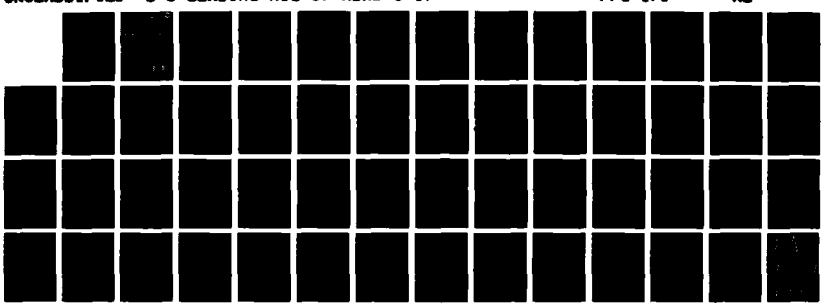
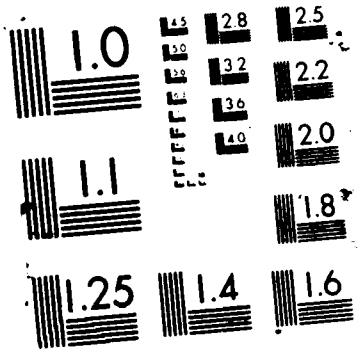
AD-A185 883 A HISTORY OF THE DEVELOPMENT OF THE NAVY MEDICAL DEPARTMENT'S WORKLOAD MANAGEMENT SYSTEM FOR NURSING(U) NAVAL SCHOOL OF HEALTH SCIENCES BETHESDA MD S B LENSING AUG 87 NSHS-5-87 1/1

UNCLASSIFIED F/G 5/9 NL




1.0
1.1
1.25
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.8
1.4
1.6

Naval School of Health Sciences

Research Department
Bethesda, MD 20814 - 50033 Report 5-87 August 1987

A History of the Development of the Navy Medical Department's Workload Management System for Nursing

LCDR Susan B. Lensing, NC, USN

Unclassified
SECURITY CLASSIFICATION OF THIS PAGE

A185 803

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION: Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT: Unlimited
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S): 5-87	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION: Naval School of Health Sciences; 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION: Health Sciences Education and Training Command
6c. ADDRESS (City, State, and ZIP Code): Bethesda, MD 20814-5033	7b. ADDRESS (City, State, and ZIP Code): Naval Medical Command, National Capital Region, Bethesda, MD 20814-5022
8a. NAME OF FUNDING/SPONSORING ORGANIZATION: Health Sciences Education and Training Command; 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code): Naval Medical Command, National Capital Region, Bethesda, MD 20814-5022	10. SOURCE OF FUNDING NUMBERS: PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO

11. TITLE (Include Security Classification)
A History of the Development of the Navy Medical Department's Workload Management System for Nursing

12. PERSONAL AUTHOR(S)
LCDR Susan B. Lensing, NC, USN

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
final	FROM Jan 1987 TO Aug 1987	August 1987	47

16. SUPPLEMENTARY NOTATION

17. COSATI CODES		
FIELD	GROUP	SUB-GROUP
05	09	

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
Patient Classification; Staffing; Nursing Workload; Nursing; Medical Personnel

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

SEE REVERSE SIDE

DTIC COPY INSPECTED 1

DTIC TAB ☐
Unannounced ☐
Justification
By
Distribution/
Availability Codes
Dist | Avail and/or Special
A-1

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT: ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION: Unclassified
22a. NAME OF RESPONSIBLE INDIVIDUAL: LCDR Susan Lensing, NC, USN	22b. TELEPHONE (Include Area Code) 22c. OFFICE SYMBOL: 295-1467

DD FORM 1473, 84 MAR — 83 APR edition may be used until exhausted. All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE

The need to objectively quantify nursing workload has led to numerous interdisciplinary studies of nurse staffing methodologies. This report provides a historical review of nurse staffing as a management function and describes patient classification, a concept underlying many staffing methodologies. A chronological history and analysis of the nurse staffing research conducted by the Naval School of Health Sciences, Bethesda, Maryland, is then presented.

In 1978 the Navy Medical Department initiated a pilot study of nursing workload by testing and modifying the assignment-element-difficulty staffing methodology. A patient classification methodology was incorporated in the Navy's staffing research when classification emerged as a prominent component of civilian nurse staffing systems. In 1983 the results of the Navy Medical Department studies were merged with nurse staffing research conducted by the US Army Health Care Studies and Clinical Investigation Activity, Fort Sam Houston, Texas. The culmination of the combined Army-Navy studies is the Workload Management System for Nursing (WMSN), a patient classification system and daily staffing allocation methodology.

In 1984 an earlier version of the WMSN was evaluated in six Naval Hospitals and at Walter Reed Army Medical Center. Following the evaluation studies, a Total Nursing Care Hours Model was developed that used indirect care percentages determined by additional Army research. The model was the basis for the revised staffing allocation tables published in the most recent WMSN Manual.

The report ends with the implementation of the revised WMSN in 34 Naval Hospitals and 50 Army Hospitals. A second report will describe the WMSN's transition from a research study to an operational system.

A HISTORY OF THE DEVELOPMENT OF THE NAVY MEDICAL DEPARTMENT'S WORKLOAD MANAGEMENT SYSTEM FOR NURSING

Report 5-87

August 1987

LCDR Susan B. Lensing, NC, USN
Workload Management System for Nursing Project Officer
Naval School of Health Sciences
Bethesda, MD 20814-5033

The views expressed in this report are those of the author. No endorsement by the Department of the Navy has been given or should be inferred.

Acknowledgment: Grateful appreciation is extended to CDR Carolyn S. Warren, NC, USN, CDR James M. LaRocco, MSC, USN, and Barbara J. Bradley for their helpful suggestions in revising earlier drafts of this paper.

EXECUTIVE SUMMARY

The need to objectively quantify nursing workload has led to numerous interdisciplinary studies of nurse staffing methodologies. This report provides a historical review of nurse staffing as a management function and describes patient classification, a concept underlying many staffing methodologies. A chronological history and analysis of the nurse staffing research conducted by the Naval School of Health Sciences, Bethesda, Maryland, is then presented.

In 1978 the Navy Medical Department initiated a pilot study of nursing workload by testing and modifying the assignment-element-difficulty staffing methodology. A patient classification methodology was incorporated in the Navy's staffing research when classification emerged as a prominent component of civilian nurse staffing systems. In 1983 the results of the Navy Medical Department studies were merged with nurse staffing research conducted by the US Army Health Care Studies and Clinical Investigation Activity, Fort Sam Houston, Texas. The culmination of the combined Army-Navy studies is the Workload Management System for Nursing (WMSN), a patient classification system and daily staffing allocation methodology.

In 1984 an earlier version of the WMSN was evaluated in six Naval Hospitals and at Walter Reed Army Medical Center. Following the evaluation studies, a Total Nursing Care Hours Model was developed that used indirect care percentages determined by additional Army research. The model was the basis for the revised staffing allocation tables published in the most recent WMSN Manual.

The report ends with the implementation of the revised WMSN in 34 Naval Hospitals and 50 Army Hospitals. A second report will describe the WMSN's transition from a research study to an operational system.

A History of the Navy Medical Department's Workload Management System for Nursing

Planning for the delivery of direct nursing care to a diverse patient population is one of the more essential management functions for a nursing department. The discernible and readily defined product of these services is the nursing care given to each patient. Planning includes defining necessary care in observable quantities, estimating the demand on a daily basis, and then developing a work schedule that gives the appropriate type and number of personnel needed to deliver the service. In addition, concern for the quality of the care requires that explicit criteria be developed to document nursing activities and performance outcomes.

The title frequently given to a nurse manager's planning function is "nurse staffing" (Hanson, 1983; Lewis and Carini, 1984). Because of scarce resources and oversight by outside agencies, nurse staffing requires an efficient and rational methodology. Young, Giovannetti, Lewison, and Thomas (1981) offer the following comprehensive definition of a staffing methodology that incorporates many of the components of planning for direct nursing care:

> The term staffing methodology implies a formal mechanism or systematic procedures used to determine the number and mix of nursing personnel that are required to provide a

predetermined standard of quality care to a specified patient population. Staffing methodologies usually encompass an integrated process of assessment and classification of patients; allocation, assignment and scheduling of nursing personnel; and an evaluation or monitoring of services rendered (p. 13).

The above definition describes only part of the complex issue of staffing. Because future events are unpredictable, an administrator cannot fully know the amount of resources necessary over the short or long term. Since resource decisions must be made with incomplete data, a number of staffing methods have been used in an attempt to predict and provide for future uncertainty. Furthermore, a staffing system developed for use in one hospital cannot readily be transported to another hospital. Differences found in management styles, staffing standards, architecture, and variations in the delivery of support services such as housekeeping, pharmacy, or respiratory therapy, can affect nurse staffing unless these elements are standardized or accounted for by some other means. The issue of nurse staffing is further complicated in a worldwide system, such as the Navy health care system, that must have a central plan for allocating resources to over one hundred shore-based treatment facilities, as well as for supporting the health care requirements of the fleet.

A decade ago the Navy Medical Department recognized that planning for the use of nursing resources needed improvement. Montgomery and Langley (1978) stated that

> The requirements of the Medical Department in the areas of planning, programming, budgeting, and accountability for the quality of patient care, the efficient utilization of resources and the cost effectiveness of the Navy Health Care System are not adequately supported by current [nurse staffing] methodologies (p. 6).

With this realization, the first of several Navy Medical Department research studies designed to quantify workload on nursing units and relate the workload both to staffing and to the quality of patient care was initiated. Traditional measures used to determine the requirements for long-term nurse staffing (billets or positions) for Naval Hospitals were "average daily patient load" or "occupied bed days." Yet, these parameters did not adequately predict staffing requirements for either a short-term shift-by-shift basis or a long-term program planning basis.

In 1978 health services researchers assigned to the Naval School of Health Sciences (NSHS), Bethesda, Maryland, proposed that a research study be undertaken to develop a staffing

system that would both predict resource requirements and allocate the available personnel based on quality-related workload measures.[1] The research ultimately led to a system called the Workload Management System for Nursing (WMSN). The current WMSN is a practical, valid, and reliable patient classification system and staffing allocation methodology in use in 36 Navy and 50 Army inpatient health care facilities.

During the development of the WMSN, Navy Nursing Department planners realized that data available from a standardized Navy-wide system used for daily staffing assignments within each facility could also be useful as a management information system to reallocate billets (nursing positions) across facilities. Navy-wide use could only be effected, however, if the variability across facilities could be taken into account by using a methodology that would measure nursing workload objectively. Then, as Army and Navy researchers combined efforts to produce a model that both services could use, researchers discussed the possibility of a military-wide system. Nurse staffing and workload data that were comparable across all military services, might be valuable in substantiating change in the requirements for total military nursing billets for the Department of Defense. Thus, even during the developmental research of the WMSN, the staffing model was envisioned as a military-wide system that would permit comparison of nursing workload across military services.

Many events went into the development of the system, but no single source of information reviews the entire developmental effort. This report will provide a historical analysis of military nurse staffing research and relate the development to studies undertaken in the civilian sector to find an objective measure of nursing workload. The report will then describe the melding of Army and Navy research that resulted in the Workload Management System for Nursing. A future paper will build on this information to describe the transition of the Navy's WMSN from research and development into an ongoing operational staffing system and offer suggestions for future evolutions of the system.

Historical Analysis of Nurse Staffing

During the 1970's, the Division of Nursing of the Department of Health, Education, and Welfare, (currently part of the Department of Health and Human Services) sponsored several studies to improve understanding of nurse staffing. These studies were undertaken at the behest of nurse administrators nationwide who were spending a significant portion of their time performing the staffing function. The lack of knowledge at that time about how to provide optimal staffing for patient care was further complicated by a critical

shortage of nurses (Aydelotte, 1973a). In one of the initial studies, Aydelotte reviewed over 1,000 methodological studies that appeared in the literature prior to 1973 and wrote detailed critiques of almost 200 of the major studies (Aydelotte, 1973b). She created a taxonomy that categorized staffing systems into four major classes: descriptive, industrial engineering, management engineering, and operations research.

The four classes represent diverse methodological approaches to measuring workload and quantifying staffing requirements. The ordering of the above categories represents an increase in both logic and theoretical abstraction. Descriptive methodologies gather data on many variables but result in a subjective assessment of staffing needs based on expert opinion and experience to derive nursing hours per patient day. A study by Levine, Siegel, and De La Puente (1961) provides a historical, but comprehensive, example of the use of descriptive staffing methods. Industrial engineering methodologies use work measurement techniques such as work sampling, time and motion studies, work distribution, and analysis of a task or function. Research conducted by Connor (1961) exemplifies nurse staffing models based on industrial engineering techniques. Management engineering studies use work measurement techniques and systems analysis to develop staffing models. The WMSN is based on management engineering.

Operations research procedures represent the most conceptually abstract technique for developing staffing systems. These techniques consist of complex mathematical models developed to represent real-life situations that involve determining the most efficient assignment of nursing personnel (Render and Stair, 1982). An efficient assignment will allocate the minimum number of personnel that gives the maximum quantity of patient care. The result is an equation that defines optimal staffing based on predefined standards for personnel categories and patient care requirements. The assignment-element-difficulty staffing model, the first model tested by Navy Medical Department researchers, was based on an operations research methodology.

Of the four general approaches to measuring nurse staffing, the operations research and descriptive methodologies were prevalent during the 1960's and 1970's, while the management engineering method has dominated staffing research studies over the last five years. According to Halloran and Vermeersch (1987), management engineering "allows a concept of nursing [measurement] meaningful to both nurses and administrators, has a clear and consistently applied protocol and produces a solution easily implemented" (p. 30).

Staffing studies conducted by the researchers at NSHS took place in two distinct phases, which also reflected the evolution nurse staffing research conducted in the civilian

sector. During the initial phase, which occurred between 1977 and 1982, the operations research methodology was used to determine staffing equations that would optimize resource allocation based on a given constraint (the actual number of staff billets assigned to a ward or unit). This technique was viewed as an objective method that would replace the use of the descriptive methods used by Naval Hospitals to plan nurse staffing. The second stage of the staffing research (1982 to 1985) used the management engineering methodology.

The studies conducted in both research phases relied on the concept of patient classification to develop a system that would quantify workload data in terms of actual patient requirements for nursing care. These workload variables (classes of patients categorized according to the amount or complexity of nursing care) were then used as parameters for the nurse staffing models. The review that follows will first discuss patient classification, a concept underlying many staffing methodologies, then describe the development of the initial nurse staffing model developed by Navy researchers using the assignment-element-difficulty technique, an operations research methodology. Finally, the paper will focus on the development of the current Workload Management System for Nursing that was based on a management engineering research model.

Patient Classification

Although patient classification is frequently referred to as a staffing methodology, the concept is not readily incorporated into the taxonomy created by Aydelotte (1973b). Instead, it is a process that underlies the basic premises for several methodologies subsumed by Aydelotte's taxonomy. The process is founded on two assumptions. Initially, it assumes that nursing workload can be quantified as discrete nursing care activities (also referred to as patient care requirements); second, the process assumes that patients can be classified into categories based on a description of their nursing care needs. The patient classification process results in data subsequently used by staffing requirements models. The number of staff needed to perform the workload is, therefore, based on the number and/or complexity of discrete nursing care activities.

Since the late 1970's the major component of a nurse staffing model subscribed to by the Joint Commission on Accreditation of Hospitals (JCAH) is a patient classification system. The JCAH interpretation of the Nursing Services Standard III states:

> The major components of a staffing system for determining patient care requirements shall include categories of

nursing personnel, a patient classification system, unit geography, methods of patient care delivery, and the availability of support services. The nursing department/service must define, implement, and maintain a system that relates patient care needs to staffing determinations for each nursing unit (Rzasa, 1983; pp. 68-69).

As a result of the JCAH standard, the terms "patient classification" and "workload analysis" have become buzzwords in nursing management literature. Although the Nursing Service Standard III directs that several of the variables categorized by Young et al. (1981) be incorporated into nurse staffing systems, the focal point for the implementation of this standard appears to be the need for a valid and reliable patient classification system. The methodology used to develop a patient classification system may account for several of the factors mentioned in the JCAH standard.

Abdellah and Levine (1979) identify two major types of classification systems, a "prototype evaluation" system and a "factor evaluation" system. Giovannetti reports that the primary difference between these systems occurs in the design of the classification instrument:

> The first generally describes the characteristics of patients typical to each category. In the second (and more common) type a number of critical indicators or descriptors of direct care requirements are separately rated and then combined to designate a patient's category. The two types are also respectively referred to as "subjective" (prototype evaluation) and "objective" (factor evaluation) instruments. This terminology is misleading, however, because some measure of subjectivity is inevitably involved in any assessment of patients' nursing care requirements (Giovannetti, 1979, p. 5).

The basis for many of the patient classification systems that differentiate individual patient's nursing requirements dates back to the work done by R.J. Connor in the late 1950's and early 1960's at Johns Hopkins Hospital. Connor used industrial engineering techniques, such as work sampling, time and motion studies, and continuous observation, to time actual elements of nursing care. These times then became the basis for classifying patients into three groups (Connor, 1961). Other methods can be used to form the basis for classification, including questionnaires, self-report, expert opinion, plus a combination of these. Because of their subjectivity, however, patient classification systems based on these latter data

gathering techniques lack the methodological consistency that is available with industrial engineering procedures (Aydelotte, 1973b).

In addition to the studies supported by the Department of Health, Education, and Welfare, several comprehensive sources describe the conceptual development of the classification approach to staffing and provide examples of currently existing systems (Lewis and Carini, 1984; Shaffer, 1986). A bibliography of patient classification literature published prior to 1983 has been summarized by Cuthert (1983).

In the military the seminal work on patient classification and nursing workload can be found in the research performed by Claussen (1955). Army Medical Department researchers initiated the development of a system in 1951 that would categorize patients based on their individual nursing care needs. The classification scheme was based on four patient care categories described by Claussen as intensive nursing care, moderate care, minimal care, and supportive care.

Claussen also identified four patient factors that were thought to have the greatest influence on nursing workload, including physical restriction, nursing procedures, instructional needs, and emotional needs. These factors were used in the descriptions of the representative patient for each of the four patient classification categories. Unfortunately, the method used to determine how these factors affected

workload was not reported.

In order to validate Claussen's approach, patient classification data were collected for one year at the U.S. Army Hospital, Fort Belvoir, Virginia. Patients were divided into two major groups: active duty and dependents of active duty or retired personnel. Claussen's data showed an appreciable difference in the length of stay between the two major groups and a difference in the amount of nursing care provided. For the same six-month period, the average amount of nursing care per patient day for dependents was four hours with 43 percent of the care provided by professional nurses. Military patients received three hours of nursing care with 29 percent given by professional nurses.

Claussen reported that the following military health care system variables had an impact on overall staffing requirements and continuity of patient care: daily patient turnover; the extent to which nursing service must perform non-nursing functions such as housekeeping, dietary, and escort services; personnel turnover necessary to meet mission requirements; and consistently heavy on-the-job training and orientation of professional and nonprofessional personnel because of the military's unique mission requirements. The report did not quantify the effect of these variables on staffing in terms of nursing care hours per patient day. Thus, although an initial patient classification system had been developed and nursing

care hours per patient category were calculated, the initial measures of nursing workload were not formalized into a staffing algorithm. Further research was recommended to develop quantitative performance standards that could be used throughout the Army to determine personnel staffing.

In summary, Claussen found that the level of care and length of stay were different for active duty vs. dependents. She suggested that several variables had an effect on the results, but she did not quantify the effect of health care system variables on nursing care hours. As Aydelotte (1973b) has pointed out, without quantification in the form of operational definitions and objective measurement strategies, an adequate staffing methodology cannot be effectively determined. The next section describes a more rigorous approach to determining staffing requirements.

Measuring Nursing Workload

The system that formed the conceptual basis for the initial nurse staffing research conducted at NSHS involved the assignment-element-difficulty methodology. This model is based on a concept of difficulty associated with elements of patient care and would be categorized in Aydelotte's taxonomy of staffing methodologies as an operations research technique. Equations were developed that gave the most effective

allocation of staff given the constraints imposed on the total number of personnel resources. The set of mathematical equations is also called an "optimizing" model. The assignment-element-difficulty technique was initially developed by Norby, Freund, and Wagner (1977) for the Medicus Systems Corporation and was based on the research of Freund and Mauksch (1975).

According to the model's developers, nursing workload is too complex to be measured solely in terms of actual time required to perform nursing activities. Therefore, the nursing staff's capacity to perform workload must be evaluated in terms of an index that would reflect factors not related to time spent on specific activities. The nontime-related factors include unit and hospital policies and routines, staff expertise, method of care delivery, numbers and types of physicians, and quality of care. Researchers suggested that nontime-related factors could be accounted for in the development of an index based on the difficulty associated with elements of patient care.

The assignment-element-difficulty approach involves making a quantitative determination of the relative difficulty of performing specific elements of daily nursing care tasks for categories of patients. The patient categories are based on an existing patient classification system. When using the assignment-element-difficulty method, two assumptions are made:

that each patient care assignment has a level of difficulty that can be calculated; and that a capacity-for-difficulty can be determined for each category of nursing personnel, including Registered Nurses (RNs), Licensed Practical Nurses (LPNs), and Nursing Assistants (NAs). Staffing coverage for one unit would be calculated using a composite of the following formula.

$$\frac{\text{Workload (in difficulty units)}}{\text{Capacity-for-Difficulty}} = \text{Coverage}$$

To use this methodology for any single unit of a hospital, two parameters must be determined: the difficulty level of an assignment (the workload); and the capability of each nursing personnel category to perform a portion of the workload (capacity-for-difficulty). Assignment elements are groups of similar nursing functions, such as "medication administration" or "A.M. care," that are rated for difficulty and correlated to patient categories based on a predefined classification system. The capacity-for-difficulty for each of the assignment elements is found using a research technique known as constant-summed paired comparisons. This research method presents nursing personnel with all possible pairs of defined assignment elements. A judgement about the relative difficulty of each pair is made based on a numerical weighting scheme. The paired

judgements then form the basis for calculating difficulty weights for each assignment element (Montgomery and Kelly, 1979).

Staffing mix (the combination of RNs, LPNs, and NAs) is addressed by having nursing supervisors judge which group of personnel should perform a given assignment element. A staffing allocation matrix derived from these data gives the optimal mix, indicating the percentages of each assignment element to be performed by each personnel group. A staffing allocation algorithm is developed for each unit of a hospital and optimizes the unique mixture of unit personnel, the difficulty of each patient assignment, and the nontime-related factors for a given number of staff available to perform the workload.

Norby et al. (1977) established that the capacity-for-difficulty was determined by the relationship between two parameters: the proportion of time spent performing actual patient care; and an index of quality of care rendered. They concluded that at an optimal level of capacity-for-difficulty, quality of care and the percent of personnel time spent in direct patient care is maximized. They hypothesized that higher levels of difficulty would have increasingly adverse effects on productivity, as reflected by direct patient care time and quality. Although the assignment-element-difficulty model appears objective, it is still based on subjective

judgements about the type of assignment and capacity-for-difficulty of each provider group.

The assignment-element-difficulty approach was adopted by Montgomery and Langley, the first Navy Medical Department researchers to document the need for an improved nurse staffing methodology. Their initial analysis proposed that the feasibility of the assignment-element-difficulty staffing methodology be investigated for use in Naval Hospitals (Montgomery and Langley, 1978). This proposal also formed the foundation for the discussions and studies that later evolved into the current WMSN.

Evaluative Criteria for a Nurse Staffing Model

Following a comprehensive review of available nurse staffing models in the civilian and military hospitals, Montgomery and Langley established the following criteria for an optimal nurse staffing model.

1. Allows for individual patient differences with respect to nursing care requirements.
2. Determines the appropriate staffing mix.
3. Considers continuity of patient care.
4. Measures quality of patient care.

5. Bases workload measurement on specification of tasks and task performance times as well as other factors that may affect the amount or variability nursing workload (Montgomery and Langley, 1978).

This set of evaluative criteria offered a starting point for the Navy's development of a nurse staffing methodology. The first criterion suggested fluctuations in daily workload resulted from variations in individual patient care requirements. Daily fluctuations would require ongoing adjustment to nurse staffing patterns. Consequently, a proposed staffing methodology should acknowledge individual care requirements as the basis for daily variations in staffing requirements.

The second criterion concerned an awareness that workload distribution resulted in a particular mix of staffing categories and skills. Staffing mix is the ratio of RNs to nonregistered nurses (NRN). NRNs may include LPNs, NAs, and in the Navy, medical corpsmen who have attended 10 or 12 weeks of training in basic nursing care and emergency medical techniques. An ideal staffing methodology would incorporate the various capabilities of these different groups into recommendations for the number and type of required personnel. Ideally, the staffing methodology would also consider the limited availability of personnel on a daily basis and readjust

the staffing mix to best use the available personnel.

Continuity of patient care, the third criterion, refers to the administrative practice of planning for individual patient care. An attempt is made on each work shift to assign the same care giver to a patient for the duration of that shift. Continuity of care planning is preferred to a fragmented approach in which elements of a patient's care are performed by different providers.

Integrating a quality component into the staffing methodology, the fourth criterion, presents a definite challenge in that quality eludes a strict quantitative definition. The quality component of a staffing model allows for an evaluation of nursing care that serves as a control mechanism providing feedback about staffing allocation decisions. Evaluation of care may be based on either the outcome of care or the process of providing the care. Although the measurement of quality presented a difficult criterion to meet, Montgomery and Langley included it with the caveat that a definition of quality could be refined as the concept was better understood.

The final criterion called for a methodology that was not rigidly bound by the narrow parameter of task performance times. The amount of nursing care is generated by sources not totally related to the amount of time needed to perform a group of tasks. Other factors, including patient condition, staff

knowledge and experience, and the physical and emotional environment of the unit, can affect both the amount and the delivery of any single nursing task, such as assisting a patient with a bed bath. In addition, a staffing system that relies solely on the summation of averaged task times is counterintuitive to the delivery of a service that the nursing profession perceives as a continuous function and not a summation of discrete tasks.

Testing a Methodology

Conceptually, the assignment-element-difficulty methodology appeared to meet the initial criteria for an optimal nurse staffing model. To test the feasibility of this methodology it was necessary to develop a valid and reliable patient classification system and to determine a standardized capacity-for-difficulty for each of the nursing service personnel groups. The research was conducted in two phases. The purpose of the initial phase was to validate the findings of Norby et al. (1977); the second phase then expanded the research methodology into three Naval Hospitals.

During the initial phase of the research, several data collection tools and techniques were developed or adapted for use by Navy Medical Department personnel. The testing sites included three medical-surgical wards at the Naval Hospital,

Charleston, South Carolina. A mechanism to measure quality of care was tested; a patient classification instrument was developed; and the research method of constant-sum paired comparisons was adapted to determine the capacity-for-difficulty for Navy nursing service personnel groups. The industrial engineering technique of work sampling was also tested.

The patient classification instrument was constructed after a review of several civilian and military systems. According to Montgomery and Kelly (1979), the instrument was primarily based on a model used by Medicus Microsystems, Inc. but incorporated the best features of several other systems already in use. The instrument was refined using information from several Nurse Corps officers at three Naval Hospitals. Montgomery and Kelly's system was comparable to Claussen's earlier approach in that it classified patients into four categories that represented the level of patient dependency on nursing personnel (Claussen, 1955). Categories or classes were identified as requiring minimal, intermediate, complete, and intensive care. The instrument comprised 17 condition indicators, each of which encompassed a major component of nursing activities or tasks, such as isolation, mobility, feeding, and vital signs. Each task was operationally defined and numerically weighted for complexity based on the judgement of nurses at the Naval Hospital, Charleston, who participated

in the study. The classification system was tested for consistency and implemented on the medical-surgical wards prior to data collection.

A work sampling data collection technique was tested to estimate the percentages of time spent in direct and indirect patient care by nursing personnel each day. A task coding list was developed that separated tasks into four major temporal categories: patient-centered, personnel-centered, unit-centered, and other-centered, which included lunch and personal time. Work sampling results were also used to determine the average percentage of time available for patient-centered activities over the course of the study.

The initial phase of the research confirmed the findings of Norby et al. (1977) in that a high level of task difficulty was related to a low level of quality as defined by an aggregate score on the process-oriented quality monitoring instrument. On the basis of the data, it was assumed that quality-related staff allocation guidelines could be generated. But, the researchers' speculation that, "the relatively elaborate workload measure, assignment-element-difficulty, may only be a surrogate measure for patient care time requirements" (1979, p. 59) offered an initial preview of their future disenchantment with the complexity of the methodology.

Based on the results of the first phase of research, the guidelines previously established for an optimal nurse staffing

model were refined. The first criterion was changed to include the patient classification concept. Individual patient differences would be accounted for by using a patient classification instrument that would relate to workload requirements. Two events external to the research process established the need to relate nurse staffing to a patient classification system. In 1979 the Navy Surgeon General had directed that all Naval Hospitals develop a patient classification system, but did not require that classification systems be standardized.[2] The Surgeon General's directive was later followed by the JCAH Nursing Services Standard III (1980), which mandated the use of a patient classification system as part of a nurse staffing methodology.

The second change to the initial criteria added a professional nursing judgement dimension to an optimal staffing model. Montgomery and Kelly (1981) stated that mathematically sophisticated models were being viewed as "increasingly depersonalized approaches to staffing which do not adequately take nursing judgement into account" (p. 22). Judgemental modifications to any model are needed when unanticipated changes in patient care requirements create significant workload variations during the course of a day. The time based model involved calculating the average amount of time required to care for a class of patients as compared to the average difficulty used in the assignment-element-difficulty model.

The refined criteria established a framework for evaluating an optimal nurse staffing methodology. By using the research tools tested in the initial study, the second phase of Montgomery and Kelly's research expanded the examination of the relationship between quality and difficulty to two other hospitals. In addition, the assignment-element-difficulty approach and a time-based approach were compared and contrasted in terms of their relationship to quality of nursing care and nursing workload.

The research found a statistically significant but very weak relationship ($R^2 = 0.03$; $p < 0.04$) between quality of care and workload that was judged to be inadequate as a basis for nursing personnel allocation decisions. High correlations ($R^2 = 0.82$; $p < 0.01$) were found between the assignment-element-difficulty model and a time-based workload model. The time-based model involved calculating the average amount of time required to care for a class of patients as compared to the average assignment difficulty used in the assignment-element-difficulty model.

Montgomery and Kelly (1981) concluded that the assignment-element-difficulty approach to staffing was superior to a time-based approach. The complex methodology required to implement the assignment-element-difficulty model in each hospital, however, would limit its superiority in practice. The authors stated that "subjective professional nursing judgement must

still be considered as the best means of validating and modifying objectively derived staffing system parameters" (p. 224). Factors attributed to individual ward conditions and to biases occurring during the quality monitoring process also appeared to affect the level of a daily quality index more than did workload. Based on the findings of the study two conclusions were drawn that would relate to future staffing system development.

1. The assignment-element-difficulty approach to nurse staffing was not feasible for use in Naval Hospitals because of the methodology's complexity.
2. A time-based nursing personnel staffing system should be further developed.

In summary, Montgomery and Kelly did not recommend using the assignment-element-difficulty approach as a nurse staffing methodology. Yet, the research did lead them to propose a generic methodology for determining personnel requirements that could be implemented on each ward or unit (Kelly and Montgomery, 1982). The revised methodology combined the use of work sampling techniques, a quality of care assessment tool, and a predefined patient classification system. The researchers suggested that baseline data be collected over a five-day period on at least one ward representing each type of

specialty nursing service (medical-surgical, pediatric, critical care, postpartum) in each hospital. Work sampling would be used to estimate both the percentage of time RNs and NRNs spent performing direct and indirect care and the percentage of time spent for nonpatient-centered ward activities and personal time (lunch and break times). The average number of patients per category, combined with the work sampling data, would be used to calculate the number of nursing care hours required for the specialty area. The appropriate number of nursing staff would be derived from the nursing care hour requirements.

Implementation Feasibility

There were several drawbacks to implementing Kelly and Montgomery's generic staffing methodology across the Navy Medical Department. First, each hospital would have to conduct a separate study for each nursing specialty area; second, not all hospitals were using a patient classification system. Furthermore, the basic assumption that an average number of patients per category be used in each ward-specific formula negates the need for daily classification. In other words, although individually calculated for each type of nursing service, the staffing formulas were based on the traditional average daily patient load parameter refined by the addition of

the average number of patients per category. So, to develop each staffing formula, the assumption was made that the same nursing care hour requirements would be maintained on a daily basis as was observed during the initial five day study period. Using a daily average conflicts with the underlying rationale for a patient classification process intended to project and plan for the daily variability in the demand for nursing care. The methodology was too complex to use on a daily basis, but it could be effective on wards that had homogeneous, non-variable requirements for nursing care.

Thus, the assignment-element-difficulty methodology appeared too complex, and the generic staffing methodology too cumbersome to implement. Also during this time period, the JCAH published standards that emphasized patient classification as the method of choice to determine staffing. Consequently, Navy research efforts were redirected to the development of a standardized system of patient classification.

Navy Department Staffing Standards Development

For historical documentation, it is important to note that another group of Navy staffing studies was being conducted at the same time that Montgomery and Kelly were investigating the feasibility of the assignment-element-difficulty technique. These comprehensive Navy staffing standards studies were under the direction of the Total Force Planning/Training Division of

the Office of the Chief of Naval Operations (OP-11). Each group of studies appears to have been performed independently. The OP-11 standards were developed using industrial engineering techniques and covered all the functions in shore-based Navy facilities, including Navy Medical Department functions.

The results of the parallel effort led to the Navy Department's Shore Requirements, Standards, and Manpower Planning System (SHORSTAMPS) Staffing Standard for Inpatient Nursing Services (MED23.001-.003) initially promulgated in June 1981. The standard was developed to quantify nurse billet (position) requirements for total Navy program planning and was validated by the Medical Department but was not implemented. Without a functional standard it was not feasible to quantify nursing service staff requirements objectively for either the individual hospital or the total Navy Medical Department. The lack of an implemented comprehensive model to determine total Medical Department nurse staffing requirements further justified the need for a nurse staffing model that could be used for both facility and headquarters (Naval Medical Command, Washington, D.C.) management information needs. The nurse staffing research, therefore, continued at NSHS.

Workload Management System Development

In an initial investigation of the patient classification

concept, Kelly and Montgomery (1981) surveyed 31 Naval Hospitals to determine the extent to which patient classification was in use. The survey data revealed that the mandate from the JCAH had spurred development of a variety of systems throughout the Medical Department. The following problems were also noted: most classification methodologies had not been tested for validity or reliability; user training was not documented; classification instruments encompassed a total range of nursing care indicators from a few to over a hundred; finally, staffing methodologies were almost as varied as the number of existing classification schemes. Thus, the patient categories or staffing allocation tables for any one system could not be compared with other systems in use.

Based on the survey results, five patient classification and staffing allocation systems deemed most feasible for Navy-wide standardization were then compared and evaluated on four criteria: ease of use, inter-rater reliability, scope of use, and user acceptance. All five systems incorporated some variation of the factor evaluative design and all were found statistically reliable.[3]

In 1982 two significant events occurred that would affect the future of the research. First, there was a change in investigators assigned to the Medical Department's nurse staffing research. Then, before the comparative study had been completed, the Nursing Division of the Bureau of Medicine and

Surgery of the Navy Medical Department decided that, based on the initial testing, one reliable and valid classification and staffing allocation system should be refined and standardized for use. One system was then selected that had the highest inter-rater reliability and required the least amount of staff time to classify a patient. The research was prematurely terminated to concentrate resources on refining the selected system. The revised system was then distributed to 34 naval hospitals in 1982 on a trial basis.[4]

The patient classification portion of the refined system consisted of a series of weighted critical indicators, each of which denoted a specific element of nursing care. A group of related elements made up a major nursing activity group, for example, vital signs, activities of daily living, treatments/medications, intravenous therapy, or specialized respiratory care. Based on an aggregate total of critical indicator point values, a patient was classified in one of five categories of nursing care: minimal (I), average (II), above average (III), maximum (IV), and intensive (V).

The staffing portion of the refined system consisted of a table of staffing ratios that identified the required nursing care hours and staff per patient per category. For example, one staff member was required for six category I patients, or four category II patients, or three category III patients. Unfortunately, no documentation is available on how these

staffing ratios were derived, how the weights were determined for the critical indicators, or how the five patient classification groups were determined.

As the initial implementation phase of the Navy's standardized classification system progressed, several problems emerged, the most significant of which was the lack of user acceptance at the facility level. Rieder and Jackson (1984) attributed this problem to the underlying philosophy of minimum staffing. The staffing allocation methodology had been designed to identify the minimum number of staff needed to give "safe" care. Because the staff nurses perceived that the instrument lacked a true determination of actual staffing requirements, they padded scores to increase the numbers requested. Rieder and Jackson (1984) indicated that a philosophy of providing an optimal number for "quality" care might have been more acceptable. But the criteria used to differentiate quality care from safe care were not defined.

Other problems included the lack of operational definitions for critical indicators, confusion regarding the weighting mechanism for the critical indicators, and lack of applicability to special care areas. Based on the feedback from the hospitals, the following changes were suggested.

1. Reevaluate the staffing philosophy upon which the workload management system is based from minimal staff to optimal staff for delivery of quality care.
2. Standardize the point value for each critical indicator based on objective time and motion studies.
3. Streamline the critical indicator list of direct care activities; add new indicators for specialty areas.
4. Expand the categories of care from five to six levels of nursing care.
5. Revise the nursing care hour requirement charts used to determine the number and mix of nursing personnel to account for direct and indirect nursing time, as well as type of unit (critical care, pediatrics, medical-surgical, and postpartum) (Rieder and Jackson, 1984).

Interestingly, after five years of nurse staffing studies, the initial attempt to implement a standardized classification and staffing allocation system throughout Navy Medical Department hospitals was based on a staffing methodology that had been created "in the field," lacked the documentation noted above, and was refined for use by expert opinion and judgement. The implementation process also revealed that, before the Medical Department could undergo a significant change from a decentralized nurse staffing function to a staffing system

planned by a centralized department, further analysis and study was required. Although a change in staffing philosophy was possible, it would not happen in a relatively short period of time (one year) and would require strong support from the Navy Nursing Department. The problems encountered during the implementation also pointed out the need for a revised classification instrument and major revisions to the staffing methodology and provided a continued impetus for research on nurse staffing in Navy Medical Department treatment facilities.

Toward a Unified System

Concurrent with the Navy's efforts to develop and implement a patient classification and staffing allocation methodology, the Army Nurse Corps had undertaken research directed toward the same goal. The Army's efforts involved the development of a patient classification system to measure a patient's direct care nursing requirements by identifying the tasks performed by inpatient nursing personnel. Sherrod, Rauch, and Twist (1981) conducted a comprehensive four-year time and motion study in which 37,000 observations were made to derive standard times and frequencies for 357 nursing tasks for direct patient care in the following specialty care areas: medical-surgical, critical care, obstetrics, psychiatric, neonatal, and pediatric. Documented care requirements and

average times for each nursing task for 720 cases were used to calculate nursing care hour requirements for direct patient care.[5]

The initial Army staffing allocation methodology was developed to determine the number and mix of care providers based on hours of care within each patient care indicator, not the category of care. Sherrod et al. (1981) demonstrated that both hours of care and categories of care determined man-hour requirements, but only nursing care hours within each patient care indicator were appropriate for the best mix of staff by skill level of nursing care providers.

> Patient classification systems that match category of care with mix of personnel make the major assumption that all patients in the same category of care have the same direct nursing care requirements; hence, the same mix of personnel can meet those care requirements. However, the present findings do not support this assumption (Sherrod, 1984; p. 510).

As a consequence, estimating appropriate staff required collecting a large amount of data every day.

The Army had developed a comprehensive, reliable, and valid patient classification and staffing system based on

replicable research. The number of data input requirements, however, had resulted in a system that was cumbersome to use. The Army consulted with an independent contractor to evaluate Sherrod's system along with a second classification system then in use in some Army Hospitals. The consultants proposed that the Army merge parts of the Sherrod system with the second system after several modifications were made to the second system (Giovannetti and Polliard, 1982). Neither system included time allocations for indirect nursing care or ward-related activities that must be part of a complete staffing allocation methodology.

In 1982 researchers from the Navy and Army met while jointly participating on a tri-service committee directed to determine nursing information systems requirements. The committee was formed by the Tri-Services Medical Information Systems (TRIMIS) Program to develop information systems requirements and documentation in areas of patient care, nursing management and administration, inservice education and training, and automated inpatient records (Rieder and Norton, 1984). Documentation and analysis of nursing workload was identified as part of a larger hospital information system. The discussions of individual service research efforts in nursing workload showed that the Army and Navy had similar goals. The logical result was a combined effort to develop a practical, feasible, and user-friendly patient classification

system from research that had been conducted independently by both services. The combined effort resulted in the first phase of the Workload Management System for Nursing.

The critical indicators from the Navy's system formed the framework for a patient classification instrument. The indicators were coupled with the time and motion data for individual nursing activities from the research by Sherrod et al. (1981). A single generic patient classification instrument was developed to be used in all inpatient nursing specialty areas except psychiatry, recovery room, and labor and delivery room. The unpredictable nature of the workload in the latter two areas made it difficult to quantify their staffing requirements prospectively. The psychiatric setting involved the use of nursing tasks that had not been comprehensively identified and timed.[6]

Based on the opinion of subject-matter experts and nursing researchers, some of the 357 direct care activities in the original instrument developed by Sherrod et al. (1981) were combined to form approximately 100 composite nursing activities. For example, the single critical indicator "assisted care for adult or child over five years" encompassed the average direct care time required for a partial bed bath, back rub, oral hygiene, serving meal trays three times a day, weighing the patient, and making an unoccupied bed, all of which individually had been reported in the Sherrod study.

Also included was time to perform nursing functions, such as assess the patient's condition, formulate nursing diagnoses, and evaluate the effectiveness of nursing care. These latter times were established by expert opinion. The composite indicators simplified the original Sherrod classification instrument and thereby decreased the amount of time needed to complete the classification procedure.

Other indicators were added to account for teaching patients and providing emotional support, two significant nursing activities that had not been identified by Sherrod et al. (1981). Standard times for these nursing activities were determined by nurse experts, not by time and motion studies. The classification instrument was further simplified by organizing similar activities into groups called "factors." The factors were not based on a statistical test such as a factor analysis, but on intuitively determined groupings of similar functions. The first version of the Workload Management System was tested for reliability and validity in six Navy Hospitals (Rieder and Jackson, 1985a) and at Walter Reed Army Hospital (Norton, 1984). The initial staffing methodology for the WMSN used a standardized amount of indirect care estimated at 55 to 65 percent. The percentage for indirect care was derived from the data collected during previous research (Montgomery and Kelly, 1981; and Kelly and Montgomery, 1981). The staffing allocation methodology was then revised following the

reliability and validity studies to incorporate the findings from an indirect care study completed by the Army.

In developing the staffing allocation portion of the refined methodology, the combined Army/Navy version incorporated a percentage of indirect care into the formulas based on the work sampling research conducted by Misener, Frelin and Twist (1983) in nine Army hospitals. The Army researchers reported that direct and indirect care time varied according to nursing specialty area, and the results of their data analyses were incorporated into staffing formulas for each of the nursing specialty areas. The study did not report the results of statistical analyses that would have tested for differences between the percentages obtained for direct care (or indirect care) for each specialty area across all nine hospitals. Misener et al. (1983) stated that the reporting of statistical significance lacked value because of the large number (107,700) of data points (p. 6). So, the percentage of direct care on each medical-surgical ward was averaged across all facilities (the range for the facilities was 17.7 percent to 30.5 percent). Future studies of indirect care time should test the assumption that no significant differences exist between military health care facilities of different size and mission.

The indirect care study percentages reported by Misener et al. (1983) have not been validated for Navy hospitals. The Army's results, however, were compared with the work sampling study results collected by Kelly (1980), which included data from eight medical-surgical wards. Ideally, the methodology used by Misener et al. (1983) should have been replicated in Navy hospitals for each nursing specialty service because controversy exists about the applicability of work sampling studies conducted in one hospital for use in another (Giovannetti, 1979). The Navy's use of the Army data assumes that indirect care in the Army system is the same for the Navy, which may not be true.

Total Nursing Care Hours Model

According to a review of NSHS internal documents and memoranda, considerable discussion took place among investigators from both the Army and the Navy concerning the appropriate technique to determine total direct and indirect nursing care hours for each patient category. Differences in opinion included whether indirect care would be a constant amount per specialty area or whether indirect care should vary according to the direct care time per patient. Consequently, both concepts were incorporated into a formula for total nursing care hours. The following formula became the basis for

the staffing allocation methodology for each nursing specialty area.

Nursing Care Hours =

Direct Care Hours + (Direct Care Hours)(% of Indirect Care)

Direct care time was determined by the patient classification instrument; indirect care percentages were based on the Misener et al. (1983) work sampling data.

Based on expert opinion and judgement, decisions were also made about the appropriate mix of nursing personnel (RNs and NRNs) and about the daily distribution of personnel for each specialty area. Staffing tables were then constructed and became part of a comprehensive step-by-step instruction manual that also included operational definitions, practice examples, and procedures for performing mandatory inter-rater reliability testing (Rieder and Jackson, 1985b). Gradually, the second version of the Workload Management System for Nursing (WMSN) was implemented.

Conclusion

By 1985 the second version of the WMSN was in use in most Naval Hospitals. Rieder and Jackson (1985a) finalized the WMSN

evaluative study and made numerous recommendations, including the following.

1. Develop the WMSN further to address patient care requirements in ambulatory care, recovery room, and labor and delivery.
2. Write a Naval Medical Command (NAVMEDCOM) Instruction to institutionalize the system to standardize the reporting procedure.
3. Assign a Nurse Corps Officer to NSHS to manage the system, refine the patient classification instrument, and assist with studies that involved nursing workload.
4. Produce quarterly WMSN reports of nursing workload across facilities to facilitate resource decision-making process.

In October 1985, a Nurse Corps billet was assigned to NSHS to manage the system. With the assignment of the WMSN Project Manager billet, the WMSN began the transition from a research project into an operational system pending completion of a NAVMEDCOM Instruction. The process undertaken to develop the role of the WMSN Project Manager and incorporate the WMSN into the Navy Medical Department as a formal patient classification and staffing allocation system will be the subject of a future paper.

FOOTNOTES

1. An official letter requesting the study has not been found. The earliest documentation of the research is described in the Research and Technology Work Unit Summary (DD 1498) dated 1 OCT 1979 Report DD-DDR&E(AR) 636(3900) titled Assignment Element Difficulty as a Basis for Nursing Personnel Staffing at Naval Hospitals. According to this document, the research began in 1978.

2. Source: Letter from Vice Admiral W.P. Arentzen, MC, USN, Surgeon General of the Navy, to the Commanding Officers of Naval Hospitals and Naval Regional Medical Centers re: Patient Classification, dated 10 October 1979.

3. The reader is referred to Kelly and Montgomery (1981) for a detailed description of each of the five classification and staffing allocation systems tested. Although not documented by Kelly and Montgomery, the system selected for standardization is thought to have originated at Naval Hospital, Jacksonville, Florida.

4. Source: Memorandum MED24C:JAJ:gmj dated 25 Jan 82. Correspondence from Nurse Corps Division of the Bureau of Medicine and Surgery to all Chiefs of Nursing Services.

5. The frequency distribution of the cases were plotted by hours of required care to establish breakpoints for six categories of nursing care. A category I patient required an hour or less of direct nursing care and a category VI patient required 24 to 36 or more hours of direct care. Factor evaluative patient classification instruments, each containing 12 or 13 patient care indicators, were developed for each of the six nursing specialty areas previously identified. A patient care indicator was a group of individual direct nursing care activities that described one of the following dimensions of nursing care: hygiene; nutrition; mobility; vital signs; assessment, medications; gastrointestinal; psychological and patient teaching; respiratory; cardiovascular and temperature regulation; skin; skeletal and neurological; urological and gynecological; obstetric; and psychiatric.

6. A psychiatric instrument was finally included in the system in 1984. However, its reliability and predictive validity has not been established.

BIBLIOGRAPHY

Aydelotte, M.K. (1973a). Staffing for Quality Care. Journal of Nursing Administration, 3, 33-36.

Aydelotte, M.K. (1973b). Nurse Staffing Methodology, A Review and Critique of Selected Literature. (DHEW Publication No.73-433). Washington, DC: U.S. Government Printing Office.

Claussen, E. (1955). Categorization of Patients According to Nursing Care Needs. Military Medicine, 116(3), 209-214.

Connor, R.J. (1961). A Work Sampling Study of Variations in Nursing Work Load. Hospitals J.A.H.A., 35(9), 40-41, 111.

Department of the Navy, Chief of Naval Operations. (1982). Staffing Standard for Provide Nursing Services (MED23.001- 003) OPNAV Instruction 5310/68 (Revised 1/79).

Freund, L.E. & Mauksch, I.G. (1975). Optimal Nursing Assignments Based on Difficulty, Final Project Report. (Contract No. HS01391). Rockville, MD: National Center for Health Services Research. (NTIS Report No. PB-254 080).

Giovannetti, P. (1979). Understanding Patient Classification Systems. Journal of Nursing Administration, 9, 4-9.

Giovannetti, P. & Polliard, F.W. (1982). A Review and Analysis of Two Patient Classification Systems. (Contract No. MDA 903-82- C-0360). Minneapolis: Health Management Systems Associates.

Halloran, E.J. & Vermeersch, P.E. (1987). Variability in Nurse Staffing Research. Journal of Nursing Administration, 17, 26-32.

Hanson, R.L. (Ed.). (1983). Management Systems for Nursing Staffing. Rockville, MD: Aspen Systems Corporation.

Joint Commission on Accreditation of Hospitals. (1980). Accreditation Manual for Hospitals-1980. Chicago: Joint Commission on Accreditation of Hospitals.

Kelly, M. (1980). Percentages of Time Spend by Nursing Service Personnel. Unpublished data. Bethesda, MD: Naval School of Health Sciences.

Kelly, M. & Montgomery, J.E. (1981). A Comparative Analysis of Patient Classification Systems for Nursing Personnel Staffing at Naval Hospitals. (Research Report 6-81). Bethesda, MD: Naval School of Health Sciences.

Kelly, M. & Montgomery, J.E. (1982). Development of Staffing Formulas for Nursing Personnel Based on Patient Classification with Quality of Care Considerations. Military Medicine, 147(2), 115-121.

Levine, E., Siegel, S. & De La Puente, J. (1961). Diversity of Nurse Staffing among General Hospitals. Hospitals, J.A.H.A. 35(9), 42-48.

Lewis, E.N. & Carini, P.A. (1984). Nurse Staffing and Patient Classification Rockville, MD: Apsep System Corporation.

Misener, T. R., Frelin, A. J., and Tiet, P>A> (1983). Time Spent In Indirect Nursing Care. (Report No. 83-004). Fort Sam Houston, TX: US Army Health Care Studies and Clinical Investigation Activity. (DTIC No. ADA 138338).

Montgomery, J.E. & Kelly. M. (1979). Assignment Element Difficulty as a Basis for Nursing Personnel Staffing at Naval Hospitals. Phase I. (Report No. 3-79). Bethesda, MD: Naval School of Health Sciences. (DTIC No. ADA 078584).

Montgomery, J.E. & Kelly, M. (1981). Assignment Element Difficulty as a Basis for Nursing Personnel Staffing at Naval Hospitals. (Research Report 5-81). Bethesda, MD: Naval School of Health Sciences.

Montgomery, J.E. & Langley, A. (1987). Toward Improved Nurse Staffing Methodologies for the Navy Medical Department. Unpublished manuscript. Naval School of Health Sciences, Bethesda, MD.

Norby, R.B., Freund, L.E. & Warger, B. (1977). A Nurse Staffing System Based Upon Assignment Difficulty. Journal of Nursing Administration, 7, 2-24.

Norton, D.A. (1984). An Evaluative Study of the Workload Management System for Nursing. Unpublished manuscript. Nursing Research Service, Walter Reed Army Medical Center, Washington, DC.

Render, B. & Stair, R.M. (1982). Quantitative Analysis for Management. Boston: Allyn and Bacon, Inc.

Rieder, K.A. & Jackson, S.S. (1984). An Evaluative Study of the Navy Medical Department's Patient Classification System and Staffing Allocation. Preliminary Report. (Research Report 1-84). Bethesda, MD: Naval School of Health Sciences.

Rieder, K.A. & Jackson, S.S. (1985a). An Evaluative Study of the Navy Medical Department's Patient Classification and Staffing Allocation System. (The Workload Management System for Nursing) Final Report. (Report No. 5-85). Bethesda, MD: Naval School of Health Sciences. (DTIC No. ADA 170377).

Rieder, K.A. & Jackson, S.S. (1985b). The Navy Medical Department's Workload Management System for Nursing Manual. Bethesda, MD: Naval School of Health Sciences. (DTIC No. ADA 170377/6/WHP).

Rieder, K.A. & Norton, D.A. (1984). An Integrated Nursing Information System--A Planning Model. Computers in Nursing, 2(3), 73-79.

Rzasa, C.B. (Ed.). (1983). A Guide to JCAH Nursing Services Standards. Chicago: Joint Commission on Accreditation of Hospitals.

Sherrod, S.M. (1984). Patient Classification System: A Link Between Diagnosis-Related Groupings and Acuity Factors. Military Medicine, 149(9), 506-511.

Sherrod, S.M., Rauch, T.M., & Twist, P.A. (1981) Nursing Care Hours Standards Study Parts I - VIII, Volumes I-IV. (Research Reports 81-001 to 81-009). Fort Sam Houston, TX: US Army Health Care Studies and Clinical Investigation Activity. (DTIC Nos. ADA 109883-ADA 109886).

Young, J.P., Giovannetti, P., Lewison, D., & Thomas, M.L. Factors Affecting Nurse Staffing in Acute Care Hospitals: A Review and Critique of the Literature. (DHEW Publication No. HRA 81-10). Washington, DC: Department of Health, Education and Welfare. (NTIS No. HRP 0501801).

END

12-87

DTIC