AN EVALUATION OF TWO PATIENT CLASSIFICATION SYSTEMS AS THE DETERMINANTS OF A STAFFING PATTERN FOR MEDICAL PATIENTS

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An Evaluation of Two Patient Classification Systems as the Determinants of a Staffing Pattern for Medical Patients

by

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ABSTRACT

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A descriptive correlational study was conducted to (a) assess the psychometric properties of two patient classification systems, (b) explore the relationship between nursing care time and intensity and (c) integrate nursing care time and intensity data to predict a staffing pattern. Seventy-one medical patients representing 373 patient days constituted the sample. The Nursing Intensity Index (NII) and the GRASP instruments were used for data collection. Descriptive and inferential statistics were used for data analysis.

High internal consistency and interrater reliability were demonstrated for both the NII and GRASP. Factor analysis generated nine factors to explain 73.6% of the variance in GRASP and three factors to explain 59.4% of the variance in the NII. NII scores were significantly correlated with GRASP scores indicating a shared variability of 49%. Regression analysis indicated that seven NII items explained 55% of the total GRASP score, thus leaving 45% of the variability in nursing workload unexplained. Integration of GRASP and NII data produced a skill mix ratio of 80 percent RN to 20 percent RNA. However, this ratio was not supported by the perceptions of direct caregivers. Methodological and application problems may have influenced this result. More research is needed to identify other factors that may affect skill mix before firm conclusions can be made.

Key Words: patient classification system; nursing care time; hours of care; quantity; nursing care complexity; intensity; skill mix; staffing pattern.

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CHAPTER I

INTRODUCTION

Staffing is a complex process which involves the determination of patient requirements and the allocation of nursing resources in appropriate numbers and skill mix to produce a desired level of care (West, 1980). Skill mix refers to the combination of more than one category of nursing personnel: registered nurse, licensed practical nurse, nurse's aide, among others, on a nursing unit (Young et al., 1981, cited in Lemieux-Charles, O'Brien-Pallas, Baker, Murray & Lamb, 1992). Matching number and mix of personnel with the patient's need for care has been a long standing challenge for nursing administrators. The challenge has become more acute and complicated as health care costs continue to escalate, technology becomes more sophisticated, the severity of patient illnesses increases and available financial resources decline.

For decades, Patient Classification Systems (PCS) or Nursing Workload Measurement Systems (NWMS) have been used extensively in hospitals throughout the United States and Canada to assign the number of staff (Alward, 1983; Cockerill & O'Brien-Pallas, 1990; Giovannetti, 1979). In 1978, approximately 1,000 hospitals in North America were using NWMS (Alward, 1983; Giovannetti, 1979). Since then, accreditation standards in both the United States and Canada have encouraged, if not mandated, the use of such systems. By 1988 most major hospitals in both countries were using, or in the process of selecting, a system (Giovannetti, 1988). The most common systems in Canadian hospitals are GRASP, NISS and MEDICUS. The provinces most likely to have nursing workload systems are Alberta (86 percent); Ontario (79 percent); and Newfoundland (60 percent) (Cockerill & O'Brien-Pallas, 1990).

Traditional PCS use hours of care to quantify the projected volume of nursing work based on the levels of patient dependency or nursing intervention. These hours are rarely analyzed by skill level to establish an appropriate staffing pattern (Rowland & Rowland, 1985). Rather, decisions concerning skill mix normally are based on historical practice, clinical judgement of nursing administrators, financial consideration, and personnel availability.

Recent research efforts have focused on combining complexity and quantity of care to project nursing costs (Prescott & Phillips, 1988; Reitz, 1985a, 1985b). While traditional PCS use hours of care as a surrogate for complexity, intensity systems are designed to measure complexity of care and estimate nursing costs. The level of complexity is based on factors that complicate implementation of the nursing process and application of knowledge and skills required to perform procedures (Prescott, 1991). If complexity of care can be used to predict required knowledge and skills, then hours of care will be based on the type of nursing personnel required to provide needed care. If empirical findings can demonstrate that the hourly rate for caregivers relates directly to nursing costs, intensity measures exhibit considerable potential to assist in skill mix determination.

Background and Rationale

In the 1930's, the American National League for Nurses surveyed 50 hospitals and recommended that 3.4 to 3.5 hours per patient day be established as the minimal basis for allocation of nursing personnel. Later, the Canadian Nurses Association reported a norm of 3.2 hours per patient day for Canada (Thibault, 1990). These figures became an allocation standard in conjunction with patient census and occupancy rates. The need for more precise and credible allocation measures motivated research on Patient Classification Systems.

In the late 1950's, Connor and colleagues at Johns Hopkins Hospital introduced a classification scheme that became the prototype for PCS used today (Giovannetti &

Thiessen, 1983, cited in Lemieux-Charles, O'Brien-Pallas, Baker, Murray & Lamb, 1992). Connor and colleagues were the first to use operations research methodology to determine staffing patterns. They also proposed that workload on a unit varies with the degree of care required by patients. Other authors added variables such as teaching and support which significantly improved predictions of nursing workload (Barr, Moores & Rhys-Hearn, 1973; Chagnon, Audette, Lebrun & Telquin, 1978; Kuhn, 1980a, 1980b; Meyer, 1978; Rhys-Hearn & Potts, 1978). The results of these studies demonstrate that categorizing patients according to assessment of care required is a better predictor of workload than care hour norms, census and occupancy rates.

Increases in acuity, advances in technology and concern for professionalism were implicated in a shift to greater RN staffing (Cleland, 1990). Evidence of this shift can be seen in the change of staffing mix in American acute care hospitals over a 15 year period. The ratio changed from 66 percent Registered Nurse (RN) to 44 percent Licensed Practical Nurse (LPN) per 100 patients in 1974 to 81 percent RN to 19 percent LPN per 100 patients in 1987 (Barry & Gibbons, 1990; Cleland, 1990). Woods Gordon (1985) noted a similar trend in acute care hospitals in Ontario. Over a three year period from 1981 to 1984 RN full time equivalent positions (FTE) increased by 4.7 percent, while Registered Nursing Assistant (RNA) FTE positions declined by 3.0 percent. A similar trend is reported by the Nursing Department at Hospital A, the setting for this study. In 1980, the nurse-to-nursing assistant ratio was 60 percent RN to 40 percent RNA; by 1988 the ratio had changed from 80 percent RN to 20 percent RNA (RNA Task Force Report, 1990).

The early research involving PCS was almost exclusively related to assessment of patient needs in order to allocate staff. With the introduction of the prospective payment system in the U.S., research efforts concentrated on investigating nursing resource use within medical diagnostic groups (Atwood, Hinshaw & Chance, 1986; Sovie, Tarcinale, Van Putte & Studen, 1985; Wolf & Lesic, 1986). The primary reason for the shift was the emergence of diagnostic related groups (DRGs) as the essential classification system for the prospective payment system (O'Brien-Pallas, Tritchler & Till, 1989).

Under this system, nursing costs were generally assumed to be constant across DRGs. Many nursing administrators disagreed with this assumption and numerous studies using hours of care as the dependent variable were conducted to demonstrate the variability of nursing resource use within DRGs. The relationships among length of stay, severity of illness, nursing diagnosis, sex, age and hours of care were also examined (Atwood, et al., 1986; Bostrom & Mitchell, 1991; Dijkers & Paradise, 1986; Halloran, 1985; O'Brien-Pallas, Tritchler & Till, 1989; Sovie et al., 1985; Trofino, 1986, 1989; Wolf & Lesic, 1986). Hours of care was found to be a better predictor of nursing resource utilization than medical diagnosis. Subsequently PCS began to be used to quantify nursing care for costing and billing purposes in the U.S. The establishment of the Management Information System (MIS) Project in the early 1980's and the subsequent development and testing of the MIS Guidelines were responsible for expanding the use of PCS in Canada to cost identification, budgeting and management reporting.

As PCS began to be used for costing, budgeting and management reporting, concerns regarding their ability to measure the full domain of nursing motivated work on nursing intensity measures. It was anticipated that if nursing intensity measures could capture the complexity of nursing actions through PCS, they would overcome the limits imposed by systems that focus primarily on nursing interventions. Prescott and Phillips (1988) and Reitz (1985a, 1985b) attempted to bridge the gap between existing PCSs and the full domain of nursing by measuring intensity (Jennings, Rea, Antopol and Carty, 1989).

Observation of nursing practice in an acute care setting has lead this researcher to question whether complexity of care is one of the factors which influenced the observed change in skill mix ratios. It is possible that a change in patient profile subsequent to advances in technology, as well as reduced length of stay and movement towards ambulatory services, increased the complexity of inpatient care and thus resulted in a change in skill mix. Support for staff mix changes was provided by independent nursing consultants from the Provincial Department of Health and a private firm following operational reviews conducted at Hospital A, the study hospital, (RNA Task Force, 1990).

Nursing Departments have long used NWMS as empirical measures to estimate the number of staff required. Skill mix has not been subjected to the same degree of objectivity. Seldom has skill mix been based on an empirical determination of patient needs for care by varying levels of technical or professional complexity.

In this era of cost containment, nurse administrators have to make difficult decisions about resource allocation. The challenge, which represents the rationale for this study, is to determine not only the number of staff, but also the level of care giver skills and education required to provide quality cost-effective care.

It is anticipated that the proposed study will contribute to the body of knowledge on staffing by merging data from a traditional NWMS with data from a nursing intensity measure to produce an acceptable staffing pattern for one nursing unit. The information gathered will also provide valuable insight into the logic of the movement towards greater RN staffing in acute care settings. Most importantly, it will further understanding and knowledge of nursing care.

The Problem

NWMS were originally designed to ensure that appropriate numbers of nursing staff were available to meet the demand for care (Alward, 1983; Dijkers, Paradise & Maxwell, 1986; Giovannetti, 1978). NWMS are now being used within the framework of Diagnostic Related Groups (DRGs) or Case Mixed Groups (CMGs) to identify nursing costs, and associate costs with clinically specific patient groups (Atwood et al., 1986; Sovie, et al., 1985; Wolf & Lesic, 1986). Most NWMS have been challenged because their task orientation discounts the complexity of the patient/caregiver interaction and fails to consider the diversity of caregivers' skills (Curtin, 1986; Dijkers & Paradise, 1986; Halloran, 1985, 1987; O'Brien-Pallas, 1988).

Researchers are beginning to address these problems through nursing intensity measures which consider both the quantity and complexity of care (Prescott & Phillips, 1988; Reitz, 1985a, 1985b). The Reitz Nursing Intensity Index (NII) incorporates important features not present in most NWMS. First, the patient is the unit of analysis and not nursing tasks. Second, the nursing process is the conceptual framework for instrument design. Third, the work of nursing theorists such as Roy, Orem and Rodgers is used to define and describe nursing practice. These features tend to increase its credibility among practicing nurses.

As stated above, NWMS provide an estimate of care required defined in hours per patient day while nursing intensity measures estimate the complexity of care defined in nursing intensity scores. The two represent a different perspective of patient requirements, each exerting a separate yet interactive effect on the ratio of nurse to nursing assistant required to meet patient needs.

Few studies however, have investigated the relationship between hours of care and intensity. Further exploration of the relationships among the variables thought to influence staffing patterns is needed. The focus of this study is to examine the relationships among hours of care and intensity scores in a sample of medical patients in an acute care setting in order to predict skill mix. Consideration of these factors that impact staffing patterns may ultimately improve quality of care and reduce health care costs.

Purpose

The purpose of this study was three-fold: (1) to assess the psychometric properties of the NWMS and NII, (2) to explore the relationship between quantity (hours of care) and complexity (intensity score) in a sample of medical patients in an acute care setting, (3) to integrate NWMS data and intensity data to predict a staffing pattern for the same medical patients. More specifically the study will attempt to answer a number of research questions as indicated below.

1. Is the GRASP NWMS a reliable and valid measure of the quantity of care requirements for medical patients?

2. Is the NII a reliable and valid measure of the complexity of care requirements for medical patients?

3. Is there a relationship between NWMS and NII scores?

4. What percentage of the variance in NWMS score will be predicted by the NII?

5. What is the quantity and intensity of nursing care required by selected medical patients as determined by application of a NWMS and the NII?

6. Can data from a NWMS be integrated with data from the NII to project a staffing pattern by identifying the number and mix of staff required to care for selected medical patients?

7. Will the projected staffing pattern be supported by caregivers' perceptions (nurses, nursing assistants and the nursing supervisor)?

Summary

This chapter has presented skill mix as a complex problem requiring complex solutions. A brief overview of past research which indicates the need for this study has also been presented. The rationale for the study, the purpose and specific research questions have been identified. Chapter II will review the literature and describe the conceptual framework used to explain the proposed relationship among the variables investigated in the study.

CHAPTER II

LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

This chapter provides an overview of patient classification systems and reviews a selection of research studies that have investigated the concept of patient classification as measures for staffing and costing nursing services. The theoretical framework used to guide the study is also discussed.

Traditional Patient Classification Systems

The concept of patient classification refers to the categorization of patients according to assessment of their nursing care requirements over a specified period of time (Giovannetti, 1979). Other terms in common usage are acuity system and nursing workload measurement system (Dijkers, Paradise & Maxwell, 1986). Patient Classification Systems (PCS) and Nursing Workload Measurement System (NWMS) are used interchangeably in this study.

NWMS are defined as prototype or factor systems. Prototype systems use profile descriptors to place patients into care levels while factor systems delineate nursing interventions (see Figure 2, Chapter 3, p. 49).

NWMS are the principal tools used for staff allocation. Most systems identify the numbers of staff needed on a daily basis, but few adequately address the issue of skill mix, that is, the ratio of registered nurse to licensed practical nurse or nursing assistant (Curtin, 1986; Dijkers & Paradise, 1986; Halloran, 1985, 1990). Cleland (1990) describes nursing as a broad inclusive occupation with many categories of personnel necessitating legal and professional definitions for each group. Most acute care agencies in Newfoundland employ registered nurses (RNs) and registered nursing assistants (RNAs) as caregivers. Legislation, practice standards and performance expectations define the role and scope of practice for each group. In reality, many areas of practice overlap with the appropriateness of the assigned caregiver, dependent upon the complexity of care required and the knowledge and skills of the individual practitioner.

The NWMS that address skill mix do so on the basis of a predetermined fixed ratio or task analysis (Adams & Johnson, 1986; O'Connor, 1988; Reider & Lensing, 1987; Schroeders, Rodes & Sheilds, 1984; Vail, Norton & Reider, 1987; Vanderzee & Glusko, 1984). The fixed ratio method has been criticized because it lacks empirical testing (Woods Gordon, 1985) and task analysis because it conceptualizes nursing as a task-based occupation (Halloran, 1990). To date there have been no documented skill mix studies which focus explicitly on developing an empirical database to determine patients' need for care in terms of levels of technical or professional expertise. In the absence of such studies and because skill mix influence costs, research related to the costing of nursing services will be discussed.

Psychometric Properties of PCS

The reliability of a NWMS must be established and maintained in the practice setting for which it is intended. Several characteristics associated with reliability are: (a) use of well defined, objective categories; (b) use of criteria for classification; and (c) training of staff in the use of the system (Murphy, 1976). Reliability must be routinely monitored through various statistical techniques. The most common are percentage of agreement, the Kappa Statistic and Pearson Product Moment Correlation Coefficient.

As with reliability, validity of the instrument must be established and re-examined in the practice setting. Face, content, criterion-related and construct validity are important to NWMS (Whitney & Killien, 1987). Face and content validity are usually assessed by a panel of nursing experts. No standard exists to test for criterion-related validity; however, in the absence of such a standard some researchers have used theoretically related measures (Halloran, 1988; O'Brien-Pallas, Cockerill & Leatt, 1992; O'Brien-Pallas, Leatt, Deber & Till, 1989; Prescott, Ryan, Soeken, Castorr, Thompson & Phillips, 1991). Only one study addressed construct validity of a traditional PCS (Chagnon, et al., 1978). There is no documentation of construct validity for GRASP, one of the systems used in this study (O'Brien-Pallas, Leatt, Deber & Till, 1989).

Comparability of PCS

Under the prospective payment system in the United States, different PCS were used by agencies as the basis for determining nursing time and costs. PCS are usually modified during implementation to account for such factors as philosophy, standards, physical layout, support systems and other relevant characteristics of the specific agency's environment. The result has been a proliferation of instruments (Kaspar, 1986) restricting comparability of data (Edwardson, 1989). Comparisons across systems and hospitals were based on the assumption that different PCS had approximately equivalent time estimates. Because PCS differ in a number of ways Phillips, Castorr, Prescott & Soeher (1992) questioned the accuracy of this assumption.

Research investigating the comparability of PCS has presented inconsistent findings. Jackson and Resnick (1982) used two prototype systems to compare the care levels of medical, surgical and intensive care patients (N=132). One of the systems was reported to be useful and reliable worldwide, however, it was not tested in their study. Interrater reliability for the second system was reported as 75 to 100 percent. Discrepancies were identified in the classification levels of 90 of the 132 patients (68.2 percent), indicating there was little correlation in the care levels ratings between these systems.

Schroeders, Rhodes and Shield (1984) compared the hours of care for medical, surgical and obstetrical patients. The instruments used for data collection were screened for accuracy on a periodic basis but interrater reliability scores were not calculated. The results reflected similar RN hours, that is, there was little difference in the hours of care projected by both the prototype and factor system.

Trofino (1986) compared the average hours of care by DRGs projected by different PCS in four acute care hospitals. Two hospitals used commercial factor systems, modified with adjustments based on inhouse time and motion studies, the third hospital used a prototype system that converted to a factor system and the fourth a prototype system. Interrater reliability between raters averaged 90 percent. Validity was not documented.

Hospitals A and B were subjected to two comparisons. The correlation results of the nursing care hours for the four hospitals were as follows: A with B, first comparison, $r(3277)=.86$; A with B, second comparison, $r(1382)=.87$; A with C $r(1596)=.88$; and A with D $r(895)=.76$. Based on these results Trofino concluded that commercial factor and other factor systems may correlate, however prototype systems may be more subjective and not valid for cost allocation.

O'Brien-Pallas, Leatt, Deber and Till (1989) examined the equivalence of hours of care estimates, of three commonly used patient classification systems: PRN, Medicus and GRASP. The sample consisted of 2002 patient days from seven different nursing units. Interrater reliability was reported as 95 percent agreement. The researchers noted that while the developers of PRN had tested their instrument for construct validity there was no documentation of equivalent testing for Medicus or GRASP. The study found that PRN predicted more hours of care (9.06), than Medicus (6.63) and GRASP (6.57). Although PRN estimates were significantly different from Medicus and GRASP ($p<.0001$), no significant differences were found between Medicus and GRASP ($p=.30$).

A second study by O'Brien-Pallas, Cockerill and Leatt (1992) using five systems PRN80, PRN76, GRASP, NISS and Medicus also demonstrated differences across systems. The study targeted patients with diseases and disorders of the circulatory system and consisted of 2294 patient days in critical and non-critical care units. Interrater reliability varied from 91 to 98 percent agreement. To validate each system, work sampling studies were conducted and the primary consultant for each instrument was requested to review the proposed application of their systems. Data were analyzed by total patient days and by unit. When total patients were included in the analysis, PRN80 estimated the greatest average hours at 11.18 (SD $\pm$8.49), followed by PRN76 at 10.79 (SD $\pm$8.13), NISS at 8.46 (SD $\pm$8.26), GRASP at 7.74 (SD $\pm$6.91) and Medicus 6.65 (SD $\pm$5.58). All differences were statistically significant with Bonferroni alphas <.00001. The Pearson's Product Moment Correlations among the systems were highly significant (r=0.89 to 0.99, p<.00001). When the data were analyzed by nursing unit, the differences in hours of care and the correlations varied, as expected, given the different care requirements for critical and non-critical care patients. Given the extremely high correlations observed for total patient days (N=2294), a number of regression equations were developed to predict the hours of care estimates of one system from another. In the absence of comparable systems, these authors suggest relational statements might be a mechanism to establish system equivalency and thus expand the use of PCS for costing purposes.

The theme running through these studies is that differences in the design, approach and use of PCS influence projected hours of care. Systematic bias must be acknowledged and overcome if these systems are to be used for cross hospital comparisons in resource utilization and cost identification. While some of these studies substantiated the expressed concerns of non-comparability, they have not addressed the adequacy of existing PCS to capture nursing complexity. Nursing complexity will be the subject of a later section of this review.

PCS as Costing Instruments

NWMS became the principal tool used to differentiate patient care requirements for costing and reimbursement purposes under the American prospective payment system. The prospective payment system instituted by congressional legislation in 1983 established 467 Diagnostic Related Groups (DRG's) for hospital patients. Principal medical diagnosis was the primary criterion for the construction of DRGs. The presence or absence of complications, comorbidities, age, sex, discharge status and length of stay were additional factors considered to exert important influences on the amount of resources used by patients (Bostrom & Mitchell, 1991).

The promoters of this system believed that patients within a specific DRG use, on average, like amounts of resources, including nursing care, support services, room and board, supplies, drugs and ancillary services (Bostrom & Mitchell, 1991). The specific cost assigned to each DRG was based on historical costs of all resources required to care for patients during hospitalization. However, the variability of nursing resources associated with each DRG was not captured and nursing costs were considered constant and associated with the room rate (Fosbinder, 1986).

Nurse administrators challenged the decision to include nursing resource use as a fixed cost. NWMS were developed because of the recognition that patients with the same medical diagnosis have significantly different nursing care requirements due to differences in severity of illness, complications and motivation (Edwardson, 1989). The underlying premise for nursing's challenge to the DRG system was that variations in nursing care could be identified, measured and converted to time standards. Time standards could then be converted to dollars and ultimately to the cost of nursing care (Fosbinder, 1986). With the introduction of the prospective payment system it became important for nurse researchers to define actual costs of nursing care per DRG.

In the mid 1980's a number of studies were conducted to explore the variable nature of the demand for nursing care/costs within the framework of DRG's. Sovie et al. (1985) examined the nursing care requirements of 24,879 patients within 459 DRGs. They used an agency specific factor system (SMH) based on the Rush Medical Centre nursing patient classification instrument to determine the nursing acuity levels of patients in the study setting. Concurrent validity of the SMH was assessed by correlating scores on this measure with those obtained from the Rush Medicus instrument. The rate of agreement between the two measures on a sample of 127 patients was 66%. Reliability of the SMH was also assessed in the study. Interrater reliability between expert raters and nurses was reported at 88 percent.

Nursing hours for a sample of 20 DRG's were presented. DRG 75, Major Chest Procedure, is cited as an example. In a sample of 74 patients the mean nursing hours was 138.1 (SD ±287.8), the range of hours varied between 4.2 to 2484.4, CV=208.4. Based on the broad range of nursing hours and the high coefficient of variance, it was concluded that the nursing needs of patients within individual DRG's were extremely variable.

In other words DRGs are not homogenous from a nursing resource utilization perspective (Sovie et al., 1985).

Comparable work related to the Canadian equivalent of the DRG, that is, case mixed groups (CMGs) produced different findings. O'Brien-Pallas, Tritchler and Till (1989) examined the hours of care estimates produced by three PCS within the framework of CMGs. The study sample consisted of 97 patients in five CMGs. Pretest interrater reliability was reported as 95 percent agreement. The author's noted that validity assessments of the systems were limited. The analysis revealed that each system estimated significantly different hours of care (p=.0017). While the range of hours was large for each system when grouped by medical diagnosis, the coefficient of variation was relatively small (CV=0.20 to 0.68). In contrast, previous results of workload estimates, not grouped by CMGs, produced higher coefficients of variation (0.79 to 1.04) O'Brien-Pallas, Leatt, Deber & Till, 1989. The authors suggest that workload estimates analyzed within CMGs are more homogenous.

Halloran (1985) investigated the effects of 31 DRGs, 37 nursing diagnoses and selected demographic variables (age, sex, marital status, payor and length of stay). Nursing workload, as measured by Rush-Medicus PCS, was the dependent variable. Interrater reliability was assumed through intensive training sessions on appropriate criteria for classification. Validity of the Rush-Medicus PCS was evaluated in two pilot studies in which nurses' estimates of direct care time was correlated with Medicus scores. The resulting coefficients $r(101)=.920$, $p<.01$ and $r(76)=.853$, $p<.01$, indicated a strong positive correlation between the two measures. The authors used multiple regression analysis to assess the predictability of each independent variable separately and subsequently combined them to generate one regression equation. The findings indicated that 26.3 percent of variation in nursing workload was explained by DRGs and 53.2 percent by nursing diagnosis. Only 4.3 percent of the variation in workload was explained by age, sex and race. Halloran also subjected the 37 nursing diagnoses and the 31 DRGs to stepwise analysis. Sixty percent of the variance in daily workload was explained by the DRG/ Nursing Diagnosis model. The results also indicated that 75 percent of the sum of the squared beta values were associated with nursing diagnosis and 25 percent with DRG's. Using this 75:25 proportion, 45% of the variation in nursing workload was associated with nursing diagnosis (.25 x 60.3), 15 percent with DRGs (.25 x 60.3) and 40 percent unexplained.

Halloran (1985) and others (Halloran and Halloran, 1985; Lagona and Strilzel, 1984; McKibben, Brimmer, Galliher, Hartley and Clinton, 1985; Trofino, 1986, 1989) used NWMS to describe the heterogeneity of nursing resource utilization within individual DRG's. The findings from these studies suggest that it is possible to determine nursing costs by NWMS, thereby discriminating between high and low complexity on the basis of hours of care provided.

While time and complexity may be highly correlated, specifically in the case of critically ill patients, the terms are not interchangeable (Giovannetti, 1986). There are many patients who require extensive amounts of nursing care time yet their care may not be considered complex. Because time cannot always be used as a surrogate for complexity, some researchers recommend that nursing intensity measures be used to more accurately reflect nursing care costs. As the use of PCS expanded beyond the measurement of patient needs for staffing to costing and reimbursement comparability, complexity and skill mix became major issues (Bostrom & Mitchell, 1991; O'Brien-Pallas, Leatt, Deber & Till, 1989; Price & Lake, 1988; Thompson & Diers, 1986).

Measures of Nursing Intensity

As cost identification gained importance, nurse administrators were concerned that the existing PCS may not be capturing the full domain of nursing. Most PCS defined nursing practice as the performance of a series of tasks or procedures. The focus on concrete behaviours did not account for the decision making complexity and the level of care provider required for patient care (Prescott et al., 1991). Measures of nursing intensity were developed to address some of these concerns.

Reitz (1985a, 1985b) developed and tested the Nursing Intensity Index (NII). The NII, based on the theoretical construct of care complexity, consists of two subscales - Biophysical Health and Behavioral Health (Reitz, 1985a, 1985b). Patients are rated on an ordinal scale from one, (minor) to four, (extreme). A level one patient exhibits mild health problems which require routine nursing interventions. A level four patient exhibits a life threatening illness which requires continual observation and assessment.

In contrast to the NWMS, the NII is a generic instrument designed for application across hospitals. Reitz (1985b) used the NII to assess the nursing care requirements of inpatients in eight clinical departments at Johns' Hopkins Hospital. The sample consisted of 784 discharges representing approximately 8,200 patient days. Interrater reliability across all departments was reported at 84 percent. Reliability of raters with respect to total score per case ranged from Ar=.955 to .555. The overall intensity scores varied widely across the scale levels in the study sample (N=784). Thirty-two percent of the patients were rated at level 1, 55 percent at level 2, 12 percent at level 3 and one percent at level 4.

Similar findings were reported for Horn's Severity of Illness Index (SII). In a total sample (N=678) 32 percent of the patients were rated at level 1, 53 percent at level 2, 14 percent at level 3 and one percent at level 4. Relevant findings revealed that mean resource use increased as NII and SII scores increased. Nursing intensity and severity of illness showed the strongest correlations in the Departments of Medicine (r=.626), Neurology (r=.613), and Psychiatry (r=.597) at a p value of .001. A very weak correlation was reported in Ophthalmology (r=.088, p=.389).

Analysis of nursing intensity by diagnostic group revealed that 239 DRGs were represented in the study population. However, the sample size in each group was small: only one case was reported in 46 percent of the DRGs while ten or more cases were reported in 5.4

percent. Ophthalmological diseases/disorders were most homogenous with respect to intensity score, while psychiatric diseases/ disorders were the least homogenous. Sixty-four percent of the DRGs were classified at only one level, 31 percent at two levels, five percent contained three levels and one percent contained four nursing intensity levels.

Homogeneity was further assessed by computing weighted average coefficients of variation for total charges across all departments. Coefficient of variation revealed that the creation of subgroups achieved greater homogeneity. The greatest reduction in variation was seen in Oncology (111.07) and Neurology (71.88). Least reduction was achieved in Psychiatry (7.93), Obs/gyn (7.12) and Ophthalmology (9.07).

Bost and Lawlor (1989) applied the Reitz NII retrospectively to 107 health records representing 10 DRGs. Statistically significant relationships were found between NII, length of stay and hospital charges. The findings revealed that DRGs were not homogenous for nursing intensity - with 20% having ratings in all four levels, and 50% in three of the four levels. Reitz (1985b) demonstrated similar findings but not so dramatically.

Bailie (1986) found nursing intensity needs of patients varied within and between DRGs. Using the NII, 36.7 percent were rated at Level 1, 41.6 percent at Level 2, 20 percent at Level 3 and 1.7 percent at Level 4. The average nursing intensity for the study population was 1.866, this compares favourably with the 2.0 average nursing intensity of Reitz (1985b). Like Reitz, Bailie demonstrated a positive correlation between the NII, length of stay and total charges.

Bailie (1986) and Bost and Lawlor (1989) applied the NII instrument retrospectively without modification. Neither study included severity of illness as a variable, but both supported the relationship between the NII and length of stay, hospital charges and DRGs. These findings again demonstrate the heterogeneity of nursing resource use within the DRG framework.

Prescott and Phillips (1988) developed the Patient Intensity for Nursing Index (PINI). The PINI was based on a definition of nursing intensity which includes the amount of care, complexity of care, and clinical judgment. The PINI consists of four conceptual dimensions 1) severity of illness, 2) dependency, 3) complexity and 4) time. The items measuring each dimension are scored on a five point ordinal scale (Castorr, Thompson, Ryan, Phillips, Prescott & Soeken, 1990; Prescott, 1991; Prescott et al., 1991; Prescott & Phillips, 1988; Prescott, Soeken & Ryan, 1989; Soeken & Prescott, 1991).

Prescott et al. (1991) reported findings on the psychometric properties of the PINI generated from a purposive sample (N=6445) representing 397 DRGs in five hospitals. The ratings were done daily by 487 RNs on 29 medical, surgical and intensive care units. Interrater reliability was reported at Kw=.62 for 408 paired ratings of day and evening RNs. The internal consistency of the PINI using Cronbach's Coefficient alpha was .85. Construct validity of the PINI was assessed by confirmatory factor analysis. Factor analysis confirmed the specified components of severity of illness, dependency, and complexity with time loading on all three factors.

The PINI was also compared with other theoretically related measures. PINI scores were reported as significantly related to medical severity of illness As-score (r=.44), length of stay (r=.31), number of secondary diagnosis r=.33, and specialty consults (r=.33). All correlations were in the slight to moderate range and were significant at p<.0001. The PINI scores were also reported as significantly related to other PCS, Medicus (r=.70), GRASP (r=.54), and San Joaquin (r=.55).

These correlations were in the substantial to moderate range and significant at p<.0001.

A contrasted group approach was used to further examine validity. Patients requiring high and low levels of care based on DRGs were identified and differences in the average PINI scores were examined. On average those patients in high care DRGs scored five points higher on the PINI, than those in low care DRGs (p<.0001). Observational study of the hours of care item revealed that the observed time spent providing care to specific patients (N=97) was reported to be significantly correlated with nurse (N=24) estimates of time (Spearmans rho=.75, p<.001). Overall percent agreement between nurse and observer was reported at 69 percent.

The researchers concluded that the internal consistency and interrater reliability of the PINI were acceptable. Validity testing also produced evidence that the PINI was a multidimensional measure of nursing intensity which relates positively to other measures of resource consumption.

In a subsequent study, Phillips, Castorr, Prescott and Soeken (1992) compared the PINI to two traditional PCS: Medicus and GRASP. Data were collected in four rural and urban hospitals ranging in size from 300 to 1000 beds. A purposive sample of 24 general medical-surgical and specialty units was selected to obtain patients from commonly occurring DRGs. Ratings were collected from two subsamples (N=1829) in which patients were rated concurrently with PINI and Medicus (N=1117). Validity of the Medicus system was assumed based on earlier work by Halloran (1985). Reliability of both systems and validity of GRASP were not reported. The mean average scores were as follows: Medicus (M=40.39, SD ±22.92), GRASP (M=63.07, SD ±19.25), and PINI (M=20.89, SD ±4.55). The average PINI score was significantly correlated with the average GRASP score (r=.66) and the average Medicus score (r=.69), indicating a shared variability of 44 and 49 percent respectively. Statistical significance level for Pearson's r was p<.0001.

Stepwise multiple regression analysis was performed to determine the degree to which average PINI item scores were predictive of the average PCS scores. The strongest predictor of Medicus scores were activities of daily living, task/procedure complexity, physiological status, mobility and hours of care (N=914). These predictors explained 51 percent of the variance in Medicus scores. The strongest predictors of GRASP scores were hours of care, task/procedure complexity, mobility and complexity of clinical judgement ($\underline{N}$=558). Together these predictors accounted for 59 percent of the variance in GRASP scores.

Phillips et al. (1992) noted that only the PINI items, 1) hours of care, 2) task/procedure complexity and 3) mobility, were significant predictors for both Medicus and GRASP scores. Further activities of daily living, physiological status, complexity of decision making were significant for one but not both scores. Finally, knowledge deficit, emotional status, severity of illness and potential for injury were not significant predictors for either Medicus or GRASP scores. The researchers suggest that there are differences in what is measured by PCS, and that these systems should not be considered interchangeable or equivalent measures of nursing intensity.

<u>Research in Skill Mix</u>

Despite references to skill mix few studies focused specifically on this concept. Minyard, Wall and Turner (1986) investigated productivity in a convenience sample comprised of different levels of care givers (RN's, LPN's and NA's). These authors found that generally productivity levels increased as skill level increased.

Glandon, Colbert and Thomasma (1989) explored the relationships among team and primary nursing, staff mix and labour costs. They found a wide variation in nursing cost by care delivery method. Adams and Johnson (1989) demonstrated that staff mix on a unit varies according to acuity/care plan rather than DRG's or Nursing Diagnosis. The results suggested that approximately 61 to 80 percent of the care delivered for a specific group of patients required RN skills, the remaining 39 to 20 percent of care could be provided by para-professionals.

Schade and Austin (1992) combined the concepts of time and complexity to develop a PCS for a pediatric ambulatory care setting. Based on work by Verran (1982, 1986) they used a series of Delphi surveys to attach mean time and complexity ratings to a taxonomy of nursing activities observable in an ambulatory care setting. Data were collected in 111 clinics and on 2219 client visits. Reliability was reported at 92.8 percent agreement. Descriptive statistics revealed considerable variation in both time and complexity scores: time ($\underline{M}$=8.3, $\underline{SD}$ $\pm$12.0), with a range between 7.8 to 67.8 minutes; complexity ($\underline{M}$=109.0, $\underline{SD}$ $\pm$38.2), with a range between 25.8 to 240 minutes.

To determine the appropriate number and mix of staff the activities provided were analyzed descriptively. The two most frequent activities are cited as examples. Nursing assessments were completed for 87.8 percent of the clients, the mean time was 12.5 minutes and the mean complexity was 55.3. These results indicated that although assessment was not the most time consuming it was among the more complex and thus required professional nursing intervention. Measurements, usually height, weight and vital signs were completed for 71 percent of clients, the mean time was 5.0 minutes and the mean complexity was 15. Because of the low complexity rating this activity could be performed by a less skilled caregiver. Numbers of staff assigned were based on total activity time determined by multiplying mean time by the frequency. Skill mix was determined by complexity rating, that is, a higher complexity rating indicated the need for more skilled staff. Schade and Austin (1992) note that although the time and complexity estimates required further validation, the information obtained was useful in evaluating and adjusting the staffing level and mix in some clinics.

Summary

This review provided an overview of traditional NWMS and their significance for determining care requirements for staff allocation and costing purposes. Several studies demonstrated the variability in nursing care requirements of patients with similar medical diagnoses (DRGs). These studies support the hypothesis that nursing care time is more accurately reflected by nursing condition than medical condition.

Using the NWMS for costing purposes was a logical step given the existing database in most hospitals. However data generated by NWMS have a number of important shortcomings. First, comparability of findings across data sets is problematic because of instrument differences and methodological limitations which may have contributed to inconsistent findings. Further reliability and validity assessments for some systems were not reported. Based on study findings one group of researchers recommended mechanisms to establish equivalence (O'Brien-Pallas, Cockerill & Leatt, 1992). Second, complexity of care has been given limited attention. Third, skill mix has not been the subject of extensive empirical research.

A number of studies demonstrated that it is possible to relate nursing costs to DRGs on the basis of hours of care provided. Others suggest that nursing costs are captured more accurately when measures of nursing intensity are used to estimate both the quantity and complexity of nursing care. One study in ambulatory care quantified nursing activities by time and complexity to evaluate and adjust staffing levels and mix (Schade & Austin, 1992).

Some important points emerging from the literature include: a) PCS have been the subject of much research attention, b) reliable and valid measures of the quantity and intensity of nursing care exist, c) the relationships among quantity of care, intensity and nursing costs have been studied, d) the relationships among quantity of care, intensity and skill mix have received little research attention.

The merger of NWMS and DRGs to identify nursing costs takes advantage of a major data collection system already present in most acute care settings (Henry, 1989). More recent studies suggest that this approach might not be appropriate because complexity of care is not accurately reflected by NWMS. It is apparent that nursing service costs should be operationalized from variables that conceptualize both the quantity and complexity of care. Once a valid and reliable system for categorizing patients according to complexity has been formulated, these data can be merged with NWMS data to determine the quantity of care required and the appropriate level of caregiver (Reitz, 1985).

The literature suggests a need for further investigation of measures of the quantity and complexity of nursing care and skill mix. As previously discussed, if skill mix can be related to cost, that is, the hourly wage of the care giver, integration of these measures may prove useful to Canadian nurse administrators by providing a more accurate match between patient need and caregiver expertise.

The current study attempted to integrate data from a NWMS and the NII to predict an appropriate number and mix of staff. The study is unique in that it is the first attempt to compare and integrate data from the GRASP System with data from a nursing intensity measure to predict skill mix. The selection of variables for this study was guided by the Nursing Resource Model developed by Atwood, Hinshaw and Chance (1986). This model was also used as the study's conceptual framework.

Conceptual Framework

The Nursing Resource Model developed by Atwood, Hinshaw and Chance (1986) was created to explain the patterns of nursing requirements, nursing resources needed and the rate of resource replacement within the framework of DRGs (see Figure 1). More specifically, the model was designed to explore the degree to which delivery of nursing care is determined by a match between the need for care, the associated time and costs and the reimbursement received.

The model consists of four stages. Stage 1 addresses patient care requirements as measured by a PCS.

The complexity of such requirements, that is the amount of professional knowledge and skills needed to provide the care, guides not only the number but also the type of staff needed, such as RN, LPN or NA. Patient classification systems consider the patients requirements on several dimensions ranging from activities of daily living, medical orders to independent nursing interventions. The complexity of nursing care associated with these activities is used to predict the type and number of resources needed.

Stage II of the model consists of the predicted resources needed. Two types of resources, nursing time and cost, are important. Nursing time is considered not only in terms of hours but also the type of personnel required. Cost is clearly associated with the amount of time needed and the type of nursing staff required. Costs are computed by multiplying time spent per patient by the average hourly wage of the caregiver.

Stage III consists of resource consumption. The important concepts in resource consumption are the number of hours used and the charges associated with these hours. Nursing hours used refers to the hours of service provided and charges refers to the dollars paid for those hours. Charges are computed by multiplying the number of paid hours by the hourly wage of the caregiver.

Stage IV consists of the rate of resource replacement. Rate of replacement is defined as the charges made to the patient based on their nursing care requirements and the number and type of nursing resources consumed.

The Nursing Resource Model predicts that resources needed, that is nursing care time and costs (Stage II), are directly related to resources consumed (Stage III) and indirectly to the rate of resource replacement charges (Stage IV). Atwood et al. (1985) used this model to substantiate long standing beliefs held by nursing, that there is little relationship between DRGs and resource demand, and there is little correlation between charges made and resources consumed. More specifically, knowing a patients DRG does not permit prediction of the complexity of care needed, the amount of staffing needed or the amount of charges made.

The Nursing Resource Model provides a useful theoretical base for studying skill mix. Patient care requirements, measured in terms of hours and complexity, are used to predict required nursing resources in terms of numbers and skill level of personnel. Thus, the importance of determining skill mix in the Nursing Resource Model is evident. Although Atwood, et al. (1985) propose the Nursing Resource Model for staffing and costing purposes, only the staffing stages, that is identification of care requirements (Stage 1) and prediction of resources needed (Stage 2) will be used in this study. Stage I will be operationalized using the GRASP NWMS to quantify hours of care and the NII will be used to quantify complexity. Hours of care and complexity score will be used to predict the numbers and skill level of nursing personnel.

Definition of Major Variables

The Nursing Resource Model was used to develop definitions for the major variables to be considered in this study.

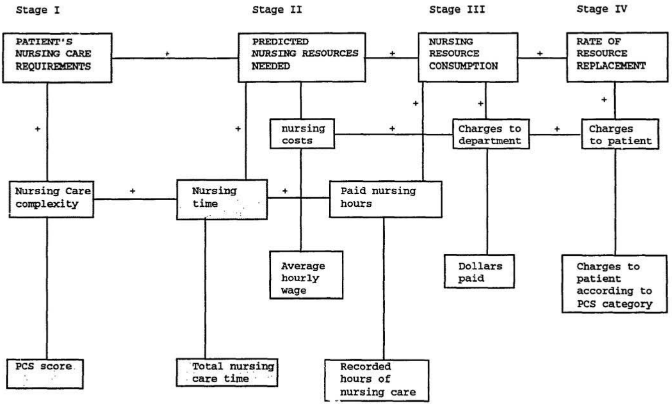
Staffing Pattern

Staffing pattern refers to the nursing resources required to provide nursing care for a specified group of patients. In this study staffing pattern is operationalized in terms of number and skill level of nursing personnel.

Skill Mix

Skill mix refers to the combination of nursing personnel, (registered nurse, licensed practical nurse, nurses aide) on a nursing unit (Young et al, 1981). In this study skill mix is defined as the ratio of registered nurses to registered nursing assistants.

FIGURE 1 Nursing Resource Model Based on Patient Care Requirements



Source: Atwood, Hinshaw and Chance (1986)

Complexity

Complexity is defined by factors that complicate implementation of the nursing process and the knowledge and skill required to perform procedures (Prescott, 1991). In this study complexity is operationalized in terms of nursing intensity scores. A nursing intensity measure categorizes patients into homogenous groups based on the complexity of their care needs. The NII developed by Reitz (1985a, 1985b) was used to measure nursing intensity in this study.

Hours of Care

A nursing workload measurement system is defined as a system which uses an open ended scale to determine hours of nursing care per patient (Cockerill & O'Brien-Pallas, 1990). Hours of care refers to nursing time spent providing care to meet patient needs. In this study hours of care are operationalized in terms of the GRASP score. The GRASP NWMS was developed by researchers in the mid 1970's (Meyer, 1978).

Objectives

The Nursing Resource Model was used to formulate the following research objectives:

1. to assess the psychometric properties of the NII and GRASP, Patient Classification Systems.

2. to determine the quantity and complexity of nursing care required by selected medical patients through application of GRASP and NII.

3. to merge data from GRASP with data from the NII to project a staffing pattern by identifying the number and mix of staff needed to provide care to medical patients.

4. to determine if the perceptions of caregivers supports the projected staffing pattern.

Summary

This chapter has presented a review of the literature related to the use of traditional PCS and Nursing Intensity Measures for staffing and costing. Staffing and costing are concepts thought to be closely related to numbers of personnel and skill mix. The Nursing Resource Model and its application to numbers and mix of staff has also been discussed. The research design and methods of the study will follow in Chapter III.

CHAPTER III

DESIGN AND METHODS

This chapter presents the research design, sample selection, the setting, human subjects protection and procedures for data collection for the study. The instruments used to measure quantity and intensity of care will be described along with the plan for data analysis.

Research Design

A descriptive correlation prospective design was used to assess the psychometric properties of two patient classification systems and their ability to predict the staffing pattern (SP) for a sample of medical patients. The quantity of care was measured by the GRASP system while intensity of care was measured by the Nursing Intensity Index (NII). The prediction for staffing pattern is SP = GRASP + NII scores, where the GRASP score (hours of care required per patient day) and NII score (nursing intensity per patient day) are the independent variables.

Setting

Participants were recruited from a 26-bed unit, which provides nursing services for patients with general medical disorders and cardiac diseases at a 323 bed tertiary care center in eastern Canada. Although the unit's main focus is post-coronary care, patient needs vary from cardiac diagnostic assessment to treatment for chronic obstructive pulmonary disease, diabetic keto-acidosis, gastro-intestinal disorders and respiratory disorders.

Patients who transfer from CCU require extensive teaching. Following assessment of teaching needs, individual or group sessions are provided on dietary modification, weight control, exercise, medication and lifestyle adjustments. Post-myocardial infarction patients require 24 hour cardio-respiratory assessments. Telemetry is used to monitor for early signs of complications including arrhythmias, congestive heart failure or recurrent angina and myocardial infarction. Nursing interventions focus on preparing patients for cardiac catheterization, angioplasty, bypass surgery and heart and liver transplantation. Other nursing interventions relate to pleural infusion, pneumothorax and tracheostomy, blood dyscrasia and overdose.

The nursing staff on the study unit consists of 24.6 full-time equivalent positions: 19.3 registered nurses, 6.0 nurse interns (third year nursing students) and 4.6 registered nursing assistant positions. Unit assignment is the method of care delivery. Unit assignment is a modification of team nursing in which a Unit leader and two assistants provide care for a group of patients, i.e., usually twelve.

Sample and Selection Criteria

Seventy-one patients, representing 374 patient days, constituted the sample. All patients present on the unit during the data collection period were included.

Human Subjects Protection

The study was approved by the Human Investigation Committee of both Memorial University of Newfoundland, Faculty of Medicine and Hospital A (see Appendix A). Permission to access the nursing unit was obtained from the Chief Executive Officer of Hospital A (see Appendix B). Nursing personnel who agreed to participate by rating subjects signed an informed consent (see Appendix C). The informed consent described the purpose, procedures and risk/benefits of the study. The consent advised nursing staff of their right to participate, refuse or withdraw without prejudice to their present or future status as staff members. Informed consent of patients was not required because they were not direct participants in the study. However, patients were not identified by name and anonymity was assured by use of a code. The completed rating scales and signed consent forms were kept on file and accessible only to the researcher.

Procedures

A pilot study involving four days of data collection was completed in March 1991 as a pretest of the Nursing Intensity Index. The pretest was necessary to familiarize the researcher with the instrument and to identify possible sources of data. At the Johns Hopkins Hospital, the developmental site of the NII, nursing documentation forms, that is, the nursing history, care plan and progress notes were structured to parallel the NII, thus facilitating data collection with ease. In the absence of such forms, data collection in this setting was anticipated and proved to be much more difficult. Typically, application of the NII involved participation at shift reports, rounds and conferences, interviews with caregivers, patients and/or family, maintenance of anecdotal records and review of the health record.

Data were collected over a 15-day period in April and May of 1991 and data collection proceeded according to the following plan. Background data were collected by the researcher from each patient's health record and recorded on the Background Data Sheet (see Appendix D). All patients had NWMS assessments completed by a registered nurse or nurse intern at 1400 hours daily, predicting the hours of care required for the next 24 hours (see Appendix E). Routine peer audits for interreliability were completed weekly. The researcher rated patients on the study unit daily using the NII assessment tool (see Appendix F). Random interrater reliability testing was completed. Registered nurses, nurse interns and registered nursing assistants independently completed an adapted staffing adequacy instrument for each patient towards the end of each shift (see Appendix G).

Research Instruments

Background data sheet

This tool was used to summarize data from the patient's health record. Specific categories of data gathered included age, sex, length of stay (LOS) and case mixed group (CMG). These variables were used to help explain variations in workload for both the NWMS and the NII (see Appendix D).

The GRASP System

NWMS are defined as either prototype or factor-based systems (Giovannetti, 1979; Jackson & Resnich, 1982; Hoffman, 1988; Barnum & Mallard, 1989). Prototype systems generally use patient profiles or descriptors to place patients into different (low to high) care levels. The average time for each care level is determined through observational study. Factor-based systems delineate nursing interventions. Knowledge of the time and frequency of interventions permits an aggregation of the care required for each patient. Figure 2 presents an overview of the major characteristics of each system. The GRASP system is a factor-based system.

The GRASP (Grace Reynolds Application and Study of PETO) system developed by a research project in the mid 1970's takes advantage of Pareto's law, a phenomenon in which a small number of activities can account for a high percentage of workload (White, 1991). This system, extensively used in hospitals throughout North America, has been operational at Hospital A since 1984.

GRASP scores are associated with standard times for specific nursing interventions. The number and scope of indicators vary by nursing unit and hospital; the norm is in excess of 40 items. Nurses complete the GRASP chart daily, assessing the volume of care their patients require for a 24-hour period, based on the nursing care plan and physician orders. The chart values are added to produce an aggregated score in hours per patient day. An aggregate of the patients total care hours predicts the number of nursing care hours required.

Figure 2 Major Characteristics of NWMS

Prototype Systems	**Factors Systems**
Descriptors	Interventions
A patient who	
- is mildly ill	- diet activities
- requires little treatment	- hygiene activities
observation or instruction...	- medication
activities	
- ...is without intravenous	- vital signs
therapy or many medications	
Measurement Outcome	
- Average hours per care level	- Hours per patient
Examples	
- Medicus	- GRASP
	- NISS
	- P.R.N.

Hospitals that use the GRASP system choose either to conduct time studies or use the values provided by the GRASP data base of over 600 user hospitals. Because both the interventions and associated time values are hospital specific, each hospital must conduct its own validity and reliability testing (Phillips, Castorr, Prescott & Soeken, 1992). Content validity of the GRASP instrument at the study hospital was established through a process of review by a panel of inhouse nursing experts who compared the care indicators and time standards with the GRASP system data base. This is the standard procedure for assessing the content validity of these instruments (Ebener, 1985; Whitney & Killien, 1987; Williams, 1988). Concurrent validity of the GRASP instrument is assessed yearly by correlating the scores on this measure with those obtained using a questionnaire related to staffing adequacy completed by charge nurses and nursing supervisors. The rate of agreement for 1990, on a sample of seven days, was 92 percent. A comparison of nurses independent rating is recognized as an important validation procedure (Williams, 1988). Criterion-related validity of the GRASP System was supported in two studies. O'Brien-Pallas, Leatt, Deber and Till (1989) reported high correlation between the hours of care provided by GRASP, Medicus, PRN76, PRN80 and NIIS, and

Phillips, Castorr, Prescott and Soeken (1992) found significant correlations between the average scores of GRASP, Medicus and PINI. There is no documentation of construct validity testing of the GRASP system (O'Brien-Pallas, Leatt, Deber & Till, 1989).

Interrater reliability of the study hospital's GRASP instrument was established through extensive inservice of the user group. Peer interrater reliability audits are conducted weekly. Agreement scores for 1991 averaged 96.4 percent agreement. Maintenance of rater agreement at 90 percent or higher documents reliability (Ebener, 1985).

The Nursing Intensity Index

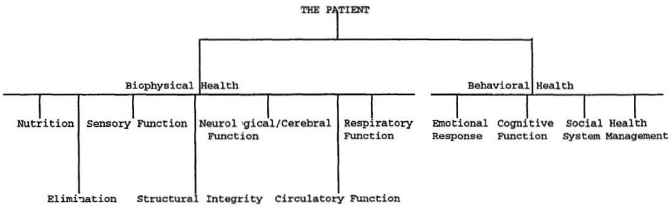
The NII was developed and used by Judy A. Reitz to provide the basis for a cost allocation system for nursing. The conceptual underpinnings of the NII are two fundamental health dimensions: biophysical health and behavioral health (see Figure 3). The biophysical health dimension, includes seven functional parameters: nutrition, elimination, structural integrity, sensory, neurologic, cerebral, circulatory and respiratory function. The behavioral health dimension includes four functional parameters: emotional response, social system, cognitive response and health management.

Narrative descriptors of the nursing process associated with each parameter provides a prototype classification scheme. An overview of the NII rating scale is presented in Figure 4. A level 1 patient, exhibits mild health problems which require routine nursing interventions, whereas a level 4 patient exhibits a life threatening illness which requires continual observation and assessment.

The parameters are rated on an ordinal scale: level 1 = minor, level 2 = moderate, level 3 = major and level 4 = extreme. Score assignment is based on application of the nursing process. The score assigned to each parameter is a measure of the nursing intensity required (Reitz 1985a). Figure 5 presents an example of how a patient is classified as level 2 (moderate intensity) with respect to cognitive response. As intensity level increases the patient exhibits increasing cognitive impairment and application of the nursing process becomes more complex. The scores assigned to each of the eleven parameters are summed. The final rating is determined by dividing the total score by the number of parameters to calculate a mean intensity rating.

Reitz (1985b) reported on the psychometric properties of the NII. The average interrater reliability score across eight clinical departments based

Figure 3 Conceptual Model of Nursing Intensity Index. Primary Health Dimensions



Source: Reitz 1985a; 1985b

Figure 4 The Nursing Intensity Index: A Generic Description of the Nursing Process

Level 1 Minor

Assessment:	Minimal to no health deficit present. Independent adaptation observed.
Planning:	Routine care planning process utilized.
Intervention:	Minimal to nursing action required.
Evaluation:	Routine evaluation of health status initiated. Good prognosis expected.

Level 2 Moderate

Assessment:	Mild health deficit limited in scope.
Planning:	Periodic revision to plan of care required.
Intervention:	Non-complex therapeutic nursing action required.
Evaluation:	Periodic re-evaluation of health status required. Good prognosis expected.

Level 3 Major

Assessment:	Significant health deficit present. Systemic involvement evident.
Planning:	Frequent revision to plan of care required.
Intervention:	Complex therapeutic nursing actions required.
Evaluation:	Frequent re-evaluation of health status required. Questionable prognosis apparent.

Level 4 Extreme

Assessment:	Life threatening health deficits present.
Planning:	Constant revision to plan of care required.
Intervention:	Constant observation, monitoring and therapeutic interventions required.
Evaluation:	Constant re-evaluation of health status required. Poor prognosis evident.

Reitz (1985a)

on 784 discharges was 84 percent agreement. Percent agreement scores ranged from 77 percent to 93 percent in the departments of Medicine and Ophthalmology respectively. Reliability of raters with respect to total NII score per case ranged from Ar=.555 to .955.

Face and content validity were assessed by a panel of nurse experts. Prototype definitions were examined systematically to verify their adequacy as measures of nursing resource use at each level. Concurrent validity was assessed by correlating the NII with severity of illness ($\underline{r}$=.61), length of stay ($\underline{r}$=.47), routine charges ($\underline{r}$=.43), total charges ($\underline{r}$=.30), pharmacy charges ($\underline{r}$=.22), radiology charges ($\underline{r}$=.27) and laboratory charges ($\underline{r}$=.23). All of the obtained Pearson's r values were significant ($\underline{p}$=.001). Predictive validity was supported by regression analysis. The eleven parameters taken together explained 72.8% of the variance in the overall NII score ($\underline{R}^2$=.728, $\underline{p}<.05$). In the regression equation the combined effects of emotional response, elimination, circulatory function, neurological function and nutrition explained 64.6 percent of the total variance. The seven remaining parameters contributed very little to the overall score.

Figure 5 Nursing Intensity Index Prototype Descriptive Definition for Cognitive Response

Definition	Intellectual processes which enable an individual to receive, process and transmit (feedback) information and which are influenced by his physiological, educational and developmental capabilities.
Level II	Moderate Intensity
Assessment	The patient exhibits some limits to process information ... and in making decisions independently ... developmental age, ... sensory or memory impairment and/or anxiety impede communication ...
Planning	Planning ... requires ... consideration to cognitive functioning. Periodic revision to care plan...
Intervention	The method of frequency of ... teaching ... may need to be altered. Clarification and reinforcement are necessary ... may only address one aspect of care at a time...
Evaluation	... demonstrates that communications process is ... impeded ... usually comprehends information after clarification ...

Reitz (1985a)

Although the NII was designed to be applied retrospectively, that is following discharge, there is precedent that it may be applied concurrently to establish a staffing algorithm (Reitz, 1986). In this study the NII was administered and scored concurrently according to guidelines prepared by Reitz. The researcher and her thesis chair attended a 16-hour inservice training session at Johns Hopkins Hospital Institute conducted by Dr. Reitz and her delegates. Approval to use the NII in this study was granted by Dr. Reitz (see Appendix H).

Staffing Adequacy Instrument

The Staffing Adequacy Instrument (SAI) developed by Williams and Murphy (1979) was adapted for use in this study (see Appendix G). The SAI relies on expert nursing judgement to assess the staffing level required to provide an acceptable standard of care. More specifically, nurses estimate the staff's ability to provide certain elements of care under different conditions.

Williams and Murphy (1979) used the SAI to determine the extent to which associations existed among objective measures of adequate staffing, the services provided and charge nurses subjective judgement of both these elements. The study was conducted on six nursing units in two hospitals representing 204 shifts. Face validity was assumed on the basis of the project staff's knowledge of the area and review of the instrument by head and charge nurses. In part, the SAI is related to patients need for care. Nurses were instructed to classify each patient's needs as minimal, average or maximum according to their professional judgement. Analysis of the amount of care differed significantly ($p<.001$). It thus appeared that nurses were quite accurate in their estimates of patient care requirements. Although personnel mix was not accounted for in the study, 23.6 percent of the responses cited less than optimal "mix of skill level" as reasons for inadequate staffing.

In the current study, direct caregivers used the SAI to rate the skill level needed that is RN, NI or RNA to provide shared care to their assigned patients. Shared care was defined as care elements listed on the GRASP instrument that fall within the scope of practice of both the RN and RNA. Shared care included routine teaching/emotional support, diet, hygiene, turn and assist activities, elimination, vital signs and other nursing care (see Appendix G). All patients were rated by at least one and as many as three caregivers. These modifications to the SAI were not expected to affect its psychometric properties.

Data Analysis

The data were analyzed using the Statistical Package for Social Sciences, revised edition (SPSSX Statistics for the Social Sciences, Inc., 1988). Descriptive statistics were used to describe the sample and to address the skill mix questions. Pearson's product-moment correlation coefficient (Pearson's r), multiple regression and factor analysis were used to assess the psychometric properties of the NII and GRASP. In the event that the assumptions of normalcy were violated, appropriate non-parametric tests would have been used, that is Spearman's Rho, log-linear analysis and logistic regression et cetera (Munroe & Page, 1993).

Concurrent validity of the instruments was assessed using Pearson's r. This statistic is recommended when investigating linear relationships between variables measured on an interval or ratio scale (Polit & Hungler, 1991). However, when ordinal data are fairly normally distributed Pearson's r is an appropriate statistic (Munroe & Page, 1993).

Predictive validity was assessed through multiple regression analysis. Stepwise multiple regression examines the relationship between the criterion variable and two or more predictor variables (Munroe & Page, 1993). Results were considered significant when p values were equal to or less than .05.

Explanatory factor analysis was used to assess construct validity of the patient classification systems. Factor analysis examines the interrelationships among large numbers of variables to identify clusters of variables that are closely linked (Burns & Groves, 1987). For data analysis an eigenvalue of 1.0 or above was considered significant.

Summary

This chapter presented the methods used to conduct the study. Where available the psychometric properties of the instruments have been reported. Modifications to the staffing adequacy instrument were discussed. Data analysis has also been described.

CHAPTER IV

RESULTS

The purpose of this chapter is to report the findings: frequencies and percents are used to summarize the data on diagnostic classification, hours of nursing care and complexity of care. Each subsection contains a brief overview of data collection procedures. Tables are presented to enhance comprehension of the results.

Sample Characteristics

The sample consisted of 71 patients, 41 male and 30 female. The mean age was 63.3 years (SD ±13.48) with a median of 66 years, a mode of 79 years and a range of 17 to 85 years. The mean length of stay (LOS) was 12.1 days (SD ±14.2) with a mode of four days. LOS ranged from two to ninety days. Twenty-five percent of the patients remained in hospital following completion of the study and therefore were excluded from the length of stay statistic.

Diagnosis, Hours of Care and Intensity

Diagnostic Classification

Case Mixed Groups (CMG) assign patients with similar clinical characteristics to mutually exclusive groups using principal medical diagnosis as the primary criterion.

Other considerations are the presence or absence of a complication or comorbidity, and the patient's age, sex and discharge status. In combination with the average LOS, these factors have the greatest influence on the amount of hospital resources used by patients.

Table 1 reports the frequency distribution of CMGs for the study population. The CMG number, an abbreviated definition and the total number and percent of patients in each diagnostic category are presented. For example CMG 194 represents Acute Myocardial Infarction (MI), with complications and/or comorbidities. Ten subjects met the criteria for this CMG grouping, representing 14.1 percent of the study population. Although thirty-nine CMGs were represented in the study population, the majority (59.1%) only had one to two patients. The most frequent CMGs in the study population were: 194 acute MI with complications/ comorbidities (14.1%), 196 cardiac catheterization (8.5%) and 195 acute MI without complications/comorbidities (7.0%). The small sample size in each CMG illustrates the diverse nature of patient profiles with regard to medical condition.

Hours of Nursing Care

The hours required to provide care for each patient per

Table 1

Distribution of Population by Case Mixed Group (N=71)

No.	CMG	Total #	Total %
194	Acute MI, cc	10	14.1
196	Cardiac Cath	6	8.5
195	Acute MI	5	7.0
215	Angina	4	5.6
199	Heart Failure	3	4.2
136	COPD	2	2.8
141	Pneumonia/pleurisy >70, cc	2	2.8
146	Bronchitis/Asthma	2	2.8
147	Bronchitis/Asthma >70	2	2.8
149	Resp S & S <70	2	2.8
197	Cardiac Cath, cc	2	2.8
219	Chest Pain	2	2.8
222	PTCA	2	2.8
289	Inflammatory Bowel Disease	2	2.8
14	TIA preceberal occlusion	1	1.4
24	Seizure/headache >70	1	1.4
95	Otitis media, URI >70, cc	1	1.4
127	Other Resp Procedure, cc	1	1.4
185	Amputation lower limb	1	1.4
201	Cardiac Arrest	1	1.4
206	Atherosclerosis >70, cc	1	1.4
212	Arrhythmia CD >70	1	1.4
213	Arrhythmia CD, CC	1	1.4
221	Other circ diag, cc	1	1.4
265	Minor bowel procedure, cc	1	1.4
287	Uncomplicated ulcer >70	1	1.4
394	Bone disease >70, cc	1	1.4
484	Diabetes >35	1	1.4
708	RB Cell Disorder >70, cc	1	1.4
754	Septicemia 18-59, cc	1	1.4
788	Other neurosis	1	1.4
794	Alcohol abuse dependence	1	1.4
816	Drug reaction	1	1.4
817	Drug reaction >70, cc	1	1.4
844	Sign & Symptom >70	1	1.4
901	Unrelated OR procedure	1	1.4
17	Cranial/peripheral nerve disorders	1	1.4
295	Esopagitis, gasterenteritis >70	1	1.4
900	Ent Unrelated OR procedure, cc	1	1.4

day (HPPD) was predicted by RNs using the GRASP workload system. The hours were adjusted to represent the actual hours the patient spent on the unit, which may have been influenced by late admission, early discharge or transfer in and out.

Table 2 reports the percentage distribution of the total required hours of care per patient day. The mean HPPD was 4.9 hours (SD ±1.47), the median 4.5 hours and the range 0.8 to 9.25 hours. The required HPPD for approximately 56 percent of the patients was below the mean, and 44 percent above the mean. It is clear that there is variation in the time required to perform nursing interventions to meet individual patients needs on a daily basis.

An aggregate of all patients HPPDs constituted the unit's daily workload defined in patient care hours (PCHs). Scope of practice guidelines governing RN and RNA practice were used to divide interventions on the GRASP instrument as care restricted to RNs (RNPCHs) and shared care (SPCHs) which could be completed by either RNs or RNAs (see p. 95). RNPCHs were computed by aggregating NWMS values for interventions defined as RN care. SPCHs were computed by aggregating NWMS values of interventions defined as shared care. The daily census

Table 2

Descriptive Profile of Sample by Total Hours of Care NWMS (N=373)

HPPD	Frequency	Percent
.80 - .99	1	.3
1.0 - 1.99	3	.8
2.0 - 2.99	8	2.1
3.0 - 3.99	109	29.2
4.0 - 4.99	90	24.1
5.0 - 5.99	67	18.0
6.0 - 6.99	63	16.9
7.0 - 7.99	22	5.9
8.0 - 8.99	5	1.3
9.0 - 9.99	5	1.3

was determined by the number of patients on the nursing unit at 2400 hours.

The unit daily profile for hours of care is reported in Table 3. The mean daily census was 24.4 patients and the mean daily PCHs were 122.7 hours. The 17.4 hour range in PCHs serves as a gross measure of the variability in daily staffing which equates to 1.5 full time caregivers working 12 hours over the 24-hour period. The mean RNPCHs for the study period was 59.4 hours and the mean SPCHs was 63.3 hours.

Intensity of Nursing Care

Each patient was assessed daily for their intensity needs. The eleven functional items were rated on an ordinal scale from one (minor) to four (extreme) intensity. The distribution of total intensity scores were examined by individual items and day. The results are reported in Table 4.

The majority of subjects scored in the moderate range on structural, circulatory, emotional and cognitive function and in the low range on the remaining items. The NII total score range across patients was 11 to 39. Histogram distributions revealed a slight positive skew with the majority of scores clustering between 11.5 to 23.5 (M=17.28, SD ±3.95; Mo 17.00, Md 17.00,

Table 3

Unit Profile of GRASP Total Hours, RN Hours and Shared Hours (N=15)

Day	Census	PCH's	RNPCH's	SPCH's
1	26	124.7	60.6	64.1
2	26	125.6	60.0	65.7
3	26	121.3	57.4	64.0
4	23	118.9	55.5	63.4
5	25	118.3	57.4	60.7
6	23	122.1	57.2	64.9
7	23	112.1	54.5	57.6
8	25	121.6	60.7	61.0
9	26	125.0	61.2	63.8
10	26	128.3	63.0	65.3
11	25	131.7	63.6	68.1
12	24	131.6	63.2	68.4
13	19	104.0	48.4	55.6
14	22	119.7	57.9	61.8
15	25	135.7	70.4	65.2
Mean SD	24.4	122.7 ±7.95	59.4 ±4.99	63.3 ±3.51
Range		118.3-135.7	48.4-70.4	55.6-68.4

Table 4

Descriptive Profile of Sample Subjects Intensity Levels by Individual NII Items (N=373)[1,2]

Item	Level of Intensity							
	Minor		Moderate		Major		Extreme	
	#	%	#	%	#	%	#	%
Nutrition	198	53.1	141	37.8	25	6.7	5	1.3
Elimination	165	44.2	161	43.2	37	9.9	6	1.6
Sensory	290	77.7	65	17.4	13	3.5	1	0.3
Structural	133	35.7	228	61.1	8	2.1	0	0
Neurological	256	68.6	95	25.5	14	3.8	4	1.1
Circulatory	82	22.0	240	64.3	45	12.1	2	0.5
Respiratory	224	60.1	127	34.0	15	4.0	3	0.8
Emotional	116	31.1	209	56.0	39	10.5	5	1.3
Social	291	78.0	63	16.9	9	2.4	6	1.6
Cognitive	119	31.9	214	57.4	27	7.2	9	2.4
Health Management	209	56.0	138	37.0	15	4.0	7	1.9

[1]Average ratings across all time periods for all patients.

[2]Four (4) missing values for all variables thus percentages off by 1.1%

The NII total score range across days was 12 to 51. Histogram results depicted a symmetrical distribution - approximately normal. Most scores were clustered between 13 to 37 (M=25.08, SD ±6.63; Mo 18, md 25.00).

The mean intensity score for each patient day was determined by aggregating the scores (one to four) across the eleven parameters. The results are reported in Table 5. In general, the subjects scored predominately at the lower end of the scale, again indicating a positive skew to the scores. The vast majority, 91% were level 1 (minor intensity), 5% level 2 (moderate intensity), and 1% level 3 (major intensity). No patients scored level 4 (extreme intensity). The mean was 1.57, mode 1.54, median 1.54, range 1.0 to 3.54, actual range 2.54. The close mean, mode and median and the low standard deviation indicate a tightened normal distribution clustering around an intensity rating of 1.5. The low observed intensity rating indicates a patient population with minor intensity needs.

Daily mean intensity for the unit was computed by aggregating the individual patient scores assigned to each of the eleven parameters contained on the NII. The results are reported in Table 6. The intensity rating

Table 5

Mean Intensity Score Per Patient Day Across Population (N=369)

NII Level	Value	Frequency	Percent	Cum Percent
Level 1	1.00000	5	1.3	1.4
	1.09091	8	2.1	3.5
	1.18182	22	5.8	9.5
	1.27273	47	12.3	22.2
	1.36364	52	13.6	36.3
	1.45455	40	10.5	47.2
	1.54545	53	13.9	61.5
	1.63636	45	11.8	73.7
	1.72727	20	5.2	79.1
	1.81818	25	6.6	85.9
	1.90909	20	5.2	91.3
Level 2	2.00000	8	2.1	93.5
	2.09091	6	1.6	95.1
	2.18182	2	0.5	95.7
	2.27273	3	0.8	96.5
	2.36364	1	0.3	96.7
	2.54545	2	0.5	97.3
	2.63636	1	0.3	97.6
	2.72727	2	0.5	98.1
	2.90909	2	0.5	98.6
Level 3	3.09091	1	0.3	98.9
	3.18182	3	0.8	99.7
	3.54545	1	0.3	100.0
Level 4	4.0000	0	0.0	

Table 6

Unit Profile of Nursing Intensity by Day (N=15)

Day	Census	NII Score
1	26	1.39
2	26	1.41
3	26	1.44
4	23	1.46
5	25	1.51
6	23	1.55
7	23	1.50
8	25	1.58
9	26	1.66
10	26	1.63
11	25	1.68
12	24	1.73
13	19	1.79
14	22	1.64
15	25	1.66
Mean	24.4	1.58
SD		(±.12)
Range		1.39 - 1.79

was ($\underline{M}$=1.58, $\underline{SD}$ ±0.12). The range was 1.39 to 1.79 and the median 2.0. Again the data suggest a low nursing intensity for this particular group of medical patients.

Hours of Care and Intensity by CMG

The NWMS and NII ratings were examined to determine the variability among CMGs. CMG 194 ($\underline{n}$=10), acute MI with complications/comorbidities was compared with a variety of other CMG's ($\underline{n}$=10) considered to be acute or chronic. The results are presented in Table 7.

Ninety percent of the patients in CMG 194 were male and 10% were female, the mean age was 59 years (range 42-82). The mean total hours was 5.2, the mean RN hours was 2.63, and the mean shared hours was 2.53. The mean intensity rating was 1.48 with a median 1.0. Conversely, the majority of the patients (55%) in the other CMGs were female, the mean age (69 years, range 56-79), total hours (6.1), RN hours (2.86), and shared hours (3.29) were higher than those for CMG 194. The mean intensity rating (1.95) and median (2.0) were also higher.

The findings in Table 7 also demonstrate that patients with greater "shared care" needs tended to be rated higher on the NII. That is, as intensity score increased, patients tended to require more care time (5.16 to 6.15 hours). The greater increase in

Table 7

Comparison of Summary Rating by Selected CMG (N=20)[1]

CMG	Age	HPPD	RNHPPD	SHPPD	NIIMean	NIIMedian
194	56	3.82	2.21	1.61	1.49	1
	67	4.16	2.12	2.04	1.18	1
	52	5.55	3.05	2.50	1.27	1
	48	3.69	2.00	1.69	1.29	1
	65	5.81	2.30	3.51	1.63	2
	74	5.73	2.25	3.17	1.36	1
	42	4.72	2.86	1.86	1.43	1
	61	7.26	4.05	3.20	1.45	1
	42	4.40	2.95	1.45	1.54	1
	82	6.81	2.49	4.32	2.14	2
Mean	59	5.16	2.63	2.53	1.48	1

CMG	AGE	HPPD	RNHPPD	SHPPD	NIIMEAN	NIIMedian
141	73	8.60	3.05	5.55	2.84	3
185	59	5.72	2.34	3.38	1.76	2
199	73	5.28	3.01	2.28	1.51	2
199	79	6.85	2.58	4.27	1.90	2
199	78	7.00	3.25	3.75	1.81	2
201	75	5.01	2.85	2.16	1.58	2
221	64	4.19	2.48	1.71	1.53	2
394	75	5.53	2.36	3.18	1.86	2
754	62	4.36	2.62	1.75	1.61	2
817	70	8.95	4.05	4.90	3.13	3
Mean	71	6.15	2.86	3.29	1.95	2

[1] CMG 194 N=10; other CMGs N=1

time (2.53 to 3.29 hours) is attributable to shared care interventions.

Psychometric Properties of the NII and NWMS

One purpose of this study was to do more extensive testing of the reliability and validity of the NWMS and the NII. Based on the literature review of reported research findings, reliability was restricted to interrater agreement and validity to face, content and criterion-related procedures. Results of the reliability analysis for percentage agreement and internal consistency are presented in the first section. The second section summarizes the results obtained on criterion referenced (concurrent, predictive) and construct validity.

Reliability of NWMS and NII

The reliability of the NWMS and NII was assessed using Cronbach's Alpha. Coefficients for the NWMS (.83) and the NII (.84) indicates that these instruments have a high degree of internal consistency. The correlation matrix of the NII is presented in Table 8. Only three correlations were strong (r>.50, p=.000): elimination and nutrition, neurological and elimination, and cognitive and neurological. Forty-eight percent were in the moderate range (r=.30 to .49, p=.000). The remainder were low (r=.10 to .30, p=.000).

Table 8

Correlation Matrix of the NII (N=374)

	Nut	Elim	Sen	Struct	Neuro	CIRC	Resp	Emot	Social	Cog	H.M.
Nut	1.00000										
Elim	.6254 p=.000	1.00J00									
Sen	.3699 p=.000	.3740 p=.000	1.0000								
Struct	.3944 p=.000	.4877 p=.000	.3385 p=.000	1.00000							
Neuro	.4361 p=.000	.5112 p=.000	.3828 p=.000	.4300 p=.000	1.00000						
Circ	.1569 p=.002	.1126 p=.030	.2640 p=.000	.1282 p=.013	.1651 p=.001	1.00000					
Resp	.3152 p=.000	.3534 p=.000	.3988 p=.000	.3432 p=.000	.4657 p=.000	.1866 p=.000	1.00000				
Emot	.3696 p=.000	.4044 p=.000	.3534 p=.000	.4052 p=.000	.4562 p=.000	.2804 p=.000	.2657 p=.000	1.00000			
Social	.3636 p=.000	.2843 p=.000	.1085 p=.036	.2544 p=.000	.3073 p=.000	.1609 p=.002	.2926 p=.000	.2193 p=.000	1.00000		
Cog	.2758 p=.000	.4088 p=.000	.2897 p=.000	.3656 p=.000	.5327 p=.000	.0936 p=.071	.2879 p=.000	.4455 p=.000	.3177 p=.000	1.00000	
H.M.	.2626 p=.000	.2369 p=.000	.1992 p=.000	.1986 p=.000	.2869 p=.000	.1452 p=.005	.1838 p=.000	.2780 p=.000	.4799 p=.000	.3597 p=.000	1.00000

The correlation matrix of the NWMS contains 741 correlations, seven percent of which were strongly correlated ($r = \geq .60$, $p = .000$), 41% were in the low to moderate range and 52% were not significant. Examples of strongly correlated variables included update assessment and HS care ($r = .85$, $p = .000$), update assessment and BP q4h ($r = .97$, $p = .000$), teaching and support and BP q4h ($r = .97$, $p = .000$), HS care and evaluation ($r = .85$, $p = .000$).

The percentage agreement for the NWMS, using three sets of paired RN ratings per week, averaged 95.9 percent. Ten paired ratings of the NII scores rated by the researcher and an external expert were strongly correlated ($r = .8961$, $p < .01$). These results indicate there was a high degree of agreement among users of both instruments.

Construct Validity of NWMS and NII

Factor Analysis of NII.

Although Reitz (1985) proposed two major subscales for the NII, construct validity was not assessed. Exploratory factor analysis was used in this study to identify the number of factors representing the eleven items of the NII. Principal components analysis (PCA) and orthogonal and oblique rotations were used to identify factors representing interrelated items. For the principal components solution the items loaded on biophysical, behavioral and circulatory factors. Although Factor 1 was the common factor for all of the 11 items, factor loading for three items was higher on Factor 2 and 3. The rotated factor solution (varimax and oblimin) confirmed the three factor structure.

Table 9 displays the eigenvalues and the percentage of variance explained by the three factors. Only those factors with eigenvalues greater than 1.0 are reported here. The results indicate that 59.4% of the variance in the sample data is attributable to three factors. Factor 1, Biophysical Health, has the greater number of items (8) and accounts for 39.8% of the variance.

The varimax and oblimin methods were employed to transform the initial factor matrix. Because there were no appreciable differences in factor loadings for the varimax and oblimin rotations, only the varimax results are presented and discussed here. The factor loadings and factor structure are summarized in Table 10.

A loading criterion of 0.5 was established to retain items as part of a factor. Although the sensory, emotion and cognitive items loaded on more than one factor, their loading values were greater than 0.5 for factor 1. According to the theoretical structure proposed by Reitz (1985) the cognitive and emotion items were expected to

Table 9

Factor Analysis Results (Varimax Rotation) of the Nursing Intensity Instrument(N=369)

Factors	Eigenvalues	Percent of Variance	Cumulative Percent
Factor 1	4.38	39.8	39.8
Factor 2	1.14	10.3	50.1
Factor 3	1.02	9.3	59.4

NOTE: Factor 1 = Biopsychological Health
Factor 2 = Behavioral Health
Factor 3 = Circulatory

Table 10

'arimax Rotation: Factor Loadings and Factor Structure for The Nursing Intensity Instrument (N=369)

Items	Factor 1 Biophysical	Factor 2 Behavioral	Factor 3 Circulatory
Nutrition	.686		
Elimination	.807		
Sensory	.576		.487
Structural Integrity	.707		
Neurological	.725		
Respiratory	.554		
Emotion	.559		.355
Cognitive	.560	.426	
Social		.809	
Health Management		.823	
Circulatory			.908

correlate with the Behavioral Health items, social system and health management. Study results indicate that these items are more highly correlated with Biophysical items than Behavioral items. Further the circulatory item did not correlate with the Biophysical items as expected. Additional research is needed on the NII to clarify the major dimensions of this instrument.

Factor Analysis of NWMS.

The 39 items on the NWMS were subjected to factor analysis using the principal components analysis (PCA) and orthogonal and oblique rotations. Principal factor analysis revealed that nine factors were needed to account for the item correlation structure. The rotated factor solutions (varimax and oblimin) confirmed the nine factor structure.

Table 11 displays the eigenvalues and percentage of variance explained. The results demonstrate that 73.6 percent of the variance in the sample data is attributed to nine factors. Factor 1, Cardiac Protocol, has the greatest number of items (10) and accounts for 29% of the variance. Factor 2, Activities of Daily Living, has nine items (9) accounting for 13.4% of the variance. The contribution of the seven remaining factors was as follows: homeostasis (6.5%), respiratory care (5.8%), prevention (4.7%), assessment (3.9%), diabetic protocol

Table 11

Factor Analysis Results of the NWMS (N=373)

Factors	Eigenvalues	Percent Variance	Cumulative Percent
Factor 1	10.73	29.0	29.0
Factor 2	4.97	13.4	42.4
Factor 3	2.40	6.5	48.9
Factor 4	2.15	5.8	54.7
Factor 5	1.75	4.7	59.4
Factor 6	1.46	3.9	63.4
Factor 7	1.35	3.6	67.0
Factor 8	1.25	3.4	70.4
Factor 9	1.17	3.2	73.6

NOTE: Factor 1 = Cardiac Protocol
Factor 2 = Activities of Daily Living
Factor 3 = Homeostasis
Factor 4 = Respiratory Care
Factor 5 = Prevention
Factor 6 = Assessment prior to intervention
Factor 7 = Diabetic Protocol
Factor 8 = Maintenance
Factor 9 = Additional Cardiac Care

(3.6%), maintenance (3.4%), and additional cardiac care (3.2%).

Factor loading and factor structure for the GRASP system are summarized in Table 12. There was no appreciable difference in factor loadings for the varimax and oblimin rotations. Only the varimax results are presented and discussed. For an item to be retained as part of the factor, it had to have a loading greater than .50.

There is no documentation of the theoretical structure for the GRASP system. If one accepts the assumption that frequency of interventions influence loading on update assessment, care planning, teaching and support, HS care, evaluation, other support and related nursing, then these items may be expected to correlate with the standard interventions (BP q4h, cardiac/respiratory assessment and oral cardiac medications) for patients with cardiac disease as demonstrated in Factor I. Further diet, bath, oral hygiene, and elimination are expected to correlate as activities of daily living, and IV medications, continuous IV care and intake and output as interventions associated with homeostasis. It is not clear why other items loaded as they did. For example, cardiac teaching and post angiogram assessment might be expected to correlate with items comprising cardiac protocol (eg.,

Table 12

<u>Factor Loading and Factor Structure for the GRASP System (N=373)</u>

	F1	F2	F3	F4	F5	F6	F7	F8	F9
Update Ass	.98								
Update Care	.98								
Teaching/Support	.98								
HS Care	.86								
BP Q4H	.96								
Card/Resp Ass	.76								
Oral Meds	.67								
Evaluate	.98								
Other Support	.98								
Related Nsg	.98								
Diet	.43	.54							
Bath	.34	.82							
Oral Hygiene		.82							
Foley Care		.82							
Facial Shave		.61							
Activity as Tolerated	.50	.63							
Skin Care		.84							
Elimination		.78							
Reality Orient		.60							
Leg Exercise			.60						
IV Meds			.61						
Cont. I/V			.80						
Intake/Output			.56				.47		
Oxygen Therapy				.58					
Nitro				.73					
Nebulizer				.77					
Temp daily	.43				.85				
Temp Q4H					.91				
BP before meds						.50			
Pulse before meds						.66			
Heparin/Insulin						.76			
Weight Daily							.78		
Bld Glucose							.66		
Telemetry								.68	
Heparin Lock								.57	
Cardiac Teaching									.74
Post Angiogram Ass									.72

cardiac/respiratory assessment). Additional research is needed to clarify the dimensions of the GRASP system.

Criterion-Related Validity

Concurrent Validity.

Pearson's and Spearman's Correlation Coefficients were used to assess the relationships between NWMS and NII scores. Because both coefficients were closely related in absolute value and the distribution of most variables approximated normalcy Pearson's r values will be reported here.

The NII score was correlated with total NWMS score and the subscales for "RN care" and "shared care". Both NII and NWMS scores were correlated with caregiver and nursing supervisor perceptions. Finally caregiver and nursing supervisor perceptions were correlated. The results are reported in Table 13.

The total intensity score had a strong positive correlation with total hours of care (r=.6991) and shared care hours (r=.6651) indicating a shared variability of 48.9 and 44.2 percent respectively. Intensity scores depicted a moderate positive correlation with RN hours of care (r=.4336), indicating that 18.8 percent of the variance was explained by the relationship of these two variables. Caregivers perceptions had a weak negative correlation with

Table 13

Correlations Among Selected Variables

Variables	N	r	r^2	P
Intensity with HC	374	.6991	48.9	.000
Intensity with RN hours	374	.4336	18.8	.000
Intensity with SC hours	374	.6651	44.2	.000
Intensity with caregiver	365	-.2666	7.1	.000
Intensity with supervisor	218	-.0198	0.0	.771
HC with caregiver	366	-.1800	3.2	.001
HC with supervisor	219	.0688	0.4	.311
Caregiver with supervisor	219	.2161	4.6	.001

NOTE: HC = hours of care.

intensity ($\underline{r}$=-.2666) and hours of care ($\underline{r}$=-.1800) accounting for seven and three percent of the shared variability respectively. Correlations of the supervisor's perception with intensity and hours of care were not significant. Caregiver perceptions and supervisor perception had a weak positive correlation ($\underline{r}$=.2161) indicating a shared variance of 4.6 percent. Given the high correlation between intensity and hours of care and intensity and shared care it is obvious that both the NWMS and the NII instruments are measuring aspects of the same theoretical construct.

Predictive Validity.

Stepwise multiple regression analysis was conducted to determine the percentage of variance in total NWMS score (total PCHs), RN score (RNPCHs) and shared care (shared PCHs) predicted by the NII. The NII items (nutrition, elimination, sensory, structural, neurological, circulatory, respiratory, emotional, social, cognitive and health management) were entered into a regression equation as predictor variables. Total PCHs, RNPCHs and Shared PCHs were the dependent variables. Tables 14, 15 and 16 present the results.

Table 14 demonstrates that seven NII variables explained 55.1 percent of the variance in total PCHs.

Table 14

Multiple Regression Analysis Results of Nursing Intensity Items with Total PCHs

Independent Variables	Multiple R	Cum R^2	R^2 Change	F Value	P
Neuro	.538	.289		150.31	.0000
Struct	.636	.405	.116	125.02	.0000
HM	.700	.490	.085	117.61	.0000
Nut	.721	.519	.029	98.90	.0000
Cog	.733	.538	.019	84.96	.0000
Social	.739	.546	.008	72.91	.0000
Elim	.742	.551	.005	63.69	.0000

NOTE: The abbreviations in the above table reflect the following: Neuro = Neurological, Struct = Structural, HM = Health Management, Nut = Nutrition, Cog = Cognitive, Elim = Elimination.

Each variable made a statistically significant (p=.0000) contribution to the regression equation. Neurological function had a greater impact on total PCHs than any other single variable in the equation. In terms of variance explained neurological function contributed 28.9 percent.

When structural integrity was entered it combined with neurological function to explain 40.5 percent of the variance in total PCHs. Health management pattern and nutrition were entered at the next two steps. These variables combined with neurological function and structural integrity to explain 51.9 percent of the variance in total PCHs (hours of care). The social and elimination items contributed minimally to the variance in total PCHs (less than 1.0%).

As shown in Table 15, only four NII items combined to explain 23.4 percent of the variance in RNPCHs. Each made a statistically significant contribution (p=.0000) to the regression equation, with respiratory function (13.6%) having the greatest overall impact on the variance in the RNPCH score.

Table 16 shows that six NII items combined to explain 54.8 percent of the variance in shared PCHs. All were statistically significant (p=.0000). The item with the greatest single impact was neurological function 31.6

Table 15

Multiple Regression Analysis Results of Nursing Intensity Items with RNPCHs

Independent Variable	Multiple R	Cum R^2	R^2 Change	F Value	P
Resp	.369	.136		58.09	.000
Circ	.430	.185	.049	41.63	.000
Struct	.469	.220	.035	34.44	.000
Nut	.484	.234	.014	27.94	.000

NOTE: The abbreviations in the above table reflect the following: Resp = Respiratory, Circ = Circulatory, Struct = Structural, Nut = Nutrition.

Table 16

Multiple Regression of Nursing Intensity Items with Shared PCHs

Independent Variable	Multiple R	Cum R^2	R^2 Change	F Value	P
Neuro	.562	.316		170.48	.0000
HM	.646	.417	.101	131.81	.0000
Struct	.703	.494	.077	119.38	.0000
Elim	.723	.523	.029	100.20	.0000
Cog	.735	.540	.017	85.55	.0000
Social	.740	.548	.008	73.47	.0000

NOTE: The abbreviations in the above table reflect the following: Neuro = Neurological, HM = Health Mairtenance, Struct = Structural, Elim = Elimination, Cog = Cognitive.

percent. The addition of health maintenance and structural integrity into the equation increased the R^2 values to 41.7% and 49.4%, respectively. These results indicate that neurological function, health maintenance and structural integrity had the most influence on changes in shared hours of care.

The overall results indicate that the independent predictor variables differed with categorization of care hours. Six (6) biophysical and behavioral items (neurological, structural, health maintenance, cognitive, social and elimination) were common predictors of both total and shared care. Only one biophysical item (nutrition) was a common predictor of total and RN care and there were no common predictors of RN and shared care. The sensory and emotional items were not significant predictors of either total, RN or shared care hours.

A second regression equation explored the predictive power of NWMS (hours of care) for nursing intensity. However, because of high multicollinearity the results were considered suspect and will not be reported here.

Nursing Care Requirements

The remainder of the findings address the aggregated care requirement for all patients on the study unit for each of 15 days. Care requirements were defined in terms of quantity, intensity and perceived skill level. NWMS, NII and perceived skill level scores were used to estimate care requirements.

Staffing Patterns

Scope of Practice and Intensity Rating.

In order to determine a staffing pattern, the GRASP instrument was reviewed with respect to scope of practice guidelines to divide total hours into RN hours and shared hours. Examples of interventions that are solely within the scope of practice of the RN include update assessment, update care plan, cardiac teaching, specialized physiological parameter monitoring, medications, IV monitoring and care, oxygen therapy, tracheostomy care, intake and output fluid monitoring and related nursing. Examples of interventions that are within the scope of practice of both the RN and the RNA are routine teaching/ emotional support, diet, hygiene, turn and assist activities, elimination, some vital signs and other nursing care. The results of this review are presented on the left side of Table 17. However scope of practice cannot be used as the sole determinant of staffing patterns. Scope of practice generally assigns tasks on the basis of caregiver skills and does not consider patient characteristics such as complexity. In the practice setting nursing judgement is used to assign

Table 17

Daily Workload Assigned to Caregivers based on Scope of Practice and Intensity Score (N=15[1])

SCOPE OF PRACTICE					Assigned Caregiver Based on Scope of Practice and Intensity Score of 1.5			
Day	Total PCH	RN PCH	SPCH	NI Intensity	RN PCH	%	RNA PCH	%
1	124.7	60.6	64.1	1.39	87.2	69.9	37.5	30.1
2	125.6	60.	65.7	1.41	84.5	67.3	41.1	32.7
3	121.3	57.4	64.0	1.44	88.4	72.8	33.0	27.2
4	118.9	55.5	63.4	1.46	86.4	72.7	32.4	27.3
5	118.3	57.4	60.7	1.51	95.2	80.5	22.0	18.6
6	122.2	57.2	64.9	1.55	96.9	79.3	25.3	20.7
7	112.1	54.5	57.6	1.50	86.5	77.2	23.3	20.8
8	121.6	60.7	61.0	1.58	102.8	84.5	18.0	14.8
9	125.0	61.2	63.8	1.66	113.4	90.7	11.6	9.27
10	128.3	63.0	65.3	1.63	113.0	88.1	15.3	11.9
11	131.7	63.6	68.1	1.68	111.2	84.4	14.8	11.2
12	131.6	63.2	68.4	1.73	115.4	87.7	16.2	12.3
13	104.0	48.4	55.6	1.79	87.9	84.5	16.1	15.5
14	119.7	57.9	61.8	1.64	94.9	79.2	24.8	20.8
15	135.7	70.4	65.2	1.66	120.5	88.8	15.2	11.2
Mean	122.71	59.4	63.3	1.58	98.5	-	23.1	-
Percent	N/A	N/A	N/A		-	80.5	-	18.9

[1]NII data for 3 patients for 1 day is missing and therefore not included in the assigned caregiver.

more complex patients to more highly skilled staff. In this study intensity rating was used as a surrogate for nursing judgement to assign patients with higher intensity score to more skilled staff.

An important dimension related to the feasibility of using a scale for the purposes of studying skill mix is the degree to which patients vary across the item's scale steps and conceptual dimensions of the tool. As noted previously, most patients (91%) participating in the study scored at the low end of the NII scale, both on the individual parameters and mean intensity score. Given the low variability of the observed NII scores and their concentration in levels one and two (minor to moderate intensity), a score of 1.5 was selected to formulate the following decision rules to predict a staffing pattern based on both quantity and intensity of patient needs.

1. For patients with an NII score of less than 1.5 the volume of shared care was assigned to the RNA.
4. For patients with an NII score of 1.5 or greater the volume of shared care was assigned to the RN.

For example, a patient requiring 5.0 hours of care (2.0 hours of RN and 3.0 hours of shared care) and an intensity rating of 1.55 would have all of their care assigned to the RN. These decision rules were combined with scope of practice guidelines to distribute workload PCHs among caregivers based on intensity. The unit profile reflecting the 1.5 decision rule is presented on the right side of Table 17.

The mean daily workload volume assigned to the RN was 98.9 (SD ±12.63) hours and a range of 84.5-120.5 hours. The mean daily workload volume assigned to the RNA was 23.1 (SD ±9.16) hours and a range of 11.6 to 41.1 hours.

Based on integration of hours of care and intensity, and using scope of practice and an assigned intensity rating of 1.5 the care assigned to the RN is 80.5 percent and the care assigned to the RNA is 18.9 percent. The projected staffing pattern is therefore approximately 80:20, that is, 80 percent RN and 20 percent RNA.

Caregivers and Supervisors Perceptions.

The perceptions of the caregivers and supervisors were used to predict a staffing pattern using skill level as a surrogate measure for intensity. Using the abbreviated staffing adequacy instrument respondents rated the appropriate skill level to provide "shared care" for individual patients daily according to the scale 1 = RN, 2 = NI, 3 = RNA. The most frequent assignment of personnel (RN, NI and RNA) represented their score. Because the NI practices within the scope of practice of the RN and often fulfils that role, these two categories were collapsed to formulate the following decision rules.

1. For a supervisor/caregiver rating of 2.0 or less, the volume of care identified as "shared care" was assigned to the RN.

2. For a supervisor/caregiver rating of >2.0 the volume of care identified as shared care was assigned to the RNA.

The results are reported in Table 18. Using the direct caregivers perception of required skill level, the daily workload volume for RN produced a(M=67.9, SD ±9.72) hours with a range between 53.5 to 85.2 hours. The mean daily workload volume assigned to the RNA was 54.5 hours (SD ±10.9) hours with a range between 31.2 and 68.1 hours. Based on scope of practice and caregivers perception, the percentage of care assigned to RN was 55 percent while the percentage of RNA care was 45 percent (see Table 18). The projected staffing pattern is therefore 55:45, that is 55 percent RN and 45 percent RNA.

Using the nursing supervisors perception of required skill level, the mean daily workload volume assigned to the RN 84.4 (SD ±19.9) hours with a range between 53.5 to

Table 18

Daily Workload Assigned to Caregiver Based on Scope of Practice and Caregiver Perception (N = 15)[1]

	Scope of Practice			Assigned Caregiver Based on Scope of Practice and Caregiver Perception				Assigned Caregiver Based on Scope of Practice and Supervisor Perception			
	PCH	RN PCH	SPCH	RN PCH	%	RNA PCH	%	RN PCH	%	RNA PCH	%
	124.7	60.6	64.1	60.6	48.6	64.1	51.4	--			
	125.6	60.0	65.7	60.0	47.7	65.7	52.2	--			
	121.3	57.4	64.0	69.9	57.6	51.4	42.4	93.9	77.4	27.4	22.6
	118.9	55.5	63.4	57.9	48.7	60.9	51.3	102.3	86.1	16.6	13.9
	118.3	57.4	60.7	68.1	57.6	49.0	41.4	91.6	77.5	25.6	21.6
	122.2	57.2	64.9	57.2	46.9	64.9	53.1	--			
	112.1	54.5	57.6	53.5	47.7	56.3	50.2	--			
	121.6	60.7	61.0	67.0	55.1	53.8	44.2	96.1	79.0	24.8	20.3
	125.0	61.2	63.8	78.6	62.9	46.4	37.1	104.2	83.4	20.8	16.6
	128.3	63.0	65.3	66.0	51.4	62.5	48.6	103.2	80.4	25.1	19.6
	131.7	63.6	68.1	63.6	48.3	68.1	51.7	107.2	81.4	24.4	18.6
	131.6	63.2	68.4	73.0	55.5	58.5	44.5	107.0	81.3	24.6	18.7
	104.0	48.4	55.6	72.7	69.6	31.2	30.0	72.7	69.9	31.2	30.1
	119.7	57.9	61.8	85.2	71.1	34.6	28.9	85.2	71.1	34.6	28.9
	135.7	70.4	65.2	85.2	62.8	50.5	37.2	70.4	51.9	65.2	48.1
Mean Percent				67.9	55.4	54.5	44.3	93.8	76.6	23.6	23.8

[1]Nursing Supervisor data for 4 days is missing therefore is not included in Supervisor assigned caregiver.

107.2 hours. The mean daily workload volume assigned to the RNA 38.1 (SD ±18.96) hours with a range between 16.6 and 65.7 hours. Based on scope of practice and the nursing supervisors perception the percentage of care assigned to the RN was 77 percent, while the percentage of RNA care was 23 percent (see Table 18). The projected staffing pattern was 75:25, that is 75 percent RN and 25 percent RNA.

The skill mix ratio produced by integrating hours of care with intensity score 80:20 differed significantly from that produced by integrating hours of care, with caregiver perceptions (55:45) whereas hours of care with the nursing supervisor's perception (75:25) differed only slightly.

Summary

Descriptive statistics revealed a diverse patient population with respect to medical diagnostic categories. Frequency distribution of the observed scores for the NWMS and perceptions of caregivers and supervisors demonstrated a diversity of patient needs with respect to hours of care and skill level required. There was also a positive skew to the nursing intensity data with scores concentrated in the low to moderate range.

Factor analysis generated three factors which explained 59.4 percent of the observed variance in the intensity score, and nine factors explaining 73.6 percent of observed variance in the NWMS score. The NII score demonstrated a strong positive correlation with total hours of care and shared care and a moderate positive correlation with RN care. These findings suggest that the NII and GRASP instruments are measuring aspects of the same theoretical constructs. Multiple regression analysis revealed that seven parameters of NII explained 55.1 percent of the variance in total NWMS score; four parameters of the NII explained 23.4 percent of the variance in RNPCHs; and six parameters of the NII explained 54.8 percent of the variance in the shared PCHs.

Using hours of care and intensity rating, a staffing pattern with a skill mix ratio of 80 percent RN and 20 percent RNA was projected. However, this staffing pattern was not validated by either the perceptions of the caregivers or the nursing supervisor.

CHAPTER V

DISCUSSION

This chapter will discuss the study's findings. The salient results related to each objective will be discussed and compared to current research.

Conceptual Framework & Objectives

The Nursing Resource Model (NRM) by Atwood et al. (1986) provided the conceptual framework for this study. The basic premise of this model is that time and complexity are key factors that must be considered when predicting the nursing resources needed to provide nursing care. If nursing care requirements are measured in terms of time and complexity, it can be inferred that nursing resources are operationalized by a unit's staffing pattern.

Following the logic of the Atwood et al. Model, the variables of time, as measured by the GRASP system, and complexity, as measured by the NII, were combined to predict a staffing pattern. The objectives of this study were to: (1) assess the quantity and complexity of care requirements for a group of medical patients, (2) use quantity and complexity estimates to predict the number and mix of staff needed, and (3) determine if the perceptions of caregivers would support the projected staffing pattern.

Nursing Care Time

GRASP Scores

The GRASP system estimated that patients in this study required an average of 4.9 (SD ±1.47) hours of nursing care per day, with a range between 0.8 to 9.25 hours (see Table 2). The only comparable study that estimated hours of care for a similar patient population using the GRASP system was by O'Brien-Pallas, Cockerill and Leatt (1992). These researchers found that patients on a medical cardiac unit averaged 3.40 (SD ±.91) hours of care with a range between 0.00 and 6.40 hours. The differences in care hours estimates between the two studies may be attributed to different patient profiles, standards of practice, support services, and inhouse modifications to the GRASP system. Nevertheless the differences serve to illustrate the non-comparability of hours of care estimates across hospitals.

Standards of Practice

The daily workload profile for the study unit averaged 122.7 (SD ±7.95) total PCHs with a range of 17.4 hours (1.5 FTE). The total PCHs were then subdivided according to standard of practice guidelines. Care activities mandated to the RN are more complex than those shared by the RN and RNA. For example, cardio-respiratory assessment, involving heart and lung sounds, is an RN only activity, while assessments of temperature, pulse and respiration are shared interventions. Based on this categorization the care hours mandated to the RN averaged 59.4 (SD ±4.99) hours with a range of 22 hours (or approximately 2.0 FTEs working a 12 hour shift). The shared care hours averaged 63.3 (SD ±3.57) hours with a range of 12.8 hours (or approximately 1.3 FTEs working a 12 hour shift).

Categorizing PCHs in this manner is not without problems. Although it is possible to use scope of practice guidelines to match tasks with skill level, the approach is flawed because its task orientation fails to account for individual characteristics of the patient or the complexity of nurse patient interactions. In the absence of comparable research, it is difficult to interpret these findings.

Reliability and Validity

The GRASP instrument used in this study had a high degree of internal consistency (alpha .83). Internal consistency for the GRASP instrument used in other studies was not reported. Interrater reliability in this study was also high at 95.9 percent agreement between raters. Interrater reliability reported by O'Brien-Pallas, Deber, Leatt and Till (1989) and O'Brien-Pallas, Cockerill and Leatt (1992) ranged from 91 to 98 percent agreement. Interrater reliability for this study also compares favourably with results from other studies using a variety of traditional PCS: 75 to 100 percent agreement (Jackson and Resnick, 1982); 88 percent agreement (Sovie et al., 1985); and 90 percent agreement (Trofino, 1986).

Construct validity of the GRASP instrument was assessed using factor analysis. A nine factor solution permitted labelling of its items in a theoretical way to account for 74% of the variance in nursing workload (see Table 11). GRASP is a factor based system which conceptualizes nursing workload as the volume of hours of care associated with nursing interventions. The majority of patients in this study were hospitalized with diseases/disorders of the circulatory system. An explanation for some of the factor loadings relates to the frequency of interventions associated with this patient profile. Specifically, Factor 1, Cardiac Protocol, which accounts for 29% of the variance, consists of eleven items that are standard interventions for patients with diseases/disorders of the circulatory system. Factor 2, Activities of Daily Living, which accounts for 13.4% of the variance, is comprised of nine dependency item: . . .h consume nursing care hours for less mobile patients, unable to provide self care.

Factor 3, homeostasis, which accounts for 6.5% of the variance, is comprised of four items associated with maintaining physiological balance. Factor 4, Respiratory Care, accounting for 5.8% of the variance, has items associated with maintaining respiration. It remains unclear why other factor loaded as observed. The portion of variance explained (74%) provides support for the validity of the GRASP system as a measure of the volume of nursing workload. No comparable findings on factor analysis of GRASP is documented. These results indicate that further work is needed to clarify the conceptual constructs of the GRASP system.

Nursing Care Complexity

Nursing Intensity Index Scores

The NII score for the majority of patients in this study was in the minor range for seven items (nutrition, elimination, sensory, neurological, respiratory, social and health maintenance) and in the moderate range for four items (structural, circulatory, emotional and cognitive) (see Table 4). The only other study that reported intensity scores for individual items of the NII was by Schmelz (1986). The majority of subjects in her study scored in the minor range for three items (social, cognitive and health maintenance), in the moderate range for seven items (nutrition, elimination, sensory, structural, neurological, respiratory and emotional) and in the major range for the circulatory item.

The observed differences in the findings between the two studies warrant further consideration. One plausible explanation is that the patients in the Schmelz study were more acutely ill and had more complex nursing care requirements. A second possibility is the variations in the interpretation of the conceptual definitions guiding the assignment of intensity levels to each functional parameter. A third possibility relates to application differences. In the previous studies, the NII was applied once per patient on discharge. In this study it was applied daily for each patient by the same rater. It is possible that repeated applications for the same patients may have influenced the independence of the measures. Without a more extensive data base for comparison purposes, it is impossible to account for disparities.

The overall intensity levels observed in this study also differed considerably from those in other studies using the NII. The percentage of ratings (minor, moderate, major and extreme) for a particular group of patients found by Reitz (1985), Bailie (1986) and Schmelz (1986) and this study are summarized below:

	N=	Minor	Moderate	Major	Extreme
Reitz (1985)	784	32.0	55.0	12.0	1.0
Bailie (1986)	60	36.7	41.6	20.0	1.7
Schmelz (1986)	50	0.0	86.0	14.0	0.0
Current Study	71	91.0	5.0	3.0	3.0

The cross study comparison data demonstrates that overall the majority of patients were rated in the minor to moderate range. While the majority of ratings in the other studies were in the moderate range, they were in the minor range for this study. The overall average intensity rating of 1.5 for this study's subjects was also lower than the average intensity ratings 2.0 and 1.87 reported by Reitz (1986) and Bailie (1986) respectively.

A second study was conducted at Hospital A, by P.A. Prescott, Ph.D., in 1992. The Patient Intensity for Nursing Index (PINI) was used to measure complexity of care. The PINI produced low intensity ratings ($\underline{M}$=23.3, $\underline{SD}$ $\pm$5.4). Based on the PINI scale steps of one to five, a score of 23.3 is below the mean score range, which is reflective of moderate intensity. The intensity ratings of the PINI for two populations (medical and surgical patients) are highly comparable to the NII ratings for cardiac medical patients. In both instances, the intensity ratings suggest that patient requirements on these three nursing units were of low complexity. Prescott (1993) suggested that one of the reasons for the low intensity ratings observed in her study might be a homogenous patient population with low intensity needs.

Following the PINI study this researcher conducted a review of Hospital Medical Records Institute (HMRI) data for the year 1992-93. CMGs and Relative Intensity Weights (RIWs) represent a measure of medical severity of illness. Nursing intensity is influenced by the patient's medical condition (O'Brien-Pallas & Giovannetti, 1993). Therefore for purposes of the review it was assumed that higher CMG and RIW rating would correlate with the degree of nursing intensity observed.

CMG and RIW data are provided to individual participating hospitals in peer groups. Hospital A's data are aggregated and reported in the teaching hospital group. Since comparative RIW data are available for the peer teaching hospitals in Canada, it is possible to make inferences regarding the complexity of patient needs at Hospital A with regard to the hospitals with known profiles of high technology, treating persons with unambiguous severity of illness. CMG data compares the number of patient days attributed to patients >70 years, with complications/comorbidities to patients <69 years without complications/comorbidities. RIW data identifies the resource use and procedural involvement of patients throughout their length of stay.

Prescott (1991) proposed that comorbidities and complications, using data such as the HMRI, would correlate highly with the PINI item for severity of illness and total score. The Prescott study found that 64% of the patient days reflected low severity of illness. A random sample of 40% of the medical and surgical CMGs for the study period were extracted and reviewed. The results of this review indicated that 75 percent of the patient days were reflective of patients who were greater than 70 years with complications/comorbidities, while 25 percent were reflective of patients who were less than 69 years without complications/comorbidities.

The RIW review identified the average relative intensity rating for medical/surgical Hospital A (1.368) and its peer group hospitals, Hospital B (1.428) and Hospital C (0.818). This review suggests that the patient profile at Hospital A is as intense with regard to resource utilization and procedures performed as the main tertiary care hospitals in Newfoundland. While the CMG and RIW data is not a direct measure of nursing intensity it is reflective of medical severity of illness and resource requirement and it serves to demonstrate a patient population that is very different from that described by either the PINI or the NII.

A retrospective audit of the health record of every seventh subject in the PINI study (N=20) was conducted by a nurse manager and this researcher. The audit identified that 85 percent of the patients had one or more secondary medical diagnosis (M=3.3, range 0-10). The presence of co-morbid conditions provides further support for the assertion that the patient population is different from that described by the PINI or the NII.

A number of application problems may have influenced the low intensity scores observed in the PINI study. First, the decision to use multiple caregivers to derive intensity ratings may have affected the results. The PINI, designed for use in a primary nursing setting, was modified to permit as many as three caregivers to provide ratings for a single patient. Analysis of the data indicated that RNs and RNAs differed considerably in their ratings. Although it was not possible to determine if the differences were related to an understanding of the PINI or the needs of patients, Prescott (1993) recommended that future applications should be restricted to RNs only.

A second potential problem with the findings related to the decision to only rate actual care given. While this decision rule may be accurate for costing, it may be less so for staffing. There are many reasons why care which ought to be delivered is not, for example, prioritization in minimum staffing situations. Decisions related to staffing cannot discount care that ought to be delivered, for this practice encourages maintenance of the status quo.

A final problem is the misaggregation of ratings associated with unit nursing. Because nursing care is fragmented under this system of care delivery, the intensity rating for specific PINI items may have been lowered. For example, if emotional support was provided by each of three caregivers occasionally during a shift, the independent score for each caregiver would be level 3. If, however, a single caregiver provided an amount of care equal to the sum of the three, the rating would increase to level 4. As used in the study, the PINI did not capture item aggregation, thus the total score may have been less than the sum of its parts.

Prescott (1993) advocated further research to determine if the full range of intensity is represented in the patient population served by Hospital A. Obviously these applications should be addressed before further research is conducted.

One explanation for the low intensity ratings generated by the NII is its limited number of scale steps and conceptual ambiguities guiding their application. The NII uses a four point ordinal scale and prototypical narrative descriptions of the nursing process associated with each of 11 functional parameters to rate intensity needs. Interpretation of the conceptual definitions guiding selection of the scale steps for this study rated 91% of the patients at or below 1.9 which is less than the mean benchmark of 2.0. Patients undergoing cardiac catheterization were bedridden and require intensive teaching, physiological monitoring, and telemetry. Despite the intensity of nursing care requirements these patients were often rated at level 2.0 or below in terms of intensity rating. Reconsideration of the number of scale steps and modifications to the conceptual definitions of the NII would help increase its sensitivity and more accurately reflect the intensity of nursing care.

A second explanation for the low intensity rating observed in this study relates to application problems associated with the NII in the study setting. The NII was developed as a retrospective instrument to be applied once per patient following discharge. Additionally at Johns Hopkins specifically structured nursing documentation tools facilitated data collection. In contrast, this study was designed for concurrent daily collection without the benefit of specifically structured documentation tools. It was, therefore, necessary to employ innovative strategies to identify relevant supporting data to capture patient intensity requirements for most of the previous 24 hours. An inability to always find this supporting documentation may have contributed to lower intensity ratings.

Reliability and Validity

The NII has a high degree of internal consistency (alpha .84). No other studies document the internal consistency of this instrument. Interrater reliability for the NII in this study, 89.9 percent agreement, compares favourably to the 84 percent agreement reported by Reitz (1985b).

Reitz (1985a, 1985b) conceptualized nursing intensity, as a two dimensional construct composed of seven biophysical and four behavioral items. In this study, factor analysis of the NII did not confirm the two major dimensions proposed by Reitz (1985a, 1985b). In fact, three factors explained 59.4% of the variance in the intensity ratings (see Table 10). Factor 1, which explained 39.8% of the variance consisted of six biophysical and two behavioral items. It was changed biopsychological to better describe the items associated with the factor with the addition of emotional and cognitive functioning. Factor 2, which explained 10.3% of the variance, consisted of two behavioral items, social functioning and health maintenance. Factor 3, which explained 9.3% of the variance, consisted of the single biophysical item of circulatory functioning. It is notable that while factor analysis explained 59.4% of the variance in nursing intensity, 40.6% remains unexplained. No previous studies using the same variables exist to help interpret these findings. The patient profile on the study unit may partially explain why the emotional and cognitive items correlated with the biophysical as opposed to the behavioral items. Reitz (1985b) did report that ratings from the NII and Horn's Severity of Illness Index showed different levels of correlations across departments.

The PINI and the NII are theoretically related instruments in that they both purport to measure the domain of nursing intensity. As measured by the PINI, nursing intensity is conceptualized as a multidimensional construct composed of four distinct but related components: severity of illness, dependency, complexity and time. The NII is a two dimensional construct which consists of the components: biophysical and behavioral health. The conceptual dimensions of the NII are based on medically derived physiological parameters, such as neurological and circulatory functioning, and behavioral parameters, such as social and emotional functioning. Dependency and complexity estimates are addressed by applying the nursing process to each of the eleven biophysical and behavioral items. In contrast the PINI has separate items for severity of illness, dependency, complexity and time. Two major constructs that do not appear to be accounted for directly by the NII are severity of illness and time. Nunnally (1978) contends that there is no conceivable way to compare factors when both different participants and variables are used. In the absence of an adequate research base it is not possible to make a valid comparison between these two measures of nursing intensity.

Nursing Care Time and Complexity

This study's findings related to quantity and intensity of care by CMG demonstrated that on average, patients with a higher NII score (1.95) required more total care time (59.4 minutes) than patients with lower NII score (1.48). Further, the findings demonstrate that the greatest increase in time is associated with shared care activities, 45.6 minutes, (see Table 7). The greater increase in shared care activities suggests that in this study, intensity is related to lower level needs such as diet, hygiene and other dependency needs. This finding is not supported by Prescott et al (1991) who compared the PINI ratings of patients in 10 different DRGs requiring high, medium and low amounts of nursing care as measured by GRASP and Medicus. Those in the high care group scored on average five points higher on the PINI than those in the low care group. However, these researchers did not subdivide care hours in their study.

Pearson's r demonstrated that the NII is strongly correlated with GRASP total hours (r=.699) and shared hours (r=.665) and moderately correlated with RN hours (r=.433), indicating a shared variability of 49%, 44% and 19% respectively. These findings suggest that intensity in this patient population is more closely associated with less complex patients requiring less complex nursing interventions. The GRASP system focuses predominantly on the volume of care, while the NII focuses primarily on nursing intensity. Although it is notable that both systems are strongly correlated, the overall amount of shared variability is only 49%. Fifty-one percent of the variability in nursing daily workload remains unexplained by the GRASP/NII model.

Complexity was not correlated with hours of care by Reitz (1985b). The only relevant firdings were reported by Phillips, Castorr, Prescott and Soeken (1992). These researchers reported the average PINI score was strongly correlated with GRASP ($\underline{r}$=.66), indicating a shared variance of 44%. The high correlations between the measure of intensity and traditional PCS indicates that both measure aspects of the same constructs. However a significant portion of daily workload remains unexplained by either PINI, NII or GRASP.

Regression analysis demonstrated that six to seven items of the NII explained 55% of the variance in GRASP total and shared hours, while four NII items explained 23% of the variance in RN hours. The best predictors of total and shared hours were the neurological, structural and health maintenance items which together accounted for 49% of the variance while the respiratory, circulatory and structural items were the best predictors of RN hours. The sensory and emotional items were not significant predictors of either GRASP total, shared or

RN care. These findings indicate that 45% of the variance in hours of care are not explained.

Phillips, et al. (1992) reported four PINI items, hours of care, task procedure complexity, mobility, and complexity of clinical judgements explained 59% of the total GRASP score. Six PINI items (injury potential, severity of illness, emotional support, ADL, physiological status and knowledge deficit) were not significant predictors of GRASP. These researchers suggested that PINI items measuring time and complexity are more highly correlated with GRASP because GRASP is designed to measure nursing tasks or procedures with more complex tasks given higher time weights. The findings from the current study do not support this assumption. Instead, the NII is more highly correlated with less complex nursing interventions such as diet, hygiene, activities of daily living, among others.

Skill Mix

The findings from the NII and perception instrument (SAI) demonstrated considerable variability on skill mix projections. The RN to RNA ratios produced were NII = 80/20, direct caregivers = 55/45 and the nursing supervisors 75/25 (see Tables 17, and 18).

One possible explanation for the differences observed is the intensity rating selected as the benchmark. Reitz

(1985b) proposed that the NII could be used to determine skill mix, however, she provided no indication as to which level requires the higher skilled caregiver. That determination was presumably left to nursing experts in the practice setting. The benchmark of 1.5 was selected primarily because of the decreased variability of the intensity ratings with the vast majority of patients 91% scoring in the minor intensity range (see Table 5). It was anticipated that perception ratings by direct caregivers and the nursing supervisor would support this selection however, they failed to do so (see Table 18). A greater degree of variability of the patients on the items and increased conceptual clarity of the NII might have indicated an alternate benchmark and thus improved the accuracy of the prediction.

Another possible explanation for the differences in projected skill mix ratios relates to the different parameters measured by the NII and the SAI. The NII measures nursing intensity directly, whereas the SAI asked the nursing supervisor and caregivers to consider patient needs in order to rate the skill level most appropriate to implement shared care activities. The findings indicate that while intensity has a low correlation with the perceptions of the direct caregivers ($\underline{r}$=-.266) indicating a shared variability of seven percent, the correlations are not linear (see Table 13). Further, intensity was not significantly correlated with the supervisor's perception. It is clear from these results that the NII and the SAI are not measuring the same parameters.

It is notable that the skill mix ratio projected by the NII more closely parallels that of the nursing supervisor than that of the direct caregivers. A possible explanation for this finding might be that both the NII rater and the nursing supervisor were one step removed from the actual delivery of care. This distance may have impacted on their ratings by artificially raising the intensity scores. It is also possible to argue that the method of assignment may have artificially decreased the ratings of the direct caregivers. As stated previously the method of assignment used in this practice setting is unit nursing. Unit nursing employs multiple caregivers, usually of different skill level to provide care in the form of a series of tasks/ interventions for a patient during a single shift. It has long been recognized there are problems with such care delivery systems. These concerns center around the multiple caregiver/task phenomena which serves to fragment care and thus precludes placing the patient in total context. The lower intensity ratings reported by the direct caregivers in this study may in part, be related to these phenomena.

Summary

This chapter has discussed the findings of the study and their relationship to other research. The findings suggest the GRASP system is a reliable and valid measure to quantify the volume of nursing workload. Methodological problems associated with the NII, that is conceptual ambiguities, the number of scale steps and application difficulties influenced the intensity rating of patients and thus the feasibility of using the NII for purposes of skill mix determination. The skill mix ratio projected by the integration of GRASP and NII data was not supported by the perceptions of direct caregivers and the supervisor. Chapter VI will identify the limitations of this study, address the implications for nursing practice and research and present conclusions.

CHAPTER VI

LIMITATIONS, IMPLICATIONS AND CONCLUSIONS

This chapter presents the limitations of this study and the conclusion drawn from the results. Implications for nursing practice and research are discussed.

Limitations

The findings of this study are subject to several limitations. Data collection was restricted to one medical unit in a tertiary care teaching hospital. Lack of information on the representativeness of the sample limits generalizability of study findings to other settings and population groups. It is not known whether the study would produce comparable results in other settings.

Another limitation was due to procedural variations in applying the NII. The NII was designed for retrospective application with a data set generated from specifically structured nursing documentation tools. In this study, the NII was applied concurrently without the benefit of these tools. Although modifications were made to facilitate data collection, difficulties surfaced in locating sufficient information to ensure reasonable confidence in intensity ratings.

The lack of comparison studies also posed problems. Differences in variables, methodologies and classification instruments precluded comparing the results of this study with other findings. Without these comparisons it is difficult to make firm conclusions.

Implications of the Study

The findings of this study have implications for nursing practice and research. Each of these areas will be addressed separately.

Nursing Practice

Nursing complexity is an important component of nursing care which, until recently, has received little research attention. The results of this study indicate that the NII has the potential to measure aspects of nursing intensity that should be considered when making skill mix decisions. However, methodological and application problems with the NII must be addressed first. The low intensity ratings observed in this study were not supported by a review of HMRI data nor by other researchers (Reitz, 1985b; Bailie, 1986; and Schmelz, 1986).

The method of assignment used in this practice setting has been suggested as a confounding variable that may have impacted the intensity scores. Nursing practice has not traditionally articulated the nature of the product it provides to clients. Nurses do not always critically reflect on the care they are providing nor do they consistently document its complexity. Without a comprehensive data base it is difficult to capture the intensity of nursing practice. A philosophical change in assignment method from one which fragments care to one which promotes an individualized holistic approach to patient care, may provide the structure for practicing nurses to more fully articulate the complexity of the nurse-patient interaction. In part, as a result of this study's findings, the nursing executive at Hospital A approved a review of its method of assignment for the general medical/surgical nursing units. The review will be conducted by the Nursing Practice Committee with representation from all levels of caregivers RNs, RNAs and nurse managers. The main objective of the review will be to identify an assignment method which has the potential to improve the quality of care and use the skills of the caregivers in the most efficient and cost-effective manner possible. This could have an added advantage of enhancing job satisfaction both personally and professionally.

Nursing Research

This study has generated the following recommendations for future nursing research:

1. Replicate the study in other sites, with contrasting and similar populations, to provide a more

extensive data base for testing the predictor equation (SP = GRASP + NII scores). This would increase generalizability of the results.

2. Nursing intensity accounted for over half of the variance in hours of care, however, a large portion of nursing workload remains unexplained. More studies are needed to support the relationships observed in this study and identify other predictors of nursing workload.

3. Continued psychometric testing of both the NII and the GRASP system is needed to clarify the conceptual dimensions of both instruments.

4. If the Atwood et al. (1986) model is to be used as a framework for determining nursing resources, more research is needed to test the model's practical utility. Problems are encountered when trying to combine two measures, such as GRASP and NII, which are derived from different theoretical bases. The most logical approach is perhaps the development of a single model which incorporates time and complexity. However, a more extensive research base is required to identify factors other than time and complexity, that may affect skill mix decisions, before firm conclusions can be made. The work initiated by Prescott and her colleagues which incorporates medical

severity, complexity of nursing care decisions, dependency/complexity and time represents an initial step. Current work by O'Brien-Pallas and her colleagues which incorporates medical severity, complexity of patient nursing condition, environment and time represents a second and theoretically related approach (O'Brien-Pallas & Giovannetti, 1993).

5. This study and others have demonstrated that patient classification can be used to measure the components of nursing care that affect costing and staffing decisions. However patient classification is not without problems. The issue relates to conceptual ambiguities, that is, as long as theoretical perspectives vary, methods will vary. Without conceptual clarity and agreement on the major concepts and conceptual and operational definitions, methodological problems will continue and affect findings. A system is needed to account for intensity, hours of care, skill mix, efficiency and cost effectiveness. Nursing leaders and researchers must agree on a standard objective method for classifying patients' care requirements which includes all of these variables.

Conclusion

The purpose of this research was to assess the psychometric properties of two patient classification systems and to explore the relationship between nursing care hours and intensity in order to predict a staffing pattern for a group of medical patients. Despite study limitations the following conclusions are drawn from the results.

Nursing care time and intensity are important factors guiding decision making related to skill mix, however the nursing intensity observed in this population was not as high as expected. Failure to obtain the expected intensity rating may be explained in part, by conceptual ambiguities and application problems associated with the Nursing Intensity Index.

Quantitative data indicated that the NII and GRASP instruments are measuring aspects of the same theoretical construct. However, a significant amount of the variation in daily nursing workload remains unexplained by the NII/GRASP Model. A combined quantitative/qualitative data base might explain more of the variance. Such a data base is proposed by proponents of a nursing minimum data set (NMDS). A NMDS is an abstraction system that represents uniform standards for collecting essential data (Werley, Devine, & Zorn, 1988).

Specific nursing elements included in the data set are nursing diagnosis, nursing interventions, nursing intensity and outcome (Hannah, 1993; Werley, Devine, & Zorn, 1988). The data source is the documented application of the nursing process which provides the rationale for, and the nature of, the care delivered. One of the suggested purposes of the NMDS is to demonstrate or project trends regarding patient care needs and allocation of nursing resources.

It may be as Giovannetti (1988) predicted that a NMDS will eliminate the need for patient classification because info mation for determining staffing resources will be included in this data set. Information related to nursing diagnosis, nursing interventions, nursing intensity and outcome will perhaps more accurately reflect the full domain of nursing workload. Instead of using theoretical measures of time and complexity to predict staffing patterns it may be more appropriate to use a qualitative/quantitative data base to derive taxonomies from the practice setting which will represent all of the theoretical constructs that reflect the variances in the nurse-patient interaction. Instead of going from theory to empirical findings it is perhaps more appropriate to go from practice to theory.

The staffing pattern projected by integration of the NII and GRASP data was not supported by the perceptions of direct caregivers. Failure to obtain this support may be explained in part, by instrument selection. The goal of clinically based research is to generate knowledge in order to provide optimal care in a cost effective manner. Determination of skill mix is integral to this goal. Skill mix determinations, however cannot be determined solely on the basis of PCS which deal with the volume and cost of care but do not capture details of clinical interventions. Although it appeared logical to combine hours of care and intensity to predict a staffing pattern, the operational measures used did not appear to be sensitive enough to reflect the full domain of nursing practice. Again the variables identified for inclusion in the NMDS may provide greater insight into skill mix determinations.

Researchers are just beginning to investigate intensity and how it relates to nursing care time. For example, there is a minimal research base for both the NII and the PINI with different populations and settings. This limited research base makes comparisons difficult.

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Appendix A

Approval Human Investigation Committee

Memorial
University of Newfoundland

Office of Research and Graduate Studies (Medicine)
Faculty of Medicine, The Health Sciences Centre

February 26, 1991

TO: Ms. J. Chubbs

FROM: Assistant Dean, Research & Graduate Studies, (Medicine)

SUBJECT: Application to Human Investigation Committee (Ref. #930)

The Human Investigation Committee of the Faculty of Medicine has reviewed your proposal entitled "An Evaluation of Two Patient Classification Systems as the Determinants of Staffing Patterns for Medical and Surgical Patients in an Acute Care Setting".

Approval, subject to the provisions in the attached letter from the Committee, has been granted from point of view of ethics as defined in the terms of reference of this Faculty Committee.

It will be your responsibility to seek approval from the Hospital(s) wherein the investigation will be conducted.

Notwithstanding the approval of the Human Investigation Committee, the primary responsibility for the ethical conduct of the investigation remains with you.

C.J. Michalski, Ph.D.

CJM/jt

Attachment

cc: Secretary, HIC
Dr. N. Gogan
Medical Director - Hospitals Involved
Ethics Committee Chairman - Hospitals Involved
Chairman of the Disciplines Involved

St. John's, Newfoundland, Canada A1B 3V6 Telex: 016-4101 Tel.: (709) 737-6762

Appendix B

Approval to Access Nursing Unit

April 1, 1991

Ms. Judy Chubbs
336 Topsail Road
St. John's, Newfoundland

Dear Ms. Chubbs,

This will grant approval to access the health records of patients on 5 West. This access is required to collect patient specific data related to the complexity and volume of nursing care to obtain a study sample. I understand your data collection will take place during April and May 1991.

Sincerely

Executive Director

/mtf

Appendix C

Consent Form

Consent to Participate in Research Involving Human Subjects

Title: A Proposal to Evaluate Two Patient Classification Systems As the Determinants of A Staffing Patter for Medical and Surgical Patients in An Acute Care Setting

Investigator: Judy A. Chubbs

Dear

I am a nurse currently enrolled in the School of Graduate Studies, Department of Nursing, Memorial University of Newfoundland. In partial fulfillment of the requirements for a Masters of Nursing Degree, I am conducting a research study.

You are asked to participate in this study. Your participation is voluntary, and you may decide to withdraw at any time without affecting your relationship as a member of the health care team.

The purpose of the study is to collect information regarding the quantity and complexity of patient care requirements in order to predict the number and mix of nursing personnel required to provide care for medical and surgical inpatients. The information collected will provide information relative to nursing resource allocation.

If you agree to participate you will be asked to complete a questionnaire prior to the end of each shift that you work during the study period. Each questionnaire will take approximately 10 minutes of your time to complete.

Your name will not be known to the investigator. On the records kept for the study you will be given a number and will only be identified by that number. All information will be kept strictly confidential.

If you have any questions about the study, you can contact me at any time by telephoning 778-3453 (office) or 368-0070 (home).

I have read this letter of explanation and understand the purpose of the study. I realize that my participation is voluntary and that I may withdraw at any time. I understand that no social, emotional or economic risks are involved.

participant	witness
investigator	date

Appendix D

Background Data Sheet

Background Data Sheet

Patient Code Number ______________________

Admission Date ______________________

Principle Medical Diagnosis ______________________

Nursing Unit ______________________

Discharge Date ______________________

Case Mixed Group ______________________

Total Hours of Care ______________________

Cost of Nursing Care ______________________

Nursing Care Profile

Day	Date	NWMS	NII
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

Total

Mean

Appendix E

GRASP Instrument

PATIENT CARE RECORD

INITIALS DENOTE CARE GIVEN

✓ DENOTES CARE GIVEN
DOCUMENTATION ELSEWHERE

× DENOTES CARE NOT GIVEN
DOCUMENTATION ELSEWHERE
Draft #4 (Revised July 1989)

DATE																					
NURSING CARE		20-24	24-04	04-08	08-12	12-16	16-20		20-24	24-04	04-08	08-12	12-16	16-20		20-24	24-04	04-08	08-12	12-16	1- 2
ASSESSMENT & PLANNING																					
Update Assessment	1							1							1						
Update Care Plan	0.5							0.5							0.5						
IMPLEMENTATION																					
TEACHING & EMOTIONAL SUPP																					
Teach/Support- Routine	2							2							2						
Cardiac Teaching	4							4							4						
DIET (Sel highest appl)																					
Feed Self - Assess	2							2							2						
Feed - Partial Assist	3							3							3						
Feed - Complete Assist	12							12							12						
HYGIENE (Sel as appl)																					
Bath/tub self - bed made	1							1							1						
Bath/tub - Part. Assist	3							3							3						
Bath/tub - Compl. Assist	5							5							5						
HS Care	1							1							1						
Oral Hygiene - C. Assist	2							2							2						
Perineal Care/Foley Care	3							3							3						
Facial Shave - C. Assist	1							1							1						
TURN & ASSIST (Sel. High. appl)																					
A.A.T. - Assess	1							1							1						
Bed/chair, turn, pos																					
skin care - partial	9							9							9						
Bed rest, turn, pos,																					
skin care - complete	14							14							14						
Leg exercise - assist	3							3							3						
ELIMINATION (Sel. High. appl)																					
Toilet - Partial Assist	4							4							4						
Toilet - Complete Assist	5							5							5						
VITAL SIGNS (Sel as appl)																					
T.O.D.	0.5							0.5							0.5						
T.q4h	3							3							3						
BP/PR q4h	3							3							3						
SUBTOTAL																					

DATE																					
NURSING CARE (Cont'd)		20-24	24-04	04-08	08-12	12-16	16-20		20-24	24-04	04-08	08-12	12-16	16-20		20-24	24-04	04-08	08-12	12-16	16-20
VITAL SIGNS (cont'd)																					
BP before medication	1							1							1						
Pulse/Apical pulse																					
before medication	1							1							1						
Post Angiogram Assess.	9							9							9						
Cardiac Respiratory Ass.	2							2							2						
Telemetry Monitoring	6							6							6						
Weight QD	1							1							1						
MED ADMIN (Select as appl)																					
Oral Medications	6							6							6						
Nitropaste/Inhaler/Drops	3							3							3						
Heparin/Insulin S.C. Inj	3							3							3						
I.V. Meds 1 - 3 trips	2							2							2						
4 - 6 trips	5							5							5						
7 - 11 trips	8							8							8						
Continuous I.V. Care	9							9							9						
Heparin Lock Care	2							2							2						
RESP CARE/SUCTION(sel as appl)																					
Oxygen Therapy	1							1							1						
Tracheostomy Care	22							22							22						
OTHER NURSING CARE(sel as app)																					
I & O Fluid Balancing	1							1							1						
Bl Glucose Monitoring	6							6							6						
Reality Orientation/																					
Safety Check	3							3							3						
EVALUATION	1							1							1						
SUPPORT ACTIVITIES																					
Support Care (Sel as appl)																					
Nebulizer Treatment	4							4							4						
OTHER SUPPORT	(4)							(4)							(4)						
RELATED NURSING	(8)							(8)							(8)						
PATIENT TRANSPORTATION																					
Nearest 0.25 hr. x 10																					
Nsg care (off unit)																					
Nsg Care (outside hosp)																					
SUBTOTALS																					
TOTAL TENTHS																					
PCH ÷ 10																					
INITIALS																					

DATE	SIGNATURE/STATUS	INITIALS	DATE	SIGNATURE/STATUS	INITIAL

Appendix F

NII Rating Summary

Nursing Intensity Index Rating Summary

Patient Code No. ________ Rater's Name ____________

Date Scored ________ Nsg. Unit ____________

Notes

	Functional Health Parameters	Level 1 Minor	Level 2 Moderate	Level 3 Major	Level 4 Extreme
B I O	Nutrition	mild/no deficits	impairment present/ some assistance, special	significant deficit/ complex plan of care	catastrophic deficits/ sustaining therapies
P H Y	Elimination	mild/no deficits	deficit present/ some assistance, special	uncompensated deficits/complex plan of care	catastrophic deficits, life therapies
S I C	Sensory Function	mild/no deficits	impairment present/ some assistance	significant uncompensated deficits/ complex	senses non-functional/constant monitoring
A L H	Protection	physio-logic barrier intact	alteration in barriers/non-complex intervention	physiologic barriers significantly compromised/complex therapies	physiologic barriers nonfunctional/extra-ordinary intervention
E A L	Neuro-logical Function	mild/no deficits	impairment present/ non complex intervention	significant deficits/ complex plan of care	catastrophic deficits/ constant monitoring
T H	Circulatory Function	mild/no deficits	impairment present/ non-complex thera-peutic intervention	significant deficits/ complex plan of care	catastrophic deficits/ constant monitoring
	Respiratory Function	mild/no deficits	impairment present/ non-complex intervention	significant deficits/ complex plan of care	catastrophic deficits/ constant monitoring
B E H	Emotional Response	indepen-dent adaptation	some maladaptive behaviors/non-complex intervention	significant mala-daptive behaviors/ complex plan of care	dangerous to self, others/constant observation
A V I O	Social System	intact/ supportive	some disorganiza-tion present/non-complex intervention	significant disorgan-ized resources/ complex plan of care	nonfunctional/ continuous external support required
R A L	Cognitive Response	mild/no deficits	impairment present/ non-complex inter-vention	significant deficits/ complex plan of care	severe impairment/ continuous inter-vention
H E A L T H	Health Management Pattern	highly adaptive health practices	inconsistent practices/non-complex intervention	significant mala-daptive health practices/complex plan of care	destructive health practices/continuous intervention

Intensity Rating
(Circle One) 1 2 3 4

Principle Diagnosis ______________________

Reitz 1985a; 1985b

Appendix G

Perception of Staffing Adequacy

APPENDIX G

Perception of Staffing Adequacy

(Modified)

Indicate the level of caregiver (eg RN, NI or RNA) who could best meet the listed needs for your assigned patients during this shift. Please complete towards the end of your shift.

Patient IP #	Routine Teaching/Support	Diet	Hygiene	Turn/Assist	Elimination	Vital Signs	Other Nsg Care	

Appendix H

Contract of Agreement

Contract of Agreement

Between Judy A. Reitz, Principal and ______________________ Student

The Nursing Intensity Index

This agreement pertains only to the use of the Nursing Intensity Index for use in the master's thesis of ______________________ (student). You agree not to sell, transfer, give, or in any way convey to any third party, person, or institution information about the training for, implementation of, or use of the Nursing Intensity Index without my written permission. This contract of agreement should not restrict ______________________ in any way in disseminating general information about or data or conclusions from the study in public reports, noncommercial seminars, or other customary means of scientific discourse.

Further, I agree to submit a copy of data and any related reports eminating therefrom to Judy A. Reitz upon completion of the study/project.

______________ Signature (Student) 2/14/91 Date

______________ Signature (Principal) 2/14/91 Date