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A STUDY TO IDENTIFY AND ANALYZE THE EFFECTS OF CATEGORY AND FREQUENCY SAMPLING ON THE REPORTING OF TOTAL NURSING CARE HOUR REQUIREMENTS

A Graduate Management Project

Submitted to the Faculty of

Baylor University

In Partial Fulfillment of the

Requirements for the Degree

of

Master of Health Administration

by

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The impact of patient categorization and frequency sampling on the accurate reporting of the number of nursing care hours needed for a given group of patients was demonstrated in this study. The results of this study further corroborated the earlier NCHSS findings of Sherrod, Rauch & Twist (1981). Overall, the principal findings of the study supported the premise that the sampling frequency of acuity data could be as infrequently as every Wednesday. However, the findings did not support the premise that sampling could be as infrequent as once a month. In general, this finding was shown to have important implications for redefining thefrequency of sampling WMSN acuity data at Womack Army Community Hospital. This was a retrospective inquiry analyzing the database collected over a 422 day period involving 79,677 cases. Patients admitted to Womack Army Community Hospital during the period of August 4, 1987 through Septemeber 29, 1988 were used for the study. Acuity data for the study was collected by professional nurses on a daily basis and entered into the Datapoint terminals, using UCA/PERS Utilization Systems

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(Uniformed Chart of Accounts/Personnel Expense Reporting Systems) software versions 4.1,4.2,4.2.1, and 4.2.2, respectively. Analysis was conducted on the total sample of patient records, and individually, for six clincal areas at WACH: medical/surgical, obstetrics/gynecology, psychiatric, newborn nursery, pediatrics and critical care for the 422 day period. Patient acuity data was provided by registration number and clinical service only, so the ethical rights of the patient were protected. The unit of analysis used was day of care.

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LIST OF TABLES

Graduate Management Project
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26 Jun 89
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I. INTRODUCTION

Purpose of the Study

The purpose of this study is to demonstrate the impact of patient categorization and frequency sampling on the accurate reporting of the number of nursing care hours needed for a given group of patients. In order to discuss this purpose, some historical data is provided.

Background

Traditionally, staffing of nursing personnel was planned based on the number of beds occupied in a given clinical area. And within the U.S. Army, staffing guides were derived from historical data such as occupied beds and available staff. However, within the past two decades, the nature and volume of the nursing workload has been altered greatly by: the rapid advances in technology, an increase in life expectancy and an aging population, the trend toward specialization, a greater emphasis on health promotion and teaching, and the prospective payment system (Wilson, 1988). As a result, staffing could no longer be considered merely a function of patient census.

The Joint Commission on Accreditation of Hospitals indicated in Nursing Service Standard III (1980) that "the Nursing Department shall define, implement, and maintain a system for determining patient requirements for nursing care on the basis of demonstrated patient need, appropriate nursing intervention and priority for care and that specific nursing personnel for each nursing care unit shall be commensurate with the patient care requirements and staff expertise." (Joint Commission on Accreditation of Hospitals, 1981). Thus, the JCAH required that nurse staffing patterns reflect the data gathered through these nursing patient classification systems.

A survey conducted within the U.S. Army Medical Department (AMEDD) in 1981 indicated that nurse managers lacked an objective method to quantify both direct nursing care requirements and the manpower needed to meet these requirements (Sherrod, 1981). In response to the JCAH mandate and the need to make sound administrative decisions about staffing requirements, the Army Nurse Corps instituted the Nursing Care Hour Standards Study. The Nursing Care Hour Standards Study (NCHSS) was conducted by the Health Care Studies Division (HCSD), U.S. Army Academy of Health Sciences, Fort Sam Houston, Texas with LTC Susie M. Sherrod, ANC acting as the principal investigator. This study proposed a mechanism for the effective allocation and utilization of nursing resources within the U.S. Army Nurse Corps--i.e., an improved patient classification system which would provide a better staffing mix based on quantified direct nursing care requirements for Critical Care, Medical/Surgical, Obstetric/Gynecology, Psychiatric, Neonatal, and Pediatric inpatient clinical services (Sherrod, Rauch & Twist, 1981).

The subsequent Nursing Care Hour Standards Study was conducted in four phases over a period of four years ending in February 1981, and is cited as being the most comprehensive and best documented task list in the nursing literature (Giovanetti, 1982). This extensive time and motion study involved over 37,000 timed measurements (approximately 27,000 adult measurements and 10,000 pediatric measurements) of 357 direct nursing care activities. Based on information obtained during this study, a staffing methodology was designed to determine number and mix of care providers. The validity of the system was later endorsed by the consulting firm Health Management Systems Associates (Vail, 1986).

Because of the large number of timed measurements of the NCHSS systems at nine facilities, data collection was limited to direct care needs of patients. As a consequence, the NCHSS involved neither indirect patient care nor unavailable time. The Army Nurse Corps, therefore, thought it essential to expand on the Sherrod study by determining the percentage of time spent by nursing personnel in other than direct care activities (i.e., indirect care and unavailable time).

Thus, the (HCSCIA) Health Care Studies and Clinical Investigation Activity of the U.S. Army Health Services Command, Fort Sam Houston, Texas, conducted a study under the direction of LTC Terry R. Misener using objective instrumentation to measure the percentage of indirect care time spent by nursing personnel on inpatient clinical services. Measurements were taken on those services which provided both direct and indirect care, and on the amount of time nursing staff were unavailable to provide care.

At the same time that the Nursing Care Hours Standard Study was being conducted, another ANC officer COL Beverly A.K. Glor was simultaneously developing a patient classification system to provide average nursing care time for six categories of patients. Glor's system is workable, however its scientific basis is questionable due to the lack of sufficient documentation to support the reliability and validity of its quantification procedures (Vail, 1986).

The Army Nurse Corps, convinced that established measures of using patient census alone was inadequate for planning budgets and allocating staffing resources, decided that a single, comprehensive patient classification system was needed for allocating and managing staff at both corporate and local levels. In January 1982, The Chief of the Army Nurse Corps Brigadier General Hazel Johnson directed LTC Janet Southby and MAJ Elizabeth A. Rimm of Walter Reed Army Medical Center's Nursing Research Service to evaluate both the Sherrod and Glor systems and make recommendations for a single system suitable for Army-wide use. Both systems were being used in several of the Army's medical treatment facilities when this evaluation was being conducted. Southby and Rimm found both systems comparable; however, neither system seemed adequate for Army-wide use. Consequently, the investigators suggested in their final report, that the Army Nurse Corps retain an outside consultant to advise the ANC on the best approach for developing a patient classification system suitable for the entire Army Medical Department.

Health Management Systems Associates (HMSA), a civilian firm of Minneapolis, was chosen by the Army Nurse Corps to evaluate the Sherrod and Glor systems and advise the Corps in relation to implementation of either system, or an alternative. The findings of HMSA supported Southby and Rimm's conclusion: both systems significantly contributed to the technology of patient classification and nurse staffing; however, neither system adequately fulfilled the performance goals of the Army. HMSA recommended the ANC merge the best parts of the Sherrod and Glor systems into a single system rather than adopt a totally different alternative or a radically modified version of either system.

In September 1982, Brigadier General Connie L. Slewitzke, Chief of the Army Nurse Corps tasked LTC James D. Vail, Chief, Nursing Research Service, Walter Reed Army Medical Center, to act on the consulting firm's recommendations to develop, test, and implement a valid and reliable system for classifying patients based on nursing care hour requirements. An additional requirement was that the system be linked to a staffing methodology using patients' needs in order to determine the number and mix of personnel required to provide nursing care.

From 1982 through 1985, LTC James D. Vail, MAJ Dena A. Norton, and MAJ Elizabeth A. Rimm, (the project's principal investigators), in close collaboration with CDR Karen Rieder, Navy Nurse Corps, produced the Workload Management System for Nursing (WMSN). The WMSN was carefully designed to meet all criteria suggested by the civilian consulting firm HMSA. This patient classification system utilizes a factor evaluation instrument listing specific descriptors of the patient care process (Hoffman & Wakefield, 1986). Each item is evaluated independently before being combined to determine a patient's category. Factor evaluation systems frequently associate a time element with each factor (minutes or points per factor) that ultimately allows for the translation of patient care needs into staffing requirements (24).

The WMSN is currently being used throughout the Army health care system. As a consequence, nurse managers in military Medical Treatment Facilities traditionally spend from thirty to sixty minutes per day gathering and calculating patient acuity data or totaling nursing care hours (Rieder & Jackson, 1985). This frequency of sampling patient acuity is done in order to allocate and use nursing resources effectively (Vail, Morton, & Rieder, 1987), based on a system of manpower allocation as devised by Sherrod, Rauch, & Twist (1981).

Problem Statement

To identify and analyze the effects of category and frequency sampling on the reporting of total nursing care hour requirements.

II. LITERATURE REVIEW

A literature review was conducted to assess the importance of accurate nursing care hour determination in manpower : source allocation. Although almost every hospital or other institution employing nurses has participated in a private, regional, or national nurse staffing study, the reports have largely been unavailable in any periodical literature, much less the literature generally accessed by nurses (Halloran & Vermeersch, 1987). Although some effort has been made by some firms to publish abstracts of nurse staffing studies in Abstracts of Hospital Management Studies or Abstracts of Health Care Management Studies, this lack of publication significantly limits utilization and interpretation of the data.

However, studies by Connor, Flagle, & Hsieh, 1961; Poland, English, Thornton, & Owens, 1970; Jelinek, Linn, & Brya, 1973: Murphy, Dunlap, Lakos, Durham, & Moriuchi, 1976; Williams, & McAthie, 1978; Thomas & Vaughan, 1986; Richards, Hexum, & Anderson, 1987; Marks, 1987; Nauert, & Watson, 1988; Rosenbaum, Willert, Kelly, Grey, & McDonald, 1988; have specifically addressed the sampling frequency of acuity data necessary to be every shift. One study by Kinley & Cronenwett determined that gathering acuity data each shift was unnecessary; these researchers determined that no one shift had data significantly closer to the mean (1987). Ledwitch states that the benchmark of a reliable PCS (Patient Classification System) is that it shows consistent data (1987, 155). Any one unit should not show a high acuity one week and a very low acuity the next.

Other nurse managers believe that patient acuity should be gathered on a daily basis in order to capture the variability of nursing intensity or acuity that occurs over the course of a patient's hospitalization (Connor, 1960; Young, 1962; Wolfe, Harvey & Young, 1965; Cullen, Civetta, Briggs, & Ferrara, 1974; Finlayson, 1976; Knaus, 1981; Cullen & Keene, 1983; Adams & Duchene, 1985 ; Vaughan &

MacLeod, 1985; Donovan & Lewis, 1987; McNeal, Hutelmyer, & Abrami, 1987; Prescott & Phillips, 1988). In a study by Krause (1987) of PCSs in eastern Wisconsin, forty-three percent of the nursing departments in the study classified patients every shift. Even with frequent reclassifying, respondents reported little success in adjusting staffing satisfactorily to the PCS requirements (193). Sheila Haas, Assistant Professor of Nursing, Loyola University, in "Patient Classification Systems: A Self-Fulfilling Prophecy", also questioned the essentiality of classifying patients every eight to twenty-four hours (1988).

One noted author in the field, Margaret McClure, Executive Director of Nursing, New York University Medical Center, feels that acuity data need only be collected monthly or quarterly; Ms. McClure uses this data solely as a basis for budgeting (1988). Nauert, Leach, & Watson (1988) state that workload for each shift can be calculated daily or periodically, although these authors do not define periodically. They feel that compliance with established standards of workload should be monitored over time rather than on a day-to-day basis.

III. CURRENT STUDY

Objectives

As stated previously, the purpose of this study is to identify and analyze the effects of category and frequency sampling on the reporting of total nursing care hour requirements. In order to accomplish this task, the following objectives were to be met:

1. A literature review would be conducted to assess the importance of nursing care hours determination in manpower resource allocation.

2. A magnetic tape containing patient acuity data for a six to twelve month period for Womack Army Community Hospital (WACH), Fort Bragg, N.C., would be obtained from HCMEDS (Health Care Management Engineering Data Systems), Ft. Detrick, Maryland through Health Services Command Resource Management Division.

3. Mainframe computer support for analysis of the data would be provided at Academic Computing Services, University of North Carolina at Chapel Hill.

4. Statistical analysis of the data would be conducted and conclusions drawn from the results.

5. Recommendations would be made for appropriate policy in standard operating procedures at WACH for frequency sampling of total nursing care hours.

Criteria

To determine whether objectives were met, results of this research will show significance at the alpha .05 level.

Assumptions

The following assumptions were made for the purposes of this research:

1. Data collected by UCA (Uniformed Chart of Accounts) will be

accurate after 1987.

2. Manpower and staffing requirements will not change as a result of this research.

3. Audits of each units' Workload Management System for Nursing, by pre-established Womack Army Community Hospital DNAPs (Department of Nursing Administrative Policy), will continue on a quarterly basis as a means to validate inter-rater reliability.

Reliability testing will be conducted by an independent, expert patient classifier appointed by nursing administration (Vail, Norton, & Rimm, 1984). An independent, expert patient classifier is defined as an RN not assigned to the unit, usually an assistant chief, Department of Nursing; evenings and night supervisor; a quality assurance (QA) nurse; or the assistant chief, Department of Nursing. The Chief, Nursing Education and Staff Development is responsible for development of levels of WMSN education commensurate with the experience and responsibilities of the nursing staff within the facility. The (CN) Chief, Department of Nursing, is responsible for ensuring that data generated by the WMSN is accurate and that inter-rater reliability is monitored (Jones, 1988).

4. (IRR) Inter-rater reliability for each unit will remain at 70 percent or better during the data collection period. IRR is done quarterly on all units, unless the IRR fell below 80 percent, in which case it was repeated after education (Jones, 1988).

5. No significant changes in case mix, workload, or resourcing of

WACH will occur in the forseeable future as a result of changes in mission, catchment area demographics, or budgetary reversal.

Limitations

The formal statistical solution to the problem identified requires data processing support in the form of a computer software program to solve multiple linear regression equations. SPSS (Statistical Package for the Social Sciences), and Visicalc are two examples of such software. If access to the required data processing support is not possible without cost to the researcher, this project can still be completed by the researcher for a cost not to exceed $600.00. Should access not be available, transmission of data will occur via LAN (local area network) or the tape will be transported to the computer services center for analysis.

Only six clinical areas will be utilized for data input in this study: Medical/Surgical, Psychiatric, Pediatric, Obstetrics/Gynecology, Critical Care, and Newborn Nursery. The Workload Management System for Nursing provides a system of patient categorization according to severity of illness in these areas only. A system for categorizing patients in Recovery Room, Operating Room, and Outpatient Clinics is currently being developed and will be available by 1990.

Research Methodology

This was a retrospective inquiry analyzing the database collected over a 422 day period involving 79,677 cases. Patients admitted to Womack Army Community Hospital during the period of August 4, 1987 through September 29, 1988 were used for the study. Acuity data for the study was collected by professional nurses on a daily basis and entered into the Datapoint terminals, using UCA/PERS Utilization Systems (Uniformed Chart of Accounts/Personnel Expense Reporting Systems) software versions 4.1, 4.2, 4.2.1, and 4.2.2, respectively.

Analysis was conducted on the total sample of patient records, and individually, for six clinical areas at Womack Army Community Hospital: Medical/Surgical, Obstetrics/Gynecology, Psychiatric, Newborn Nursery, Pediatrics and Critical Care for the 422 day period. Patient acuity data was provided by registration number and clinical service only, so the ethical rights of the patient were protected. The unit of analysis used was day of care.

Two classes of predictor variables were defined. Categories was the first class of predictor variables defined (see Table 3) with membership being coded as "1", "0" if otherwise. Sampling Frequency Methodology was the second class of predictor variables defined. Sampling frequency variables included: every day, every other day, every third day, every seven days, every Wednesday, every month, December 1987, and January 1988. Random sampling was done to match cases with controls for every other day, every third day and every seven days. The dependent variable was total acuity points or total nursing care hours as defined in the Workload Management System for Nurses. Predictor variables included Categories I-VI, with membership for each case being coded "1" if assigned, "0" otherwise.

This research utilized an existing Nurse Patient Classification System, the Workload Management System for Nursing (WMSN), developed jointly by the U.S. Army and U.S. Navy, to measure the intensity of nursing services provided to the patients at Womack Army Community Hospital, Fort Bragg, N.C. The WMSN incorporates a "factor evaluative patient classification instrument which identifies and independently rates specific elements of an individual patient's direct care" (Green et al., 1985). The elements, called critical indicators, are combined to produce a total rating, placing that patient in a particular category or class (Rieder & Jackson, 1986).

The WMSN consists of 82 critical indicators, placed into ten major categories of direct nursing service: vital signs, monitoring, activities of daily living, feeding, treatments, respiratory therapy, teaching, emotional support, and continuous care. For example, "Activities of Daily Living", factor three contains five critical indicators:

1. Self/minimal care (adult or child) > 5 years.
2. Assisted care > 5 years, positions self.
3. Complete care > 5 years, assist with positioning.
4. Total care > 5 years, position and skin care every 2 hours.
5. Extra linen change and partial bath twice per shift.

Each indicator specifies the sequence and type of care incorporated into the activity. The WMSN assigns a point value to each critical indicator in congruence with the amount of time necessary to perform that service. Each point representing 7.5 minutes of direct nursing care time, was drawn from a four year time and motion study of 357 direct care nursing activities conducted by Sherrod (Sherrod et al, 1981). During the course of the Nursing Care Hours Standards Study, nine Army hospitals were used to collect 37,000 observations. A study conducted by Kelly (1980) across three Navy Hospitals, was in support of the Nursing Care Hours Standard Study by Sherrod. A comparison of multiple hospital studies demonstrated that findings from both the Army and Navy research corresponded with findings from the civilian community (Lake, 1983). The Sherrod study has been cited as having the most comprehensive and best documented task list to be found anywhere in nursing literature (Giovanetti, 1982).

Users determine a patient's category of care by totaling the number of points in all critical indicator groups. A category I patient, for example, requires minimal care; a category VI patient requires extensive nursing care (see Table 1). After the user has classified patients, he or she determines total nursing care hour requirements and converts this number to the number and mix of staff required to provide care for that group of patients on a 24-hour basis.

The nurse manager determines staffing needs according to the number of nursing care hour requirements for any group of patients. The staffing method consists of nursing care hour requirement charts and personnel requirement charts that represent each of six clinical areas of practice: Medical/Surgical, Pediatrics, Psychiatry, Obstetrics/Gynecology, Nursery, and Critical Care (Vail et al., 1987). (See Table 1, next page).

Table 1. **Categories and Nursing Care Hours**

Category	**Hours**	**Direct Care Description**
Category I	0-12 hours	self care/minimal care
Category II	13-31 hours	moderate care
Category III	32-63 hours	acute care (1 staff:3-5 patients)
Category IV	64-95 hours	intensive care (1 staff:2 patients)
Category V	96-145 hours	continuous care (1 staff:1 patient)
Category VI	> 145 hours	critical care (>1 staff:1 patient)

Validity and reliability of the Workload Management System for Nursing was established in a study conducted by Rieder and Jackson (1985) across six Navy hospitals in the continental U.S. The consistency of the WMSN was assessed through comparison with the Nursing Care Hours Standards (NCHS) tool developed by the Army which had demonstrated content and criterion related validity. A correlation of .81 between the two tools was found.

For inter-rater reliability, an agreement level of 80 percent was set as the minimally acceptable criterion. The overall inter-rater reliability agreement level for the six hospitals was 85 percent. Findings for all factors were above .90 except for emotional support, complex treatments, teaching, and simple treatments. Correlations for all factors were significant beyond the .01 level (Green et al., 1987). Inter-rater reliability was assessed quarterly at Womack Army Community Hospital in accordance with pre-established (DNAP) Department of Nursing Administrative Policy.

Descriptive data on the sample were obtained initially to characterize predictor variables within each data set. As a means of testing various hypotheses about relationships between the predictor and dependent variables, multiple linear regression models (Finstuen & Alley, 1983) were constructed for each of the criterion variables. These models are demonstrated in Table 3. Eight models were used defining different sampling frequencies for assessing total nursing care hours. These models included sampling frequencies ranging from the full model of every day sampling to once a month sampling (the first day of each month was used).

Each model has one full and two restricted equations. The first full equation controls for category and sampling frequency, while the second controls for whatever category only, assuming no day-to-day differences, and the third equation tests the sampling frequency plus an assigned weight, a_oU. (See Legend below).

Table 2. **Legend for Multiple Linear Regression Equations**

Legend for Multiple Linear Regression Equations	
Y=total nursing hours	**a_o=mean total nursing care hours**
b=least squares regression weight	
C=category	**U=unit vector**

Table 3. **Multiple Linear Regression Equations by Model**

Model / **Predictors**	**Effect**
Category (C)	Category differences
1. $Y=a_0U+b_1C1+b_2C2+b_3C3+b_4C4+b_5C_5+b_6C_6+b_7C_7$ where Y is total nursing hours, b is a least squares regression weight, C is category, & U is a unit vector	
2. $Y=a_0U+b_1C1+b_2C2+b_3C3+b_4C4+b_5C_5+b_6C_6$	Category constant differences; assumes no day-to-day differences
3. $Y=a_0U$	No category differences
Every Other Day (QOD)	
1. $Y=a_0U+b_1C_1+b_2C_2+b_3C_3+b_4C_4+b_5C_6+b_6QOD$	Category differences accounted for
2. $Y=a_0U+b_1C1+b_2C2+b_3C3+b_4C4+b_5C_5+b_6C_6$	Category constant differences; assumes no day-to-day differences
3. $Y=a_0U+b_1QOD$	No category differences

Table 3. **Multiple Linear Regression Equations by Model**

Model Predictors	Effect
Every Other Day (QOD)	
4. $Y=a_oU+b_1C_1+b_2C_2+b_3C_3+b_4C_4+b_5C_5+b_6R16$ where a predictor R16= 16 random days in a month	Category differences accounted for; used as a control for QOD model
5. $Y=a_oU+b_1C1+b_2C2+b_3C3+b_4C4+b_5C_5+b_6C_6$	Category constant differences; assumes no day to day differences
6. $Y=a_oU+b_1R_{16}$ where R_{16}=16 random days in a month	No category differences accounted for
Every Third Day (Q3D)	
1. $Y=a_o+b_1C_1+b_2C_2+b_3C_3+b_4C_4+b_5C_5+b_6Q3D$	Category differences accounted for
2. $Y=a_oU+b_1C1+b_2C2+b_3C3+b_4C4+b_5C_5+b_6C_6$	Category constant differences; assumes no day-to-day differences
3. $Y=a_oU+b_1Q3D$	No category differences
Every Third Day (Q3D)	
4. $Y=a_oU+b_1C_1+b_2C_2+b_3C_3+b_4C+_4b_5C_6+b_6R10$ where R10=10 random days in a month	Category differences accounted for; used as a control for Q3D model
Every Third Day (Q3D)	
5. $Y=a_oU+b_1C1+b_2C2+b_3C3+b_4C4+b_5C_5+b_6C_6$	Category constant differences; assumes no day-to-day differences
6. $Y=a_oU_+b_1R10$	No category differences accounted for

Table 3. **Multiple Linear Regression Equations by Model**

Model	Predictors	Effect
Every Seventh Day (Q7D)		
1.	$Y=a_0U+b_1C_1+b_2C_2+b_3C_3+b_4C+_4$ $b_5C_6+b_5Q7D$	Category differences accounted for
2.	$Y=a_0U+b_1C1+b_2C2+b_3C3+$ $b_4C4+b_5C_5+b_6C_6$	Category constant differences; assumes no day-to-day differences
3.	$Y=a_0U_+b_1Q7D$	No category differences
Every Seventh Day (Q7D)		
4.	$Y=a_0U+b_1C_1+b_2C_2+b_3C_3+b_4C+_4$ $b_5C_5+b_6R4$ where R4=4 random days in a month	Category differences accounted for; used as a control for Q7D model
5.	$Y=a_0U+b_1C1+b_2C2+b_3C3+$ $b_4C4+b_5C_5+b_6C_6$	Category constant differences; assumes no day-to-day differences
6.	$Y=a_0U_+b_1R4$	No category differences
Every Wednesday (QWEDNESDAY)		
1.	$Y=a_0U+b_1C_1+b_2C_2+b_3C_3+b_4C+_4$ $b_5C_5+b_6QWEDNESDAY$	Category differences accounted for
2.	$Y=a_0U+b_1C1+b_2C2+b_3C3+$ $b_4C4+b_5C_5+b_6C_6$	Category constant differences; assumes no day-to-day differences
3.	$Y=a_0U_+b_1QWEDNESDAY$	No category differences

Table 3. **Multiple Linear Regression Equations by Model**

Model	Predictors	Effect
December 1987 (DEC)		
1.	$Y=a_0U+b_1C_1+b_2C_2+b_3C_3+b_4C+_4$ $b_5C_6+b_5$DECEMBER	Category differences accounted for
2.	$Y=a_0U+b_1C1+b_2C2+b_3C3+$ $b_4C4+b_5C_5+b_6C_6$	Category constant differences; assumes no day-to-day differences
3.	$Y=a_0U_+b_1$QDECEMBER	No category differences
January 1988 Model (JAN)		
1.	$Y=a_0U+b_1C_1+b_2C_2+b_3C_3+b_4C+_4$ $b_6C_6+b_5$QJANUARY	Category differences
2.	$Y=a_0U+b_1C1+b_2C2+b_3C3+$ $b_4C4+b_5C_5+b_6C_6$	Category constant differences; assumes no day-to-day differences
3.	$Y=a_0U_+b_1$QJANUARY	No category differences
Once A Month Model (QMONTH)		
1.	$Y=a_0U+b_1C_1+b_2C_2+b_3C_3+b_4C+_4$ $b_6C_6+b_5$QMONTH	Category differences
2.	$Y=a_0U+b_1C1+b_2C2+b_3C3+$ $b_4C4+b_5C_5+b_6C_6$	Category constant differences; assumes no day-to-day differences
3.	$Y=a_0U_+b_1$QMONTH	No category differences coded as one variable

IV. DISCUSSION

Because of budgetary constraints, a model for each month within the period sampled was not analyzed. The statistical analysis for this research cost the author $1,200.00.

Findings addressed to each of the following are described: a)descriptive statistics, b)regression analyses, and c)reliability and validity.

Descriptive Statistics

Means and standard deviations for the total sample were obtained initially to characterize category and sampling variables. (See Table 3). 51% of WACH patients were Category II, 25.4% were Category III, and 17.2% were Category I. Category IV, V, and VI comprised 3.6%, 1.7%, and 1.0% of the patient population, respectively. In Pediatrics, there were no Category VI patients. Obstetrics/Gynecology had no Category V patients and .1% Category VI patients. Newborn Nursery had .2% Category VI patients.

The above percentages were not surprising since WACH does not have an NICU (Neonatal Intensive Care Unit) and transfers out most high risk obstetrical and newborn patients. Similarly, Psychiatry had .1% Category VI patients since those requiring long-term acute care are transferred to other facilities such as Walter Reed Army Medical Center. See Appendix B for individual clinical service means and standard deviations.

Table 4. **Means and Standard Deviations for the Total Sample (All Clinical Services)**

Variable	**Mean**	**SD**
Y	29.568	7.507
QOD	29.443	7.299
Q3D	28.738	6.709
Q7D	32.693	9.131
QWD	30.657	6.453
R4D	27.478	3.003
R10D	27.497	5.098
R16D	29.790	7.226
Dec	27.297	2.973
Jan	31.838	9.664
QMonth	29.000	2.016
C_1	.172	.066
C_2	.512	.096
C_3	.254	.064
C_4	.036	.040
C_5	.017	.014
C_6	.010	.009

Regression Analyses

Results for the total sample, from each of the eight regression models (Table 2) computed for both category and sampling frequency, are shown in Table 4. Results for individual services are shown in Appendix C. The sample size for all of the computations was 79,677 patients over a period of 422 calendar days.

The significant $\underline{F}$ ratios for category models indicated that differences in category had a considerable impact on the dependent measure, total nursing care hours. $\underline{F}$ ratios for each of the sampling frequency models was significant at $\underline{p} \leq .0000$ except for the **DEC** and **QMONTH** models. This was not surprising as December is usually a month of low census due to the Christmas holiday. The **QMONTH** model utilized the first and only day of each month, so it is not surprising that the resulting ratio was not significant. The sampling frequency model with the highest R^2 was the **Q3D** model (R^2=.7114).

Table 5. **Statistical Comparison of Regression Models for the Total Sample (All Clinical Services)**

MODEL	R^2	DF_1	DF_2	F Ratio	P
CATEGORY	.9927	5	56	1542.3061	.0000
QOD					
1	.9928	6	55	1237.5005	.0000
2	.9927	5	56	1542.3061	.0000
3	.6961	1	60	137.4916	.0000
4	.9931	6	55	1324.6225	.0000
5	.9927	5	56	1542.3061	.0000
6	.5855	1	60	84.7224	.0000
Q3D					
1	.9934	6	55	1381.3619	.0000
2	.9927	5	56	1542.3061	.0000
3	.7114	1	60	147.7097	.0000
4	.9930	6	55	1306.0323	.0000
5	.9927	5	56	1542.3061	.0000
6	.2070	1	60	15.6646	.0002
Q7D					
1	.9928	6	55	1269.7628	.0000
2	.9927	5	56	1542.3061	.0000
3	.2424	1	60	19.2099	.0000
4	.9927	6	55	1267.9875	.0000
5	.9927	5	56	1542.3061	.0000
6	.3094	1	60	26.8858	.0000
QWEDNESDAY					
1	.9928	6	55	1274.3992	.0000
2	.9927	5	56	1542.3061	.0000
3	.3401	1	60	30.9227	.0000

Table 5. **Statistical Comparison of Regression Models for the Total Sample (All Clinical Services)**

MODEL	R^2	DF_1	DF_2	F Ratio	P
CATEGORY	.9927	5	56	1542.3061	.0000
DEC 87					
1	.9928	6	55	1276.8892	.0000
2	.9927	5	56	1542.3061	.0000
3	.0014	1	60	.0863	.7699
JAN 88					
1	.9929	6	55	1295.1391	.0000
2	.9927	5	56	1542.3061	.0000
3	.3261	1	60	29.034	.0000
QMONTH					
1	.9929	6	55	1281.4208	.0000
2	.9927	5	56	1542.3061	.0000
3	.0929	1	60	6.1510	.0160

Reliability and Validity

The expectations for inter-rater reliability were not met during the period of analysis. Inter-rater reliability was less than 70 percent for selected nursing units at Womack Army Community Hospital, Ft. Bragg, during third and fourth quarter-1987, and second, third, and fourth quarter-1988. (See Table 5). However, this value is confounded by the consideration that measures of reliability may have been due to inadequate documentation, not to the ability of the rater to categorize patients. As per Womack Army Community Hospital Department of Nursing Adminstrative Policy, any unit that scores below 80 percent on the quarterly audit is automatically retrained on the use of the Workload Managment System for Nursing.

Table 6. **Womack Army Community Hospital Inter-rater Reliability**

UNIT	QUARTER					
CALENDAR YEAR	87		88			
	3rd	4th	1st	2nd	3rd	4th
Male Surgical	100	60	80	40	100	83
Female Surgical	40	100	100	100	80	60
Surgical ICU/RR	100	100	100	*	100	100
Pediatrics	100	80	85	100	80	100
Obstetrics	100	80	100	100	100	100
Nursery	100	80	80	100	100	100
Psychiatric	80	80	100	100	100	100
Orthopedic	80	100	87	80	100	100
EENT	100	100	100	100	**	66
Medical Icu. Step Do	80	100	80	100	60	60
Female Medicine	60	100	80	100	100	60
Male Medicine	80	100	100	66	100	100

* Had one patient only during audit.
** Unit closed during third quarter due to lack of staff.

The validity of the Workload Management System for Nursing was established in a study conducted by Rieder and Jackson (1985) across six Navy hospitals in the continental U.S. The consistency of the WMSN was assessed through comparison with the Nursing Care Hours Standards (NCHS) tool developed by the Army which had demonstrated content and criterion related validity. A correlation of .81 between the two tools was found.

V. CONCLUSIONS AND RECOMMENDATIONS

The impact of patient categorization and frequency sampling on the accurate reporting of the number of nursing care hours needed for a given group of patients was demonstrated in this study. The results of this study also further corroborated the earlier Nursing Care Hours Standards Study findings of Sherrod, Rauch & Twist (1981).

Overall, the principal findings of the study supported the premise that the sampling frequency of acuity data could be as infrequently as every Wednesday. However, the findings did not support the premise that sampling could be as infrequent as once a month. In general, this finding was shown to have important implications for redefining the frequency of sampling Workload Management System for Nursing acuity data at Womack Army Community Hospital, Fort Bragg, N.C.

Because inter-rater reliability was less than 70 percent at some points during the analysis period, some may feel that the findings should be considered as specific only to Womack Army Community Hospital, Fort Bragg, North Carolina. However, reliability in this instance is not in the measurement sense (accuracy or precision of a measuring instrument), but refers to corresponding with another rater, and includes as error those findings without adequate documentation. To the extent that these findings exist, one should be circumspect and realize that Womack Army Community Hospital does not differ in any systemic way from other medical treatment facilities of similar size and mission.

To the extent that the level of the independent variable shows a a lag between the **QOD** and **QMON** sampling frequencies, there seems to be enough slippage to cause predictions to be unreliable. What factor reduces reliability after the third day? One could speculate as to the reason **Q3D** was the minimum sampling frequency by looking at Womack Army Community Hospital's ALOS (Average Length of Stay) for the period of analysis (August 1987-September 1988). According to the Medical Statistics Section, Patient Administration Division, the ALOS was 3.9 days (Hutson, 1989). With these statistics in mind, one could expect a different patient population at WACH every 3.9 days. Thus, it would seem reasonable that Womack Army Community Hospital's ALOS may be the factor that causes predictions to be unreliable after the third day.

In considering why the **QMONTH** sampling frequency was not significant, another question arises: do we expect consistency across the entire month? Probably not, since the average daily census for that period of time was 201, average daily discharges 51, and average daily admissions 50.3 (Hutson, 1989). According to those statistics, Womack Army Community Hospital admitted every day as many as it discharged during that time period. Essentially, Womack Army Community Hospital overturned at least one fourth its population every day through admissions and discharges. Thus, the **QMONTH** sampling frequency was not significant because of Womack Army Community Hospital's admission and discharge rate.

Since **Q3D** appears to be the minimum sampling frequency for Womack Army Community Hospital, one could speculate as to savings in manpower obtained by decreasing sampling acuity data from every day to every third day. Currently, nurse managers at Womack Army Community Hospital spend from 292.5 to 360 hours per month sampling acuity data, based on figures provided in the Reider and Jackson (1985) study on the Navy Medical Department's Patient Classification and Staffing Allocation System. Womack Army Community Hospital has 13 nursing units and the above figures are derived based on a 30 day month.

In accepting **Q3D** as the minimum sampling frequency, the Department of Nursing, Womack Army Community Hospital, could save as much as 260 hours of nursing time each month. In order to illustrate this point in a monetary fashion, consider the following calculation: for an institution paying a contract Registered Nurse $24.25 per hour (which includes the agency fee), a savings of from $2,364 to $6,305 per month could be projected with an annual savings of between $28,372 to $75,650 (Majors, 1989). Granted, in this time of a nationwide nursing (Maraldo, 1988) shortage, this illustration is not a suggestion to hire fewer nurses, but just to get the most from the ones already working.

It is therefore, the recommendation of this author that the sampling frequency of patient acuity data at Womack Army Community Hospital be changed to at least every third day. Further research is needed to explore a sampling frequency that is reliable for all military medical treatment facilities. Future research should characterize not only medical treatment facilities according to sampling frequency, but also individual nursing units. Nursing unit identification codes not available at the time of the study are now utilized for UCA/PERS (Uniformed Chart of Accounts/Personnel Expense Resporting System) terminal input.

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APPENDIX A

DEFINITIONS

Category is defined as the representative groupings of patients according to their nursing care time requirements (Rieder & Lensing, 1987).

Critical Indicators of Care are those direct care activities that have the greatest impact on nursing time rather than patient outcome (Rieder & Lensing, 1987).

Direct Patient Care is all care given by nursing personnel which takes place in the presence of the patient and/or family. These activities are observable, behavioral, and include the following: "placement of equipment at the bedside, explanation of procedure to patient, preparation of patient response, performance of treatments, . . .assessment/observation of patient response, and teaching" (Rieder & Jackson, 1985), removal of equipment from area, and recording. In a nine facility Army study, 25 percent of staff time was spent in direct care (Rieder & Lensing, 1987).

Factors are items on a patient classification instrument which reflects an area of patient need for nursing care (Vail, 1986).

Indirect Patient Care is defined as those tasks performed away from the patient. These tasks can be divided into eight subcategories: communications including patient conferences; assessing patients' needs and planning their care; preparing medications, supplies and equipment; travel and transportation; ward administration; housekeeping; and waiting time. In a nine facility Army study, 61 percent of staff time was spent in indirect care (Rieder & Lensing, 1987). In the Misener study (1987) on indirect patient care requirements, charting and doing clerical work, and administrative functions (ie, patient classification), accounted for almost 50 percent of the indirect care time.

Inpatient is any child or adult who has been admitted to the medical treatment facility.

Inter-Rater Reliability is the agreement by factors and by category that is achieved when two trained raters assess the same patient during the same time period using the same patient classification system (Vail, 1986).

Non-RN are nursing service personnel other than Registered Nurses who have satisfactorily completed an orientation program to the hospital: the individual corpsmen, LPNs, and medical ward clerks.

Nurse Patient Classification System is a process for assessing and classifying patients, over a specified period of time, to determine the number of staff members required to provide that care (Sherrod, 1984).

Nursing Care Hour Requirements are the number of hours of nursing care time required for each category of patient based upon an assessment of their direct and indirect nursing care requirements in the Workload Management System for Nurses. This is manually operationalized via six pre-calculated patient care hour requirement charts (Vail, 1986).

Patient Classification System is the process of grouping patients according to an assessment of their nursing care requirements over a specified period of time (Vail, Norton, & Rimm, 1984).

Personnel Requirements are the number and mix of RNs and paraprofessionals required to care for the patient workload on a unit. In the WMSN, this is operationalized via two charts: acute care and intensive care. The acute care chart allocates a 40% RN to a 60% paraprofessional mix and distributes 45% of this staff to the day shift, 35% to the evening shifts, and 20% to the night shift. In contrast, the intensive care chart utilizes a 60% RN to 40% paraprofessional personnel mix which is evenly distributed across each shift (Vail, 1986).

Points are the numbers assigned to each specific critical indicator based upon documented time and motion studies. Each point in the WMSN is equal to 7.5 minutes of direct nursing care time (Vail, 1986).

Registered Nurses are nurses who have graduated from a professional nursing program and have successfully met a state's requirement for licensure. They must also have satisfactorily completed an orientation program to the hospital.

Relative Validity is extent to which the system measures what it purports to measure. When comparative ratings of direct nursing care required on the Workload Management System for Nursing instrument and the Nursing Care Hours Standard Study instrument generated on all inpatients by trained, independent raters will yield significant agreements on nursing care hours required and patient categories (Vail, 1986).

Reliability is the accuracy or precision of a measuring instrument (Kerlinger, 1986).

Total Nursing Care Hours is the sum of direct care hours plus the quotient: direct care hours multiplied by the percentage of indirect care hours (Rieder & Lensing 1987).

Staffing Methodology is a systematic process encompassing all the procedures and methods used to determine the number and kinds of nursing personnel required to provide nursing care of a predetermined quality to a specific group of patients.

Unavailable-for-care times "include those activities not directed toward patient care or unit management that detract from time available for patient care" (Misener 1987, 234). Unavailable for care time can be subdivided into an on-the-unit activity component and an off-the-unit activity component. Off-the-unit activities may be unique to the military, such as field training exercises and participating in parades.

Workload Management System for Nurses is a model for determining staffing requirements based upon identified patient care needs (Rieder & Lensing, 1987). It is based on a system of manpower allocation as devised by Sherrod, Rauch, & Twist (1981), in their initial Nursing Care Hour Standards Study, and also on Time Spent In Indirect Nursing Care Study, by Misener & Frelin, 1983.

APPENDIX B

Table B-1. **Means and Standard Deviations for MEDICAL/SURGICAL**

Variable	Mean	SD
Y	28.048	6.799
QOD	27.921	6.789
Q3D	27.499	6.737
Q7D	30.915	7.890
QVD	29.656	6.294
R4D	26.771	4.698
R10D	26.845	4.967
R16D	28.334	6.248
Dec	26.355	3.658
Jan	29.742	8.558
QMonth	29.000	2.016
C_1	.210	.088
C_2	.533	.102
C_3	.199	.072
C_4	.033	.034
C_5	.015	.021
C_6	.010	.012

Table B-2. **Means and Standard Deviations for CRITICAL CARE**

Variable	Mean	SD
Y	66.895	52.233
QOD	64.526	44.343
Q3D	62.996	49.876
Q7D	73.058	58.718
QVD	51.920	18.186
R4D	53.253	19.494
R10D	49.881	26.229
R16D	65.597	52.065
Dec	49.341	11.870
Jan	65.597	68.478
QMonth	29.000	.071
C_1	.047	.182
C_2	.300	.156
C_3	.354	.126
C_4	.119	.091
C_5	.098	.139
C_6	.081	.139

Table B-3. **Means and Standard Deviations for OBSTETRICS/GYNECOLOGY**

Variable	Mean	St.Dev.
Y	38.527	10.285
QOD	29.932	9.611
Q3D	29.763	6.414
Q7D	32.628	13.239
QWD	29.634	8.654
R4D	27.473	5.392
R10D	27.792	7.953
R16D	30.148	10.559
Dec	27.156	4.370
Jan	33.897	13.657
QMonth	29.000	2.016
C_1	.003	.011
C_2	.556	.209
C_3	.416	.168
C_4	.024	.073
C_5	.000	.000
C_6	.001	.005

Table B-4. **Means and Standard Deviations for NEWBORN NURSERY**

Variable	Mean	St.Dev.
Y	39.986	10.285
Q0D	39.607	9.611
Q3D	38.525	6.414
Q7D	43.583	13.239
QWD	42.504	8.654
R4D	37.212	5.392
R10D	38.144	7.953
R16D	39.907	10.559
Dec	38.277	4.370
Jan	41.696	13.657
QMonth	29.000	2.016
C_1	.016	.045
C_2	.250	.156
C_3	.633	.201
C_4	.080	.142
C_5	.019	.055
C_6	.002	.014

Table B-5. **Means and Standard Deviations for PEDIATRICS**

Variable	Mean	St.Dev.
Y	23.778	6.707
QOD	23.904	7.345
Q3D	22.932	5.532
Q7D	25.365	7.660
QVD	26.478	6.973
R4D	21.438	2.113
R10D	22.494	4.634
R16D	24.857	6.772
Dec	21.805	3.215
Jan	25.750	8.470
QMonth	29.000	2.016
C_1	.275	.134
C_2	.450	.114
C_3	.244	.117
C_4	.027	.052
C_5	.005	.014
C_6	.000	.000

Table B-6. **Means and Standard Deviations for PSYCHIATRY**

Variable	Mean	St.Dev.
Y	21.887	7.789
QOD	22.217	8.382
Q3D	21.427	7.665
Q7D	25.642	5.762
QWD	28.412	10.159
R4D	20.168	7.684
R10D	20.847	8.675
R16D	22.745	8.604
Dec	20.051	5.899
Jan	23.723	8.926
QMonth	29.000	2.016
C_1	.128	.125
C_2	.724	.171
C_3	.125	.173
C_4	.001	.007
C_5	.021	.049
C_6	.001	.012

APPENDIX C

Table C-1. Statistical Comparison of Regression Models
MEDICAL/SURGICAL

MODEL	R^2	DF_1	DF_2	F Ratio	P
CATEGORY	.9832	5	56	656.1733	.0000
QOD					
1	.9832	6	56	537.0485	.0000
2	.9832	5	56	656.1733	.0000
3	.6778	1	60	126.2523	.0000
4	.9832	6	55	538.2599	.0000
5	.9832	5	56	656.1733	.0000
6	.5426	1	60	71.8540	.0000
Q3D					
1	.9832	6	55	537.2609	.0000
2	.9832	5	56	656.1733	.0000
3	.6259	1	60	100.3920	.0000
4	.9832	6	55	538.2839	.0000
5	.9832	5	56	656.1733	.0000
6	.3396	1	60	30.8602	.0000
Q7D					
1	.9842	6	55	573.0874	.0000
2	.9832	5	56	656.1733	.0000
3	.2759	1	60	22.8660	.0000
4	.9832	6	55	537.5673	.0000
5	.9832	5	56	656.1733	.0000
6	.3799	1	60	36.7653	.0000
QWEDNESDAY					
1	.9855	6	55	634.1360	.0000
2	.9832	5	56	656.1733	.0000
3	.2813	1	60	23.5935	.0000

Table C-1. **Statistical Comparison of Regression Models**
MEDICAL/SURGICAL

MODEL	R^2	DF_1	DF_2	F Ratio	P
CATEGORY	.9832	5	56	656.1733	.0000
DEC 37					
1	.9832	6	55	537.1066	.0000
2	.9832	5	56	656.1733	.9899
3	.0000	1	60	.0001	.9899
JAN 88					
1	.9833	6	55	540.2178	.0000
2	.9832	5	56	656.1733	.0000
3	.2638	1	60	21.5091	.0000
MONTH					
1	.9842	6	55	571.2281	.0000
2	.9832	5	56	656.1733	.0000
3	.0630	1	60	4.0400	.0489

Table C-2. **Statistical Comparison of Regression Models**
CRITICAL CARE

MODEL	R^2	DF_1	DF_2	F Ratio	P
CATEGORY	.9110	5	56	114.6949	.0000
QOD					
1	.9450	6	56	157.5428	.0000
2	.9110	5	56	114.6949	.0000
3	.8769	1	60	427.4402	.0000
4	.9406	6	55	145.2219	.0000
5	.9110	5	56	114.6949	.0000
6	.8449	1	60	326.8428	.0000
Q3D					
1	.9348	6	55	131.5420	.0000
2	.9110	5	56	114.6949	.0000
3	.7361	1	60	167.3978	.0000
4	.9152	6	55	98.9939	.0000
5	.9110	5	56	114.6949	.0000
6	.1095	1	60	7.3776	.0086
Q7D					
1	.9115	6	55	94.4182	.0000
2	.9110	5	56	114.6949	.0000
3	.0367	1	60	2.2881	.1356
4	.9112	6	55	94.1090	.0000
5	.9110	5	56	114.6949	.0000
6	.1915	1	60	14.2181	.0004
QWEDNESDAY					
1	.9116	6	55	94.0195	.0000
2	.9110	5	56	114.6949	.0000
3	.6923	1	60	134.9949	.0000

Table C-2. **Statistical Comparison of Regression Models**
CRITICAL CARE

MODEL	R^2	DF_1	DF_2	F Ratio	P
CATEGORY	.9110	5	56	114.6949	.0000
DEC 87					
1	.9322	6	55	126.2026	.0000
2	.9110	5	56	114.6949	.0000
3	.0251	1	60	1.5455	.2186
JAN 88					
1	.9169	6	55	101.2048	.0000
2	.9110	5	56	114.6949	.0000
3		1	60		.0000
MONTH					
1	.9110	6	55	93.9357	.0000
2	.9110	5	56	114.6949	.0000
3	.1148	1	60	7.7810	.0071

Table C-3. **Statistical Comparison of Regression Models**
OBSTETRICS/GYNECOLOGY

MODEL	R^2	DF_1	DF_2	F Ratio	P
CATEGORY	.9305	5	56	150.1214	.0000
QOD					
1	.9326	6	56	125.9215	.0000
2	.9305	5	56	150.1214	.0000
3	.5814	1	60	83.3394	.0000
4	.9356	6	55	133.1629	.0000
5	.9305	5	56	150.1214	.0000
6	.4069	1	60	41.1696	.0000
Q3D					
1	.9307	6	55	123.2713	.0000
2	.9305	5	56	150.1214	.0000
3	.4111	1	60	41.9003	.0000
4	.9311	6	55	123.9112	.0000
5	.9305	5	56	150.1214	.0000
6	.1116	1	60	7.5398	.0080
Q7D					
1	.9409	6	55	146.1618	.0000
2	.9305	5	56	150.1214	.0000
3	.1722	1	60	12.4887	.0008
4	.9309	6	55	123.6589	.0000
5	.9305	5	56	150.1214	.0000
6	.0026	1	60	.15792	.6925
QWEDNESDAY					
1	.9365	6	55	135.3661	.0000
2	.9305	5	56	150.1214	.0000
3	.0396	1	60	2.4747	.1209

Table C-3. **Statistical Comparison of Regression Models**
OBSTETRICS/GYNECOLOGY

MODEL	R^2	DF_1	DF_2	F Ratio	P
CATEGORY	.9305	5	56	150.1214	.0000
DEC 87					
1	.9316	6	55	124.8663	.0000
2	.9305	5	56	150.1214	.0000
3	.0104	1	60	.6314	.4300
JAN 88					
1	.9336	6	55	128.9349	.0000
2	.9305	5	56	150.1214	.0000
3	.3951	1	60	39.1973	.0000
MONTH					
1	.9831	6	55	652,2313	.0000
2	.9305	5	56	150.1214	.0000
3	.17723	1	60	12.92463	.0007

Table C-4. **Statistical Comparison of Regression Models**
NEWBORN NURSERY

MODEL	R^2	DF_1	DF_2	F Ratio	P
CATEGORY	.9825	5	56	801.6016	.0000
QOD					
1	.9845	6	56	714.8046	.0000
2	.9825	5	56	801.6016	.0000
3	.6407	1	60	107.0172	.0000
4	.9834	6	55	666.0942	.0000
5	.9825	5	56	801.6016	.0000
6	.5017	1	60	60.4127	.0000
Q3D					
1	.9833	6	55	662.6185	.0000
2	.9825	5	56	801.6016	.0000
3	.4677	1	60	52.7231	.0000
4	.9826	6	55	635.2120	.0000
5	.9825	5	56	801.6016	.0000
6	.0895	1	60	5.9007	.0181
Q7D					
1	.9828	6	55	640.7422	.0000
2	.9825	5	56	801.6016	.0000
3	.1189	1	60	8.1025	.0060
4	.9841	6	55	696.3464	.0000
5	.9825	5	56	801.6016	.0000
6	.0297	1	60	1.8388	.1802
QWEDNESDAY					
1	.9833	6	55	658.6149	.0000
2	.9825	5	56	801.6016	.0000
3	.3207	1	60	28.5328	.0000

Table C-4. **Statistical Comparison of Regression Models**
NEWBORN NURSERY

MODEL	R^2	DF_1	DF_2	F Ratio	P
CATEGORY	.9825	5	56	801.6016	.0000
DEC 87					
1	.9835	6	55	668.5550	.0000
2	.9825	5	56	801.6016	.0000
3	.0154	1	60	.9442	.3351
JAN 88					
1	.9827	6	55	636.9727	.0000
2	.9825	5	56	801.6016	.0000
3	.2922	1	60	24.7764	.0000
MONTH					
1	.9831	6	55	652.2313	.0000
2	.9825	5	56	801.6016	.0000
3	.1772	1	60	12.9246	.0007

Table C-5. **Statistical Comparison of Regression Models**
PEDIATRICS

MODEL	R^2	DF_1	DF_2	F Ratio	P
CATEGORY	.9710	5	56	477.8228	.0000
QOD					
1	.9755	6	56	447.4252	.0000
2	.9710	5	56	477.8228	.0000
3	.6426	1	60	107.9154	.0000
4	.9713	6	55	379.3754	.0000
5	.9710	5	56	477.8228	.0000
6	.5378	1	60	69.8198	.0000
Q3D					
1	.9729	6	55	402.5541	.0000
2	.9710	5	56	477.8228	.0000
3	.5822	1	60	85.7090	.0000
4	.9728	6	55	400.5063	.0000
5	.9710	5	56	477.8228	.0000
6	.2016	1	60	15.1523	.0003
Q7D					
1	.9713	6	55	379.7913	.0000
2	.9710	5	56	477.8228	.0000
3	.2456	1	60	19.5347	.0000
4	.9718	6	55	386.6846	.0000
5	.9710	5	56	477.8228	.0000
6	.0002	1	60	.0142	.9055
QWEDNESDAY					
1	.9720	6	55	389.1870	.0000
2	.9710	5	56	477.8228	.0000
3	.2105	1	60	16.0061	.0002

Table C-5. **Statistical Comparison of Regression Models**
PEDIATRICS

MODEL	R^2	DF_1	DF_2	F Ratio	P
CATEGORY	.9710	5	56	477.8228	.0000
DEC 87					
1	.9724	6	55	394.7347	.0000
2	.9710	5	56	477.8228	.0000
3	.0169	1	60	1.0358	.3129
JAN 88					
1	.9725	6	55	397.3705	.0000
2	.9710	5	56	477.8228	.0000
3	.2410	1	60	19.0572	.0001
MONTH					
1	.9731	6	55	405.9189	.0000
2	.9710	5	56	477.8228	.0000
3	.0878	1	60	5.7812	.0193

Table C-6. **Statistical Comparison of Regression Models**
PSYCHIATRY

MODEL	R^2	DF_1	DF_2	F Ratio	P
CATEGORY	.9408	5	56	178.1792	.0000
QOD					
1	.9445	6	56	156.0210	.0000
2	.9408	5	56	178.1792	.0000
3	.6346	1	60	104.2079	.0000
4	.9408	6	55	145.8313	.0000
5	.9408	5	56	178.1792	.0000
6	.4163	1	60	42.8088	.0000
Q3D					
1	.9562	6	55	200.3266	.0000
2	.9408	5	56	178.1792	.0000
3	.3449	1	60	31.6003	.0000
4	.9419	6	55	148.8094	.0000
5	.9408	5	56	178.1792	.0000
6	.2436	1	60	19.3301	
Q7D					
1	.9443	6	55	155.4455	.0000
2	.9408	5	56	178.1792	.0000
3	.1329	1	60	6.2006	.0036
4	.9409	6	55	146.0944	.0000
5	.9408	5	56	178.1792	.0000
6	.0005	1	60	.0339	.8545
QWEDNESDAY					
1	.9418	6	55	148.3466	.0000
2	.9408	5	56	178.1792	.0000
3	.0591	1	60	3.7731	.0560

Table C-6. Statistical Comparison of Regression Models
PSYCHIATRY

MODEL	R^2	DF_1	DF_2	F Ratio	P
CATEGORY	.9408	5	56	178.1792	.0000
DEC 87					
1	.9412	6	55	146.9035	.0000
2	.9408	5	56	178.1792	.0000
3	.0637	1	60	4.0844	.0477
JAN 88					
1	.9441	6	55	154.9987	.0000
2	.9408	5	56	178.1792	.0000
3	.2397	1	60	18.9182	.0001
MONTH					
1	.9409	6	55	146.0433	.0000
2	.9408	5	56	178.1792	.0000
3	.0565	1	60	3.5929	.0628