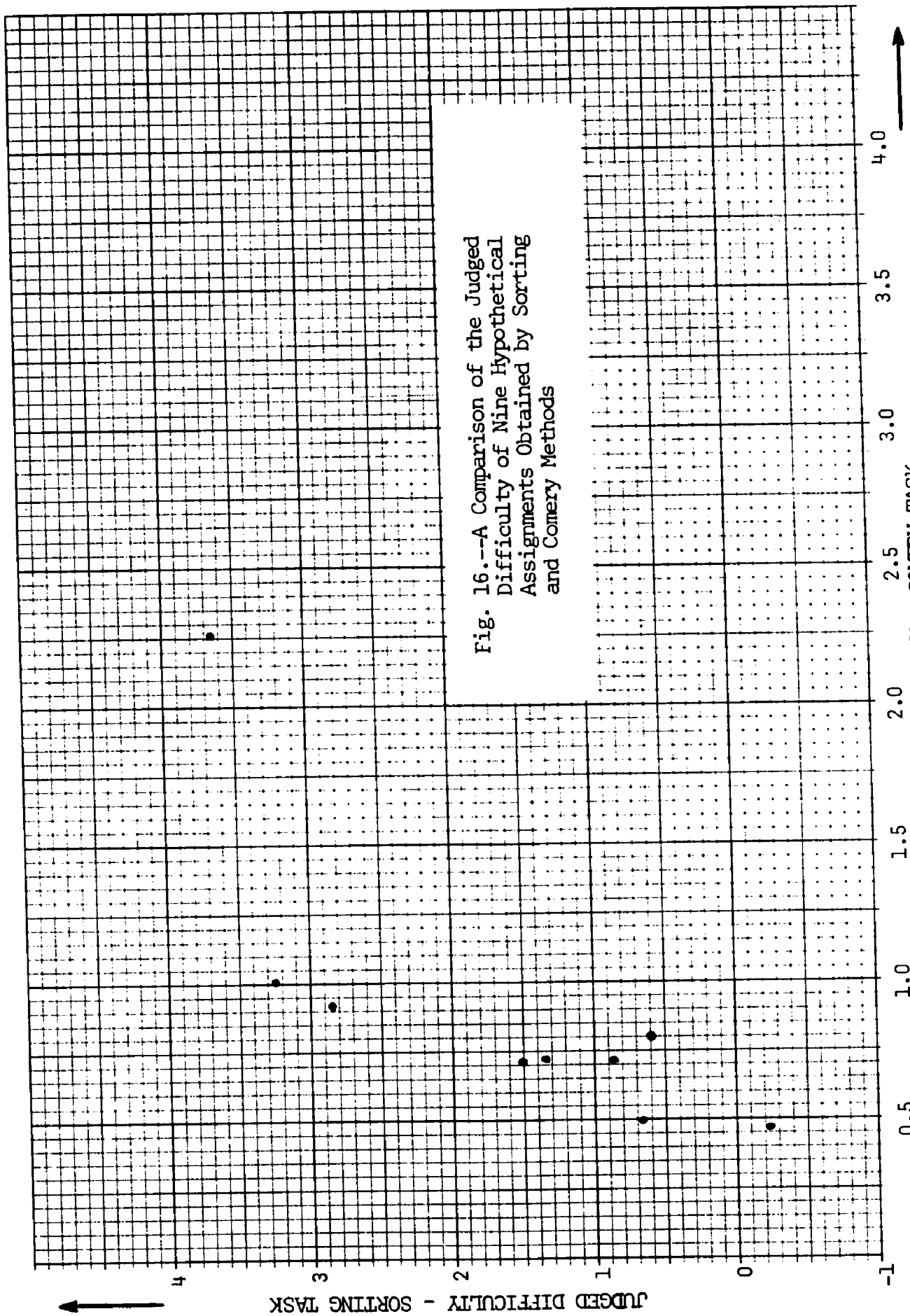


Fig. 16.--A Comparison of the Judged Difficulty of Nine Hypothetical Assignments Obtained by Sorting and Comery Methods

Both the sorting task and the constant sum Part II questionnaire were designed to provide information as to the type of function required for calculating assignment difficulty based on the included assignment elements and the number of times each element is repeated. Because of the apparent similarity of the results of the sorting task and the Part II questionnaire, and because of the difficulties noted above with the sorting task, it was decided to use only the Part II questionnaire on the subjects from the four study units.

CHAPTER V

DESIGN FOR DATA COLLECTION

Thus far, a methodology for structuring and measuring nursing assignments has been presented. Also, we have proposed specific hypotheses regarding the expected relationships between the measure of nursing assignments and indicators of nursing performance. The pretest phase determined the actual assignment elements used on four actual nursing units at The University of Michigan Hospital, Ann Arbor. Also, a methodology for computing the difficulty of observed assignments based on the structural representation of the assignments was indicated by the pretest.

In order to test the specific hypotheses on the four study units, it was necessary to obtain the data necessary to estimate the parameters of the assignment model. In this chapter, the data requirements and the methodology used in data collection are presented in detail. Each variable will be discussed in turn.

5.1 The Difficulty of Observed RN Assignments

Estimation of this parameter for assignments observed on the four study units required two separate data collection efforts. First, the RN's normally assigned to these units were asked to complete Parts I and II of the Nursing Assignment Questionnaire. Analysis of this data provided estimates of the difficulty of assignment elements, (S_j), which comprise their assignments and confirmed the appropriateness of

the linear function to compute D, the estimated difficulty of observed assignments. Secondly, a methodology had to be designed for reporting observed RN assignments in terms of assignment elements. This meant that we required not only assignment components to be reported, but also patient condition. Having the S_j estimates, the function for computing D, and daily reports of components included in RN assignments and the condition of the patients included in each component, we would be able to calculate the difficulty D, of observed RN assignments.

5.1.1 Administration of the Nursing Assignment Questionnaires

Based on the one-week investigation of assignment components used on the four study units (reported in Chapter IV), two questionnaires were prepared and pretested. These two questionnaires were called Part I and Part II. The Part I questionnaire was designed to obtain estimates of the difficulty of the 15 assignment elements. Each assignment element is paired with every other assignment element and the subject is asked to make a constant sum judgment. The Part II questionnaire presents pairs of hypothetical assignments in the same format as Part I. The purpose of Part II is to provide a basis for evaluation of any function used to calculate D, the computed difficulty of an observed assignment.

The questionnaires were presented to all available RN's on the four study units in two 1-hour sessions. In the first session, the RN's read the definitions and instructions for Part I and completed the

Part I questionnaire. The Part II questionnaire was completed at the second 1-hour session.

5.1.2 Patient Condition

Twice each day, the Head Nurses on the study units noted the patient condition for all patients on their units. They reported this information on the form presented as Appendix 1. On the basis of their checks, the patient class (Self Care, Intermediate Care, Intensive Care) was determined for each patient for each period (AM and PM) of the day. The scheme for determining the class was as follows: a point scale was assigned to each factor.

Number of Points	Item
0	Ambulation - at Liberty (Ad. Lib.)
2	Ambulation - with Assistance
2	Ambulation - Strictly Confined to Bed (SCB)
0	Bathing - Self
2	Bathing - Partial Self
3	Bathing - Complete Assistance
0	Feeding - Self
2	Feeding - Partial Self
3	Feeding - Complete Assistance
0	Orientation - Oriented
2	Orientation - Confused
3	Orientation - Disoriented
3	Orientation - Unconscious
2 each if checked	IV, Oxygen, Isolation
3 each if checked	Vital Signs (VS), Suction, Circle Bed, Post Operative, Dialysis, Incontinent

The total points for each patient during each period were added and the patient was considered:

Self Care if total points equal 0

Intermediate Care if total points equal 2 to 7 and no more than one "3" is checked

Intensive Care if total points equal more than 7 or, if less than 7 but two "3"'s are checked

5.1.3 Components Included in RN Assignments

It was necessary to know for each RN on the unit the elements included in her assignment and the number of times each element was repeated. This entailed the reporting of which patients an RN was giving medications to, which patients she was giving treatments to, and so on. Knowing this, and having information as to patient condition, the needed information could be obtained.

RN assignments were reported on the same form as patient condition (Appendix 1), since the reporting of both types of data required a listing of patients. The form provided space for the separate reporting of as many as five different assignment periods[1] for each patient unit. In fact, two assignment periods were usually reported--one representing the morning assignment and the other was the afternoon assignment. In completing the form, the Head Nurse entered the RN's number in the column representing the kind of activity which that RN had responsibility for, for each patient. For example, if RN number 4 had responsibility during the morning for medications for patients A, B,

[1] An "assignment period" is defined to be a period of time during which all RN assignments remain the same.

C and D, the Head Nurse would enter the number "4" in the medication column in the rows having patients A, B, C and D's name. If number four were doing treatments as well for patients C and E, then the number "4" would be entered in the treatment column in the rows having patients C and E's names.

Usually, each Head Nurse recorded the assignments of 3 to 6 RN's in about 10 to 20 minutes, depending on the number of personnel and the complexity of the various assignments.

In coding the assignment data for processing, the steps were as follows: (1) determine each patient's condition during the morning and afternoon, (2) count the number of Self Care patients to whom nurse K gave medications, (3) count the number of Intermediate Care patients to whom nurse K gave medications, (4) count the number of Intensive Care patients to whom nurse K gave medications, (5) count the number of Self Care patients to whom nurse K gave treatments, (6) and so on. Each assignment could then be represented by 15 numbers, each number representing the number of patients of <u>that</u> condition for whom nurse K had <u>that</u> kind of responsibility. For example:

Medications			Treatments			Morning Care			Afternoon Care			Total Care		
Self	Interm.	Inten.	S	I	I	S	I	I	S	I	I	S	I	I
3	0	2	3	0	2	0	0	0	0	0	0	0	2	0

would indicate that nurse K had medications for 3 Self Care patients and 2 Intensive Care patients, treatments for 3 Self Care patients and 2 Intensive Care patients, and total care for 2 (other) Intermediate Care patients.

It should be recalled at this point that this particular scheme was designed for the particular study units based on a one-week pretest (see Chapter IV) and would not be expected to apply directly to all other patient units (although, once the assignment components used on other units are defined, the same methodology would be expected to be applicable).

5.2 Proportion of Time in Activities

In order to estimate the proportion of time spent by RN's in various activity categories, the work sampling technique was utilized. This technique, described by Arnstein,[2] consists of instantaneous observations of the RN's on a patient unit and the simultaneous recording of what each person is doing at the time she is observed. In order to facilitate recording, activities are grouped (as, for example: Direct Patient Care) so that each activity appears in only one group. The method is based on the fact that "the number of times an activity is observed being performed is closely correlated with the total time spent in its performance."[3]

In stating the hypotheses above, we have already seen the activity categorization scheme to be used. (This scheme is presented in more detail in 5.2.2.) We now proceed with other problems of the design of this portion of the study.

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[2]Arnstein, M. G., op. cit.

[3]Jelinek, R. C., op. cit., p. 45.

5.2.1 Time Required for Data Collection

Because a sampling procedure for estimating the amount of time spent in activity groups was proposed, the first task was to estimate the number of observations of RN's operating at a particular level of difficulty which would provide the desired estimates within specified limits of accuracy. First,[4] we assume that the assignment period lasts, on the average, four hours. It was considered adequate precision if an activity (group) taking 10% of the assignment period could be estimated within plus or minus five minutes with 95% confidence. Since 10% of an assignment period was 0.4 hours, five minutes = 5/24 or 0.20 precision. In order to obtain this precision (S) with confidence of 95%, the necessary sample size (N) could be calculated for an activity taking P = 0.1 of the assignment period as follows[5]:

$$N = \frac{(1.96)^2}{S^2} \cdot \frac{(1-P)}{P} = \frac{(1.96)^2}{(.20)^2} \cdot \frac{.9}{.1} = 785.7$$

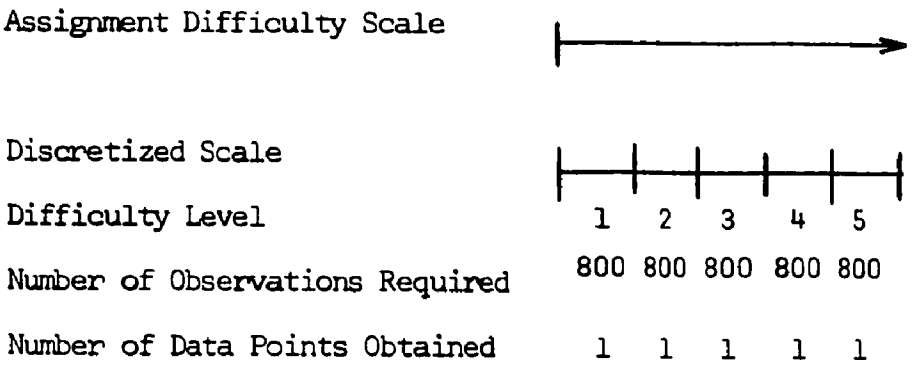
If we now discretize the entire index scale into five equal interval regions, approximately 800 observations had to be obtained

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[4]The format for this portion of the discussion follows Wolfe, H., A Multiple Assignment Model for Staffing Nursing Units, Operations Research Division, The Johns Hopkins Hospital, Baltimore, Md., p. 89.

[5]Heiland, R. E., and Richardson, W. J., Work Sampling, McGraw-Hill (New York), 1957.

within each interval in order to obtain five data points. Pictorially, we have:



Each replication would require another 800 observations at each index level.

Prior observations indicated that there were, on the average, 4.6 RN's per day on the patient units available for study. It was estimated that one observer could complete 12 observations per hour on each RN. Within each categorical level of the index value, 800 observations were required. Let us now estimate the length of the observational period required to obtain one complete set (5) of data points. We will assume having available only one patient unit.

$$800 \ \frac{\text{observations}}{\text{difficulty level}} \ \div \ 12 \ \frac{\text{observations}}{\text{hour}} \ = \ 67 \ \frac{\text{hours of observation}}{\text{difficulty level}}$$

Using five category levels, this indicates that

$$5 \times 67 = 335 \text{ hours of observation}$$

would be required at a minimum. However, it is safe to assume that the first 335 hours of observation would not be precisely those required for estimating within each of the five categories.

It was thought that the difficulty of assignments observed would probably have some type of distribution. On this basis, let us assume that the index values we observe are really normally distributed. This implies that our major concern is to observe a sufficient number of times at the low and high ends of the difficulty scale (levels 1 and 5). We must then determine how many observations from a normal population are required to obtain 67 hours of observation at levels 1 and 5.

Since the categories will be based on the observed levels of difficulty, let us assume that the 2.5% extremes will not be observed. Hence the range of index values observed, converted to N(0,1) variates, will be from -2.0 to +2.0 or a total range of 4.0. Dividing this range into five equal intervals, the lower interval then has boundaries -2.0 to -1.2; the upper interval has boundaries 1.2 to 2.0. The area under the probability curve in these intervals is 0.1151. Hence,

$$.1151\ (X) = 67 \text{ hours}$$
$$X = 582 \text{ hours}$$

Then 582 hours of observation are required to obtain one data point in the highest and lowest difficulty intervals. One patient unit provides the opportunity to observe $(4.6 \text{ RN's})\ (8\ \frac{\text{hr.}}{\text{day}})\ \ (5\ \frac{\text{days}}{\text{week}}) = 184\ \frac{\text{RN hrs.}}{\text{week}}$

Then approximately

$$582/184 = 3.2 \text{ weeks}$$

of observation (or 16 days) would be required to obtain one complete set of data from one patient unit. The equivalent of two full time observers were used. However, each observer toured two patient units during her shift. Hence, a minimum of two data sets were expected to be obtained from the four study units.

5.2.2 Design for Work Sampling Study

According to the estimates for data requirements, the work sampling study was designed to be conducted over a sixteen-day period. Four RN's acted as observers and were employed by the Bureau of Hospital Administration, The University of Michigan, for this study. Each observer worked a four-hour shift on each study day, although observers were assigned to floors (6th or 7th) and to shifts (morning or afternoon) so as to minimize the effects of observer bias. Observations were made on weekdays only.

The observers received approximately two days training before the study began. A portion of this training was classroom, while a considerable amount took place on the study units. During this portion of the training, observers worked in pairs, making and comparing trial observations.

Each observer was instructed to collect observations by making "tours" through the two units on her floor. The observation sheet, Appendix 10, provided a guide for the RN badge numbers they were to locate. As each badge was sighted, the activity the RN was engaged in was recorded, according to the code structure presented in Table 11. Observers were instructed to begin tours at intervals no smaller than five minutes. Observers were asked to attempt to begin each tour from a different physical location on the floor.

Observations were coded by compiling the activities for each RN (by badge number) for each assignment period. Associated with these observations was the element description of the RN's assignment. An example of the structure for compiling the work sampling observations is presented in Table 12.

TABLE 11

Codes for Work Sampling Observations

Major Category	Code	Description
1		Direct Patient Care
	11	Medication Activity
	12	Treatment Activity
	13	Morning Care Activity
	14	Afternoon Care Activity
	15	Other Direct Care Activity
2		Indirect Patient Care
	21	Medication Activity
	22	Treatment Activity
	23	Morning Care Activity
	24	Afternoon Care
	25	Other Indirect Care
	26	Exchange of Information about Patient
	27	Medical Record Activity
3		Personnel Centered Activity
4		Unit Centered
5		Personal, Unoccupied, Standby

TABLE 12

Example of Analysis of Work Sampling Data

Assignment Period		Difficulty Index (Based on elements in the assignment)	Total # Obs.	# of Direct Patient Care Obs.	# of other Obs.
1	RN_1	81	36	15	21
	RN_2	74	35	12	23
	RN_3	27	36	5	31
2	RN_1	58	42	12	30
	RN_2	73	42	15	27
	RN_3	38	42	9	33
3	RN_1	90	45	20	25
	RN_2	55	45	17	28
	RN_3	47	45	15	30

Since we wish to establish the relationship between the index value for the assignment and, say, the proportion of observations of direct patient care, we would retabulate the data as shown in Table 13.

TABLE 13

Example of Analysis of Work Sampling Data
(Continued)

Index Category	Index Range		Assignment Period			
1	0 - 20	CUM DPC*	0	0	0	X_1
		CUM OBS*	0	0	0	= 800
2	21 - 40	CUM DPC	5	14	14	X_2
		CUM OBS	36	78	78	= 800
3	41 - 60	CUM DPC	0	12	44	X_3
		CUM OBS	0	42	132	= 800
4	61 - 80	CUM DPC	12	27	27	X_4
		CUM OBS	35	77	77	= 800
5	81 - 100	CUM DPC	15	15	25	X_5
		CUM OBS	36	36	81	= 800

* CUM DPC = Cumulative Direct Patient Care Observation
* CUM OBS = Cumulative Total Observations

5.3 Quality Index

Since it was desired to judge only those tasks whose completion is more likely if the RN and HN assignment is "easy" than if it is "difficult," the check list developed by the Veteran's Administration had to be abridged. This was necessary since some of the tasks in the complete list are not the responsibility of Nursing Service in The University Hospital but belong to Service Unit Management, Housekeeping, or some other department. Even if the responsibility of Nursing Service, some tasks may never be engaged in by RN's or HN's, but always be the responsibility of the Ward Clerk.

An RN consultant, experienced with the use of the VA instrument and experienced at The University Hospital, reviewed the VA check list in light of the objectives of this study. Thirty-six items were judged by her to be non-dependent on the RN and HN assignments and deleted from the study check list. The remaining items, presented in Appendix 3, were the tasks whose completion was judged to be dependent on the "difficulty" of RN and HN assignments. These 76 items were judged in the Quality measurement portion of this research. These items formed the set of tasks whose completion was more likely, the "easier" the RN and HN assignments were.

Past use of the complete, 112-item tool indicated that a standard deviation of a point on the scale of approximately five percentage points was associated with the index of quality derived. Assuming the same standard deviation would be associated with the results using the reduced 76-item instrument, approximately 10 applications of the check list would be required in order to obtain one quality index data point accurate

to within ±3 percentage points at $\alpha = .05$. An observer was expected to be able to make in the neighborhood of 17 observations per day, based on past experience with the complete 112-item tool. Hence, one observer was used to cover all four patient units. The patients to be judged on any day were determined from only those patients who are included in the assignment of one or more of the RN's and HN's on the patient units. That is, a patient who was being cared for by a student nurse, a private duty nurse, or some combination of aides and Licensed Practical Nurses would not be considered available for quality rating for that particular assignment period. If, later in the day, the patient again became associated with some RN or HN assignment, he would again be available for quality judgments.

Since 16 days of observation were planned, 272 data sets (16 x 17) were expected to be obtained. These 272 data sets would provide 7 data points per study unit, or 14 data points for each pair of study units. Associated with each data point would be the average difficulty of assignments of the RN's and HN's on the unit during the period in which the observations were collected to obtain the data point.

5.3.1 Number of Quality Index Observations

One RN observer (with no previous experience on the study units) obtained all Quality Index observations. Each observation entailed randomly selecting a patient from one of the four patient units and completing the check list (Appendix 3) for that patient. The observer was able to complete 15 such check lists per day, yielding approximately 60 check lists per patient unit over the study period.

CHAPTER VI

RESULTS

This dissertation has proposed a model for obtaining a measure of the difficulty of nursing assignments. In order to validate the model, certain hypotheses were constructed detailing the expected relationships between such a measure of difficulty and several measures of performance. In order to test these hypotheses, estimation and, in turn, data collection in an actual operating situation was required. In this chapter, the results of the data collection and analysis are reported.

6.1 Description of 6th and 7th Floor Subjects

All subjects from the 6th and 7th floors were asked to complete a background questionnaire regarding their education and hospital experience. This information is summarized in the table below:

TABLE 14

Subject Background

FLOOR	EDUCATION		UNIV. HOSP. EXPER.		TOTAL EXPER.		
	BSN	DIPLOMA	< 6 Mo.	> 6 Mo.	< 6 Mo.	6 Mo. - 1 Yr.	> 1 Yr
6	7	4	5	6	4	1	6
7	4	4	4	4	3	1	4

The numbers in the cells represent the number of subjects reporting themselves in each category. There is apparently no reason, on the basis of education or experience of the subjects, to expect wide differences between the difficulty scales obtained from subjects from each floor.

6.2 Measuring Assignment Difficulty

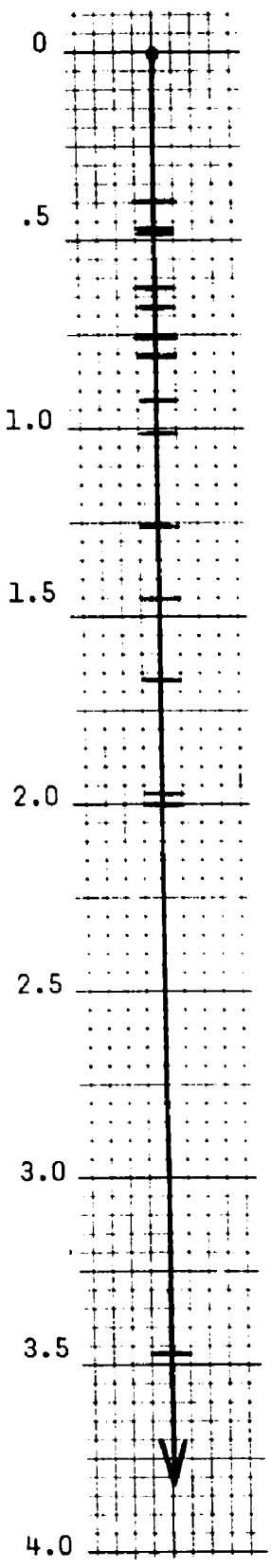
Eleven RN's from the 6th floor and eight RN's from the seventh floor were given Parts I and II of the questionnaire. All questionnaires were administered either before or after a regular work day. No questionnaire session lasted more than an hour for any subject, and all subjects were paid on an overtime basis for their participation. During Session 1, the subjects completed the background questionnaire, the definitions and instructions, and Part I. During Session 2, the subjects reviewed the "Instruction for Part II" (Appendix 6), the definitions, and completed Part II.

6.2.1 Results of Constant Sum Questionaire - Assignment Elements

The scales derived from the responses of subjects from the sixth and seventh floors to Part I of the questionnaire (termed 6I and 7I responses) are presented in Figures 17 and 18. In addition, a single scale (called 6I-7I) obtained by pooling all subjects is presented in Figure 19.

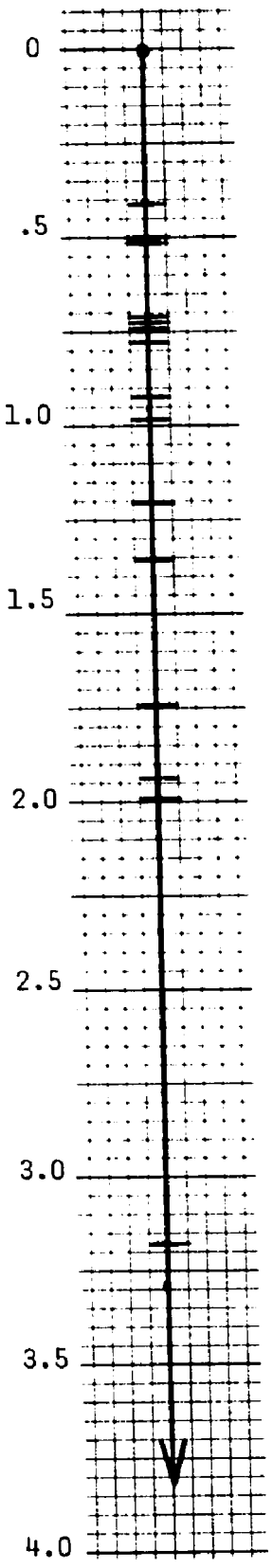
The coefficients of interest for these Part I scales are presented in Table 15.

Fig. 17.--Difficulty Scale for Assignment Elements (6I) - 11 Subjects



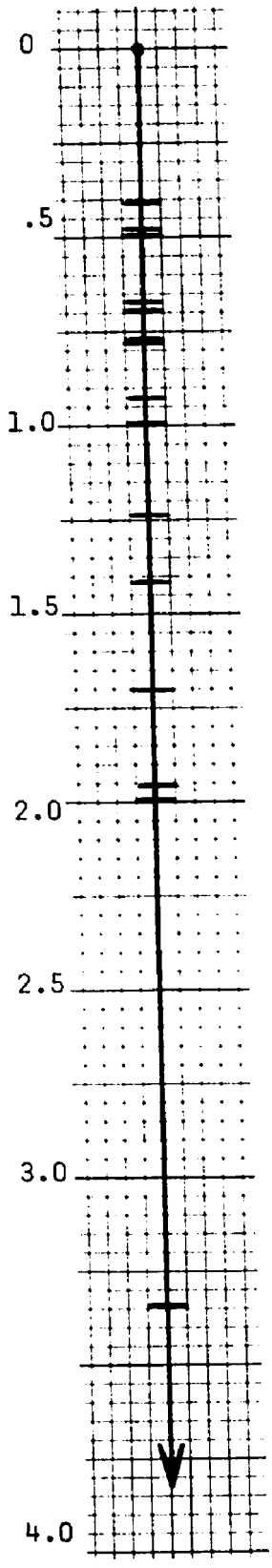
Scale Value (S_j)	Element
.3992	Total care for one self care patient
.4808	Afternoon care for 5 self care patients
.4870	Medications for 5 self care patients
.6382	Treatments for 5 self care patients
.6757	Morning care for 5 self care patients
.7659	Medications for 5 intermediate care patients
.8115	Total care for one intermediate care patient
.9295	Afternoon care for 5 intermediate care patients
1.0122	Treatments for 5 intermediate care patients
1.2671	Medications for 5 intensive care patients
1.4550	Morning care for 5 intermediate care patients
1.6730	Total care for one intensive care patient
1.9744	Afternoon care for 5 intensive care patients
2.0019	Treatments for 5 intensive care patients
3.4750	Morning care for 5 intensive care patients

Fig. 18.--Difficulty Scale for Assignment Elements (7I) - 8 Subjects



Scale Value (S_j)	Element
.4175	Total care for one self care patient
.5011	Afternoon care for 5 self care patients
.5088	Medications for 5 self care patients
.7103	Morning care for 5 self care patients
.7215	Treatments for 5 self care patients
.7311	Total care for one intermediate care patient
.7817	Medications for 5 intermediate care patients
.9285	Afternoon care for 5 intermediate care patients
.9799	Treatments for 5 intermediate care patients
1.2083	Medications for 5 intensive care patients
1.3544	Morning care for 5 intermediate care patients
1.7479	Total care for one intensive care patient
1.9432	Afternoon care for 5 intensive care patients
1.9960	Treatments for 5 intensive care patients
3.1770	Morning care for 5 intensive care patients

Fig. 19.--Difficulty Scale for Assignment Elements (6I-7I) - 19 Subjects



Scale Value (S_j)	Element
.4075	Total care for one self care patient
.4898	Afternoon care for 5 self care patients
.4967	Medications for 5 self care patients
.6722	Treatments for 5 self care patients
.6903	Morning care for 5 self care patients
.7732	Medications for 5 intermediate care patients
.7766	Total care for one intermediate care patient
.9290	Afternoon care for 5 intermediate care patients
.9984	Treatments for 5 intermediate care patients
1.2414	Medications for 5 intensive care patients
1.4109	Morning care for 5 intermediate care patients
1.9610	Afternoon care for 5 intensive care patients
1.9975	Treatments for 5 intensive care patients
3.3401	Morning care for 5 intensive care patients

TABLE 15

Coefficients - Part I Questionnaire

Subject Group	6I	7I	6I-7I
Number of Subjects	11	8	19
Range of Consistency Coefficients	0.88** - 1.00**	0.88** - 0.97**	
Coefficient of Agreement (within floors)	.7673**	.8327**	0.7866**
Coefficient of Concordance[1] (between floors)	0.9964**		

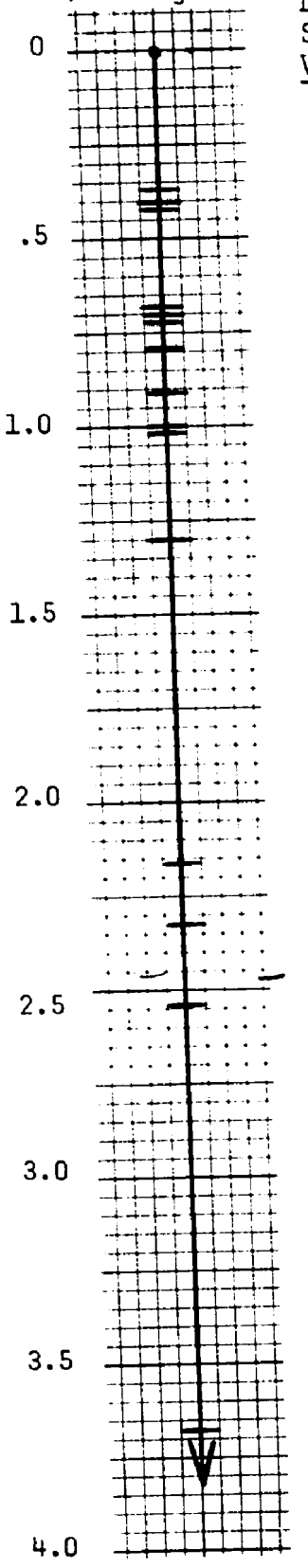
**All coefficients significant at α = .01 level.

6.2.2 Results of Constant Sum Questionnaire - 15 Hypothetical Assignments

The scales derived from the responses of the subjects to Part II of the Constant Sum Questionnaire (termed 6II and 7II) are presented in Figure 20. The numbers beside the scale correspond to the numbers of the 15 hypothetical assignments which are listed in Figure 13. As above, a single scale (termed 6II-7II) obtained by pooling the responses of all 19 subjects, is presented in Figure 21.

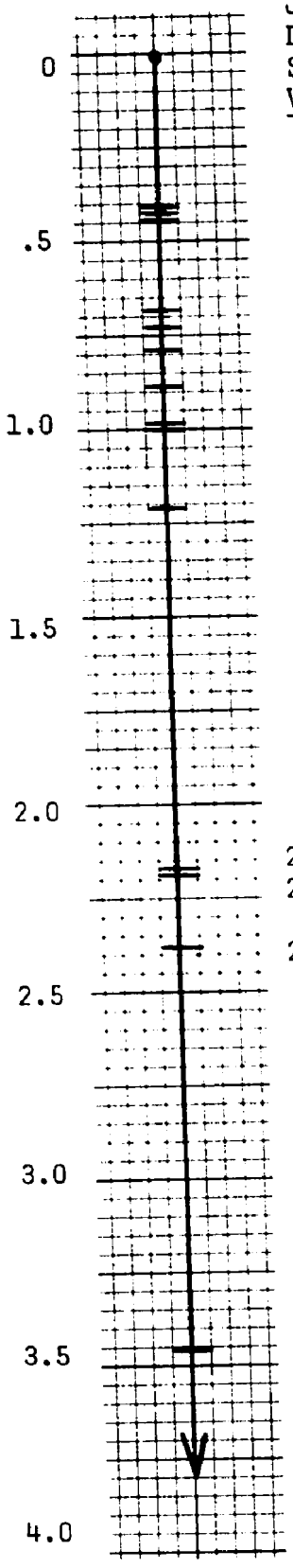
[1]The coefficient of concordance, not discussed previously, is a measure of the degree to which the two groups ranked the stimuli in the same order. It varies between 0.0 and 1.0, representing no agreement and perfect agreement in ranking. The methodology for this test can be found in Edwards, op. cit.

Fig. 20.--Difficulty Scale for Hypothetical Assignments (6II and 7II)



6II (11 subjects) Judged Diff. Scale Value	Assign. No. (See Fig. 13)	7II (8 subjects) Judged Diff. Scale Value	Assign. No. (See Fig. 13)
.3743	1	.4627	6
.4029	6	.4835	2
.4132	2	.5306	1
.6817	10	.6909	3
.7081	3	.7075	10
.7213	7	.7611	7
.7987	4	.7981	4
.9154	12	.8638	12
1.0009	5	.9566	5
1.0229	9	.9752	9
		1.1012	13
1.3058	13		
		2.0189	8
2.1673	11	2.2064	15
2.3294	8	2.2211	11
2.5438	15		
		3.2316	14
3.6717	14		

Fig. 21.--Difficulty Scale for Hypothetical Assignments (6II - 7II) - 19 Subjects



Judged Difficulty Scale Value	Assignment No. (See Figure 13)
.4284	6
.4380	1
.4432	2
.6926	10
.7015	3
.7385	7
.7984	4
.8926	12
.9826	5
1.0017	9
1.2120	13
2.1785	8
2.1873	11
2.3877	15
3.4647	14

The coefficients of interest for the Part II scales are presented in Table 16.

TABLE 16

Coefficients - Part II Questionnaire

Subject Group	6II	7II	6II-7II
Number of Subjects	11	8	19
Range of Coefficient of Consistency	.82** - 1.00**	.93** - .99**	
Coefficient of Agreement (within groups)	.7617**	.7463**	.7471**
Coefficient of Concordance	0.9874**		

**Significant at $\alpha = .01$ level.

In order to determine the appropriateness of using a linear combination of the form

$$D = \Sigma n_i S_i$$

to approximate the difficulty of observed assignments, the scales derived from the 6I, 7I, and 6I-7I analysis were applied to the 15 hypothetical assignments evaluated in the 6II, 7II, and 6II-7II analysis. If the linear hypothesis were to be acceptable, an acceptably linear relationship had to be observed between the judged and estimated (by the function) difficulty of the 15 hypothetical assignments.

The function used in obtaining the D's in Figures 22, 23 and 24 was

$$D = \sum_{i=1}^{12} (n_i/5)S_i + \sum_{i=13}^{15} n_i S_i \qquad (1)$$

where n_i = the number of patients included in the ith assignment element. As before, we recall that the first 12 assignment elements represent groups of 5 patients. Hence, in order to determine the number of times any of the first 12 elements is repeated in an assignment, we take $n_i/5$. If $n_i = 12$ for some $i \leq 12$, then that element is "repeated" 12/5 = 2.4 times. The factor (2.4) (S_i) is then added into the difficulty of the total assignment.

Linear regression yields the following statistics regarding Figures 22, 23 and 24.

TABLE 17

Regression Coefficients for Judged vs. Calculated Difficulty

Figure		Coeff. of Determ.	Mult. Corr. Coeff.	Std. Error of Estimate	Std. F Ratio
20	6I(D) - 6II	.92	.96	.23	142.2**
21	7I(D) - 7II	.86	.93	.32	77.6**
22	6I-7I(D) - 6II-7II	.90	.95	.30	114.1**

**Significant at α = .01 level.

On the basis of the analysis of the questionnaires, the following decisions seemed justified.

1. The scales derived from 6I and 7I were replaced by (6I-7I) in all further analysis.

2. The linear function (Eq. 1) was accepted as an adequate estimator of total assignment difficulty based on the difficulty of the included elements [from (6I-7I)] and the number of times each included element was repeated.

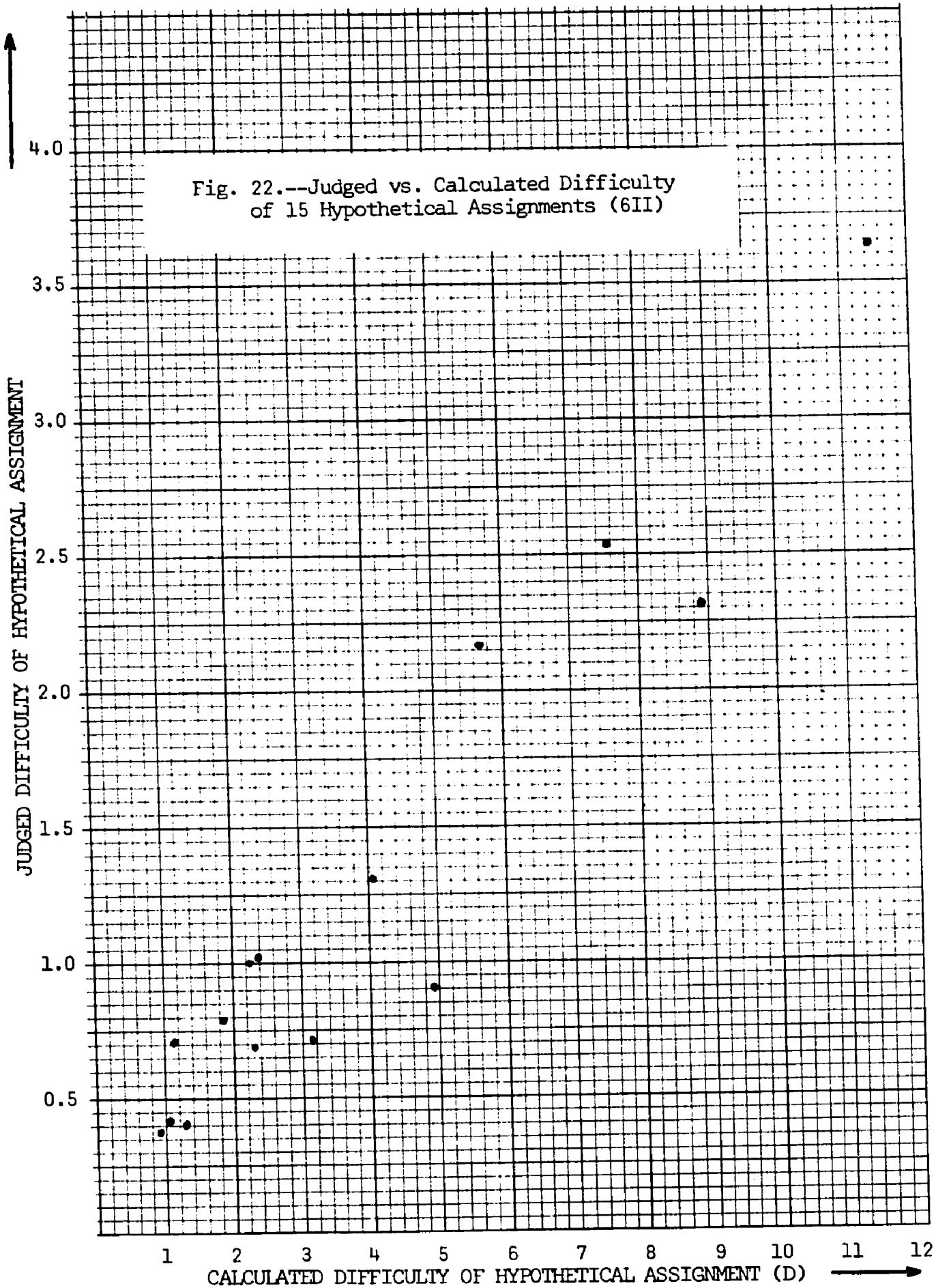
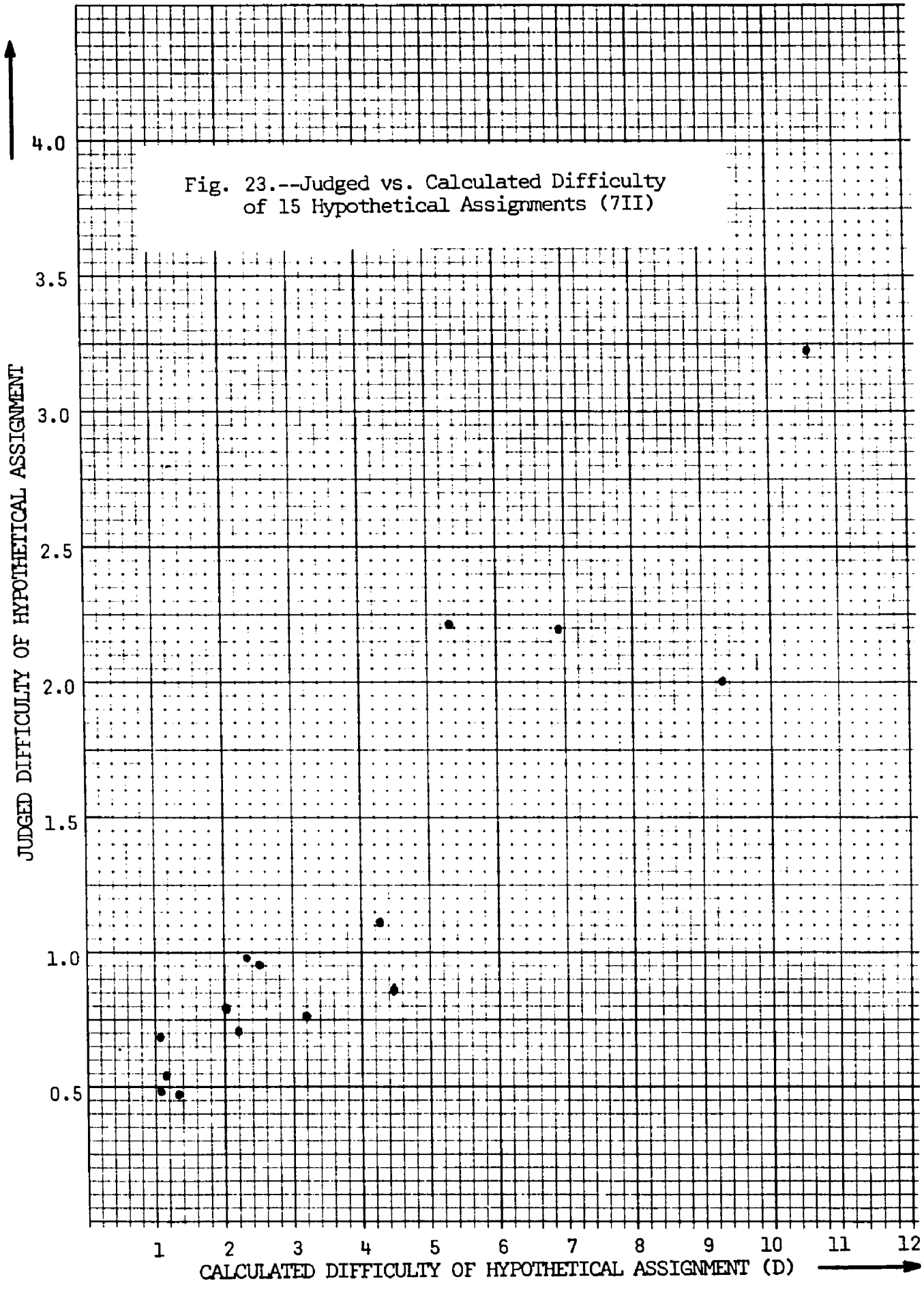


Fig. 22.--Judged vs. Calculated Difficulty of 15 Hypothetical Assignments (6II)


Fig. 23.--Judged vs. Calculated Difficulty of 15 Hypothetical Assignments (7II)
JUDGED DIFFICULTY OF HYPOTHETICAL ASSIGNMENT
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
1
2
3
4
5
6
7
8
9
10
11
12
CALCULATED DIFFICULTY OF HYPOTHETICAL ASSIGNMENT (D)

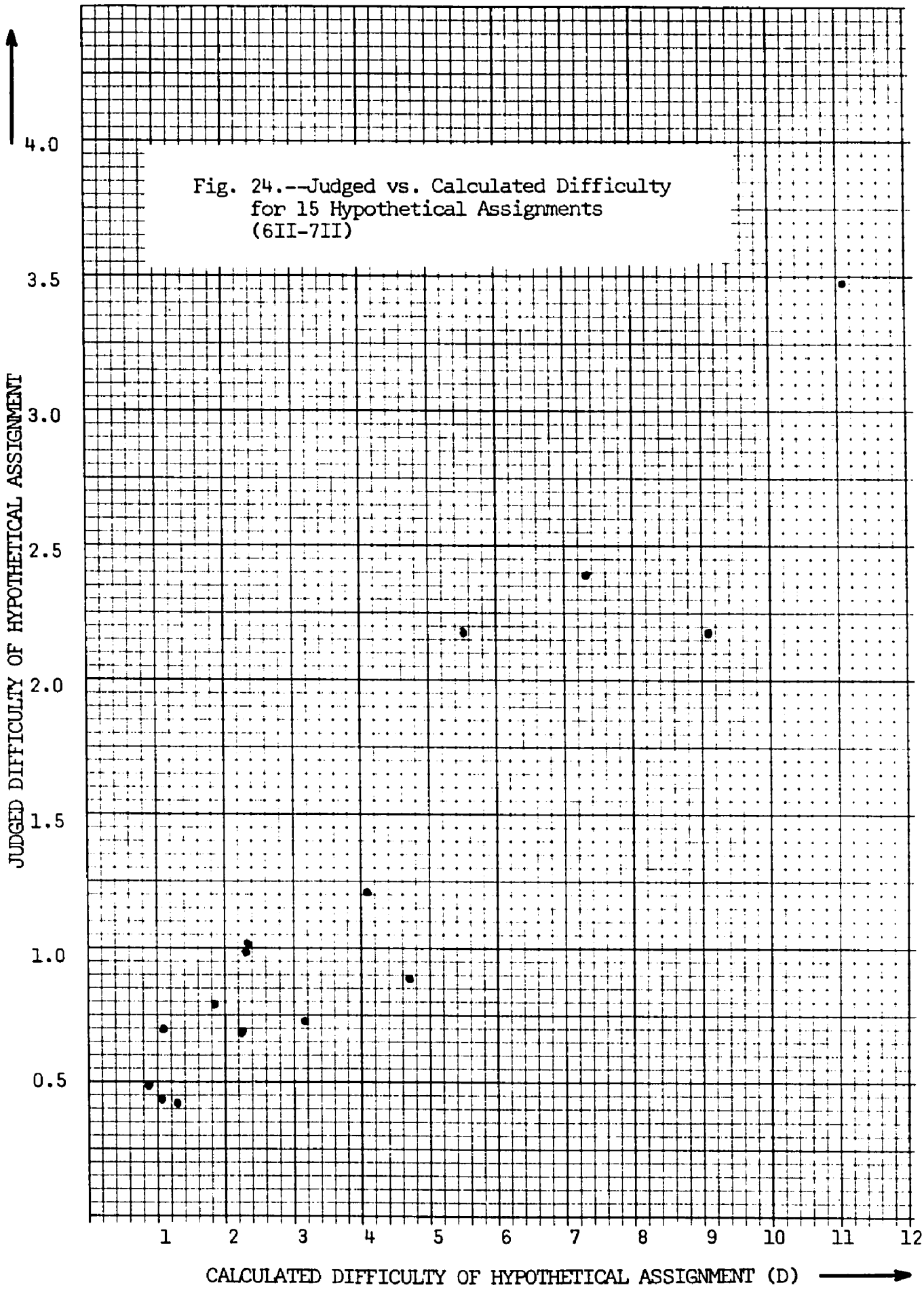


Fig. 24.--Judged vs. Calculated Difficulty for 15 Hypothetical Assignments (6II-7II)

The difficulty of all assignments observed during the 16-day work sampling period, then, was calculated using the S_i from (6I-7I) (Figure 19) and the equation

$$D = \sum_{i=1}^{12} (n_i/5)S_i + \sum_{i=13}^{15} n_i S_i$$

Table 18 presents the difficulty scale derived from 6I-7I responses in a somewhat altered format. This Table corresponds to Figure 19.

TABLE 18

Difficulty Scale Values for
Assignment Elements
6I-7I

	I Self Care	II Intermediate Care	III Intensive Care
Morning Care - 5 patients	.6903	1.4109	3.3401
Treatments - 5 patients	.6722	.9984	1.9975
Medications - 5 patients	.4967	.7732	1.2414
Afternoon Care - 5 patients	.4898	.9290	1.9610
Total Care - 1 patient	.4075	.7766	1.7034

It is of interest to note that the ratio between the difficulty scale values for the three levels of patient condition appears to be close to 5:2:1 for each component. In estimating the difference in direct patient care time provided to the three levels of patients,

Connor suggested 1/2 hour for self care, 1 hour for intermediate care, and 2.5 hours for intensive care, also a ratio of 5:2:1.

6.3 Difficulty of Assignments and Proportion of Time Spent in Activity Groups

In order to investigate the relationship between the proportion of time spent in activity categories and the difficulty of assignments, the work sampling observations were grouped according to level of assignment difficulty. Investigation of the observed assignments indicated that at least two data points per interval could be obtained if the difficulty scale were subdivided into five intervals. The intervals used are shown in Table 19.

TABLE 19

Difficulty Levels for Work Sampling Analysis

Difficulty Level	Range of D	
1	0.0 - 1.0	lowest difficulty assignment
2	> 1.0 - 2.0	
3	> 2.0 - 3.0	medium difficulty assignment
4	> 3.0 - 4.5	
5	> 4.5	highest difficulty assignment

The work sampling observations associated with each RN observed on each day were included with all other observations of other RN's on all other days having assignments in the same difficulty interval. When the total

number of observations which accumulated in any interval was greater than 800, one data point was recorded and the accumulated observations in that interval were set to zero, and the accumulation process begun again. The work samplers obtained approximately one RN observation per minute; hence some 16,200 observations were made in all, providing a total of 22 data points having some 800 observations each. All observers were qualified RN's, and received training in the work sampling procedure prior to the data collection period. The total number of data points obtained in each interval, and their values in each of the work sampling categories are shown in Table 20. Figure 25 presents graphically the mean of the observations at each level of assignment difficulty for each of the work sampling categories.

One way analyses of variance[2] run on each column of Table 20 indicate significant differences between levels of difficulty beyond the $\alpha = .01$ level for all work sampling categories.

Both linear and non-linear forms were estimated by regression analysis.[3] In all cases, the non-linear equation estimated was of the form

$$\text{Proportion} = a + bD + cD^2$$

---

[2]Due to the fact that the data are proportions, a variance stabilizing transformation ($\arcsin \sqrt{X_i} = X_K$) was made on each data point prior to the analysis of variance computation.

[3]The major portion of the data analysis from this point on will be accomplished by regression analysis. For a general discussion of theory and computational techniques employed, see Hald, A., Statistical Theory with Engineering Applications, John Wiley & Sons, New York, 1952.

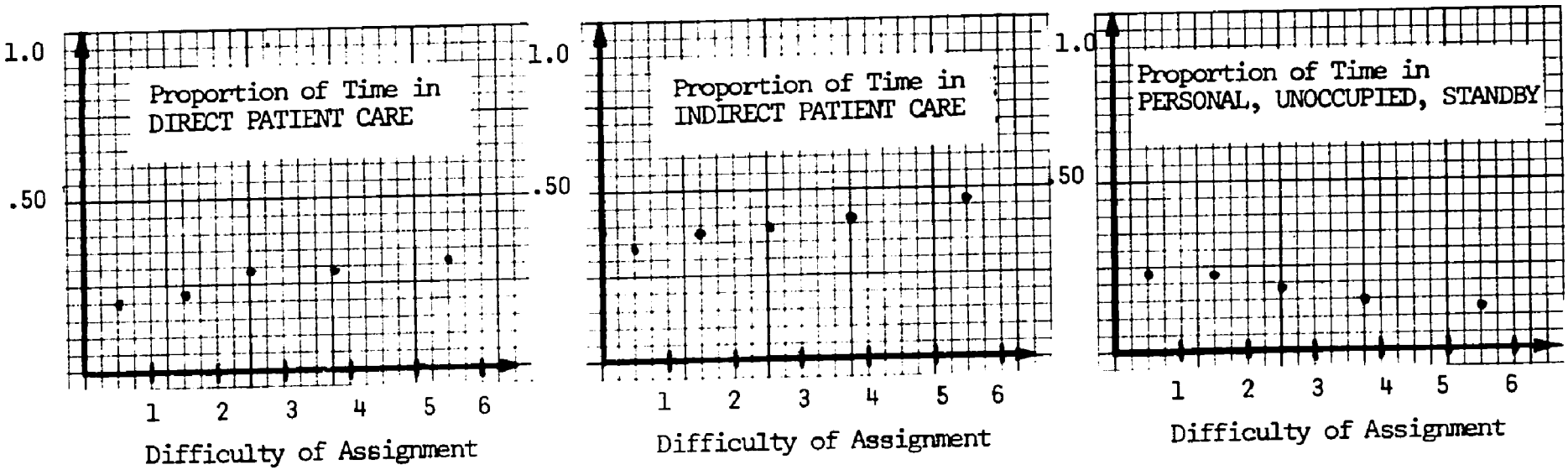
TABLE 20

Work Sampling Observations: The Proportion of Time Spent in Activity Categories at Various Levels of Assignment Difficulty

Difficulty Level	No. of Observations		ACTIVITY GROUP			SUMMARY	
			Direct Patient Care	Indirect Patient Care	Personal, Unoccupied & Standby	Patient Oriented Activity[1]	Non-Patient Oriented Activity[2]
1	3		.2013	.3597	.2440	.5610	.4390
			.2154	.3474	.1731	.5629	.4371
			.1754	.2945	.2769	.4699	.5301
		MEANS	.1974	.3339	.2313	.5313	.4687
2	4		.2796	.3787	.2019	.6583	.3417
			.1848	.4010	.2814	.5857	.4143
			.2295	.3635	.2150	.5930	.4070
			.2258	.4070	.2114	.6329	.3671
		MEANS	.2299	.3876	.2274	.6175	.3825
3	6		.2746	.3837	.2170	.6583	.3417
			.2949	.3689	.1606	.6637	.3363
			.3156	.4703	.1238	.7859	.2141
			.2819	.3995	.1667	.6814	.3186
			.2841	.3983	.2072	.6824	.3176
			.3081	.3497	.2134	.6578	.3422
		MEANS	.2932	.3951	.1815	.6883	.3118
4	6		.3068	.4683	.1366	.7552	.2248
			.3076	.4177	.1519	.7253	.2747
			.2862	.4029	.1597	.6892	.3108
			.2827	.4497	.1495	.7324	.2676
			.3096	.4045	.1810	.7141	.2859
			.2168	.4287	.1737	.6455	.3545
		MEANS	.2850	.4286	.1587	.7136	.2864
5	3		.2817	.5098	.1134	.7915	.2085
			.3155	.4559	.1230	.7714	.2286
			.3429	.4243	.1665	.7672	.2328
		MEANS	.3134	.4633	.1343	.7767	.2233

[1]Patient Oriented Activity = Direct Patient Care and Indirect Patient Care.

[2]Non-Patient Oriented Activity = Personal + Unit Centered + Personnel Centered.



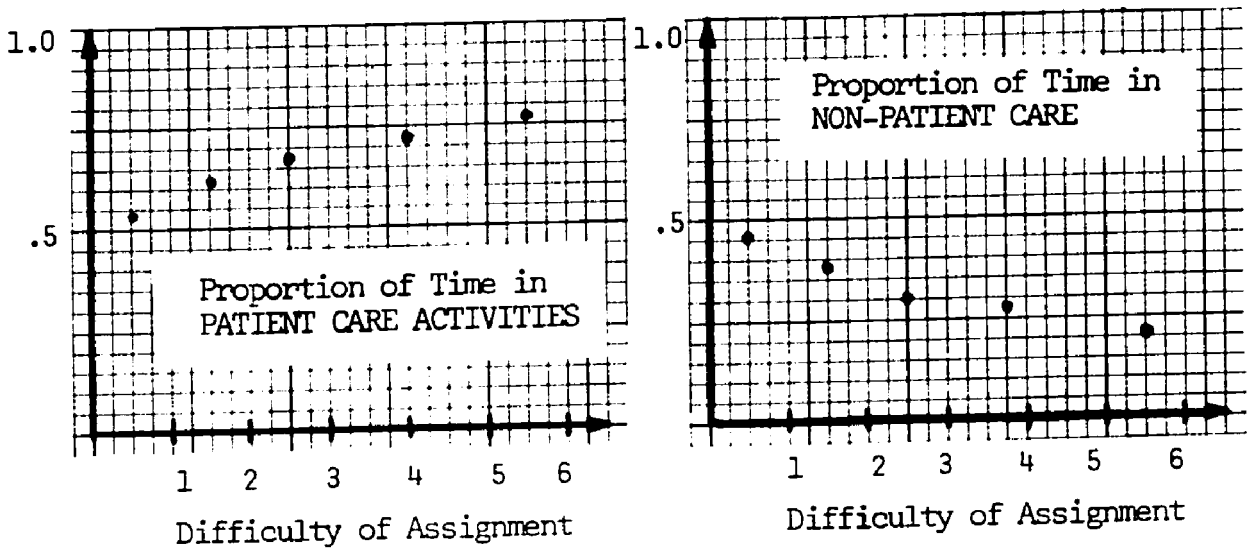


Fig. 25.--Difficulty of RN Assignment and Proportion of Time Spent in Activities

Table 21 presents the standard error of the estimates obtained.

TABLE 21

Linear vs. Quadratic Standard Errors of the Estimate for Proportion of Time Spent in Activities

Dependent Variable	Standard Error of the Estimate (Y)	
Proportion of Time Spent in:	Linear	Quadratic
Direct Patient Care	.0339	.0315
Indirect Patient Care	.0324	.0329
Patient Care	.0455	.0424
Personal Time	.0326	.0332
Non-Patient Care (Personal + Unit Centered + Personnel Oriented Activities)	.0455	.0424

In all but two cases (Personal Time and Indirect Patient Care), the non-linear form appears to yield a slightly improved estimate of the dependent variables. The accepted equations describing the relationship between assignment difficulty and the proportion of time spent in activity categories are presented in Table 22.

6.4 Difficulty of Assignments and the Quality Index

Patients were selected at random from the four patient units and a determination was made about the completion or non-completion of 76 activities. The observation sets were grouped sequentially for each

TABLE 22

Accepted Work Sampling Equations
(D = Assignment Difficulty)

			Std F	Coeff. Det.	Mult. Corr. Coeff.	Standard Error of Estimate (Y)
Direct Patient Care	%DPC	= 0.1717 + .0547 D** − .0055 D^{2*} (.0167)[a] (.0027)	14.23**	.60	.77**	.0315
Indirect Patient Care	%IDPC	= .3370 + .0239 D** (.0046)	27.52**	.58	.76**	.0324
Patient Care Activities	%PTCA	= .4970 + .0892 D** − .0073 D^{2*} (.0225) (.0036)	31.45**	.76	.87**	.0424
Personal	%Pers	= .2446 − .0217 D** (.0046)	22.31**	.53	.73**	.0326
Non-Patient Care Activities	%NPTCA	= .5030 − .0892 D** + .0073 D^{2*} (.0225) (.0036)	31.45**	.76	.87**	.0424

[a]Numbers in parentheses are the standard error of the regression coefficient which appear above them.

*Significant at α = .05 level.

**Significant at α = .01 level.

Significance Levels

Standard F Ratio: For α = .01 with 2, 19 degrees of freedom, critical F = 5.93; For α = .01 with 1, 20 degrees of freedom, critical F = 8.10.

Correlation Coefficient: For α = .01 with 3, 19 degrees of freedom, critical r^2 = .620; For α = .01 with 2, 20 degrees of freedom, critical r^2 = .537.

of the four patient units and two separate measures were derived. (Each measure was obtained by cumulating groups of 10 observation sets from each patient unit.) The first measure was the Non-Patient Oriented Quality Index. This proportion was determined from items 1, 2, 3, 71, 72, 73, 74, 75 and 76 from each observation. The second measure was the Patient-Oriented Quality Index. This measure was obtained from all remaining items initially, and finally from a reduced set of the remaining items: Nos. 6, 11, 13, 14, 18, 20, 21, 22, 24, 38, 43, 44 and 46. The derivation of the reduced set of items is discussed later.

For each set of 10 observations from each patient unit, it was possible to determine the average difficulty of RN assignments (day shift only) associated with the time period over which those 10 observations were made (about 2 1/2 days). Hence, it was possible to investigate the relationship between average assignment difficulty and the two Quality Indices.

Six groups of 10 data sets were obtained on each of the four units, providing a total of 24 observations. Figure 26 presents the data points obtained in associating the Non-Patient Oriented Quality Index with the average difficulty of RN assignments. Least-squares regression indicates that average RN assignment difficulty accounts for 51% of the variance of the Non-Patient Oriented Quality Index ($r = 0.71$). This coefficient was found to be significantly different from zero at the $\alpha = .01$ level. Other statistics regarding the

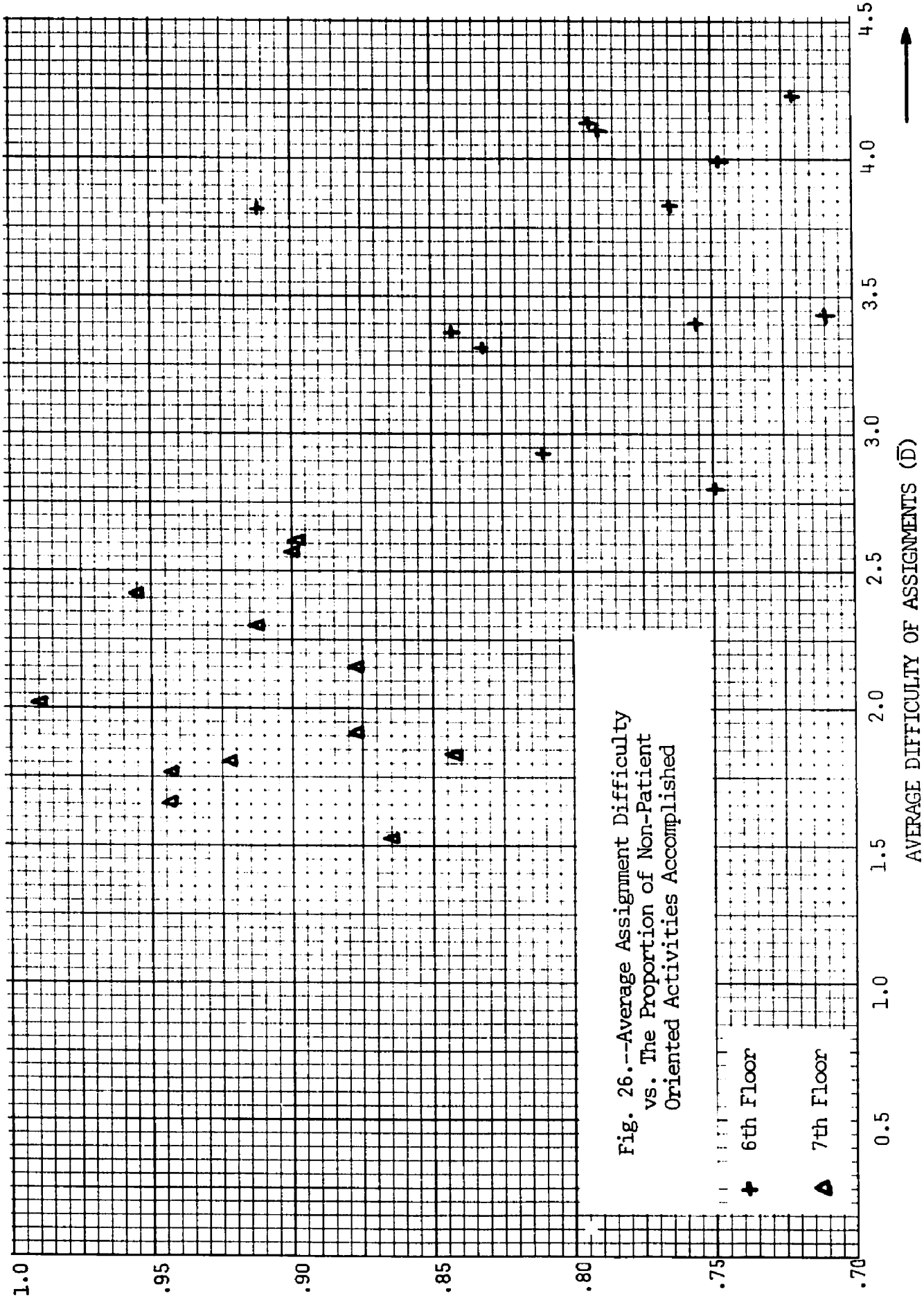


Fig. 26.--Average Assignment Difficulty vs. The Proportion of Non-Patient Oriented Activities Accomplished

regression are shown in the equation below:

Non-Patient Oriented Quality Index	=	1.029 - .064D** (.013)	Std. Error of Estimate (Y)	r	
			.058	.711**	

**Significant at α = .01 level.

Using the complete set of patient-oriented activities and investigating the Patient-Oriented Quality Index with respect to average RN assignment difficulty, yielded Figure 27. Although unexpected, this shotgun pattern was immediately suspected to be the result of the fact that the completion or non-completion of most of these activities in no way related to the difficulty of assignment. Most of these, being patient care activities, should be the ones accomplished first ("and always") regardless of assignment difficulty.

There remained the possibility, however, that some of these activities might be considered to be "marginal" by the RN. If so, then that subset of the patient-oriented activities which had fairly low completion rates (on the order of 20-70%) would be the set whose completion or non-completion would most likely be affected by the level of assignment difficulty.

On the basis of an activity-by-activity analysis, activities 6, 11, 13, 14, 18, 20, 21, 22, 24, 38, 43, 44 and 46 were selected to form the reduced set of "marginal" patient-oriented activities. Their average completion rate was 0.5820 compared to the average rate of completion for all clinical activities, 0.6212. Figure 28 presents marginal

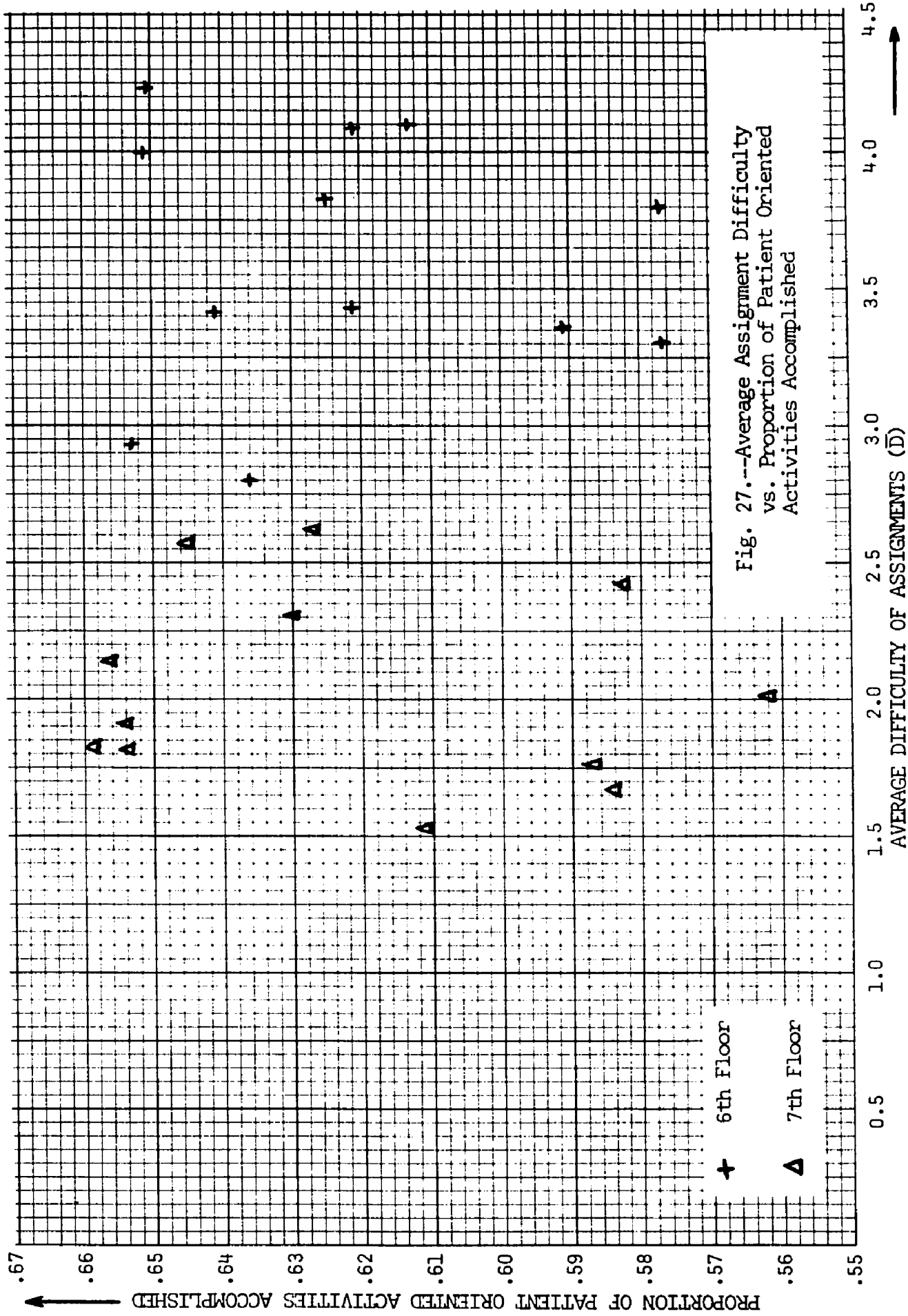


Fig. 27.--Average Assignment Difficulty vs. Proportion of Patient Oriented Activities Accomplished

Patient-Oriented Quality Index as a function of the average difficulty of assignment.

The overall correlation between $\bar{D}$ and the marginal Patient-Oriented Quality Index is $r = 0.27$. Treating the data from each floor separately, we get r(Floor 7) = 0.47, and r(Floor 6) = -0.27. These coefficients are not significantly different from zero at the $\alpha = .05$ level of confidence. An interpretation of Figure 28 will be presented in the following chapter.

An instrument such as the one used to measure the proportion of activities accomplished should be internally sensitive. For our purposes, this means that we would expect the Non-Patient Oriented Quality Index to decrease as the Patient-Oriented Quality Index increased. This expectation is further justified by noting the decreasing proportion of non-patient oriented activities accomplished as average difficulty increases (Figure 26) and the relatively "constant" proportion of patient-oriented activities accomplished at the higher difficulty levels. We expect that in order to maintain this constant proportion of patient-oriented activities, the proportion of non-patient oriented activities must be sacrificed. This expectation is borne out as is shown in Figure 29 (adjusted for floor effect). The multiple correlation coefficient for this relation is 0.75, which is significant at the $\alpha = .01$ level. The multiple regression equation obtained was:

Patient Oriented Quality Index = .9318 -.4687 (Non-Patient Oriented Quality Index)**
(.0895)

+.0579 (Floor)**
(.0141)

**Significant at $\alpha = .01$ level.

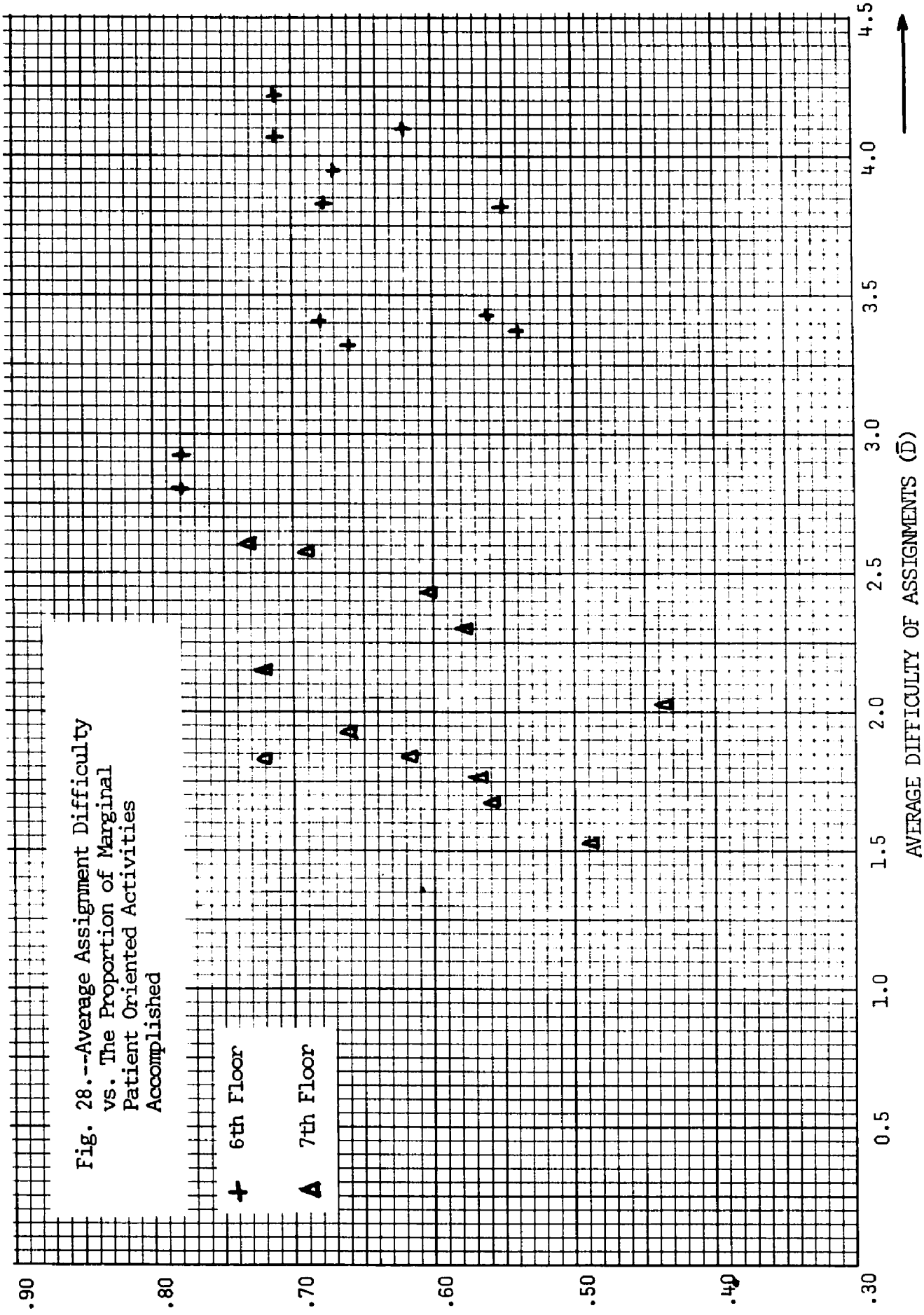


Fig. 28.--Average Assignment Difficulty vs. The Proportion of Marginal Patient Oriented Activities Accomplished

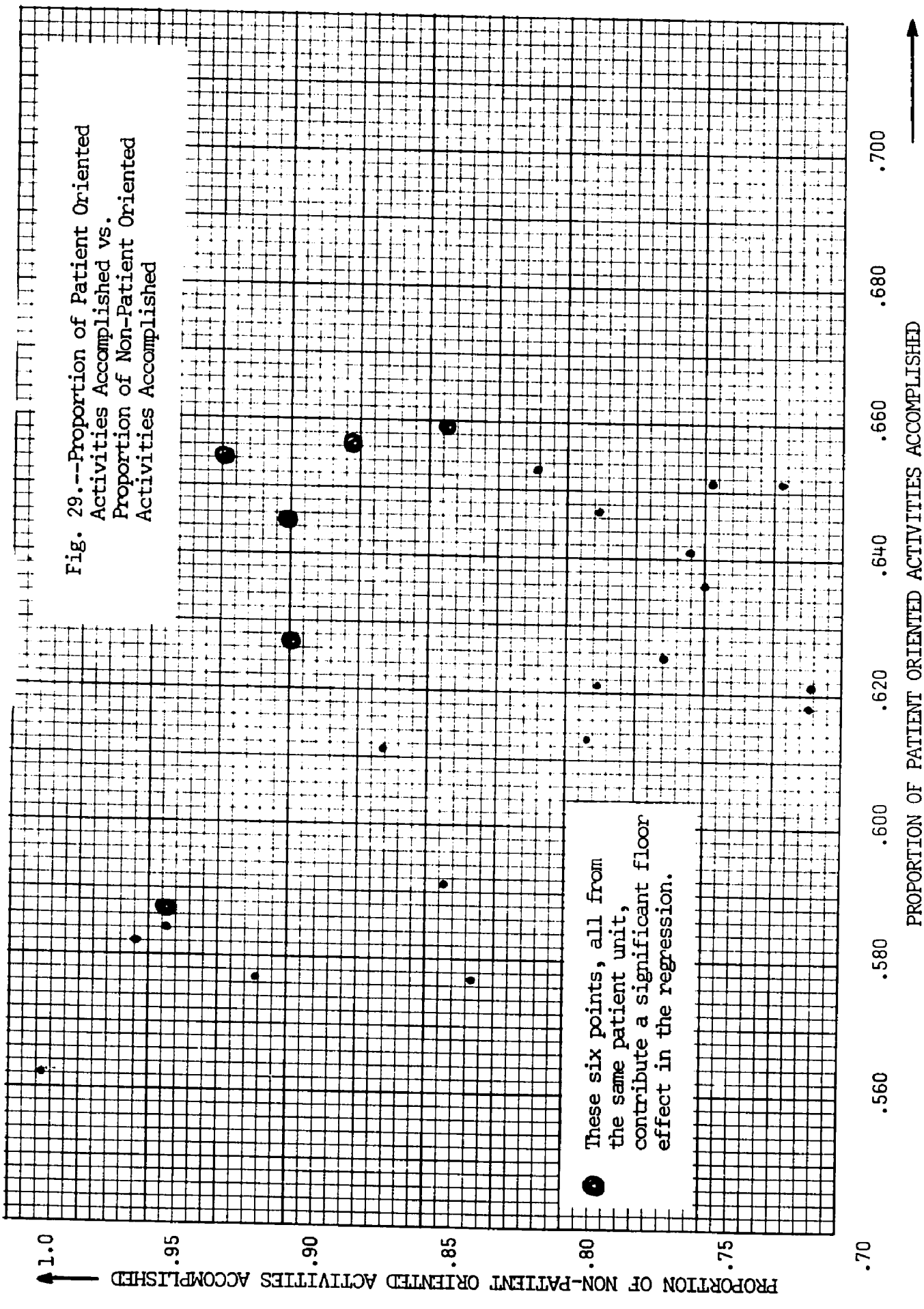


Fig. 29.--Proportion of Patient Oriented Activities Accomplished vs. Proportion of Non-Patient Oriented Activities Accomplished

6.5 Assignment Difficulty and Workload Factors

Table 23 presents the results of several regressions which were executed to investigate the relationship between assignment difficulty and factors which difficulty was hypothesized to reflect. In these analyses, the measure of difficulty was obtained by averaging the difficulty measures for all RN's in each team during half-day periods. Thus, if there were two RN's on a team which had n_1 aides, n_2 students, N total patients, N_1 self care patients, N_2 intermediate care patients, etc., the average of the difficulty of the two RN assignments (D') was associated with n_1, n_2, N, N_1, N_2, etc. This set of data constituted one observation. In all, 134 such observations were obtained.

The first three regressions in Table 23 indicate that the difficulty of RN assignments is sensitive to changes in staff to workload ratios. That is, the difficulty of RN assignments generally decreases as:

1) More RN's per patient day are available
2) More total staff per patient day are available
3) More RN's and students per patient day are available

Also, we note in regression 4 that the difficulty of RN assignments tends to decrease as demand for direct patient care time increases.

TABLE 23

Assignment Difficulty and Workload Factors

Regression Number	Dependent Variable	Independent Variable	T	Coeff. of Determ: R^2 (Correlation Coeff: r)	Std. Error of Est. ($\overline{D}'$)
1.	$\overline{D}$	RN Hours/Pt. Days	-4.61**	.1369 (-.3701**)	1.47
2.	$\overline{D}'$	Total Staff/Pt. Hours Days	-3.99**	.1065 (-.3264**)	1.50
3.	$\overline{D}'$	(RN+Student)/Pt. Hours Days	-7.61**	.3019 (-.5495**)	1.32
4.	$\overline{D}'$	Weighted Pt. Demand (Hrs. direct pt. care to be provided)[4]	-4.91**	.1525 (-.3906**)	1.46
5.	$\overline{D}'$	RN Hours/WPD	-2.42**	.0419 (-.2047*)	1.5656

*Significant at α = .05 level.

**Significant at α = .01 level.

[4]Weighted patient demand (WPD) was determined from the Connor equation and is thought to roughly correspond to the hours of Direct Patient Care to be provided by all nursing unit personnel. It is computed as follows:

WPD = (0.5) No. of Self Care Patients + (1.0) No. of Intermediate Care Patients + (2.5) No. of Intensive Care Patients

CHAPTER VII

ANALYSIS AND INTERPRETATION OF THE RESULTS

7.1 Analysis of Results

This research has, up to this point, proposed a model for measuring the difficulty of Registered Nurse assignments. Several specific hypotheses derived from the model were then formulated. A study was designed to obtain estimates of the parameters of the model so that the hypotheses could be tested. The results of this study were presented in Chapter VI. It now remains to review the results of the model estimation, to determine which of the specific hypotheses were supported by the estimation and, finally, to interpret the implication of these results with regard to the validity of the model.

The Difficulty of RN Assignments was obtained by first, developing a structure for representing RN assignments in terms of assignment elements; second, obtaining a subjective measure of the difficulty of each assignment element (S_j); and third, determining a functional relationship suitable for representing the difficulty (D) of an RN's assignment in terms of the difficulty of the included assignment elements. The functional relationship used was

$$D = \sum_{i=1}^{12} (n_i/5)\,(S_i) + \sum_{i=13}^{15} (n_i)\,S_i$$

where

n_i = number of patients associated with the ith assignment element.

S_i = difficulty scale value of the ith assignment element.

If a particular assignment element were not included in an assignment, n_i was set equal to zero for that element.

The proportion of time spent by RN's in various categories of activities was determined by means of a work sampling study.

The Quality Index was determined by the application of a pre-established list of activities to randomly selected patients. These activities were separated into two types, non-patient oriented and patient oriented. Due to the high completion rate of most of the patient oriented activities, a reduced set of activities, termed "marginal," was identified by relatively low completion rates. This "marginal" set then comprised a measure of the patient oriented Quality Index.

Of major interest in this study were the relationships observed between assignment difficulty and the performance variables.

Table 22 presents the accepted regression equations between assignment difficulty and the proportion of time spent in direct patient care, indirect patient care, patient care, personal time, and non-patient care activities. The data points plotted at each level of difficulty are the means of the observations obtained. All regression coefficients were significant at the $\alpha = .05$ level as were all correlation coefficients.

Hypotheses 1 and 2 were stated as follows:

Hypothesis 1 — As the difficulty of Registered Nurse (RN) assignments increases, RN's will tend to devote progressively smaller increments of their time to Direct Patient Care activities.

Hypothesis 2 — As the difficulty of RN assignments increases, RN's will tend to devote progressively smaller increments of their time to Patient Oriented activities (Direct + Indirect).

The non-linear form of the Direct Patient Care and the Patient Care equations indicate that we cannot reject Hypothesis 1 or 2. Apparently, as the difficulty of RN assignments increases, RN's tend to spend progressively smaller proportions of their time in Direct Patient Care and Patient Care activities.

Hypothesis 3 was stated as follows:

Hypothesis 3 — As the difficulty of RN assignments increases, RN's will tend to devote less time to Non-Patient Oriented activities (Personnel + Housekeeping + Personal).

The non-linear form of the Non-Patient Oriented activity equation in Table 22 support Hypothesis 3. As the difficulty of the assignment increases, the time devoted to Non-Patient Oriented activities decreases non-linearly.

The proportion of time spent in Indirect Patient Care activities apparently increases linearly with increasing assignment difficulty. Personal time, on the other hand, appears to decrease linearly with increasing difficulty. These results all support the proposed model and are important in several respects. We have shown that the proportion of time spent by RN's in activities changes as RN assignments

change. In addition, we have developed a measure, based on the content of an RN's assignment, that predicts the amount of the expected change in the proportion of time measure. This measure of assignment difficulty, then, gives quantitative meaning to alternative RN assignments in terms of the proportion of time likely to be spent in various activity categories.

Hypothesis 4 was stated as follows:

> Hypothesis 4 — As the average difficulty of RN assignments increases, RN's will tend to accomplish a smaller proportion of:
> a. Non-patient oriented and
> b. Patient oriented
> activities.

Figures 26 and 28 display graphically the observed Non-Patient Oriented and marginal Patient Oriented Quality Indices as a function of assignment difficulty. On the basis of these figures, it appears that we cannot reject Hypothesis 4a, but that Hypothesis 4b can be rejected. Higher levels of assignment difficulty do appear to be associated with lower proportions of Non-Patient Oriented activities accomplished, but this does not appear to hold for the marginal Patient Oriented activities.

Cautious interpretation of these figures is advised, however. We note in Figure 26 (regarding the proportion of Non-Patient Oriented activities accomplished) that there appear to be two clusters of observations. These clusters can be distinguished by a "Floor" difference as well as a difficulty difference. Two linear regression analyses were performed. In the first, the Quality Index was assumed dependent on only the Floor effect. In the second, the Quality Index was assumed dependent

on only the average difficulty of RN assignments. The coefficients on the independent variable was significantly different from zero in both equations. The equation using the Floor term had the highest coefficient of determination: 0.5057 (using $\bar{D}$) and 0.6278 (using Floor) and a lower standard error of the Quality Index (0.0064 difference).

We do observe, however, in reviewing the work sampling results, that there appears to be no problem of a Floor effect. High levels of assignment difficulty on one floor are apparently indicative of more difficult assignments on that floor than on the other floor. Hence, the difficulty effect and not a Floor effect is probably the causal factor in determining the proportion of activities accomplished in Figure 26.

We turn now to the final area of interest regarding the hypothesized measure, its ability to reflect the patient unit "situation" or workload factors.

We saw in Table 23 the results of several regression analyses which treated the average difficulty of RN assignments as the dependent variable and various workload factors as the independent variable. As expected, the difficulty of RN assignments tends to decrease as:

1. the ratio RN hours/patient day increases
2. the ratio total staff hours/patient day increases
3. the ratio (RN + student) hours/patient day increases

We note also that a negative relation appears to exist between assignment difficulty and the hours of direct patient care to be provided by all staff (as determined from the Connor equation). This implies that

as more hours are to be provided, the difficulty of RN assignments decreases. This coincides with the results of the work sampling portion of this study. There, we saw that if the difficulty of RN assignments is high, the proportion of time devoted to direct patient care is relatively constant. Presumably, as more direct patient care hours are required, additional persons are added to the nursing unit staff. The addition of extra persons has two effects; first, more direct patient care time can be provided and, second, the redistribution of work reduces the difficulty of everyone's assignment from the level it had been prior to the use of additional personnel.

An investigation of the relationship between WPD (Hours of Direct Patient Care to be provided) and staff size confirms this interpretation. We find

			Standard Error of Estimate	r
#RN Hours available	= 1.543 +	0.7643 (WPD)** (.0590)	1.5432	.7457**
#Total Staff Hours available	= 6.1730 +	3.0575 (WPD)** (.2360)	8.6700	.7457**

**Significant at α = .01 level.

Regression number 5 in Table 23 indicates a statistically significant relationship between the average difficulty of RN assignments and the ratio RN hours available/hours of DPC to be provided. Hence, as the ratio of RN hours to direct patient care hours required increases, the average difficulty of RN assignments tends to decrease. This supports the previous argument regarding the effect of additional personnel in that workload redistribution with changes in staff level does tend to affect the average

difficulty of RN assignments. Hence, we find that we cannot reject Hypothesis number 5, which stated:

Hypothesis 5 — The average difficulty of RN assignments will tend to be greater on days when the ratio (RN hours available)/(Hours of Direct Patient Care to be provided) is small.

We conclude from the regression presented in Table 23 that the measure of difficulty of RN assignments does reflect the patient unit situation. That is, the same factors which are supposed to influence staffing also influence the difficulty of RN assignments.

Finally, let us not forget that we have been thinking of difficulty as the dependent variable in the above discussion. It may, in actual practice, be the independent variable with the workload indicators dependent. Let us return to the concept of the assignment process mentioned earlier. It was pointed out that HN's are instructed to consider RN patient care assignments first in the process of dividing up the unit workload. If an initial determination indicates that the assignments are going to be so difficult that proper care cannot be provided, the Head Nurse is instructed to request more personnel. Hence, the number of auxiliary and float personnel and the staff-to-patient load ratios may be, in practice, dependent on the difficulty of initial assignments.

7.2 Implications of Results - Staffing

At the outset of this paper, we raised the question: "What is the relationship between nursing assignments and nursing performance?" It was intended that the successful development and validation of the

assignment model would provide insight regarding this question. In the following discussion, the assumption is made that the time spent by RN's in patient oriented activities is directed toward the completion of the activities observed in the Patient Oriented Quality Index. Similarly, we assume that the time spent by RN's in non-patient oriented activities is directed toward the completion of the activities observed in the Non-Patient Oriented Quality Index. These are clearly very liberal assumptions to make. There is some reason to expect, however, that time spent in Direct and Indirect patient care is devoted to the accomplishment of activities in the Patient Chart, Patient Comfort, Patient Welfare and Safety, etc., categories of the Quality Index. It also seems reasonable to expect that time devoted to the Housekeeping, Personnel, and Personal categories of activities should, at least in part, be directed toward the completion of activities presented in the Nursing Unit, Ward Medical Administration, Ward Building Management and General categories in the Quality Index.

Let us consider the non-patient oriented activities first. We observed that there was a non-linear decrease in the proportion of time spent in non-patient oriented activities as assignment difficulty increased. Similarly, we observed a decrease in the proportion of non-patient oriented activities accomplished. These results are represented by solid lines in Figures 30 and 31. We note in Figure 30, however, that the first three data points lie on the dashed straight line which has been constructed. Presumably, this dashed line represents the "proper" rate of decrease in the proportion of time spent in this activity category as assignment

Fig. 30.--Assignment Difficulty and the Proportion of Time in Non-Patient Care Activities

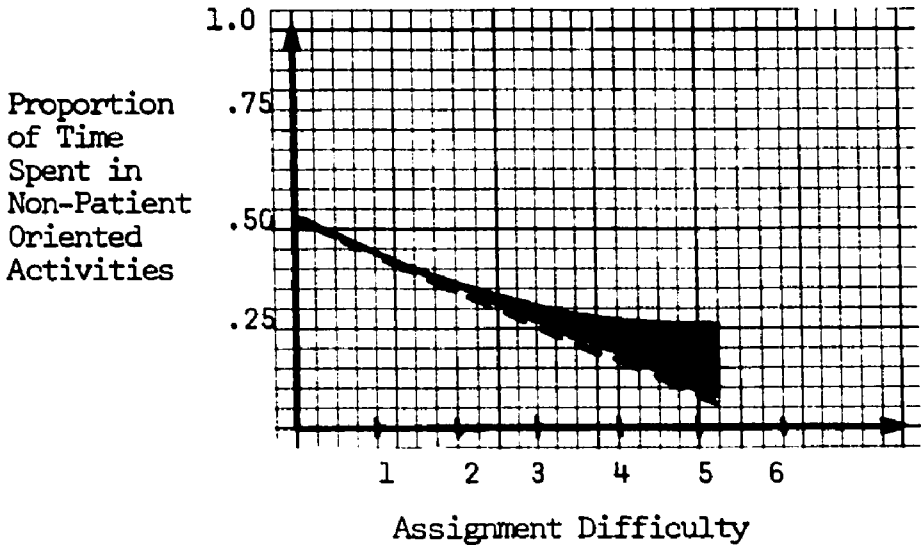
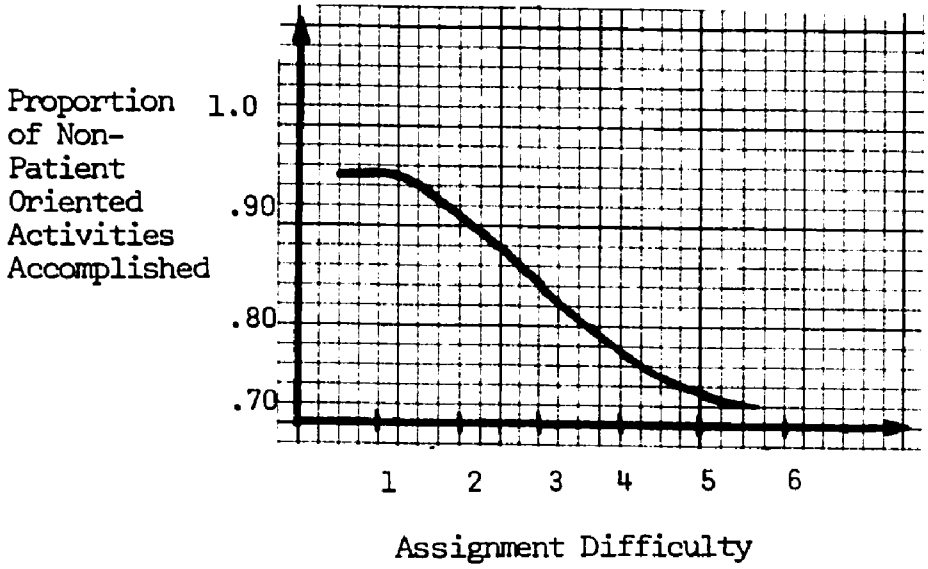


Fig. 31.--Assignment Difficulty and the Proportion of Non-Patient Oriented Activities Accomplished

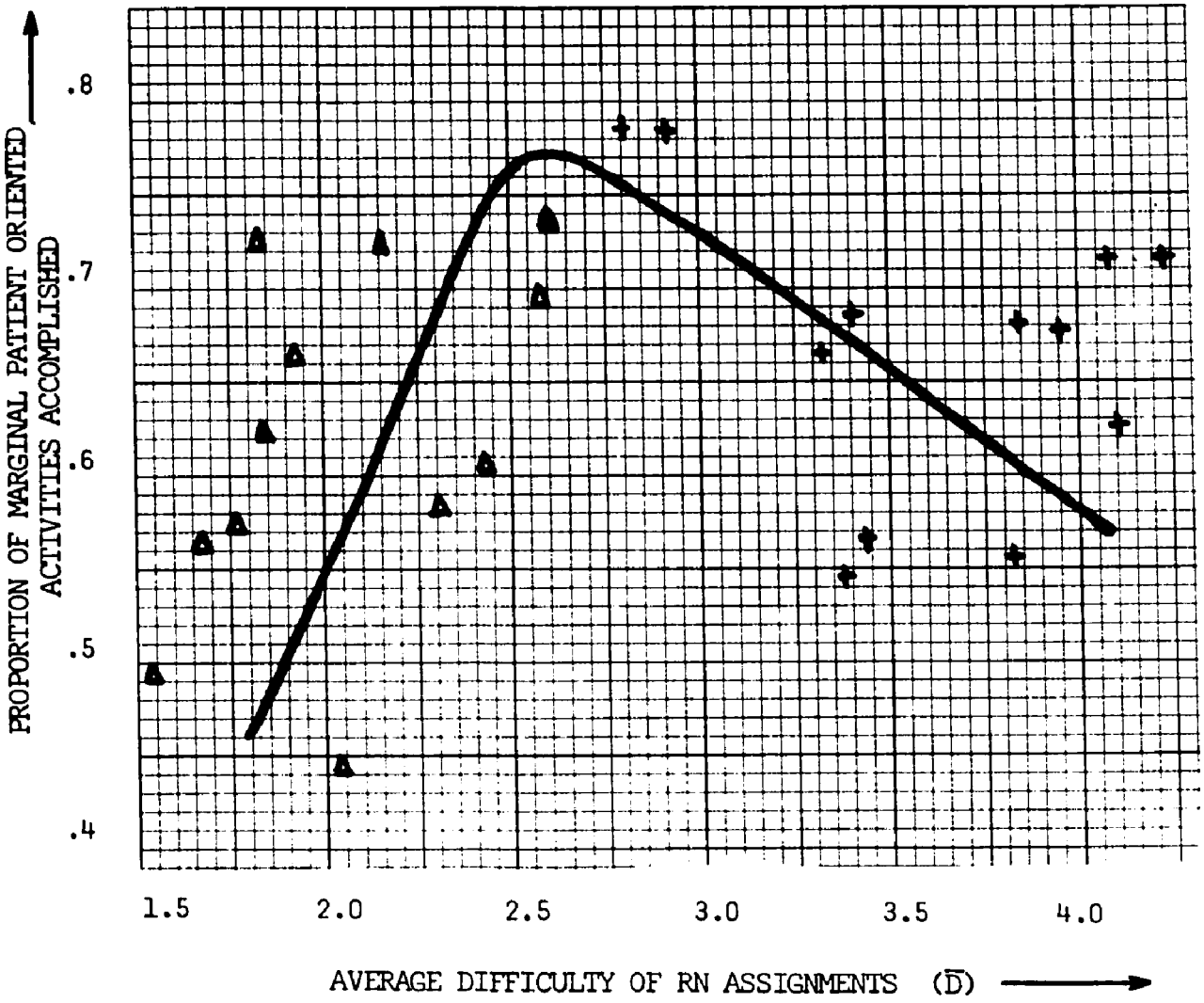


difficulty increases. This is deduced from Figure 31, which shows that over the interval of assignment difficulty where the proportion of time being spent in non-patient oriented activities is decreasing at its greatest rate, the proportion of activities accomplished remains constant and relatively high. Only as the deficiency (shaded) in the proportion of time spent in non-patient care activities builds up, does the proportion of activities accomplished begin to drop. This point is approximately a difficulty level of 2.5 for the study units.

We now return to Figure 27 (reproduced on the following page in Figure 32) which presented the data points obtained when we looked at average assignment difficulty and the proportion of marginal patient care activities accomplished. This relationship had been hypothesized to be linear with negative slope. On the basis of the results of the regression analysis, we must reject this hypothesis (Hypothesis 4b). Based, however, on the results of a regression analysis performed on the data from each floor, a line has been constructed in Figure 32 which represents a "best fit" to the data. Note that the constructed curve implies that the proportion of marginal patient oriented activities accomplished is low at low difficulty assignments; and that this proportion increases until the difficulty level reaches approximately 2.5; then decreases as the difficulty level goes beyond 2.5. This result certainly differs from the expected relationships. What can explain it?

Consider the other results of this study already discussed. It was shown above that Total Staff Hours available tended to increase as the patient's need for Direct Patient Care (WPD) increased. In Table 23, we

Fig. 32.*--Average Assignment Difficulty vs. the Proportion of Marginal Patient Oriented Activities Accomplished



*Note: Neither the positive nor negative sloping portions of the curve constructed in Figure 32 were found to be significant. The curve is constructed for purposes of discussion and as an indication of possible hypotheses in future research.

saw that as WPD increased, the difficulty of RN assignments tended to decrease. Hence, it appears that when a high need for direct patient care time exists on a unit, nursing administration tends to respond by adding more personnel, both professional and auxiliary. This has the effect of allowing the patient care responsibility to be divided among more personnel than normally available, which in turn allows RN assignments to be less difficult. But other problems arise, primarily coordination and supervision of the additional non-professional personnel. Hence, low difficulty days are probably not those days when there is little work to do; on the contrary, these are probably the days when the patient demand is highest. The administrative process tends to be sensitive to the level of patient demand, and responds to high demand by placing more auxiliary personnel than normal on the units. This has the effect of reducing the nurse's patient care responsibility while increasing her supervisory and coordinative responsibility.

Hence, low difficulty in patient care responsibility is probably highly correlated with high supervisory responsibility. If so, this would account for the rising portion of the curve in Figure 32. What is probably happening is that the supervisory responsibility is decreasing and the patient care responsibility is increasing . . . up to approximately 2.5 on the difficulty scale. Past this level, the patient care responsibility becomes too great, and the proportion of activities accomplished begins to fall. The supervisory factor is minimal here (at higher levels of difficulty we have found relatively low levels of staff

size). Instead, the cause for the drop in the proportion of activities accomplished is the near zero slope of the amount of time spent in patient care activities.

Figures 33 and 34 summarize the discussion. The dotted line in Figure 33 represents the hypothesized "proper" rate of increase in the proportion of time which should be devoted to patient care activities. Note that it is never the same as the solid line (converse to Figure 30), the observed proportions of time spent in patient care activities. Below 2.5, the observed falls short of the "proper" due to the higher supervisory responsibility that tends to accompany low difficulty assignments on the study units. Above 2.5, the observed falls short of the "proper" due to the inability of the RN to devote a greater proportion of her time to patient care activities.

Hence, we can "explain" Figure 34. While our explanation is not contradicted by any prior study or by any data collected in this study, it still has not been statistically tested. It, really, represents a plausible but not validated model of the assignment process. This model is a refinement of the assignment model which was validated in this paper and represents an area for further research.

Let us continue for one moment the assumption that we have correctly interpreted Figure 34. What management implications are drawn? First, it appears that the correct solution to the days when the assignment difficulty is less than 2.5 is the removal of auxiliary personnel. Although the nurse will have to assume more patient care responsibility, the reduction in supervisory responsibility more than makes up for this change.

Fig. 33.--Assignment Difficulty and the Proportion of Time Spent in Patient Care Activities

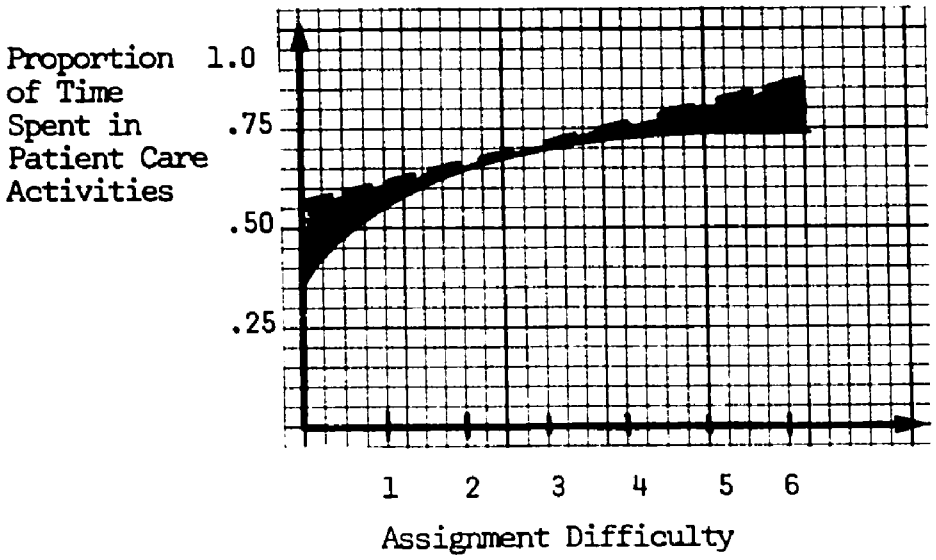
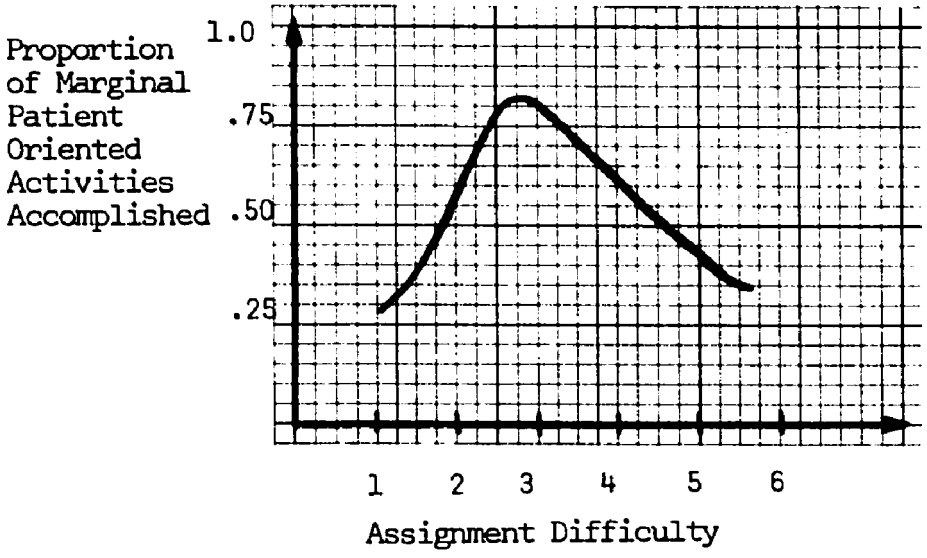


Fig. 34.--Assignment Difficulty and the Proportion of Marginal Patient Oriented Activities Accomplished



On the other hand, the figure suggests that the use of additional auxiliary personnel would be desirable when RN assignments are greater than 2.5.

The difficulty level of 2.5 then becomes fairly meaningful. Above this level of difficulty, a smaller proportion of time than "proper" (based on the proportion of completed activities) is devoted to patient care oriented activities and a larger proportion of time than "proper" is devoted to non-patient oriented activities. Apparently, then, the difficulty level of 2.5 signals the point at which patient demands begin to be omitted due to "overload." The use of the term "overload" is not to be misconstrued. It is not saying that RN's having assignments of greater than 2.5 difficulty are going to be unable to handle the great proportion of patient care demands (both patient oriented and non-patient oriented). We recall that our measures were based on a small number of the marginal types of activities.

What is meant by the use of the term "overload" is that the "proper" elasticity in the proportion of time available for patient oriented and non-patient oriented demands probably does not exist beyond the difficulty level of about 2.5 for the study units.

The management implication of this observation is clear: RN's having assignments with difficulty values greater than 2.5 can be expected to sacrifice the completion of some marginal activities. RN's having assignments at levels less than 2.5 could accept more patient care responsibility with little or no effect on the proportion of required

activities accomplished. Hence, optimal staffing is that which allows all RN's to have patient care assignments equal to 2.5 in difficulty.

This simple rule does not weigh, of course, the cost of losing the accomplishment of activities against the cost of adding an additional RN.

Of course, the preliminary nature of this data cannot be over-emphasized. What has been shown statistically is that a consistent measure of difficulty based on the assignment model can be obtained, and that this measure has meaning with respect to both the proportion of time spent in activities and the proportion of activities accomplished. There is, however, strong indication that further research in this area is warranted, and this will be discussed in the next chapter.

Three things must be pointed out here:

1) It is important to note that the use of the value 2.5 is an approximation made to ease discussion of the Figures and relates only to the four patient units studied.
2) The set of activities called marginal patient oriented activities is a small subset of the set of patient oriented activities. Figure 34 reflects the performance in this subset only.
3) As mentioned, the rising portion of data in Figure 32 is associated with two units on one floor, while the falling portion of data was obtained from two units on the other floor. The two sets do not overlap, although they do meet

at the "elbow" of the fitted curve. The interpretation, given above, may then be incorrect due to the fact that floor differences and not difficulty differences account for the shape of the relationship.

This question can only be answered by further research. It is expected, however, that if floor differences were significant, and not level of difficulty differences, then the work sampling results (Figure 25) would have been significantly distorted. In the work sampling analysis, assignments from both floors contributed to data points at the high and low ends of the difficulty scale and the expected relationships resulted. It is doubtful that difficulty could be a satisfactory explanatory variable for the proportion of time measure but an unsatisfactory explanatory variable for the proportion of activity measure.

7.3 Implications of Results - Individual Assignments

This research suggests two potential applications for the measure of assignment difficulty: (A) evaluating assignments made by traditional methods and (B) constructing assignments in a "building block" fashion toward meeting some objective for the total assignment pattern. The difference between these two possible applications hinges on the assignment-making process itself.

A. Traditional method - the traditional procedure followed by Head Nurses is to first determine the appropriate pattern of organization (Team, Functional, or Case) and then to allocate responsibilities to available personnel, according to the pattern selected. This allocation takes many factors into consideration:

1. cultural background of patients and staff
2. age (patient and staff)
3. amount of supervision available and required
4. patient needs and condition
5. geographic location of patients
6. etc.

B. Component method - a second method of making assignments, which we might term the component method, does not require the initial establishment of a pattern for guiding the composition of individual assignments. Instead, we think of each patient "needing" the equivalent of "total nursing care." The assignment is made by selecting from among alternative methods of allocating components between available RN's.

Let us return now to considering the use of the index if the traditional method of making assignments is employed. After the assignments have been determined, we characterize each assignment in terms of the assignment elements appropriate to it. For each RN assignment elements become a scheme for the classification of assigned activities under the most appropriate heading. The seven components, being derived from observations of common activity groupings, are expected to provide a rather adequate set of categories. It is possible, following this "classification," to establish an Index associated with any assignment derived by the traditional methods.

Hence one assignment can be compared to another, using the value of the index as the basis of comparison. Changes in assignments made by the traditional method can be evaluated by determining the associated change in the value of the index.

Using the information as to how the index is related to dependent variable measures, a means is at hand for evaluating the implications of an assignment at a particular level of the index and of adding or deleting activities from a given assignment. Assignments could be made by the traditional method and then the index values associated with these assignments evaluated with respect to dependent variables. If it appears that the assignment is approaching a saturation level for direct patient care (i.e., no more time available for this class of activities), the assignment might be reduced. If it appears that the quality of nursing care will be sacrificed due to an assignment being too large, the assignment can be reduced to a more desirable level.

Hence, assignments made according to the traditional methods can be evaluated using the index. The activities associated with an individual's assignment need only be classified into the appropriate set of components and the index describing the assignment is immediately derived. This index can then be used to compare the assignment to other assignments as to evaluate the difficulty of the assignment relative to some criteria associated with dependent variables.

If we are able to forego the intermediate step of classification of activities into appropriate components, the "component" method of assignment is derived. Here, we do not disregard all of the individual nuances of the traditional method, only defer consideration of them until the time of selection between alternative assignment possibilities.

This method might also be thought of as a "building block" method of establishing assignments since the components are essentially regarded

as such. We begin by recognizing that each patient must receive (by some combination of components) a total care component or its equivalent. While any number of the staff available might be involved in providing the equivalent of "total care" to any single patient, we restrict this number to a maximum of three different RN's. Hence, the possible ways a patient can receive "total care or its equivalent" with one, two or three RN's involved are described below:

One RN involved

total care component in her assignment for this patient

Two RN's involved (included in their assignments are the following components)

RN_1 total care except meds
RN_2 meds only 5 patients (including this patient)

OR

RN_1 total care except treatments
RN_2 treatments only 5 patients (including this patient)

Three RN's involved (included in their assignments are the following components for the patient in question)

RN_1 total care except meds and treatments
RN_2 treatments only 5 patients (including this patient)
RN_3 meds only 5 patients (including this patient)

For a given group of patients and RN staff, there are many alternative ways in which care components can be divided between the staff, the only

constraint being that each patient receive total care or its equivalent. The index can add in the evaluation and selection of the assignment most desirable.

Consider, for example, the following situation: we have three patients, one Class I, one Class II and one Class III. We also assume only three of the seven assignment components: total, partial and functional. We wish to determine the "best" assignment of the care responsibility for these three patients by dividing the responsibility between two available RN's. The possible ways in which a patient can receive total care or its equivalent are:

<u>One RN</u> - total care element for this patient

<u>Two RN's</u> - RN_a partial care element for this patient

RN_b functional care element for this patient

The possible assignments are those shown in the following table:

TABLE 24

Example of Use of Difficulty Scale for Evaluating Patterns of Assignment

PATTERN OF ASSIGNMENT	CLASS ↳	PATIENT 1 I	PATIENT 2 II	PATIENT 3 III	DIFFICULTY RN_1	DIFFICULTY RN_2
1		T_1	T_2	T_1	25	15
2		T_1	T_1	T_2	20	20
3		T_2	T_1	T_1	5	35
4		T_1	T_1	P_1F_2	35	3
5		T_1	P_1F_2	T_1	35	2
6		P_1F_2	T_1	T_1	36	1
7		T_1	P_1F_2	P_1F_2	30	5
8		P_1F_2	T_1	P_1F_2	33	4
9		P_1F_2	P_1F_2	T_1	33	3
10		T_2	T_2	P_1F_2	15	23
11		T_2	P_1F_2	T_2	10	27
12		P_1F_2	T_2	T_2	3	36
13		T_2	P_1F_2	P_1F_2	25	10
14		P_1F_2	T_2	P_1F_2	18	19
15		P_1F_2	P_1F_2	T_2	13	23
16		P_1F_2	P_1F_2	P_1F_2	28	6
17		T_1	P_2F_1	P_1F_2	22	13
18		T_2	P_2F_1	P_1F_2	17	18
19		P_2F_1	T_1	P_1F_2	31	6
20		P_2F_1	T_2	P_1F_2	18	21
21		P_2F_1	P_1F_2	T_1	31	5
22		P_2F_1	P_1F_2	T_2	11	25
23		P_2F_1	P_1F_2	P_1F_2	26	8
24		P_1F_2	P_2F_1	P_1F_2	20	14
25		P_1F_2	P_1F_2	P_2F_1	16	18

In this table T_1 represents total care assignment of this patient to RN_1, P_1F_2 represents a partial care assignment of this patient to RN_1, with a functional activity assigned to RN_2. Each patient, according to each

pattern, receives the equivalent of total care. Assume the following matrix of index values.

TABLE 25

Example of Assignment Element Difficulty Structure

		PATIENT CLASS		
		I	II	III
TYPE OF COMPONENT	Total	5	15	20
	Partial	3	10	15
	Functional	1	2	3

By appropriate reference to the matrix, we can establish an index value for each RN in each of the possible patterns. These scores are shown in the rightmost two columns on the table. (The difficulty values are computed by an additive method.)

The difficulty scores of each assignment for each of the two RN's are shown on Table 1 in the rightmost two columns. Summing these two scores for each assignment pattern yields a total difficulty index which ranges from 34 to 40. The difference between RN_1 and RN_2 assignment ranges from 0 to 35. The Head Nurse's objectives in making the assignment might be three:

1. provide "total care" element to patient 3
2. select assignment with minimum sum difficulty
3. select assignment with minimum difference between RN_1 and RN_2

The minimum possible total difficulty of those patterns which have patient 3 cared for by a total care element is 36. Of these patterns which sum to 36, pattern #15 has the minimum difference of difficulty between the assignments of RN_1 and RN_2. Hence, pattern 15 would be selected.

If, on the other hand, the importance of considerations 2 and 3 were reversed, we see that pattern #2 would be selected as "best."

It should be noted finally that the relationship between the index and dependent measure provides additional information which could be employed in selecting the "best" pattern from among the many alternatives. For example, all patterns having index scores for either RN above a certain value might be discarded as affecting quality too severely or not allowing effective use of time. Indeed, this is an area of decision-making where, depending on the importance attached to the various factors involved, there could be many alternative solutions to the same situation. Objectives could be related to the utilization of personnel, the satisfaction of patients, personnel and physicians, and any one or more of the many aspects of the kind and amount of care each patient receives. Not only is it likely that each individual would consider these factors to be of different importance in the establishment of assignments, but, from day to day, as the unit situation changes, each individual may change her own "system" of weighting.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

This research has developed and validated a model for measuring nursing assignments. The model is thought to be generalizable to any existing or future method for allocating patient care responsibility to RN staff. In particular, the research has:

1. Developed an elemental structure for representing the patient care responsibilities of RN's in terms of their scope of responsibility, the number of patients and the condition of patients included in the assignment.
2. Shown that a highly consistent measure of the difficulty of each of the assignment elements can be obtained by using a constant sum questionnaire.
3. Shown that a simple linear function can be used to compute the difficulty of an observed assignment by knowing the elements in the assignment and the number of times that each element is repeated.
4. Shown that the computed measure of assignment difficulty is significantly related to both the proportion of time spent in patient oriented and non-patient oriented activities and the proportion of a predefined set of non-patient oriented activities accomplished.

Furthermore, there was significant indication that the average assignment difficulty reflects certain workload measures such as the number of RN hours per patient day and the number of RN hours per weighted patient day. There is indication that the measure of assignment difficulty reflects the effects of using additional personnel on patient units with comparatively heavy work loads. These results imply the ability of the measure of assignment difficulty to be useful for characterizing the staff and workload situation on a patient unit in terms of a single variable, the average difficulty of RN assignments.

Implied by the data obtained, but not statistically verified, is the potential usefulness of the difficulty measure of nursing assignments as an indicator of "overload" situations, i.e., periods when more staff is needed on a unit in order to maintain a high rate of activity completion. Conversely, it appears that the measure of assignment difficulty will allow recognition of those RN's who have "room" in their assignment for additional responsibility.

Finally, by the measure of assignment difficulty, we have gained new understanding of the relationship between nursing assignments and nursing performance which, it is hoped, will prove useful in the management of nursing organizations.

8.1 Areas for Future Research

Several questions of research interest are raised by this study. First, it is important that we attempt to gain more understanding of the relationship between perceived difficulty and assignment characteristics.

To what extent do time related factors influence difficulty in comparison to some of the other influences listed on page 32? Or, more generally, what is the relationship between perceived and "actual" difficulty?

Secondly, an in-depth analysis of the difficulty scale of assignment elements is warranted. Why are the elements ordered as they are, and why the great difference between Morning Care and all other elements? Can some management action be taken to reduce the major contributors to the difficulty of some of the elements? What organizational factors can be examined by using the difficulty of assignment elements as a criteria? Perhaps, for example, the effects of the Unit Manager approach to patient unit organization would be reflected in the assignment element difficulty scales of RN's working on patient units which have and which do not have this additional assistance.

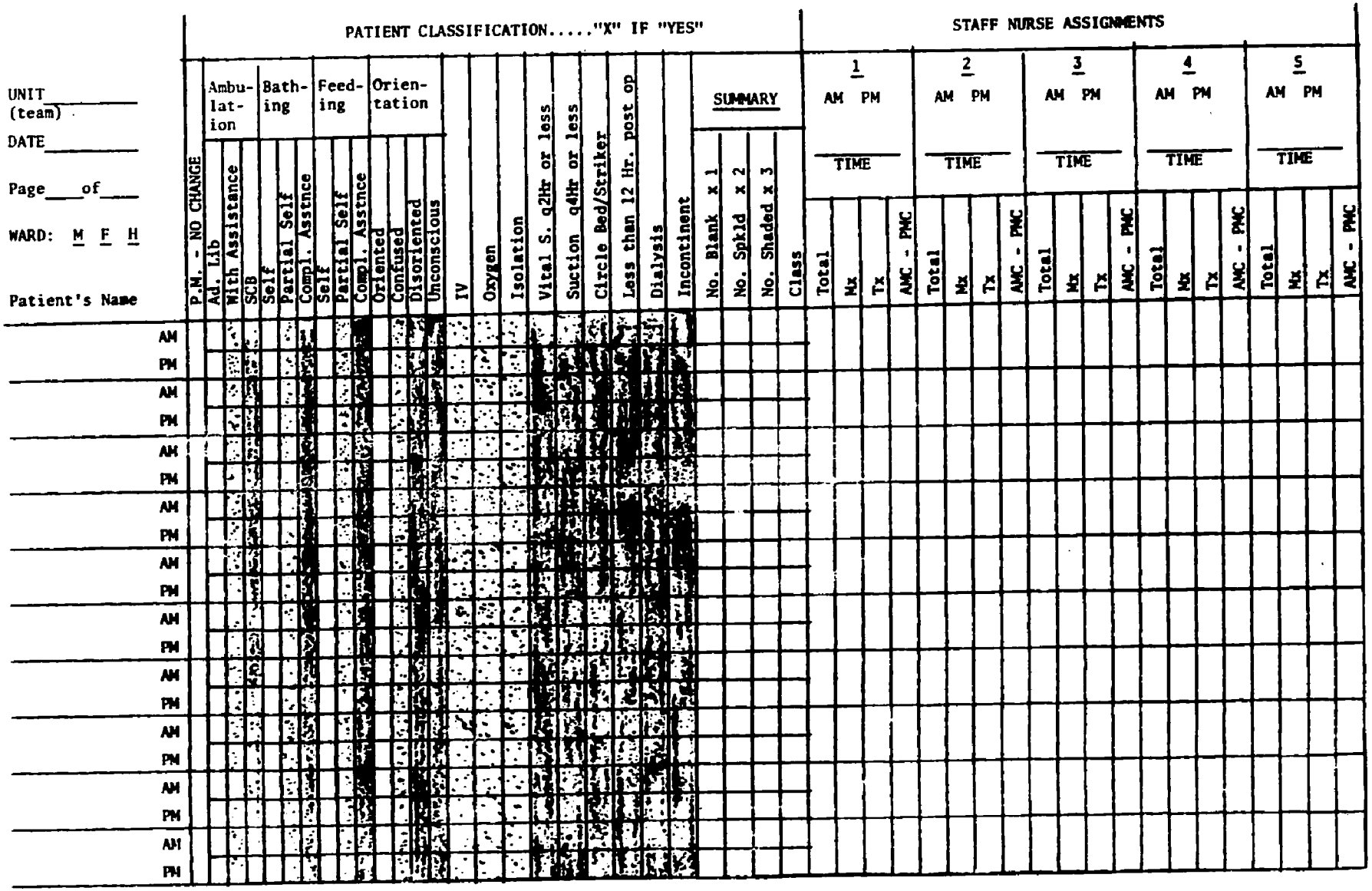
One of the primary directions for further research should be in evaluating the adequacy and usefulness of the difficulty measure of RN assignments to problems of staffing and assigning RN's on patient units. A suitable objective for this type of research would be to determine difficulty standards for nursing assignments. Such standards would be useful to both RN and nursing management for purposes of evaluating the patient unit situation.

Furthermore, future research could be directed toward attempting to establish the relationship between the level of skill of an individual and the difficulty he perceives in the various aspects of his work.

Finally, this research indicates that additional investigations should be made in the psychometric measurement of work. Many jobs have evaded the classical standards setting methodologies due to their non-repetitive or "non-measurable" characteristics. At first glance, none of these is more non-repetitive or non-measurable than the patient care responsibilities of the Registered Nurse working on a Medical or Surgical patient unit. Perhaps, approached with the methodology and concepts employed in this dissertation, some of these jobs may now yield to methods of standard setting by means of psychometric scaling.

APPENDIX 1

PATIENT CLASSIFICATION AND RN ASSIGNMENT FORM


UNIT (team)
DATE
Page of
WARD: M F H
Patient's Name
PATIENT CLASSIFICATION.....'X' IF 'YES'
P.M. - NO CHANGE
Ambu-lat-ion
Ad. Lib
With Assistance
SCB
Bath-ing
Self
Partial Self
Compl. Asstnce
Feed-ing
Self
Partial Self
Compl. Asstnce
Orien-tation
Oriented
Confused
Disoriented
Unconscious
IV
Oxygen
Isolation
Vital S. q2Hr or less
Suction q4Hr or less
Circle Bed/Striker
Less than 12 Hr. post op
Dialysis
Incontinent
SUMMARY
No. Blank x 1
No. Spkld x 2
No. Shaded x 3
Class
STAFF NURSE ASSIGNMENTS
1
2
3
4
5
AM PM
TIME
Total
Mx
Tx
AMC - PMC
AM
PM

APPENDIX 2

BACKUP SHEETS - CHECKLIST

1. INTRODUCTION

a. The use of the term quality index in this paper refers to a quality measurement obtained through statistical sampling. It should not be interpreted as "Statistical Quality Control" as may be defined by statisticians or others.

b. The system for quality estimation (or measurement) described in this plan is an adaptation of the methodology that was tested at VAH, Long Beach, California, during the summer of 1966.

c. The specific items or factors reflecting quality of nursing care have been developed in such a manner that random samples of qualitative data can be collected by registered nurses. Quality factors utilized in the evaluation of nursing care include areas relative to patient safety and welfare, comfort, environment, and specific items relating to continuity of care.

d. These quality factors provide the bases for determining numerical indicators of the quality of nursing care.

2. DEFINITIONS

a. The primary objective of the Quality Index is to provide a tool or aid to the professional personnel in making an evaluation of some aspects of patient care.

b. Factor: Each question appearing on the Nursing Care Quality Control Work Sheet is called a factor. See Exhibits A-1 - A-9.

c. Observation: An observation is made when the "observer" (nurse collecting the quality data) decides, on the basis of examination of the patient or of a condition, or a record, whether a specific quality factor is to be answered "yes" or "no". The number of observations made is equivalent to the number of factors receiving a "yes" or "no" answer. A factor answered by "NA" (not applicable) does not represent an observation. Base observations regarding charting, orders and Kardexes on events of the 24^{o} preceding the observation tour.

d. Observation Tour: A tour begins when a nurse leaves her working area and begins making observations related to the nursing unit

and patient selected. The observation tour ends when the nurse has completed all observations related to each factor of the nine work sheets.

3. OUTLINE OF THE PLAN

a. This Quality Index is based on random selection of ward nursing units, and random selection of patients within the nursing units to obtain observations of factors reflecting the quality of care provided. A large enough sample taken at random from a total situation (the population of facts studied) will approximate the features and characteristics of the total situation. You will not be asked to perform the randomization procedure. Three primary rules must be followed when using sampling methods to estimate quality levels:

(1) Sample items (procedures, patients, nursing units, etc.) must be selected according to the schedule provided.

(2) A sufficient number of sample observations must be made to provide the precision desired in the estimate.

(3) A "yes" or "no" decision regarding the acceptability of specific criteria of the quality of care being given must truly reflect the condition observed.

b. The Quality Index study requires the use of nine Work Sheets which represent nine major areas and a total of one hundred and thirteen questions or factors to be answered or rated by a "yes" or "no" or "not applicable" (NA).

c. Backup information or guidelines are included in the writeup to help clarify questions or factors on the work sheets which are not self-explanatory.

Example: Backup information for the Work Sheet - "General" is recorded on Exhibit C-1. Backup information or guidelines for other Work Sheets are illustrated as Exhibits C-2 to C-7. Questions or factors listed on the Work Sheets - "Ward Medical Administration" and "Ward Building Management" need no backup information or guidelines.

Work Sheets	Backup Information
1. General	Exhibit C-1
2. Patient Welfare and Safety.	Exhibit C-2
3. Patient Comfort	Exhibit C-3

4.	Patient Room	Exhibit C-4
5.	Patient's Chart.	Exhibit C-5
6.	Nursing Care Plan.	Exhibit C-6
7.	Nursing Unit (excluding patient room)	Exhibit C-7
8.	Ward Medical Administration.	None
9.	Ward Building Management	None

EXHIBIT C-1

(Backup information for Work Sheet Number A-1 - General)

1. General

1. Have the Head Nurse and staff developed objectives of the nursing care for the unit?

1.1 Have these objectives been clearly defined and are they available on the unit?

1.2 Are personnel on the unit familiar with the objectives?

2. Are means of implementing the objectives defined?

2.1 Has the in-service training program at the unit level been planned with the unit objectives in mind?

3. Is there evidence that the health team members plan for nursing care together?

4. Is there evidence that the nursing staff collaborates with the physician and other disciplines in planning to meet patient care needs?

4.1 Does the Head Nurse/team leader make regular scheduled rounds with the physician?

4.2 Does the Head Nurse and/or team leader have established, routine meetings with

a. Social work

b. Occupational therapy

c. Dietetics

d. Physical therapy

e. Hospital school

5. Self evident

6. Is there an in-service education program?

6.1 Are in-service education programs planned for personnel on all shifts?

6.2 Is there an established schedule of in-service programs?

6.3 Are these programs comprehensive?

EXHIBIT C-2

(Backup information for Work Sheet Number 2 - Patient Welfare and Safety)

2. Patient Welfare and Safety

1. Patient requires no immediate attention?

1.1 Does the patient have a request?

1.2 Are there signs or symptoms of a threat to patient's life (dyspnea, bleeding, diaphoresis, suicidal ideas, etc.)?

1.3 Is the patient having pain, nausea or vomiting?

1.4 Is the patient tense and/or restless, angry, or disoriented?

1.5 Is the patient depressed?

2. Are the bedside table and other self-care equipment positioned for the safety of the patient?

2.1 Is the patient able to reach his water?

2.2 Are all the items needed by the patient available in or on the bedside stand?

2.3 Can the bedside table be raised or lowered easily?

3. Is the call light or other mechanical communication device within easy reach, working and in good condition?

3.1 Can the patient reach his light without strain?

3.2 Is the cord secured?

3.3 Does the call light work?

3.4 Is the type of call system appropriate for the patient?

3.5 Is the cord clean and free of frayed areas?

4. Is the bed in proper position?

4.1 Is the bed in a therapeutic position if indicated?

e.g., a. Semi-Fowlers after a carotid angiogram
b. Flat or trendelenberg after a pneumoencephalogram
c. Fowlers with pulmonary edema

4.2 Is the bed positioned to facilitate respirations and circulation?

EXHIBIT C-2

4.3 Is the bed at the proper height to facilitate patient activity?

4.4 Is the bed at the proper height for administering patient care?

5. Are siderails up if indicated?

5.1 Are they up:

a. following the administration of sedatives
b. following the administration of analgesics such as Demerol and Morphine sulfate
c. following recent administration of anaesthesia
d. when a patient is disoriented
e. when a patient has a history of Grand Mal seizures
f. when a patient has a history of vertigo, loss of consciousness, etc.

6. Are restraints and/or protective devices applied when indicated and in a safe and comfortable manner?

6.1 Are the siderails padded for restless, disoriented and/or seizure patients?

6.2 Are hard restraints, (e.g., leather) padded with soft, absorbent material?

6.3 Have measures been taken to protect the skin from direct contact with jacket, kerlix, posey, etc., restraints?

6.4 Are the skin areas in direct contact with restraining devices erythematous and/or broken (e.g., the axilla with a jacket restraing)?

6.5 Have measures been taken to limit skin apposition which is secondary to restraint devices (e.g., are the fingers wrapped when mitten restraints are necessary)?

6.6 Restraints should not be fastened to siderails.

7. Are dressings and/or supports applied in a safe and comfortable manner?

7.1 Is the dressing adequate, clean, secure and as comfortable as possible?

8. Does the patient have all the preventive or protective appliances he needs? (Bedboards, footboards, trapeze, etc.) Self-evident.

8.1 Are the equipment and appliances described in the medical and nursing care plans provided and used correctly?

EXHIBIT C-2

9. Is the patient in optimal body alignment?

   9.1 Is the patient positioned to insure a clear airway and to facilitate respirations?

10. Are measures being taken to minimize the development and/or progression of contractures, decubitus ulcers, foot drop, etc.?

   10.1 Are range of motion exercises being given?

   10.2 Are pressure areas protected, (e.g., bridged) if indicated?

   10.3 Are affected limbs in proper position to prevent contractures and foot drop (e.g., are the feet placed firmly against a footboard when indicated)?

   10.4 Are the necessary devices used to maintain optimal positioning (e.g., are sandbags or some other such measure being utilized to prevent external lateral rotation of the legs)?

11. Self-evident.

12. Are oxygen precautions being taken?

   12.1 Are oxygen precaution signs obvious?

   12.2 Is the "no smoking" restriction enforced?

   12.3 When an oxygen tent is used, is the mattress covered with plastic with the sides of the tent properly secured?

   12.4 Are electrical devices grounded or disconnected?

13. Are isolation precautions being taken?

   13.1 Are isolation units clearly demarcated?

   13.2 Is the physical setting appropriate (e.g., is a patient with a respiratory infection in a private room)?

   13.3 Are gowns, masks, gloves, etc. readily available and in a clean area?

   13.4 Are adequate measures provided for disposing of contaminated linen, equipment and waste?

14. Self-evident.

EXHIBIT C-3

(Backup information for Work Sheet Number 3 - Patient Comfort)

3. Patient Comfort

1. Does patient appear comfortable? Self-evident.

2. Is the patient's bed comfortably made?

2.1 Has space in bedding been allowed for patient's feet and toes?

2.2 Is the patient covered for comfort?

2.3 Is the bed clean and dry?

2.4 Is the bed long enough for the patient?

2.5 Are extraneous items removed from the bed?

3. Is the patient's skin condition satisfactory?

3.1 Are skin conditions on admission identified? (Chart)

3.2 Is the skin clean?

3.3 Has the patient's skin condition improved or deteriorated since admission?

3.4 Are decubitus ulcers present?

4. Self Evident

5. Self Evident

6. Self Evident

7. Self Evident

8. Is patient prepared in advance for mealtime?

8.1 Has the patient been properly positioned for his tray?

8.2 Has he had the opportunity to wash his hands before his tray was served?

9. Are nursing personnel accessible to patient during meals?

9.1 Is the food prepared for the patient, if necessary?

EXHIBIT C-3

9.2 Is the patient fed in a relaxed manner and at a rate satisfactory to him?

9.3 Is the food mechanically suited for the patient?

10. Has provision been made to avoid unnecessary exposure of patient?

10.1 Are curtains or screens present if necessary?

11. Self Evident

12. Self Evident

EXHIBIT C-4

(Backup information for Work Sheet Number 4 - Patient Room)

4. Patient Room

1. Is the room appearance satisfactory and workably arranged?

1.1 Does the room or cubicle appear neat and clean?

1.2 Is the furniture arranged conveniently for the patient?

1.3 Can nursing personnel carry out care with minimal rearranging of furniture or equipment?

1.4 Is the lavatory clean and well stocked?

2. Are all pieces of equipment, supplies, or articles in the room in use?

2.1 Is there equipment such as oxygen, suction machine, etc., which have been discontinued in the room?

2.2 Have the trays and supplies not being used in caring for the patient been removed from the area?

2.3 Is there extra linen in the cubicle or room?

3. Is the temperature and ventilation optimal?

3.1 Are appropriate measures being taken to maintain optimal environmental temperatures for patients with hyperthermia or hypothermia?

3.2 Are windows open or closed according to the needs of the patient?

3.3 Is the cubicle or room free of smoke?

4. Is the lighting optimal for the patient?

4.1 Does the patient have a bedside light?

4.2 Can the patient reach and adjust the light?

4.3 Are the bulbs working?

5. Is the noise level satisfactory?

5.1 Does the noise of construction, repair, or maintenance of

hospital property disturb the patient?

5.2 Can the patient carry on a conversation without raising his voice appreciably?

5.3 Are personnel conversing quietly with patient and/or other personnel?

5.4 Can the patient hear nurses' conversations from their office?

6. Self Evident

7. Self Evident

EXHIBIT C-5

(Backup information for Work Sheet Number 5 - Patient Charts)

5. Patient's Chart

1. Self Evident

2. Have medications been charted correctly?

2.1 Are the nurses' initials in the proper space on the medication record indicating that medicine was given?

2.2 Are the PRN, STAT, or one-time orders charted on nurses' notes?

2.3 Are the route and site of administration of injections indicated on nurses' notes?

2.4 Is the legal signature used?

2.5 If unable to give medication, has the space on the medication record been circled and the reason indicated on nurses' notes?

3. Are reasons for and effect of PRN, STAT and one-time medication been charted on nurses' notes?

3.1 Has the reason for patient's request for medication been elicited?

3.2 Have the type, location and severity of pain been identified and noted?

3.3 Have the type, location and severity of urticaria been indicated?

3.4 Have location, type and severity of rash been noted?

3.5 Has time patient obtained relief of condition been noted?

3.6 Are any untoward symptoms or reaction to drug noted?

3.7 Has the medications' effectiveness been indicated?

3.8 Are the time and type of treatment indicated?

3.9 Are the type and amount of solution indicated?

3.10 Have the effects and results of treatment been charted?

3.11 Has the signature been used?

EXHIBIT C-5

4. Self Evident

5. Self Evident

6. Have vital signs been taken as ordered?

   6.1 Have the vital signs been taken as frequently as ordered by the doctors and nurses?

   6.2 Have the vital signs been taken as frequently as indicated by the patient's condition?

7. Have vital signs been recorded correctly?

   7.1 Has the TPR been recorded on proper graph? (TPR graph, B/P graph, B/P record or nurses' notes?)

   7.2 Has the B/P been recorded on proper form? (TPR graph, B/P graph, B/P record, or nurses' notes?)

   7.3 Is the legal signature used?

8. Is intake and output record current?

   8.1 Has intake and output been recorded on proper form?

   8.2 Have the time, amount, type and route of administration been indicated?

   8.3 Have totals for each shift been kept?

   8.4 Has 24-hour total been maintained?

   8.5 Is there a total for both intake and output?

9. If orders are not carried out, have pertinent comments been recorded?

   9.1 Has the reason been indicated on nurses' notes why treatment or medication was not given?

10. Have all orders been dated and signed by physician?

   10.1 Has the date been indicated in proper column on doctor's order sheet?

   10.2 Does a signature appear?

EXHIBIT C-5

11. Was notification and response of physician charted?

    11.1 Has physician been notified?

    11.2 On admission?

    11.3 Any significant change in patient's condition?

    11.4 Any complaints of unusual pain?

    11.5 Any reactions or untoward symptoms to drugs, blood, etc.?

    11.6 Any questions or problems regarding medical care?

    11.7 Request by patient?

    11.8 Has response of physician been indicated, including time, date, and reply, on nurses' notes?

12. Are pertinent, recurring activities charted?

    12.1 Has there been any charting within past 48 hours?

    12.2 Have signs and symptoms; observations of the patient been recorded?

    12.3 Have the type and time of special oral hygiene been indicated on nurses' notes?

    12.4 Has ROM been charted with indication of time given and part or parts exercised?

    12.5 Has incontinent, scrotal, or catheter care been charted indicating time, amount, type of solution, amount and color of drainage and effects?

    12.6 Have any of the patient's feelings and reactions to his illness, care and/or progress been noted on nurses' notes?

    12.7 Has any teaching done for patient and/or family been charted on nurses' notes?

    12.8 Any changes in patient's condition been noted?

    12.9 Has ambulation and exercise of patient been indicated if pertinent?

    12.10 Has turning of patient with or without skin care been noted?

    12.11 Has the kind and amount of fluid forced been charted?

EXHIBIT C-5

12.12 Does the chart indicate the frequency and type of stools?

12.13 Do the notes indicate the type, frequency, time, appearance of wound and patient tolerance of each dressing change?

12.14 Is the frequency of trach care indicated?

12.15 Is the frequency of tracheal suctioning, along with the tolerance of the patient, and the amount, color and consistency of the secretions noted?

12.16 Does the chart contain information on the type of solution, amount, frequency, times, character of the returns and patient tolerance of irrigations?

13. Do the nurses' notes reflect existing patient or family teaching?

13.1 Is there any notation of explaining care to patient and/or family?

13.2 Is there any notation of instruction of patient and/or family regarding procedures (administration of insulin, care of colostomy, how to get in wheelchair, etc.)?

13.3 Is there any notation of patients' acceptance and understanding of the nurses' teaching?

13.4 Have any needs of the patient been identified through interaction with the patient and nursing intervention been charted?

13.5 Is there any evidence of how the patient is accepting his illness and how he feels about his prognosis?

13.6 Is there any evidence of how the patient feels regarding his progress and possible discharge?

14. Self Evident

15. Self Evident

16. Self Evident

17. Self Evident

EXHIBIT C-6

(Backup information for Work Sheet Number 6 - Nursing Care Plans)

6. Nursing Care Plan

1. Are long-term goals identified?

1.1 Are optimal goals for the patient identified and individualized?

1.2 Do the goals include rehabilitation of the patient?

1.3 Do the goals include the family in the rehabilitative process?

1.4 Are the goals realistic?

2. Is nursing care plan current and individualized?

2.1 Have recent needs and problems of the patient been added?

2.2 Are the needs listed specific for the patient?

2.3 Are all the needs of the patient identified (physical, physiological, emotional, teaching, and diversional)?

2.4 Is the plan of action specific, appropriate, and effective for the patient's needs?

2.5 Have deletions been made when pertinent?

3. Do various staff members contribute to nursing care plans?

3.1 Is there more than one person's handwriting on the nursing care plans?

3.2 Is there evidence of medical, paramedical and nursing collaboration?

4. Does the plan identify emotional needs of the patient and suggest an approach to them?

4.1 Are his knowledge of and feeling toward his prognosis identified?

EXHIBIT C-6

4.2 Is the plan of action for his emotional needs specific, appropriate and effective?

5. Does the plan reflect diversional needs? Is plan of action appropriate?

5.1 Is there evidence that the patient's hobbies, likes, or dislikes have been considered in diversional therapy?

5.2 Would additional diversional activity be therapeutic?

6. Does the plan reflect the teaching needs of patient and/or family? Is plan of action appropriate?

6.1 Does the plan indicate what the patient knows and accepts about his condition?

6.2 Does the plan of action indicate how specifically to help the patient understand his condition?

6.3 Does the plan indicate the procedures which need to be taught to the patient and/or family and specify how and to whom these are to be taught?

6.4 Does the plan indicate the progress of the patient and/or his family in the established teaching program?

7. Does the plan reflect pertinent therapeutic needs and the plan of action? Is the plan of action appropriate?

7.1 Does the plan indicate whether or not the patient has a dressing, its site, type and method and frequency of change?

7.2 Does the plan indicate presence of tubes (catheters, N-G, trach., etc.) and indicate the special care required?

7.3 Does plan reflect any therapies (inhalation, physical medicine) for the patient and does it specify who is to administer it, when and how?

7.4 Does the plan indicate pertinent signs and symptoms to be observed regarding treatment and medications received (anticoagulants, etc.)?

8. Does the plan reflect the promotion of self-care activities? Is plan of action appropriate?

EXHIBIT C-6

8.1 Have the activities which the patient may be able to do for himself been identified?

8.2 Is the self-care teaching plan specific and appropriate?

8.3 Does the plan reflect the current status of the patient's progress?

8.4 Does the plan reflect inclusion of the patient's family if indicated?

9. When forced fluids are ordered, does the plan indicate the frequency, time, kind and amount of fluids to be given over a specific period of time?

9.1 Have the patient's needs (such as rest, therapy, etc.) been considered in establishing the time to offer fluids?

9.2 Does the plan indicate the kind of fluid to offer?

9.21 Have the patient's dietary needs and limitations been considered (salt free, bland, etc.)?

9.22 Have the patient's likes and dislikes been considered?

9.3 Does the plan indicate the amount of fluid to offer at each specific time?

9.31 Has a desired total been calculated for the entire 24 hours and then divided for the specific times?

9.4 Does the plan indicate the specific route of administration (oral, tube, etc.)?

10. When fluids are to be restricted, does the plan specify the time, kind and amounts of fluid to be given over a specific period of time?

10.1 Has the patient's needs and habits (such as rest, therapy, etc.) been considered in establishing the specific times?

10.2 Have the patient's dietary needs been considered (salt-free, bland, etc.)?

10.3 Has the desired total for 24 hours been calculated and then divided into amounts for each time indicated by patient's needs (rest, therapy, etc.)?

EXHIBIT C-6

11. Does the plan indicate time, kind and method of administering special oral hygiene?

    11.1 Are the specific times indicated for special oral hygiene -- rather than just b.i.d., t.i.d., p.r.n., etc., and are these optimal times?

    11.2 Is the most effective solution being used?

12. Does the plan indicate need and time of smoking supervision?

    12.1 Are the doctor's restrictions considered?

    12.2 Is the patient's condition considered in establishing frequency?

13. Does the plan specify ambulation and exercise times?

    13.1 Are the patient's needs for rest periods considered?

    13.2 Does the plan indicate the specific extent of ambulation or exercise (walk around bed, length of ward, sit in chair at bedside 15 minutes, etc.)?

14. Does plan indicate time for turning and positioning?

    14.1 Are specific times noted for turning the patient?

    14.2 Are limitations of turning and positioning indicated?

    14.3 Are there specific instructions for maintaining good body alignment?

    14.4 Has the patient's comfort been considered?

15. Does plan indicate time, method and specific areas for special skin care and is the plan adequate?

    15.1 Is specific time indicated rather than bid, tid, q24 hrs., etc.?

    15.2 Are specific bony prominences or other areas identified?

    15.3 Is the type of skin care indicated (massage, lotion, powder, or medication, etc.)?

EXHIBIT C-6

16. Does the plan indicate specific methods and time range of motion is to be done to selected joints? Is plan of action appropriate?

    16.1 Has the patient's need for rest between activities been considered in establishing times?

    16.2 Has the specific time been indicated rather than bid, tid, etc.?

    16.3 Does the plan indicate whether the patient or a member of his family should be taught to do the range of motion?

    16.4 Has the extent of limitation been indicated (e.g., do not force right thumb in extended position)?

    16.5 Have the specific joints been indicated?

    16.6 Has it been specified whether active or passive range of motion is indicated?

17. Does plan identify problems of bowel and bladder elimination and indicate an appropriate plan of action?

    17.1 Does the patient feel he has a problem with his bowels or bladder?

    17.2 Is the patient incontinent of stool or urine? Is patient constipated?

    17.3 Does the plan indicate the specific problem?

    17.4 Is the plan of action specific for the problem?

    17.5 Is the plan of action effective (conversation and observation of chart)?

EXHIBIT C-7

(Backup information for Work Sheet Number 7 - Nursing Unit)

7. Nursing Unit

1. Does nurses' station appear to be effectively organized?

1.1 Is the general appearance cluttered?

1.2 Are charts in chart rack or in neat order on desk?

1.3 Are x-rays in proper place?

1.4 Are clinical records put away or in neat order?

1.5 Are books and manuals neatly arranged in a proper place?

1.6 Are window sills free of articles?

1.7 Are the desks, chairs, counters and window sills clean?

1.8 Are screens and windows clean?

1.9 Is floor clean?

1.10 Is medicine area counter clean?

1.11 Are used syringes disposed of properly?

1.12 Is equipment clean and neatly arranged?

1.13 Are sinks in the medicine area clean?

1.14 Are medicine cupboard doors and windows clean?

2. Is the medicine room or cabinet locked and/or under close supervision?

2.1 Are the narcotics doubly locked?

2.2 Are prepared medications locked?

3. Does medication refrigerator contain medications and medication vehicles only, and are these neatly and conveniently arranged?

3.1 Does the refrigerator contain milk, water, juice or other liquids not used as vehicles?

EXHIBIT C-7

3.2 Does it contain nourishments?

3.3 Does it contain any other supplies?

4. Are drugs alphabetized and/or arranged in a systematic fashion; are external and internal drugs separated?

4.1 Are internal and external drugs separated?

4.2 Are external drugs labeled as such?

5. Have the discontinued drugs been returned to pharmacy when indicated?

6. Is the utility area orderly?

6.1 Is used equipment in area soiled?

6.2 Are there articles immersed in solution?

6.3 Are reusable supplies rinsed and put in Central Service basket?

6.4 Are supplies and equipment properly stored?

7. Self Evident

8. Are treatment and examinating rooms neat and conveniently arranged?

8.1 Are supplies clean and neatly stored in appropriate place?

9. Self Evident

10. Self Evident

11. Self Evident

12. Self Evident

13. Self Evident

14. Self Evident

15. Self Evident

APPENDIX 3

OBS_____

EXHIBIT A-1

WORK SHEET

Hospital Unit_____ Bed No._____

Patient Name_____ Date_____

Patient Number_____ Time_____

Patient Classification I ____ Medical ____
II ____ Surgical ____
III ____ Other ____

1. GENERAL

Factor No.		YES	NO	NA	Study Factor No.
.01	Is there evidence that cooperative relations exist amongst members of the health team? ----------				1
.02	Is there evidence that the nursing staff collaborates with physician and other disciplines in planning to meet patient care needs? ----------				2
.03	Are the hospital formulary, reference books and manuals neatly arranged, accessible and up-to-date? ----------				3
	TOTAL	___	___	___	

EXHIBIT A-1

1. GENERAL (cont'd)

Observer comments (reference backup information if available):

Factor No.

EXHIBIT A-2

WORK SHEET

Hospital Unit_____ Bed No._____ Date_____

Patient Classification I ____ Medical ____ Time_____
II ____ Surgical ____
III ____ Other ____

2. PATIENT WELFARE AND SAFETY

Factor No.		YES	NO	NA	Study Factor No.
.01	Patient requires no immediate attention?				4
.02	Is the bedside table and other self-care equipment positioned for the safety of the patient?				5
.03	Is the call light or other mechanical communication device within easy reach, and in proper working condition?				6
.04	Is the bed in proper position? (semi-Fowler, trendelenberg, etc.)				7
.05	Are side-rails up, if indicated?				8
.06	Are restraints and/or protective devices applied when indicated, and in a safe and comfortable manner?				9
.07	Are dressings and/or supports applied in a safe and comfortable manner?				10
.08	Does the patient have all the preventive or protective devices he needs? (Bedboards, footboard, trapeze, etc.)				11
.09	Is the patient in optimal body alignment?				12
.10	Are optimal measures being taken to minimize the development of contractures, decubitus ulcers, footdrop, etc.?				13
.11	Are adequate oxygen precautions being taken?				14
.12	Are adequate isolation precautions being taken?				15
.13	Is the urinal and/or bedpan clean, convenient, and positioned for safety?				16

TOTAL ___ ___ ___

EXHIBIT A-2

2. PATIENT WELFARE AND SAFETY (cont'd)

Observer comments (reference backup information if available):

Factor No.	

EXHIBIT A-3

WORK SHEET

Hospital Unit_____ Bed No._____

Date_____

Time_____

3. PATIENT COMFORT

Factor No.		YES	NO	NA	Study Factor No.
.01	Does patient appear to be comfortable?				17
.02	Is the patient's bed comfortably made?				18
.03	Is the patient's skin condition satisfactory?				19
.04	Are nails (toes and fingers) clean and trimmed?				20
.05	Does the patient's hair appear clean?				21
.06	Is the patient shaved for comfort and cleanliness?				22
.07	Is oral hygiene satisfactory?				23
.08	Is patient prepared in advance for mealtime?				24
.09	Are nursing personnel accessible to patient during meal?				25
.10	Has provision been made to avoid unnecessary exposure of patient?				26
.11	Is the urinal and/or bedpan positioned for accessibility?				27
.12	Is the bedside table and other self-care equipment positioned for the convenience of the patient?				28
	TOTAL	___	___	___	

Observer comments (reference backup information if available):

Factor No.	

EXHIBIT A-4

WORK SHEET

Hospital Unit_____ Bed No._____

Date_____

Time_____

4. PATIENT ROOM

Factor No.		YES	NO	NA	Study Factor No.
.01	Is the room appearance satisfactory? --				29
.02	Are all pieces of equipment, supplies, or articles in the room being utilized or on standby basis? ---				30
.03	Is the temperature and ventilation optimal? ----------				31
.04	Is lighting optimal for the patient? --				32
.05	Is the noise level satisfactory? ------				33
.06	Are window sills and radiators free of articles? ----------				34
.07	Is the room free from noxious odors? --				35
	TOTAL	___	___	___	

Observer comments (reference backup information if available):

Factor No.	

EXHIBIT A-5

WORK SHEET

Hospital Unit_____ Bed No._____

Date_____

Time_____

5. PATIENT'S CHART

Factor No.		YES	NO	NA	Study Factor No.
.01	Have medications been given as ordered?				36
.02	Have medications been charted correctly?				37
.03	Are reasons for and effect of PRN, STAT and onetime medications charted on nurses' notes?				38
.04	Have treatments been given as ordered?				39
.05	Have treatments been charted correctly?				40
.06	Have vital signs been taken as ordered?				41
.07	Have vital signs been recorded correctly?				42
.08	Is intake and output record current?				43
.09	If orders are not carried out, have pertinent comments been recorded?				44
.10	Have all orders been dated and signed by physician?				45
.11	Was notification and response of physician charted?				46
.12	Are pertinent recurring activities charted?				47
.13	Do the nursing notes reflect existing patient or family teaching?				48
.14	Are nurses' notes legible?				49
.15	Are approved abbreviations being used?				50
.16	Are recorder's signature and initials noted?				51
	TOTAL	___	___	___	

EXHIBIT A-5

5. PATIENT'S CHART (cont'd)

Observer comments (reference backup information if available):

Factor No.	

EXHIBIT A-6

WORK SHEET

Hospital Unit_____ Bed No._____

Date_____

Time_____

6. NURSING CARE PLAN

Factor No.		YES	NO	NA	Study Factor No.
.01	Are long term goals identified? -------				52
.02	Is nursing care plan current and individualized? ----------				53
.03	Do various nursing staff members contribute to nursing care plans? -----				54
.04	Does the plan identify current emotional needs of the patient and suggest an approach to them? ----------				55
.05	Does the plan identify current diversional needs and suggest an approach to them? ----------				56
.06	Does the plan indicate the current teaching needs of patient and/or family and suggest an approach to them?				57
.07	Does the plan identify current pertinent therapeutic needs and indicate the appropriate action? (Example: dressings, tracheotomy care, inhalation therapy, observation for bleeding as a result of anticoagulant, etc.) ----------				58
.08	Does the plan identify current self-care activities and suggest methods for their promotion? ----------				59
.09	When forced fluids are ordered, does the plan indicate the frequency, time, kind and amount of fluids to force? ----------				60
.10	When fluids are to be restricted, does the plan indicate the time, kind and amount of fluids to be given over a 24-hour period? ----------				61

EXHIBIT A-6

6. NURSING CARE PLAN (cont'd)

Factor No.		YES	NO	NA	Study Factor No.
.11	Does the plan indicate time, kind and method of administering special oral hygiene?				62
.12	Does plan indicate need and time of smoking supervision?				63
.13	Does the plan specify ambulation and exercise times? Does it provide for adequate rest?				64
.14	Does plan indicate time for turning and positioning, and is this schedule adequate?				65
.15	Does plan indicate time, method and specific areas for special skin care and is the plan adequate?				66
.16	Does plan indicate specific methods and times range of motion is to be done to selected joints? Is the plan of action appropriate?				67
.17	Does plan identify current problems of bowel and bladder elimination and indicate an appropriate plan of action?				68
.18	Does plan identify a discharge program consistent with current nursing needs and care?				69
.19	When you observed the patient, did his overall appearance reflect that he was receiving the nursing care noted in his nursing care plan?				70
	TOTAL	___	___	___	

Observer comments (reference backup information if available):

Factor No.	

EXHIBIT A-7

WORK SHEET

Hospital Unit_____ Bed No._____

Date_____

Time_____

7. NURSING UNIT (EXCLUDING PATIENT ROOM)

Factor No.		YES	NO	NA	Study Factor No.
.01	Is the medicine room or cabinet locked and/or under close supervision?				71
.02	Does medication refrigerator contain medications and medication vehicles only, and are these neatly and conveniently arranged? ----------				72
.03	Are treatment and examining rooms neat, clean, and conventiently arranged? ----------				73
.04	Is the emergency tray clean, accessible and complete? Are contents organized to facilitate ease in locating? -------				74
	TOTAL	___	___	___	

Observer comments (reference backup information if available):

Factor No.	

EXHIBIT A-8

WORK SHEET

Hospital Unit_____ Bed No._____

Date_____

Time_____

8. WARD MEDICAL ADMINISTRATION

Factor No.		YES	NO	NA	Study Factor No.
.01	Are the charting entries for admission and transfers complete? -----				75
	TOTAL	___	___	___	

Observer comments (reference backup information if available):

Factor No.	

EXHIBIT A-9

WORK SHEET

Hospital Unit_____ Bed No._____

Date_____

Time_____

9. WARD BUILDING MANAGEMENT

Factor No.		YES	NO	NA	Study Factor No.
.01	Is the area used for medication preparation clean? ----------				76
	TOTAL	—	—	—	

Observer comments (reference backup information if available):

Factor No.	

APPENDIX 4

The University of Michigan

Department of Industrial Engineering
Bureau of Hospital Administration

Nursing Assignment Questionnaire

QUESTIONNAIRE INSTRUCTION

This questionnaire is part of a research effort being conducted by the Bureau of Hospital Administration, The University of Michigan. The purpose of the research is to attempt to gain an understanding of nursing assignments and nursing workload.

The Questionnaire consists of two parts. Part I is a set of paired items which will require approximately 45 minutes to complete. Part II will be given at your second session and is not included here.

In both parts of the questionnaire, we will be using terms which you may not have heard before. Before you begin Part I, read (and study) the following definitions. Your understanding of the definitions will make your job much easier, and will help to insure the validity of the study results.

DEFINITIONS: This section is divided into two parts: defining PATIENT CONDITION and defining COMPONENTS and ELEMENTS of an RN's assignment.

1. PATIENT CONDITION. For purposes of this questionnaire, we will define three levels of patient condition: 1) Self Care, 2) Intermediate Care, and 3) Intensive Care patients based on the degree to which the patient is self sufficient. The criteria for classification of paients is as follows:

A SELF CARE patient is a patient who:

1. is ambulatory with no assistance or with assistance
2. can bathe himself
3. can feed himself or, requires food cut
4. is oriented
5. and has no need for any miscellaneous assistances

An INTENSIVE CARE patient is a patient who:

1. is not ambulatory or up in chair with assistance
2. bathing - requires complete assistance
3. feeding - requires food cut or complete assistance and who requires 1 or more of the following:

IV
Oxygen
Isolation
Vital Signs more frequent than q^2 Hr.
Suction more frequent than q^4 Hr.
Circle Bed or Striker
Dialysis

and/or who is:

Incontinent
Disoriented
Unconscious

An INTERMEDIATE CARE patient is a patient who is not classified by the above as being either SELF CARE or INTENSIVE CARE.

It would be helpful for you now to take a moment to review the above criteria for classification, thinking of patients you have come into contact with recently and their appropriate classification category.

Remember that patient classification (for uniformity of these results) must be done with respect to only the criteria as described above (no matter how you may personally feel about the adequacy of the criteria, etc.).

2. ASSIGNMENT COMPONENTS. Nursing assignments can be thought of as being made up of "assignment components," groupings of RN tasks which represent the scope of responsibility the RN has for a patient or group of patients in her assignment. Components, then, can be defined by particular task groupings which the RN has responsibility for completing. While many different task groupings are used, the most frequently used assignment components on your units are the following:

   1. Medications for 5 patients - You are assigned to give medications to a group of 5 patients on your unit. The activities for which you are responsible include the following, or as many of them as are required by the patients, along with whatever teaching, explaining, observing, or evaluating that is commonly associated with the performance of these activities.

      Give oral medication
      Check, terminate and/or assist in IV medication
      Give hypo medication
      Give intramuscular medication
      Check, terminate and/or assist in blood transfusion
      Prepare oral medication
      Prepare hypo, IM, IDermal
      Prepare IV and/or Hypodermoclysis medication
      Prepare and/or check medication care and/or list

   2. Treatments for 5 patients - You are assigned to give treatments to a group of 5 patients on your unit. The activities for which you are responsible include the following, or as many of them as are required by the patients, along with whatever teaching, explaining, observing, or evaluating that is commonly associated with the performance of these activities.

Assist Dr. with exam
Assist Dr. with treatment
Catheterize patient
Take blood pressure
Give gavage
Apply sterile dressing
Check O_2 tent therapy
Peritoneal Dialysis
Start, check and/or terminate suction
Assist patient walking with/ without crutches
Fill and/or apply ice pack dressing
Chart nurse's notes

3. Morning Care for 5 patients - You are assigned to give morning care to a group of 5 patients on your unit. You have no help, such as from an aide, LPN, or student in completing this portion of your assignment. The activities for which you are responsible include the following, or as many of the following as are required by the patients, along with whatever teaching, explaining, observing, or evaluating that is commonly associated with the performance of these activities.

Give and/or remove bedpan
Give drinking water
Dress and/or undress patient
Answer patient call signal
Assist patient in/out of bed
Adjust patient's position in bed
Make occupied bed
Give complete/partial bed bath
Feed patient
Adjust bed
Adjust heat, light, ventilation

4. Afternoon Care for 5 patients - Your responsibility is precisely the same as in #3 above, except, in the activities required for afternoon care, beds and baths are not included. Hence, Afternoon Care can be best thought of as Morning Care without beds and baths for the 5 patients involved.

5. Total Care for a single patient - You have responsibility for total care for a single patient. This means that you take care of his Meds, Treatments, and Morning or Afternoon Care requirements, along with whatever teaching, explaining, observing, or evaluating that is commonly associated with the performance of these activities.

EXAMPLE: As an example of the use of components to describe RN assignments, let us suppose Nurse Jones has responsibility for all of the care activities for five patients, and acts as medication nurse for 15 other patients. We would represent her assignment using the component structure as follows:

Component	No. of Times Component Repeated (Corresponding to Number of Patients)
Total Care for a single patient	5
Medications for 5 patients	3

3. Assignment Elements. Now, one final step remains: that of putting together the concepts of patient condition and assignment components to form "assignment elements."

We do this by recognizing that we can have each component associated with a self care, intermediate care, or intensive care patient. Hence the first three "assignment elements" are:

1. Medications for 5 self care patients
2. Medications for 5 intermediate care patients
3. Medications for 5 intensive care patients

Similarly, we can associate each of the other assignment components with each of the three levels of patient condition (or Self Sufficiency) to obtain 15 "assignment elements." These are listed below:

1. Medications for 5 self care patients
2. Medications for 5 intermediate care patients
3. Medications for 5 intensive care patients

4. Treatments for 5 self care patients
5. Treatments for 5 intermediate care patients
6. Treatments for 5 intensive care patients

7. Morning Care for 5 self care patients
8. Morning Care for 5 intermediate care patients
9. Morning Care for 5 intensive care patients

10. Afternoon Care for 5 self care patients
11. Afternoon Care for 5 intermediate care patients
12. Afternoon Care for 5 intensive care patients

13. Total Care for one self care patient
14. Total Care for one intermediate care patient
15. Total Care for one intensive care patient

One or more of these "assignment elements" can be used to describe a major portion of an RN's assignment. For example, suppose an RN was assigned:

Total Care for 2 self care patients

Total Care for 1 intermediate care patient

Total Care for 2 intensive care patients

Medications for 5 self care patients

Medications for 10 intermediate care patients

Then we could represent her assignment by showing the "elements" present and the number of times (corresponding to the number of patients) that each element was present. For the above example we would have:

Element	No. of Time Element Repeated (corresponding to number of patients)
Total Care for one self care patient	2
Total Care for one intermediate care patient	1
Total Care for one intensive care patient	2
Medications for 5 self care patients	1
Medications for 5 intermediate care patients	2

The two parts which follow in this questionnaire are designed to help us determine:

1. The relative difference in difficulty which you see between assignment elements, and
2. The relative difference in difficulty which you see between assignments.

Instructions for each part will be presented before the part itself. They will be heavily dependent upon your understanding of the definitions presented in this Introduction. Before you proceed to Part I, go back and review the definitions and the assignment elements, relating them to your own nursing experience.

Now proceed to the instructions for Part I.

Nursing Assignment Questionnaire

PART I

Instructions

In PART I, you will be asked to make a judgment about many pairs of assignment elements. In order to introduce you to the type of judgment that you are to make for each pair of elements, consider the following example pair:

Example: 1a. Total Care for one self care patient....._____

b. Treatments for 5 intermediate care patients....._____

Now, assume that either Element 1a or Element 1b was going to be part of your assignment. In your opinion, which of these two elements would increase the difficulty of your whole assignment the most? You should consider both the type of responsibility and the number of condition of patients in each element. (In order to decide, it might be helpful for you to return to the definitions for a review).

Please complete the following:

In my opinion, the difficulty of my assignment would be increased more if Element _____ (a or b) were added than if Element _____ (a or b) were added.

Now, please consider the following pair of elements

Example: 2a. Morning Care for 5 intensive care patients....._____

b. Total Care for one intermediate care patient...._____

Again, assume that either Element 2a or Element 2b was going to be included in your assignment. In your opinion, which of these two elements, 2a or 2b, would increase the difficulty of your assignment the most? You should consider both the type of responsibility and the number and condition of patients in each element.

Just place a check ( ) on the line beside the element 2a or 2b which would increase the difficulty of your assignment the most.

In Part I, you are asked to do more than place a check mark. After you have decided which element of the pair would, if added to your assignment, increase the difficulty of your assignment the most, you are asked to divide 100 points between the two elements in accordance with how much more difficult is one element of the pair compared to the other. Thus, if you selected 2a as more difficult than 2b, you might assign 60 of the 100 points to Element 2a and 40 points (60 + 40 = 100) to Element 2b. You would then be representing Element 2a as being in the ratio of 60 to 40, or 3 to 2, with Element 2b. A point division of 75 to 25 would indicate a ratio of 3 to 1. The points you assign should represent the extent to which you think of one of the elements being more difficult than the other. Of course, you may divide the 100 points between the elements in any proportion you choose, just so that your point assignment totals to 100 for each pair.

Now look at the third and fourth examples. This is how the pairs will appear in Part I (except for the points assigned for demonstration).

Example: 3a. Medications for 5 self care patients..... 20

b. Medications for 5 intensive care patients..... 80

TOTAL 100

Example: 4a. Morning Care for 5 intermediate care patients..... 50

b. Afternoon Care for 5 intensive care patients..... 50

TOTAL 100

Example 3. The respondent indicates that the difficulty of Element 3b (80) is about four times that of Element 3a (20).

Example 4. The respondent indicates that the difficulty of Element 4a (50) is about the same as that of Element 4b (50).

In summary, your job in PART I is as follows:

First: decide which element in each pair is the more difficult, based on the type of responsibility, number, and conditions of patients in each element in the pair.

Second: divide 100 points between the two elements in accordance with how much more difficult is the one element than the other.

Please review these instructions whenever you wish, and remember that this is not a test. The only "correct" answer to each pair is your conscientious appraisal of the relative difficulty of the two elements presented.

NOW PROCEED TO PART I.

APPENDIX 5

PART I

1. a. Treatments for 5 self care patients....._____
   b. Afternoon Care for 5 self care patients....._____
   100

2. a. Afternoon Care for 5 intensive care patients....._____
   b. Total Care for one intermediate care patient....._____
   100

3. a. Total Care for one intensive care patient....._____
   b. Morning Care for 5 intensive care patients....._____
   100

4. a. Treatments for 5 intermediate care patients....._____
   b. Morning Care for 5 intensive care patients....._____
   100

5. a. Afternoon Care for 5 intermediate care patients....._____
   b. Medications for 5 intermediate care patients....._____
   100

6. a. Medications for 5 intensive care patients....._____
   b. Treatments for 5 intermediate care patients....._____
   100

7. a. Morning Care for 5 self care patients....._____
   b. Afternoon Care for 5 intermediate care patients....._____
   100

8. a. Morning Care for 5 intermediate care patients....._____
   b. Morning Care for 5 self care patients....._____
   100

9. a. Total Care for one intensive care patient....._____
   b. Total Care for one self care patient....._____
   100

10. a. Morning Care for 5 intensive care patients....._____
    b. Total Care for one intermediate care patient....._____
    100

11. a. Medications for 5 self care patients....._____
    b. Total Care for one self care patient....._____
    100

12. a. Morning Care for 5 intermediate care patients....._____
    b. Treatments for 5 intensive care patients....._____
    100

13. a. Medications for 5 self care patients....._____
    b. Morning Care for 5 intermediate care patients....._____
    100

14. a. Medications for 5 intermediate care patients....._____
    b. Treatments for 5 self care patients....._____
    100

15. a. Treatments for 5 intermediate care patients....._____
    b. Medications for 5 self care patients....._____
    100

16. a. Treatments for 5 intensive care patients....._____
    b. Afternoon Care for 5 intensive care patients....._____
    100

17. a. Medications for 5 self care patients....._____
    b. Morning Care for 5 intensive care patients....._____
    100

18. a. Morning Care for 5 self care patients....._____
    b. Afternoon Care for 5 intensive care patients....._____
    100

19. a. Total Care for one intermediate care patient....._____
    b. Afternoon Care for 5 intermediate care patients....._____
    100

20. a. Medications for 5 intensive care patients....._____
    b. Total Care for one intensive care patient....._____
    100

21. a. Afternoon Care for 5 self care patients....._____
    b. Afternoon Care for 5 intermediate care patients....._____
    100

22. a. Treatments for 5 self care patients....._____
    b. Morning Care for 5 self care patients....._____
    100

23. a. Treatments for 5 intensive care patients....._____
    b. Treatments for 5 self care patients....._____
    100

24. a. Medications for 5 intermediate care patients....._____
    b. Morning Care for 5 self care patients....._____
    100

25. a. Morning Care for 5 intensive care patients....._____
    b. Treatments for 5 intensive care patients....._____
    100

26. a. Total Care for one self care patient....._____
    b. Total Care for one intermediate care patient....._____
    100

27. a. Afternoon Care for 5 intermediate care patients....._____
    b. Afternoon Care for 5 intensive care patients....._____
    100

28. a. Total Care for one intermediate care patient....._____
    b. Medications for 5 self care patients....._____
    100

29. a. Medications for 5 intermediate care patients....._____
    b. Total Care for one self care patient....._____
    100

30. a. Afternoon Care for 5 intensive care patients....._____
    b. Medications for 5 intermediate care patients....._____
    100

31. a. Treatments for 5 self care patients....._____
    b. Morning Care for 5 intermediate care patients....._____
    100

32. a. Treatments for 5 intermediate care patients....._____
    b. Total Care for one intensive care patient....._____
    100

33. a. Total Care for one intermediate care patient....._____
    b. Treatments for 5 intensive care patients....._____
    100

34. a. Morning Care for 5 intermediate care patients....._____
    b. Medications for 5 intensive care patients....._____
    100

35. a. Medications for 5 intensive care patients....._____
    b. Treatments for 5 intensive care patients....._____
    100

36. a. Medications for 5 self care patients....._____
    b. Medications for 5 intermediate care patients....._____
    100

37. a. Afternoon Care for 5 self care patients....._____
    b. Morning Care for 5 intermediate care patients....._____
    100

38. a. Morning Care for 5 self care patients.....
    b. Treatments for 5 intensive care patients.....
    100

39. a. Afternoon Care for 5 self care patients.....
    b. Morning Care for 5 intensive care patients.....
    100

40. a. Afternoon Care for 5 intensive care patients.....
    b. Total Care for one intensive care patient.....
    100

41. a. Total Care for one intermediate care patient.....
    b. Morning Care for 5 self care patients.....
    100

42. a. Treatments for 5 intensive care patients.....
    b. Treatments for 5 intermediate care patients.....
    100

43. a. Afternoon Care for 5 intensive care patients.....
    b. Morning Care for 5 intensive care patients.....
    100

44. a. Afternoon Care for 5 self care patients.....
    b. Medications for 5 intensive care patients.....
    100

45. a. Medications for 5 self care patients.....
    b. Afternoon Care for 5 intensive care patients.....
    100

46. a. Morning Care for 5 self care patients.....
    b. Total Care for one self care patient.....
    100

47. a. Afternoon Care for 5 intermediate care patients.....
    b. Treatments for 5 self care patients.....
    100

48. a. Afternoon Care for 5 self care patients.....
    b. Treatments for 5 intermediate care patients.....
    100

49. a. Medications for 5 intensive care patients.....
    b. Total Care for one intermediate care patient.....
    100

50. a. Afternoon Care for 5 intermediate care patients.....
    b. Morning Care for 5 intensive care patients.....
    100

51. a. Morning Care for 5 self care patients.....
    b. Morning Care for 5 intensive care patients.....
    100

52. a. Afternoon Care for 5 intermediate care patients.....
    b. Morning Care for 5 intermediate care patients.....
    100

53. a. Medications for 5 self care patients.....
    b. Afternoon Care for 5 self care patients.....
    100

54. a. Treatments for 5 self care patients.....
    b. Total Care for one intensive care patient.....
    100

55. a. Treatments for 5 intermediate care patients.....
    b. Total Care for one self care patient.....
    100

56. a. Medications for 5 intensive care patients.....
    b. Afternoon Care for 5 intensive care patients.....
    100

57. a. Morning Care for 5 intermediate care patients.....
    b. Total Care for one intensive care patients.....
    100

58. a. Morning Care for 5 self care patients.....
    b. Afternoon Care for 5 self care patients.....
    100

59. a. Treatments for 5 intermediate care patients.....
    b. Morning Care for 5 self care patients.....
    100

60. a. Afternoon Care for 5 self care patients.....
    b. Medications for 5 intermediate care patients.....
    100

61. a. Afternoon Care for 5 intensive care patients.....
    b. Total Care for one self care patient.....
    100

62. a. Afternoon Care for 5 self care patients.....
    b. Total Care for one intensive care patient.....
    100

63. a. Afternoon Care for 5 intensive care paients.....
    b. Treatments for 5 self care patients.....
    100

64. a. Afternoon Care for 5 intermediate care patients.....
    b. Medications for 5 self care patients.....
    100

65. a. Morning Care for 5 self care patients.....
    b. Medications for 5 intensive care patients.....
    100

66. a. Morning Care for 5 intensive care patients.....
    b. Total Care for one self care patient.....
    100

67. a. Treatments for 5 intermediate care patients.....
    b. Afternoon Care for 5 intensive care patients.....
    100

68. a. Medications for 5 self care patients.....
    b. Morning Care for 5 self care patients.....
    100

69. a. Afternoon Care for 5 self care patients.....
    b. Total Care for one self care patient.....
    100

70. a. Treatments for 5 intermediate care patients.....
    b. Afternoon Care for 5 intermediate care patients.....
    100

71. a. Medications for 5 self care patients.....
    b. Medications for 5 intensive care patients.....
    100

72. a. Afternoon Care for 5 self care patients.....
    b. Afternoon Care for 5 intensive care patients.....
    100

73. a. Morning Care for 5 self care patients.....
    b. Total Care for one intensive care patient.....
    100

74. a. Morning Care for 5 intensive care patients.....
    b. Medications for 5 intermediate care patients.....
    100

75. a. Treatments for 5 intensive care patients.....
    b. Afternoon Care for 5 intermediate care patients.....
    100

76. a. Afternoon Care for 5 intensive care patients.....
    b. Morning Care for 5 intermediate care patients.....
    100

77. a. Medications for 5 intensive care patients.....
    b. Total Care for one self care patient.....
    100.

78. a. Total Care for one intensive care patient.....
    b. Total Care for one intermediate care patient.....
    100

79. a. Morning Care for 5 intermediate care patients.....
    b. Medications for 5 intensive care patients.....
    100

80. a. Medications for 5 intermediate care patients.....
    b. Treatments for 5 intensive care patients.....
    100

81. a. Treatments for 5 intermediate care patients.....
    b. Total Care for one intermediate care patient.....
    100

82. a. Afternoon Care for 5 self care patients.....
    b. Treatments for 5 intensive care patients.....
    100

83. a. Medications for 5 intermediate care patients.....
    b. Medications for 5 intensive care patients.....
    100

84. a. Morning Care for 5 intensive care patients.....
    b. Morning Care for 5 intermediate care patients.....
    100

85. a. Treatments for 5 intensive care patients.....
    b. Total Care for one intensive care patient.....
    100

86. a. Medications for 5 intensive care patients.....
    b. Afternoon Care for 5 intermediate care patients.....
    100

87. a. Total Care for one self care patient.....
    b. Morning Care for 5 intermediate care patients.....
    100

88. a. Treatments for 5 intermediate care patients.....
    b. Medications for 5 intermediate care patients.....
    100

89. a. Morning Care for 5 intensive care patients.....
    b. Treatments for 5 self care patients.....
    100

90. a. Treatments for 5 intensive care patients....._____
b. Medications for 5 self care patients....._____
100

91. a. Total Care for one self care patient....._____
b. Afternoon Care for 5 intermediate care patients....._____
100

92. a. Treatments for 5 intermediate care patients....._____
b. Treatments for 5 self care patients....._____
100

93. a. Medications for 5 intensive care patients....._____
b. Morning Care for 5 intensive care patients....._____
100

94. a. Morning Care for 5 intermediate care patients....._____
b. Total Care for one intermediate care patient....._____
100

95. a. Treatments for 5 intermediate care patients....._____
b. Morning Care for 5 intermediate care patients....._____
100

96. a. Afternoon Care for 5 self care patients....._____
b. Total Care for one intermediate care patient....._____
100

97. a. Treatments for 5 self care patients....._____
b. Medications for 5 intensive care patients....._____
100

98. a. Total Care for one self care patient....._____
b. Treatments for 5 intensive care patients....._____
100

99. a. Total Care for one intensive care patient....._____
b. Medications for 5 self care patients....._____
100

100. a. Treatments for 5 self care patients....._____
b. Total Care for one self care patient....._____
100

101. a. Afternoon Care for 5 intermediate care patients....._____
b. Total Care for one intensive care patient....._____
100

102. a. Medications for 5 intermediate care patients....._____
b. Total Care for one intermediate care patient....._____
100

103. a. Treatments for 5 self care patients....._____
b. Medications for 5 self care patients....._____
100

104. a. Total Care for one intensive care patient....._____
b. Medications for 5 intermediate care patients....._____
100

105. a. Treatments for 5 self care patients....._____
b. Total Care for one intermediate care patient....._____
100

APPENDIX 6

The University of Michigan

Department of Industrial Engineering
Bureau of Hospital Administration

Nursing Assignment Questionnaire

QUESTIONNAIRE INSTRUCTION

PART II: INSTRUCTIONS

In PART II of the Nursing Assignment Questionnaire, you are asked to perform the same kind of task as you did in PART I. In PART II, however, the pairs will be comprised of hypothetical assignments rather than assignment elements. You are asked to compare the assignments in each pair and to divide 100 points between them according to how much more difficult is one assignment of the pair compared to the other. Each hypothetical assignment is represented by some combination of the assignment elements which were defined in the instructions for PART I. Before you begin PART II, please go back and review the Definitions.

Consider each assignment in PART II as a half day assignment. In some pairs, one or more elements in the assignments will be either morning or afternoon care, hence the half day period being referred to will be evident. For those pairs where no period is specified, just pick either the morning or afternoon in order to make your judgment.

Finally, you are reminded to report 2 hours overtime for your participation in these questionnairing sessions. Thank you.

APPENDIX 6

The University of Michigan

Department of Industrial Engineering
Bureau of Hospital Administration

Nursing Assignment Questionnaire

QUESTIONNAIRE INSTRUCTION

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Consider each assignment in PART II as a half day assignment. In some pairs, one or more elements in the assignments will be either morning or afternoon care, hence the half day period being referred to will be evident. For those pairs where no period is specified, just pick either the morning or afternoon in order to make your judgment.

Finally, you are reminded to report 2 hours overtime for your participation in these questionnairing sessions. Thank you.

APPENDIX 7

PART II QUESTIONNAIRE

1. a. Total care for three self care patients
   Total care for one intensive care patient....._____

   b. Medications for 5 intermediate care patients
   Medications for 10 intensive care patients....._____ 100

2. a. Afternoon care for 10 intermediate care patients
   Total care for five intermediate care patients....._____

   b. Medications for 15 intensive care patients
   Morning care for 10 intensive care patients
   Total care for one intensive care patient....._____ 100

3. a. Morning care for 5 self care patients
   Morning care for 15 intermediate care patients
   Morning care for 5 intensive care patients....._____

   b. Treatments for 10 intermediate care patients
   Morning care for 10 intermediate care patients....._____ 100

4. a. Medications for 10 self care patients
   Treatments for 5 self care patients
   Total care for one intensive care patient....._____

   b. Treatments for 10 intermediate care patients
   Morning care for 10 intermediate care patients....._____ 100

5. a. Medications for 5 intensive care patients
   Treatments for 5 intensive care patients
   Morning care for 5 intensive care patients....._____

   b. Medications for 5 self care patients
   Medications for 10 intermediate care patients....._____ 100

6. a. Morning care for 5 self care patients
   Morning care for 5 intermediate care patients....._____

   b. Medications for 10 self care patients
   Treatments for 5 self care patients
   Total care for one intensive care patient....._____ 100

Part II continued
Page 2

7. a. Medications for 15 intermediate care patients
Afternoon care for 10 intermediate care patients....._____

b. Medications for 5 intensive care patients
Treatments for 5 intensive care patients
Morning care for 5 intensive care patients....._____
100

8. a. Medications for 10 intermediate care patients
Total care for five intensive care patients....._____

b. Medications for 15 intermediate care patients
Afternoon care for 10 intermediate care patients....._____
100

9. a. Morning care for 5 self care patients
Morning care for 15 intermediate care patients
Morning care for 5 intensive care patients....._____

b. Total care for three intensive care patients....._____
100

10. a. Treatments for 10 intermediate care patients
Morning care for 10 intermediate care patients....._____

b. Medications for 15 intensive care patients
Morning care for 10 intensive care patients
Total care for one intensive care patient....._____
100

11. a. Treatments for 15 self care patients....._____

b. Total care for three intensive care patients....._____
100

12. a. Medications for 10 intermediate care patients
Total care for five intensive care patients....._____

b. Medications for 15 intermediate care patients....._____
100

13. a. Treatments for 15 self care patients....._____

b. Medications for 10 intermediate care patients
Total care for five intensive care patients....._____
100

14. a. Medications for 5 self care patients
Medications for 10 intermediate care patients....._____

b. Total care for three self care patients
Total care for one intensive care patient....._____
100

Part II continued
Page 3

15. a. Medications for 10 self care patients
Treatments for 5 self care patients
Total care for one intensive care patient....._____

b. Treatments for 15 self care patients....._____
100

16. a. Medications for 15 intermediate care patients....._____

b. Afternoon care for 10 intermediate care patients
Total care for five intermediate care patients....._____
100

17. a. Treatments for 15 self care patients....._____

b. Treatments for 10 intermediate care patients
Morning care for 10 intermediate care patients....._____
100

18. a. Medications for 15 intermediate care patients
Afternoon care for 10 intermediate care patients....._____

b. Afternoon care for 10 intermediate care patients
Total care for five intermediate care patients....._____
100

19. a. Medications for 15 intensive care patients
Morning care for 10 intensive care patients
Total care for one intensive care patient....._____

b. Medications for 5 intensive care patients
Treatments for 5 intensive care patients
Morning care for 5 intensive care patients....._____
100

20. a. Morning care for 5 self care patients
Morning care for 5 intermediate care patients....._____

b. Morning care for 5 self care patients
Morning care for 15 intermediate care patients
Morning care for 5 intensive care patients....._____
100

21. a. Medications for 5 intermediate care patients
Medications for 10 intensive care patients....._____

b. Medications for 5 intensive care patients
Treatments for 5 intensive care patients
Morning care for 5 intensive care patients....._____
100

Part II continued
Page 4

22. a. Total care for three self care patients
Total care for one intensive care patient....._____

b. Medications for 15 intermediate care patients
Afternoon care for 10 intermediate care patients....._____
100

23. a. Medications for 15 intermediate care patients....._____

b. Total care for three self care patients
Total care for one intensive care patient....._____
100

24. a. Medications for 5 self care patients
Medications for 10 intermediate care patients....._____

b. Medications for 15 intermediate care patients
Afternoon care for 10 intermediate care patients....._____
100

25. a. Treatments for 10 intermediate care patients
Morning care for 10 intermediate care patients....._____

b. Medications for 15 intermediate care patients....._____
100

26. a. Total care for three intensive care patients....._____

b. Medications for 15 intensive care patients
Morning care for 10 intensive care patients
Total care for one intensive care patient....._____
100

27. a. Medications for 5 intensive care patients
Treatments for 5 intensive care patients
Morning care for 5 intensive care patients....._____

b. Afternoon care for 10 intermediate care patients
Total care for five intermediate care patients....._____
100

28. a. Medications for 15 intensive care patients
Morning care for 10 intensive care patients
Total care for one intensive care patient....._____

b. Treatments for 15 self care patients....._____
100

29. a. Medications for 5 self care patients
Medications for 10 intermediate care patients....._____

b. Total care for three intensive care patients....._____
100

Part II continued
Page 5

30. a. Afternoon care for 10 intermediate care patients
Total care for five intermeidate care patients....._____

b. Medications for 5 self care patients
Medications for 10 intermediate care patients....._____
100

31. a. Total care for three self care patient
Total care for one intensive care patient....._____

b. Medications for 10 intermediate care patients
Total care for five intensive care patients....._____
100

32. a. Medications for 10 self care patients
Treatments for 5 self care patients
Total care for one intensive care patient....._____

b. Morning care for 5 self care patients
Morning care for 15 intermediate care patients
Morning care for 5 intensive care patients....._____
100

33. a. Medications for 15 intensive care patients
Morning care for 10 intensive care patients
Total care for one intensive care patient....._____

b. Medications for 15 intermediate care patients....._____
100

34. a. Medications for 10 intermediate care patients
Total care for five intensive care patients....._____

b. Medications for 5 self care patients
Medications for 10 intermediate care patients....._____
100

35. a. Morning care for 5 self care patients
Morning care for 5 intermediate care patients....._____

b. Medications for 15 intermediate care patients....._____
100

36. a. Treatments for 15 self care patients....._____

b. Medications for 5 self care patients
Medications for 10 intermediate care patients....._____
100

Part II continued
Page 6

37. a. Medications for 5 intermediate care patients
Medications for 10 intensive care patients....._____

b. Medications for 10 intermediate care patients
Total care for five intensive care patients....._____
100

38. a. Medications for 15 intermediate care patients
Afternoon care for 10 intermediate care patients....._____

b. Medications for 15 intermediate care patients....._____
100

39. a. Medications for 5 intermediate care patients
Medications for 10 intensive care patients....._____

b. Treatments for 10 intermediate care patients
Morning care for 10 intermediate care patients....._____
100

40. a. Afternoon care for 10 intermediate care patients
Total care for five intermediate care patients....._____

b. Morning care for 5 self care patients
Morning care for 15 intermediate care patients
Morning care for 5 intensive care patients....._____
100

41. a. Medications for 15 intensive care patients
Morning care for 10 intensive care patients
Total care for one intensive care patient....._____

b. Medications for 15 intermediate care patients
Afternoon care for 10 intermediate care patients....._____
100

42. a. Medications for 15 intermediate care patients....._____

b. Medications for 10 self care patients
Treatments for 5 self care patients
Total care for one intensive care pateint....._____
100

43. a. Afternoon care for 10 intermediate care patients
Total care for five intermediate care patients....._____

b. Treatments for 10 intermediate care patients
Morning care for 10 intermediate care patients....._____
100

Part II continued
Page 7

44. a. Medications for 5 intermediate care patients
Medications for 10 intensive care patients....._____

b. Morning care for 5 self care patients
Morning care for 5 intermediate care patients....._____
100

45. a. Treatments for 15 self care patients....._____

b. Afternoon care for 10 intermediate care patients
Total care for five intermediate care patients....._____
100

46. a. Medications for 15 intermediate care patients
Afternoon care for 10 intermediate care patients....._____

b. Total care for three intensive care patients....._____
100

47. a. Medications for 5 intensive care patients
Treatments for 5 intensive care patients
Morning care for 5 intensive care patients....._____

b. Total care for three self care patients
Total care for one intensive care patient....._____
100

48. a. Medications for 5 intermediate care patients
Medications for 10 intensive care patients....._____

b. Medications for 10 self care patients
Treatments for 5 self care patients
Total care for one intensive care patient....._____
100

49. a. Morning care for 5 self care patients
Morning care for 5 intermediate care patients....._____

b. Medications for 15 intensive care patients
Morning care for 10 intensive care patients
Total care for one intensive care patient....._____
100

50. a. Medications for 5 intensive care patients
Treatments for 5 intensive care patients
Morning care for 5 intensive care patients....._____

b. Treatments for 10 intermediate care patients
Morning care for 10 intermediate care patients....._____
100

Part II continued
Page 8

51. a. Medications for 15 intermediate care patients
Afternoon care for 10 intermediate care patients....._____

b. Treatments for 10 intermediate care patients..
Morning care for 10 intermediate care patients....._____
100

52. a. Medications for 5 intensive care patients
Treatments for 5 intensive care patients
Morning care for 5 intensive care patients....._____

b. Medications for 10 intermediate care patients
Total care for five intensive care patients....._____
100

53. a. Treatments for 15 self care patients....._____

b. Medications for 5 intermediate care patients
Medications for 10 intensive care patients....._____
100

54. a. Total care for three self care patients
Total care for one intensive care patient....._____

b. Morning care for 5 self care patients
Morning care for 15 intermediate care patients
Morning care for 5 intensive care patients....._____
100

55. a. Medications for 10 self care patients
Treatments for 5 self care patients
Total care for one intensive care patient....._____

b. Total care for three intensive care patients....._____
100

56. a. Morning care for 5 self care patients
Morning care for 5 intermediate care patients....._____

b. Afternoon care for 10 intermediate care patients
Total care for five intermediate care patients....._____
100

Part II continued
Page 9

57. a. Medications for 10 intermediate care patients
Total care for five intensive care patients.....

b. Morning care for 5 self care patients
Morning care for 15 intermediate care patients
Morning care for 5 intensive care patients.....
100

58. a. Medications for 15 intermediate care patients
Afternoon care for 10 intermediate care patients.....

b. Medications for 5 intermediate care patients
Medications for 10 intensive care patients.....
100

59. a. Medications for 10 self care patients
Treatments for 5 self care patients
Total care for one intensive care patient.....

b. Medications for 15 intermediate care patients
Afternoon care for 10 intermediate care patients.....
100

60. a. Medications for 5 intermediate care patients
Medications for 10 intensive care patients.....

b. Medications for 5 self care patients
Medications for 10 intermediate care patients.....
100

61. a. Afternoon care for 10 intermediate care patients
Total care for five intermediate care patients.....

b. Total care for three intensive care patients.....
100

62. a. Medications for 5 intermediate care patients
Medications for 10 intensive care patients.....

b. Morning care for 5 self care patients
Morning care for 15 intermediate care patients
Morning care for 5 intensive care patients.....
100

63. a. Afternoon care for 10 intermediate care patients
Total care for five intermediate care patients.....

b. Total care for three self care patients
Total care for one intensive care patient.....
100

Part II continued
Page 10

64. a. Medications for 5 intensive care patients
Treatments for 5 intensive care patients
Morning care for 5 intensive care patients....._____

b. Treatments for 15 self care patients....._____
100

65. a. Medications for 15 intermediate care patients
Afternoon care for 10 intermediate care patients....._____

b. Morning care for 5 self care patients
Morning care for 5 intermediate care patients....._____
100

66. a. Treatments for 10 intermediate care patients
Morning care for 10 intermediate care patients....._____

b. Total care for three intensive care patients....._____
100

67. a. Medications for 10 self care patients
Treatments for 5 self care patients
Total care for one intensive care patient....._____

b. Afternoon care for 10 intermediate care patients
Total care for five intermediate care patients....._____
100

68. a. Treatments for 15 self care patients....._____

b. Medications for 15 intermediate care patients
Afternoon care for 10 intermediate care patients....._____
100

69. a. Medications for 5 intermediate care patients
Medications for 10 intensive care patients....._____

b. Total care for three intensive care patients....._____
100

70. a. Medications for 10 self care patients
Treatments for 5 self care patients
Total care for one intensive care patient....._____

b. Medications for 5 intensive care patients
Treatments for 5 intensive care patients
Morning care for 5 intensive care patients....._____
100

Part II continued
Page 11

71. a. Treatments for 15 self care patients....._____

b. Morning care for 5 self care patients
Morning care for 5 intermediate care patients....._____
100

72. a. Medications for 5 intermediate care patients
Medications for 10 intensive care patients....._____

b. Afternoon care for 10 intermediate care patients
Total care for 5 intermediate care patients....._____
100

73. a. Medications for 15 intermediate care patients
Afternoon care for 10 intermediate care patients....._____

b. Morning care for 5 self care patients
Morning care for 15 intermediate care patients
Morning care for 5 intensive care patients....._____
100

74. a. Treatments for 10 intermediate care patients
Morning care for 10 intermediate care patients....._____

b. Medications for 5 self care patients
Medications for 10 intermediate care patients....._____
100

75. a. Medications for 15 intermediate care patients....._____

b. Medications for 5 intensive care patients
Treatments for 5 intensive care patients
Morning care for 5 intensive care patients....._____
100

76. a. Afternoon care for 10 intermediate care patients
Total care for 5 intermediate care patients....._____

b. Medications for 10 intermediate care patients
Total care for five intensive care patients....._____
100

77. a. Morning care for 5 self care patients
Morning care for 5 intermediate care patients....._____

b. Total care for three intensive care patients....._____
100

78. a. Morning care for 5 self care patients
Morning care for 15 intermediate care patients
Morning care for 5 intensive care patients....._____

b. Medications for 15 intensive care patients
Morning care for 10 intensive care patients
Total care for one intensive care patient....._____
100

Part II continued
Page 12

79. a. Medications for 10 intermediate care patients
Total care for five intensive care patients....._____

b. Morning care for 5 self care patients
Morning care for 5 intermediate care patients....._____
100

80. a. Medications for 5 self care patients
Medications for 10 intermediate care patients....._____

b. Medications for 15 intermediate care patients....._____
100

81. a. Medications for 10 self care patients
Treatments for 5 self care patients
Total care for one intensive care patient....._____

b. Medications for 15 intensive care patients
Morning care for 10 intensive care patients
Total care for one intensive care patient....._____
100

82. a. Medications for 5 intermediate care patients
Medications for 10 intensive care patients....._____

b. Medications for 15 intermediate care patients....._____
100

83. a. Medications for 5 self care patients
Medications for 10 intermediate care patients....._____

b. Morning care for 5 self care patients
Morning care for 5 intermediate care patients....._____
100

84. a. Treatments for 10 intermediate care patients
Morning care for 10 intermediate care patients....._____

b. Medications for 10 intermediate care patients
Total care for five intensive care patients....._____
100

85. a. Medications for 15 intermediate care patients....._____

b. Morning care for 5 self care patients
Morning care for 15 intermediate care patients
Morning care for 5 intensive care patients....._____
100

Part II continued
Page 13

86. a. Morning care for 5 self care patients
Morning care for 5 intermediate care patients....._____

b. Medications for 5 intensive care patients
Treatments for 5 intensive care patients
Morning care for 5 intensive care patients....._____
100

87. a. Total care for three intensive care patinets....._____

b. Medications for 10 intermediate care patients
Total care for five intensive care patients....._____
100

88. a. Medications for 10 self care patients
Treatments for 5 self care patients.
Total care for one intensive care patient....._____

b. Medications for 5 self care patients
Medications for 10 intermediate care patients....._____
100

89. a. Treatments for 10 intermediate care patients
Morning care for 10 intermediate care patients....._____

b. Total care for three self care patients
Total care for one intensive care patient....._____
100

90. a. Medications for 15 intermediate care patients....._____

b. Treatments for 15 self care patients....._____
100

91. a. Total care for three intensive care patients....._____

b. Medications for 5 intensive care patients
Treatments for 5 intensive care patients
Morning care for 5 intensive care patients....._____
100

92. a. Medications for 10 self care patients
Treatments for 5 self care patients
Total care for one intensive care patient....._____

b. Total care for three self care patients
Total care for one intensive care patient....._____
100

Part II continued
Page 14

93. a. Morning care for 5 self care patients
Morning care for 5 intermediate care patients.....

b. Treatments for 10 intermediate care patients
Morning care for 10 intermediate care patients.....
100

94. a. Medications for 10 intermediate care patients
Total care for five intensive care patients.....

b. Medications for 15 intensive care patients
Morning care for 10 intensive care patients
Total care for one intensive care patient.....
100

95. a. Medications for 10 self care patients
Treatments for 5 self care patients
Total care for one intensive care patient.....

b. Medications for 10 intermediate care patients
Total care for five intensive care patients.....
100

96. a. Medications for 5 intermediate care patients
Medications for 10 intensive care patients.....

b. Medications for 15 intensive care patients
Morning care for 10 intensive care patients
Total care for one intensive care patient.....
100

97. a. Total Care for three self care patients
Total care for one intensive care patient.....

b. Morning care for 5 self care patients
Morning care for 5 intermediate care patients.....
100

98. a. Total care for three intensive care patients.....

b. Medications for 15 intermediate care patients.....
100

99. a. Morning care for 5 self care patients
Morning care for 15 intermediate care patients
Morning care for 5 intensive care patients.....

b. Treatments for 15 self care patients.....
100

Part II continued
Page 15

100. a. Total care for three self care patients
Total care for one intensive care patient....._____

b. Total care for three intensive care patients....._____
100

101. a. Medications for 5 intensive care patients
Treatments for 5 intensive care patients
Morning care for 5 intensive care patients....._____

b. Morning care for 5 self care patients
Morning care for 15 intermediate care patients
Morning care for 5 intensive care patients....._____
100

102. a. Medications for 5 self care patients
Medications for 10 intermediate care patients....._____

b. Medications for 15 intensive care patients
Morning care for 10 intensive care patients
Total care for one intensive care patient....._____
100

103. a. Total care for three self care patients
Total care for one intensive care patient....._____

b. Treatments for 15 self care patients....._____
100

104. a. Morning care for 5 self care patients
Morning care for 15 intermediate care patients
Morning care for 5 intensive care patients....._____

b. Medications for 5 self care patients
Medications for 10 intermediate care patients....._____
100

105. a. Total care for three self care patients
Total care for one intensive care patient....._____

b. Medications for 15 intensive care patients
Morning care for 10 intensive care patients
Total care for one intensive care patient....._____
100

APPENDIX 8

ANALYSIS PROCEDURE - CONSTANT SUM QUESTIONNAIRE

Analysis of the constant sum questionnaires (Part I and Part II) will be accomplished by an adaption of the method first used by Comery[1] and, subsequently, by others.[2,3] The adaptation allows the possibility of fallible data, and is presented in Torgerson.[4] The analysis provides a scale value for each of the stimuli on the dimension of interest. Briefly, the analysis determines those values for the set of long S_j for which

$$Q = \sum_{j=1}^{n} \sum_{k=1}^{n} \left(\log W''_{jk} - \log W'_{jk} \right)^2$$

is a minimum. In the above expression

S_j = true scale value of stimulus j.

S'_j = estimated scale value of stimulus j.

$W''_{jk} = \log S'_k - \log S'_j$ (derived value)

$W'_{jk} = \log S_k - \log S_j$ (observed value)

Hence, the objective of the estimation procedure is to minimize the difference between the derived and observed values of $\log W_{jk}$.

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[1]Comery, A. L., "A Proposed Method for Absolute Ratio Scaling," Psychometrika, 15, 1950, 317-325.

[2]Guilford, Psychometric Methods, Second Edition, McGraw-Hill, New York, 1954.

[3]Baker, K. E., and Dudek, F. J., "Weight Scales from Ratio Judgments and Comparisons of Existent Weight Scales," Journal of Experimental Psychology, 50, 1955, 293-308.

[4]Torgerson, W. S., Theory and Methods of Scaling, John Wiley and Sons, New York, 1958.

Torgerson states that for Comery's procedure, "demonstration of independence of the scale of the particular set of stimuli used would require additional experimentation."[5] He goes on to point out, however, that any disagreement between the additional results from a second experiment (re: equisection methods) and the results of the original experiment might just as easily be attributable to the lack of ability to make valid judgments of sense distances. Hence, we would most likely retain the Comery scale "and consider the equisection results to be inappropriate."[6] Torgerson goes on to point out that since no statistical test for the goodness of fit has yet been devised,

> The experimenter's own judgment must be used to determine whether the fit of the computed ratios to the observed ratios is adequate. Assuming a close agreement between the theory and data, it is clear that the second test is satisfied in at least a preliminary way. For, if the n(n-1)/2 independent observed ratios can be reproduced from n scale values it is reasonable to conclude that the scale is independent of any particular ratio."[7]

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[5] Ibid., p. 116.

[6] Ibid., p. 116.

[7] Ibid., p. 116.

APPENDIX 9

DATA ANALYSIS PROCEDURE - CATEGORICAL JUDGMENT

Analysis: In this task, the stimuli are hypothetical assignments represented by various combinations of assignment elements and number of patients associated with each element. It is desired to obtain scale values for each stimulus.

The basic equation set for categorical judgment, based on Thurstone's general judgment model,[1] is:

$$t_g - S_j = X_{jg} \left(J_j^2 + J_g^2 - 2r_{jg}J_jJ_j\right)^{1/2}$$

for: $j = 1, 2, \ldots n$ (n = no. of stimuli)

$g = 1, 2, \ldots m$ ($m + 1$ = no. of categories)

where:

t_g = mean location of t^{th} category boundary

J_g = dispersion of g^{th} category boundary

S_j = scale value of stimulus (or assignment) J.

J_j = discriminal dispersion of stimulus j and category boundary g.

r_{jg} = correlation between momentary positions of stimulus j and category boundary g

X_{jg} = unit normal deviate corresponding to the proportion of times stimulus j is sorted below boundary g

Assumptions: In analysis of the data, we assume J_j = constant, J_g = constant and r_{jg} is constant for all values of j and g (or

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[1] Thurstone, L. L., "A Law of Comparative Judgment," Psychological Review, 34, 1927, 273-286.

equivalently, the value under the radical in the above equation is constant). This set of assumptions (referred to as "condition D") is consistent with the experimental technique used, and provides estimates not only of the stimuli scale values but also the values of each category boundary.

With this method of analysis, the average absolute discrepancy between the derived or fitted proportions p''_{jg} and the observed proportion p'_{jg} is taken as an evaluation of the goodness of fit of the model to the data. This difference can be expressed as

$$p''_{jg} - p'_{jg} = \frac{1}{mn} \sum_{J=1}^{n} \sum_{g=1}^{n} p''_{jg} - p'_{jg}$$

Torgerson notes that an additional check on the model can be obtained by plotting rows against rows and columns against columns. "Systematic departures from linearity would indicate that the assumptions underlying the procedure used have not been met."[2]

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[2]Torgerson, W. S., Theory and Methods of Scaling, John Wiley and Sons, 1958, p. 241.

THE UNIVERSITY OF MICHIGAN

NURSING UTILIZATION STUDY

UNIVERSITY HOSPITAL

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