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14. ABSTRACT
This retrospective study examined the nurse staffing proportion at Martin Army Community Hospital and whether this proportion was a significant predictor of reported negative inpatient outcomes. The proportion of nursing staff to patients was examined to determine if there is a correlation to three specific diagnoses. The specific diagnoses were post operative wound infection, pneumonia, and decubitus ulcers, as captured from the hospital data repository (MHS MART or M2). The information was collected retrospectively for a period of 48 month period from October 2003 to September 2007. This research utilized a regression analysis to predict whether nurse staffing proportion has any effect on three specific diagnoses. This study failed to reject the null hypothesis and therefore, no significant findings were noted from the regression analysis of inpatient bed days, nurse proportion, and the negative diagnoses.

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Army-Baylor University Graduate Program in Health and Business Administration

Nurse Staffing Proportions and Negative Outcomes

Presented to LTC Lee W. Bewley, Ph.D., FACHE

In partial fulfillment of the requirements for
Completion of the Army-Baylor University
Graduate Program in Health and Business Administration

By
John L. Ament, CPT, AN

Martin Army Community Hospital, Fort Benning, Georgia
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Table of Contents

Abstract

This retrospective study examined the nurse staffing proportion at Martin Army Community Hospital and whether this proportion was a significant predictor of reported negative inpatient outcomes. The proportion examined was inpatient nursing staff to the number of inpatient bed days. The proportion of nursing staff to patients was examined to determine whether there is a correlation to three specific diagnoses. The specific diagnoses were post operative wound infection, pneumonia, and decubitus ulcers, as captured from the hospital data repository (MHS MART or M2) over a 48 month period from October 2003 to September 2007. This research utilized a regression analysis to predict whether nurse staffing proportion has any effect on three specific diagnoses. The specific demographic variable, or independent variable, is nurse staffing proportion (number of nurse Full Time Equivalents to the number of inpatient bed days per month). The dependent variable is the specific diagnoses stated as postoperative wound infections, pneumonia, and skin breakdown. The focus of the study was to determine if there was a significant trend related to the nursing staff proportion and three specific diagnoses. The goal was to conclude if a significant relationship exists between a particular diagnosis and the proportion of nurse staffing. This study failed to reject the null hypothesis and therefore, no significant findings were noted from the regression analysis of inpatient bed days, nurse proportion, and the negative diagnoses.

Disclosure Statement

The views expressed in this paper are those of the author and do not reflect the official policy or position of Baylor University, U.S. Army Medical Command, Department of the Army, Department of Defense, or the U.S. Government.

Statement of Ethical Conduct in Research

Patient confidentiality was strictly adhered to during this research study. Patients' medical information was protected at all times, and under no circumstances will it be discussed or released to any outside agency.

Introduction

The ratio of nursing staff to the population of hospital patients is a measure that must be determined appropriately to ensure patients receive quality health care that is not compromised by insufficient nurse staffing. Multiple states are considering, or have enacted, regulations in an attempt to mitigate issues of patient safety and quality of care related to unfavorable ratios of hospital inpatients to nursing staff. In 1999, the Institute of Medicine (IOM) released the report, "To Err is Human," estimating 98,000 Americans die annually from medical errors. This report stressed that the reason for these errors was due to a poorly designed healthcare system rather than individual clinical competency. More recently, there has been research indicating medication errors injure 1.5 million people and cost billions of dollars annually (Craigle, 2007). Since the late 1990s, there has been increased media attention concerning the national nursing shortage, in addition to the relationship between the Registered Nurse/Licensed Practical Nurse (RN/LPN) staffing proportions and the number of nursing errors that coincide with inadequate inpatient nursing staff.

Conditions that Prompted the Study

The conditions prompting this research stemmed from previous studies performed to demonstrate that, "Hospital nurses believe understaffing is a serious problem which affects the quality of care patients receive. Nurses report that low staffing is contributing to a wide range of specific patient care problems, including insufficient patient education and errors" (Hart, 2003).

Federal government regulators, state government regulators, patients, and nurses perceive a problem with the assumed lack of nurses in the workforce, therefore warranting a more focused, data-driven approach to these issues. The nursing profession is specifically concerned with a higher incidence of medical errors that may lead to higher mortality rates, decreased job

satisfaction, and increased staffing turnover. These adverse effects are detrimental to the healthcare environment and may lead to a decrease of nurses in the labor force.

Public perception is that patient to nursing staff ratios can influence quality and outcome of patient care either positively or negatively (medical error). Legislation to establish a maximum number of patients per nurse has been investigated in all regions of the country. Such legislation is consistently supported within the nursing profession, particularly younger nurses (Hart, 2003). Increasing legislation will not only help to ensure uncompromised, safe patient care, but also improve nurse retention.

This study will be significant in determining the validity of historic studies and the practicality of nurse to patient ratios as being a possible predictor for medical errors. The determination of whether the component of staffing structure is flawed parallels the idea that the system is more often the problem than individual provider competency.

Unit of Analysis

The unit of analysis is the proportion of nurse to patient at Martin Army Community Hospital (MACH), specifically monthly nursing FTE's to inpatient bed days. The independent variable is nurse to patient proportion, while the response, or dependent, variables are specific negative patient outcomes. The unit of analysis, nurse to patient ratio, is defined as number of registered nurses providing direct care for patients in all inpatient units of the medical treatment facility. The acuity of patients can determine how many nurses are required to provide adequate care. This study uses a regression analysis to determine the appropriate amount of nurses staffed on each unit, per number of inpatients requiring care.

Purpose Statement

The purpose of this research is to identify whether the nurse to patient staffing proportion at MACH is a significant predictor of reported negative patient outcomes, specifically diagnoses of post operative wound infection, pneumonia, and decubitus ulcers. These diagnoses were determined to be a negative outcome if they are the second through eighth diagnosis the patient received during inpatient care at MACH. Primary diagnoses, those for which the patient was admitted, were not considered. The importance of this pertains to the influence on cost, particularly the cost of error versus the cost of staff. The cost of medical care in the US is higher than in any other country and medical errors alone account for $3.5 billion of medical cost as reported by the Institute of Medicine. The cost of staff, an outcome of workload management, is a common nurse staffing problem due to the difficulty in predicting the ratio of nursing staff for each unit needed to ensure adequate nursing care.

Problem Statement

The United States nursing profession is repeatedly expressing the need for more nurses to adequately care for the population of inpatients. However, it is known through research of nursing licensures that sufficient numbers of nurses are available, but are not employed as inpatient providers. It is important to note that nurses have significant bargaining power in the workforce due to the limited availability of inpatient nurses. Appropriate staffing of the hospital inpatient areas is a constant challenge for hospital leadership nationwide and must be addressed to ensure patients are receiving the necessary care and safety is not compromised due to staffing inefficiencies. However, the question remains from the nursing force and the U.S. population on whether strict nurse to patient staff ratios should be legislated or utilized at all. Moreover, does inpatient nursing to patient mix influence positive or negative patient outcomes and to what

degree? Does the proportion of nurse to inpatient occupied bed day lead to more complications and added length of stay? Additionally, the number of inpatient bed days stresses a system that is already at maximum capacity to satisfy patient demand. Quality is subsequently lacking with additional complications and increased lengths of stay. Furthermore, it increases cost of care on the overall healthcare system, as well as decreasing access to care for other patrons of healthcare services.

Research Question & Hypothesis

Is the patient to nurse staffing proportions a significant predictor of reported negative patient outcomes? The hypothesis is that nurse staff to patient proportions are not a significant predictor of reported negative medical patient outcomes.

Objectives of the Study

The objective of this study is to determine, through a structured methodology, whether there is a significant correlation between nurse staffing proportions and negative patient outcomes. The research will use a foundation that has already conducted investigation of nurse to patient staffing ratios. A historical review of the influence of nurse staffing ratios and negative patient outcomes at MACH will be conducted to identify specific quality and safety indicators.

Issues: The primary issue with the research question is whether accurate and reliable data has been collected, as accurate reporting of medical errors has often been selective by the reporting personnel. Hospitals strive to decrease staffing budgets while continuing to provide the utmost quality of healthcare. With the cost of labor being a large portion of the hospitals overall yearly cost, maximizing staff productivity enables the reduction of expenditures. However, the public expectation remains that any healthcare provider or facility will deliver quality healthcare. The issue of patient to nursing ratios has been researched across the spectrum, but research

specifically looking at large medical centers compared to smaller community facilities has not

been as readily investigated. Many studies have been done over broad regions of the country

with larger sample sizes, but very few studies have been performed on this topic utilizing a

smaller sample size. The Army Community Hospital (ACH) is considered a smaller facility due

to a relatively low inpatient bed capacity. This population may need further study on its ability to

avoid medical errors.

Importance: Federal and state governments, patients, and nurses perceive a problem with

the lack of nurses in the workforce and the result of understaffing. The nursing profession is

specifically is concerned with a higher incidence of medical errors. This may lead to higher

mortality rates, lower job satisfaction, and burnout leading to a higher importance of the lack of

nurses in the nursing workforce. Public perception is that the nursing staff can influence quality

of patient care positively or negatively (medical error). Legislation to establish maximum

number of patients a nurse can be required to care for has been investigated in all regions of the

country. The support for such legislation is consistently strong among the nursing profession,

particularly younger nurses (AFT Healthcare, 2003).

Significance: This study will be significant in validation of historic studies and the

practicality of utilizing nurse to patient ratios as a predictor of medical errors. Support for

appropriate nursing staff parallels the idea that the system is at fault more often than individual

provider competency.

Assumptions: The general perception from nurses is that a low nurse to patient staffing

ratio is a predictor of increased medical errors. It is assumed that having a low nurse to patient

ratios decreases job satisfaction of nurses and the pool of nurses in the labor force, while

increases medical complications and increases professional burnout.

The independent variable is defined as the proportion of nursing FTE to the number of inpatient bed days per month in all units of hospital. The dependent variables, negative patient outcomes, are defined as post operative wound infection, pneumonia, and decubitus ulcers. The rest of the paper will address the literature overview for this topic, a theoretical overview of the Donebedian Theory, the experimental design and statistical method used, data obtained, and results of study.

Literature Review

There has been much discussion on how the staffing ratio of RN's to patients affects the outcomes of inpatients. Many diagnoses have been identified as outcomes related to inappropriate nursing care. "Several studies have found that higher percentages of RN's in the skill mix or higher RN full time equivalents (FTEs) per patient census were associated with decreased risk-adjusted mortality; decreased urinary tract infection, thrombosis, and pulmonary complications in surgical patients; decreased pressure ulcers; decreased pneumonia; lower rates of postoperative infection; and fewer medication errors" (Spetz, 2000).

There are many views and opinions on this particular trend. Some say that the low staffing levels result in early nursing burnout which can directly influence nursing care. When nursing staff feels that they are overworked, the tendency to be more careless and apathetic becomes an increasing potential problem. "Three of five (59%) hospital nurses say that the staffing level at their hospital is having a negative impact on the quality of care patients receive" (Hart, 2003). Another reason that staffing level affects the quality of patient care is that the acuity of patients related to the number of nurses caring for the patients can affect how much time and attention is allotted for each patient. If one nurse is caring for 5 patients that require increased volumes of time and attention, it is likely that errors will occur, symptoms of problems

will be missed, and patients inevitably neglected. "Med-Surg nurses report that on average they are caring for 8.0 patients per shift, with more than two-thirds (69%) caring for six or more patients and 82% caring for five or more" (Hart 2003). Multiple studies have identified similar diagnoses that appear to have a trend toward inefficient nursing care. The New England Journal of Medicine (2002), has linked "lower staffing levels with patients' increased risk of pneumonia, urinary tract infection, post-operative infection, sepsis, ulcers, gastrointestinal bleeding, cardiac arrest, longer hospital stay, and in some cases, death." The number of nurses and the skill level they have has a clear impact on the quality of nursing care provided which can greatly influence the patient outcomes. "Patient outcomes depend not only on the type and severity of patients' illnesses, but also on human resources factors such as the mix of nurses, doctors, ancillary personnel, and on the work environment or culture of the hospital" (Hershbein, 2005).

With the rising concern of staffing levels and negative patient outcomes, states are beginning to consider legislation regulating for nurse-patient mandates as a proposed solution to some of the concerning staffing issues. Furthermore, "Initiatives include various levels of studies involving outcomes, staffing and quality of care" (Rowland, 2000). As our patient population begins to age, the patients are becoming more ill and the nurses are becoming scarce. There are continual budget constraints and insufficient funds to support the need for nurses. "Nurses therefore, have requested the assistance of elected officials on the state and federal level to protect patients by holding hospitals accountable for the provision of adequate nurse staffing through legislative or regulatory means" (ANA State Government Relations, 2005). As the various states look at enforcement measures to help implement an efficient staffing plan, there are plans being developed. "The ANA's *Principles for Nurse Staffing,* provides recommendations on appropriate staffing and requires nurses to be an integral part of the nurse

staffing plan development and decision-making process" (ANA State Government Relations, 2005).

Another area of concern that requires further analysis is the issue of cost and whether the cost of more staffing outweighs the cost of medical and nursing errors. Many hospitals begin to cut costs by decreasing the skill level or number of higher paid positions. "As a cost-saving measure, health care administrators also reconfigured organizational structures to eliminate or downgrade higher-paid positions, such as nurses. Administrators began to hire assistive personnel, with less skill and at less pay, to assume many functions previously performed by RNs" (Romig, 2000). It is a difficult balance to determine how to best facilitate quality nursing care, positive patient outcomes, and overall optimal costs. "A key component needed to make definitive conclusions on how quality and outcome variables relate to nursing is a need for standardized data collection and public availability of timely aggregate data" (Rowland, 2000). There is a great need for further research and studies to be done on this as a result of inconclusive, inaccurate, or insufficient data available. "Data analysis that draws definitive cause and effect between current staffing patterns and patient care outcomes is still in its infancy in terms of research and development. However, more data continues to emerge in this field over time, as patient care quality and changes in hospital staffing patterns across the country are explored in more depth through grant and research funding" (Rowland, 2000).

Theoretical Overview

Donebedian's Healthcare Quality theory was chosen as an analysis model for this study. "The structures of healthcare organizations affect the internal and external processes of the organization, and ultimately these processes affect the outcomes or products of the organization." (Reker, Hoenig, Slone, Horner, Hamilton, Duncan, 2000). We often focus on the structure and

inputs to the process but fail to measure the output and outcomes. Outcome measurement will be assessed using retrospective analysis. In this study, the focus will be on the structure and outcomes portion of this theory and the process portion will not be addressed.

Conceptual Model

Donebedian's theory will be placed in Bacharach's framework to model healthcare quality through structure, process, and outcome. This will be demonstrated by examining the structure of nurse staffing levels and the outcomes of medical errors. The anatomy of a theory can be broken down into three main elements including constructs, variables and operationalized measures (Conceptual model 1). Kaplan's study, as cited in Bacharach (1989), states that constructs are not observed directly or indirectly but are often defined as observable. They lack empiricism such as taste, touch, sight, smell, and hear. The observable entities are called variables. Bacharach also states the constructs are connected to each other by propositions and the variables are connected to each other by hypotheses. Each variable has two or more empirical measures and can be derived from experience or experiment. Measurements are the way researchers operationalized the variables and can be numerically classified as continuous, categorical or dichotomous.

Methods

This retrospective study will examine the nurse staffing proportion at MACH and whether this proportion is a significant predictor of reported negative patient outcomes. The time frame for this study will include a four year period of October of 2003 through September of 2007. The sample size will include all RN/ LPN inpatient nursing staff and all inpatients having diagnoses of post operative wound infections, pneumonia, and decubitus ulcer (skin breakdown, bed sore) over the forty-eight months studied. The diagnoses were researched by using the

International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) from the Military Health System (MHS) Management Analysis Reporting Tool (MART).

The research described here, utilizing an alpha risk of 0.05 ($\alpha > 0.05$), is used to determine whether the proportion of nurse staffing to inpatient bed days has an effect on the aforementioned specific diagnoses. The specific demographic variable or independent variable is nurse staffing proportion or the number of nurse Full Time Equivalents (FTE) assigned to each patient per patient bed day. The dependent variables will be the specific ICD-9-CM codes (998.3-998.31, 998.5, 998.59, 486, and 707-707.9) that stand for the main categories of the inpatient diagnoses being assessed (post operative wound infections, pneumonia, and decubitus ulcer/ bed sore). Focus is on the trends of these diagnoses as a result of deviations in FTE to inpatient bed day proportions. The intent of the study is to determine whether the information from prior research on nurse to patient ratios is reliable and valid. This will determine if there is a significant correlation between provider to patient proportion and three specific patient diagnoses.

This paper follows a retrospective study design with a regression analysis, performed three times: this method was chosen to examine associations in determining predictive levels of minimal staffing needed for adequate inpatient care.

Description of Experimental Design

X = Treatment: X = Staff of nurses to patients.

O = Observation: O = Diagnoses of hospital acquired wound infections, pneumonia, and skin breakdown.

$X_1 O_1$
$X_1 O_2$
$X_1 O_3$

Regression Equation: $Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 .... + b_nX_n + \in$

Y_1 = Diagnosis of Post Operative Wound Infections

Y_2 = Diagnosis of Pneumonia

Y_3 = Diagnosis of Decubitus Ulcers

X = Patient to nursing ratio

Hypothesis Statement

The null hypothesis is that nurse staff proportions are not a significant predictor of reported negative medical patient outcomes. The alternate hypothesis is that patient to nurse staffing proportions is a significant predictor of reported negative medical patient outcomes.

Hypothesis/ Statistical Notation

H_o: No significant difference(s) exists between nurse proportions and negative outcomes.

H_o: $\mu_1 = \mu_2 = \mu_n = ... \mu_{34}$

H_a: Significant difference(s) exists between nurse ratios and negative outcomes.

H_a: $\mu_1 \neq \mu_2 \neq \mu_n \neq ... \mu_{34}$

With this study, the occurrences of secondary diagnoses are observed from the MHS MART (M2) database. The focused diagnoses examined at MACH over a 48 month period were hospital acquired post operative wound infections, pneumonia, and decubitus ulcers relating to deviations in the amount of nursing care available for the patient population. The average monthly staffing proportion was determined by analyzing the hospitals monthly FTE information from Medical Expense and Performance Reporting System (MEPRS) from each inpatient nursing section and the reported inpatient bed days from M2. The Statistical Package for Social Sciences (SPSS) version 11 was used to perform the analysis of the data.

Limitations of the Study

Limitations to the data collection of registered nurses and licensed practical nurse at Martin Army Community Hospital are that there was not a reliable daily nursing database for each of the inpatient areas. However, monthly staffing has been collected and placed in the MEPRS data repository since 2001. An additional staffing tool and report was from a nurse analyst that started an inpatient excel spreadsheet that dates back to June of 2004. The information is self-reported from each of the reporting tools and a flaw to this model is that the accuracy and precision of each submission is only as reliable as the individual that had reported it.

At MACH there are 71 licensed inpatient beds for fiscal year 2007. However, approximately 50 beds are staffed each month. Assuming an average of 30 days in each month, this equate to a possible 1,500 inpatient bed days per month. Further, the data collected for inpatient bed days was captured by M2 with each MEPRS code from the admitting service. The MEPRS system inaccurately captures data regarding number of inpatient bed days such that calendar days are utilized as opposed to calculating 24 hour periods. Therefore, inpatient bed days are artificially inflated and data inaccurately represented, indicating that more staffing is needed than necessary.

There is no way to ascertain whether a nurse had four individual patients or cared for twelve surgical outpatients during the day. Therefore, a limitation to study arises due to the inability of the tracking tool, M2, to separating how many patients a nurse is caring for on a given day. As a result, the study utilizes a nurse to inpatient bed day proportion.

A negative outcome needed to be defined, so it was defined as post operative wound infection, pneumonia, and decubitus ulcer. The data repository M2 only collects up to eight

diagnoses. However, there is no specific ICD-9 code for nosocomial pneumonia. After

eliminating the primary diagnosis, for which the patient was admitted, the 2nd through 8th

diagnoses were included in the data set. The average stay at MACH is two to three days, so post

operative wound infections due to nursing care and pressure ulcers were infrequent occurrences,

because they typically develop after longer hospital stays. The infrequent occurrences noted,

after further investigation, were due to the natural rates of occurrence across the U.S. rather than

the nurse to inpatient bed day proportion.

Statistical Tool

The data was collected from the MEPRS and M2 data repositories and exported into

Excel spreadsheets. The independent variable is the proportion of FTEs of inpatient nursing staff

to the monthly amount of inpatient bed days. The dependent variable is one of the three negative

outcome diagnoses (post operative wound infection, pneumonia, and decubitus ulcer). The

simple linear regression analysis is used to answer the following questions, and determine if

there is a straight-line fit to the data that minimizes deviations from the line. Does inpatient

nursing to patient mix influence positive or negative patient outcomes and to what degree? Does

the nurse to inpatient occupied bed day proportion lead to more complications and added length

of stay? Looking for relationship between variables (X and Y), SPSS version 11 was used to

analyze the two variables and to determine the strength of their relationship. The linearity

diagnostic for parametric tests is shown when there is no significance of the independent variable

influencing the dependent variable. This phenomenon is further explained by the rationale that

certain diagnosis will develop whether there is a constant nursing FTE to inpatient bed day's

proportion or not. The description of the variables and measures are seen in the code sheet (Table

1). The type of sampling used was purposeful, utilizing the entire inpatient population of MACH

over a retrospective period of four years. This data was obtained with the methods described

above (MEPRS and M2) and then placed into an Excel spreadsheet and then the statistics run

with the SPSS program. The reliability is assessing the consistency of this study from the other

studies that have been done in this area. Studies done in this area include those noted in the

literature review.

Method Validity and Reliability

Reliability is concerned with the consistency and dependability of a measuring

instrument, i.e., it is an indication of the degree to which it gives the same answers over time,

across similar groups and irrespective of who administers it. There have been several studies and

research done on nursing staff issues. This measurement tool (reliability) is a retest to what has

been shown in other studies.

The validity of a study refers to the concepts that are being investigated; the people or

objects that are being studied; the methods by which data are collected; and the findings that are

produced. There are several different types of validity that are assessed in each study. For this

study, I will assess content, criterion, construct, internal, and external validity. Face validity: The

three selected diagnoses that are entered into M2 will be considered a direct result of staffing

proportions. Content validity: For this, there is the trust that the professionals who input the data

into the M2, MEPRS, and Nurse staffing sheets are knowledgeable and had faith in the accuracy

of the data they were entering. Criterion-related validity: I am unable to assess this as there is

inconsistent data on this topic per hospital and per unit. Construct validity: The theoretical

concept is the perception that the insufficient amount of patient providers directly influences

negative patient outcomes. Internal validity: The problem with accurately assessing this is that

we cannot be entirely conclusive that the negative patient outcomes are only a direct result of

poor nursing ratios. It is possible that other extraneous variables will influence the dependent variables in this study. This is one of the weaknesses for the data collection and validity. External validity: The structure of hospitals remains similar for large medical centers and the acuity of patients. Community hospitals also are similar with staffing and patient acuity. As this study will be sampling the smaller hospital units, the results for this can be considered valid for the same or similar population. The results could also be generalized to apply to the larger hospital environments as well. It is necessary to repeat nurse to patient proportion studies under similar conditions, i.e. a hospital environment, in order assess the repeatability and reproducibility of conclusions.

Data Analysis Techniques

Error diagnostics will be examined with developing the alternate hypotheses (Ha). Attempts to take all precautions to reduce the possibilities of committing Type I or Type II errors will be evaluated. A Type I error is an Alpha error that would reject the null hypothesis when it is true, whereas a Type II error is Beta error that would accept the null hypothesis when it is false. It is essential to prevent committing either of these errors with the study. To test for the possibilities of committing these errors, I will use the SPSS program to conduct the regression analysis. Established at the outset by a researcher when using statistical analysis to test a hypothesis (e.g., 0.05 level or 0.01 significance level). A significance level of 0.05 indicates the probability that an observed difference or relationship would be found by chance only 5 times out of every 100 (1 out of every 100 for significance level of 0.01). It indicates the risk of the researcher making a Type I error (i.e. an error that occurs when a researcher rejects the null hypothesis when it is true and concludes that a statistically significant relationship/difference exists when it does not), or a type II error (an error that occurs when a researcher accepts the null

hypothesis when it is false and concludes that no significant relationship/difference exists when it does).

Results

A review of historical data of nursing FTE, in patient bed days, and certain diagnoses were assessed at MACH. The historical information was broken into Fiscal Year and Fiscal Month for a total of 48 months. The average monthly nursing available FTE from FY 2004 until FY 2007 was 84.92 (median 82.92)(Chart 1). Each FTE is equal to 168 hours worked for each nursing staff member per month. The FTE of 83.2 is multiplied by the 168 hours to give MACH an average of 13,977 hours of inpatient nursing care per month. The staff took care of an average of 1,229 (median 1,226) inpatient bed days each month. These numbers yield a proportion of approximately 14.5 hours of inpatient nursing staff for each hour of inpatient nursing care. Restated, MACH has sufficient inpatient nursing staff to take care of the projected inpatient population during the time period studied.

Three diagnoses, post operative wound infection, pneumonia, and decubitus ulcer, were examined as the dependent variables (see chart 2 for frequency of occurrence). These three diagnoses were compared with the nurse staff to inpatient bed proportion (independent variable). There was an average of 0.63 post operative wound diagnoses each month (n=48). The coefficient of determination R^2 is 0.017 and the regression significance is 0.379. There was an average of 5.23 pneumonia diagnoses each month (n=48). The coefficient of determination R^2 is 0.09 and the regression significance is 0.519. There was an average of 0.46 decubitus ulcer diagnoses each month (n=48). The coefficient of determination R^2 is 0.002 and the regression significance is 0.765 (Table 2, 3, 4, & 5).

Discussion

With a so called never ending shortage of nursing providers in the U.S. workforce several questions are raised. First, are there truly not enough nurses to take care of individuals hospitalized from illness? Second, if there are enough nurses in the population, why are they not working in the hospital?

Further work on developing plans and frameworks to assess the appropriate ratio for nurses to patients is essential in better patient outcomes. Hospitals need to develop a structure that will enable better patient outcomes while achieving a more manageable nurse workload. Cost is a continued obstacle and limitation for this goal. However, if hospitals can look beyond the initial financial commitment, the return on investment is exponentially rewarding. These rewards would include increased staff satisfaction and therefore, a better nurse retention rate. Patient satisfaction will also lead to high rating scores of the hospital, which in turn generates more revenue and marketing potential. The overhead cost of placing more money into staffing, can have a long-term pay off in customer and staff satisfaction leading to a business of satisfaction, quality, and success.

It is in the best interest of hospitals and nurses to work together to develop a common solution for this current dilemma. As demonstrated by the lack of intense research and constantly changing data, more research and field studies on nurse to patient ratios and their connection to negative patient outcomes is indicated. Further investigation on what the overall costs for the hospitals actually are in regards to negative patient outcomes will be an integral part of directing the appropriate plans of action. Also, with our decrease in nurses on a national level (decline in nursing school enrollment, staff burnout, aging workforce), retention is an essential part of this solution. Developing an appealing environment to attract nurses into the field is essential to

maintaining a strong and steady workforce in this area. In addition, for hospitals to continue to make money and manage their business in the competitive healthcare market, the quality of patient care and patient outcomes will continue to play a part of profit margins in the healthcare business. If a hospital has the reputation of high nurse to patient ratios, high quality of customer service (related to staff satisfaction), and high rates of quality related to patient outcomes, the hospital's success will prove to give the most competitive edge in the healthcare marketplace.

It was expected that this study would produce a detailed description of the relationship between the nurse per patient staffing and selected diagnoses, to determine if one variable explained the other. Taken further, the information may have been used to improve quality of care and patient safety with any meaningful evidence based practice. The findings could also be used to investigate the relationship of nurse staffing ratios at smaller facilities (ACH, rural hospital), versus larger medical center type facilities, contributing to negative inpatient outcomes. As shown in the results there was no significant information that suggest the independent variable influences any of dependent variables. A histogram and P-P Plot was generated for each diagnosis in order to determine whether the data followed a specified distribution (Figures 1, 2: diagnosis 1, Figures 3, 4: diagnosis 2, Figures 5, 6: diagnosis 3). Each histogram shows plots of residuals corresponding to the appropriate P-P plot for each diagnosis. The study failed to reject the null hypothesis due to low significance levels (see table 3, 4, 5). Restated, there are no significant differences that can be shown or not shown to exist between nurse proportions and the stated negative outcomes within the parameters of MACH staffing practices.

Conclusions and Recommendations

It is imperative hospitals and nurses work together to develop a common solution for changing the perception of insufficient staffing for the patient population. Superior nursing care in the United States is widely available and legislation to create mandatory nurse to patient ratios may not be the solution to the staffing issues. This research could not find any significance in a relationship between the inpatient hospital nurse and patient population in regards to a reason that three specific diagnoses occur. "Many published nursing studies (and even more unpublished ones) result in nonsignificant findings" (Polit, Beck, 2004). It is evident by the lack of intense research and constantly changing data, more research and field studies on nurse to patient ratios and their connection to negative patient outcomes is indicated. Further investigations on what are the overall costs for the hospitals as they relate to negative patient outcomes will be an integral part of directing the appropriate plans of action. Also, with our decrease in nurses as a whole (decline in nursing school enrollment, staff burnout, and aging workforce), retention is an essential part of this solution. Developing appealing incentives to attract nurses into the field is essential to maintaining a strong and steady workforce. In addition, for hospitals to continue to increase revenue and manage a competitive market, the quality of patient care and patient outcomes will be fundamental to the success of the healthcare business.

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Conceptual Model Diagram
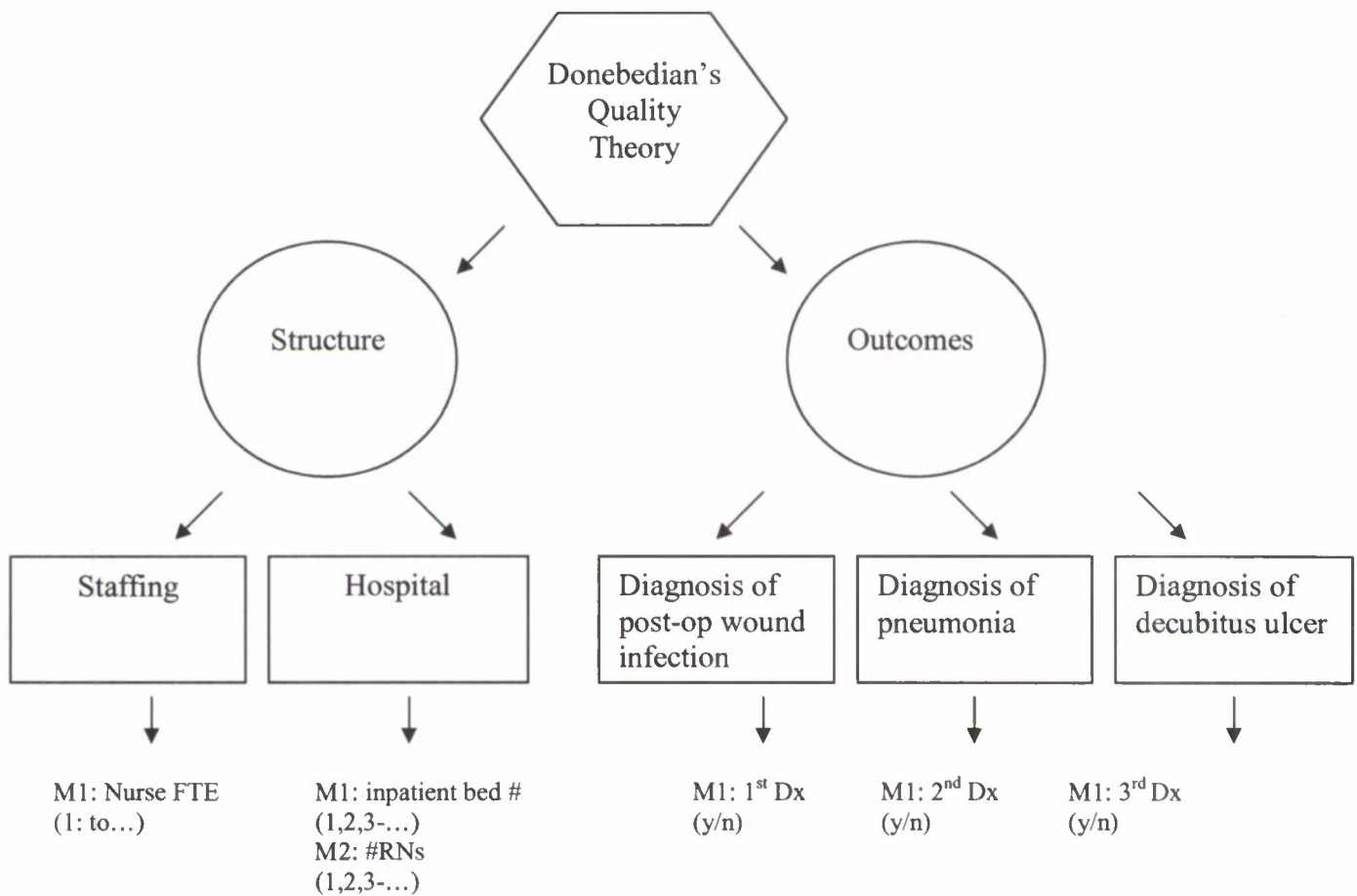
$$Y = f(X) \ \text{ or } \ Y = f(\text{nurse staffing}) \ \text{ or } \ \text{Negative outcome diagnosis} = f(\text{nurse staffing})$$
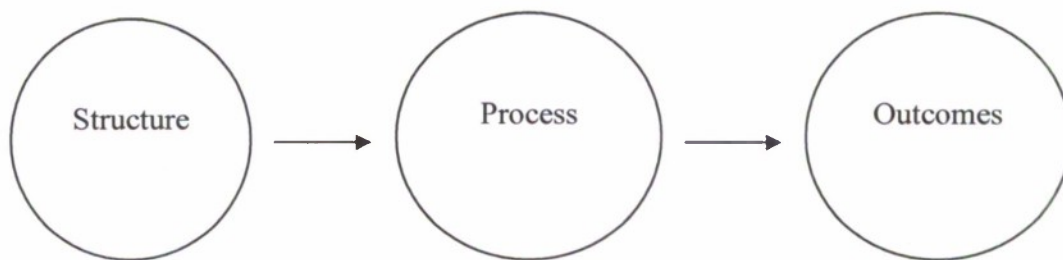
Nurse staffing to patient care proportion will influence adverse diagnoses.

Conceptual model 1. *Donebedian Theoretical Structure vs. Outcome.*

Table 1
Variable Code Sheet

Equation Variable	SPSS Variable Code	Label	Description	Operationalized	Data Source
Y_1 (dependent variable)	Dx1	Dx post op wound infections	Secondary diagnoses of infection of surgical wound site acquired after surgical procedure	Dichotomous Variable 0 = No 1 = Yes	M2
Y_2 (dependent variable)	Dx2	Dx pneumonia	Secondary diagnoses of pneumonia acquired during hospital stay	Dichotomous Variable 0 = No 1 = Yes	M2
Y_3 (dependent variable)	Dx3	Dx skin breakdown	Secondary diagnoses of skin breakdown (ulcers, redness) acquired during hospital stay	Dichotomous Variable 0 = No 1 = Yes	M2
X_1 (independent variable)	Pt Nurse Proportion	Nurse to patient proportion	Number of nurse to patient	Continuous variable 0 to n	MEPRS

Table 2
Descriptive statistics Nurse Staffing Proportions & Outcomes.

Variables	n	Mean	σ^2
Post operative wound infections	48	0.63	0.789
Pneumonia	48	5.23	2.224
Decubitus ulcer	48	0.46	0.824
Nurse to patient proportion	48	0.071	0.015

Table 3
ANOVA Dx 1.

Model	*Sum of Squares*	*df*	*MS*	*F*	*Sig.*
Regression	0.494	1	0.494	0.790	0.379
Residual	28.756	46	0.625		
Total	29.250	47			

Table 4
ANOVA Dx 2.

Model	*Sum of Squares*	*df*	*MS*	*F*	*Sig.*
Regression	2.112	1	2.112	0.422	0.519
Residual	230.367	46	5.008		
Total	232.479	47			

Table 5
ANOVA Dx 3.

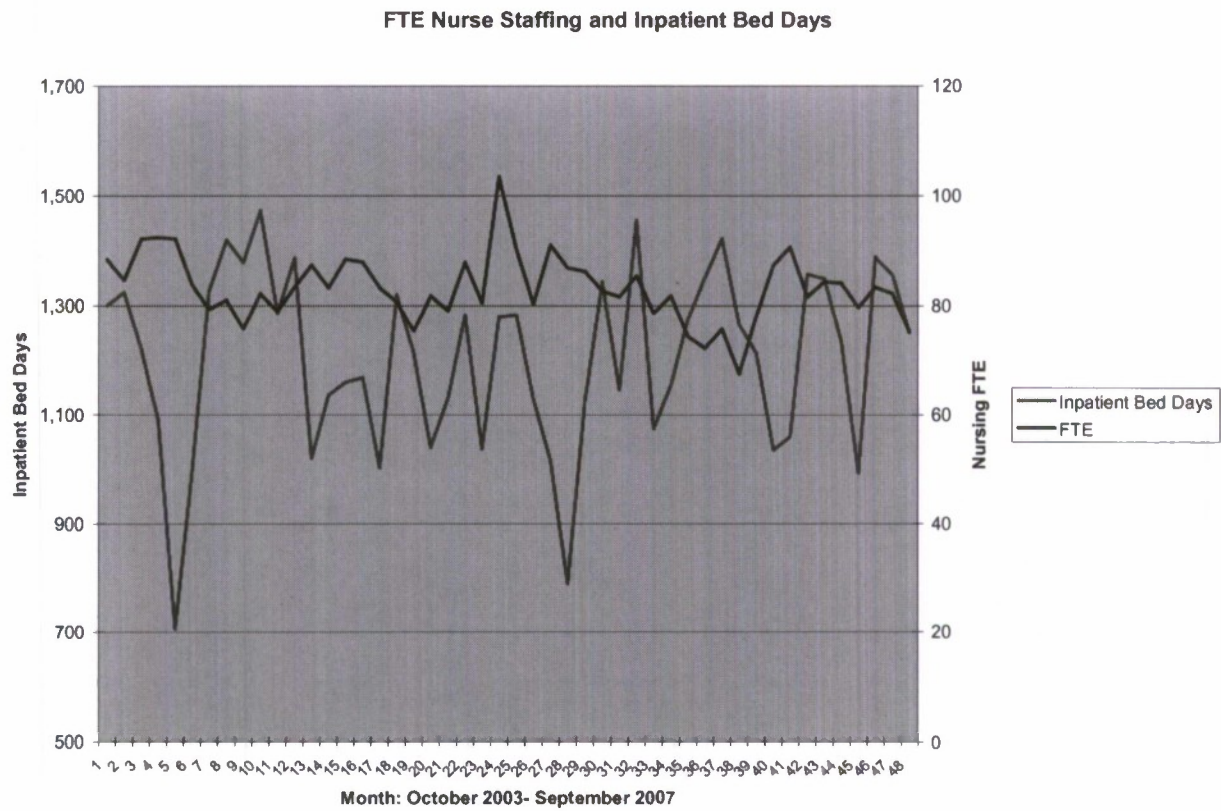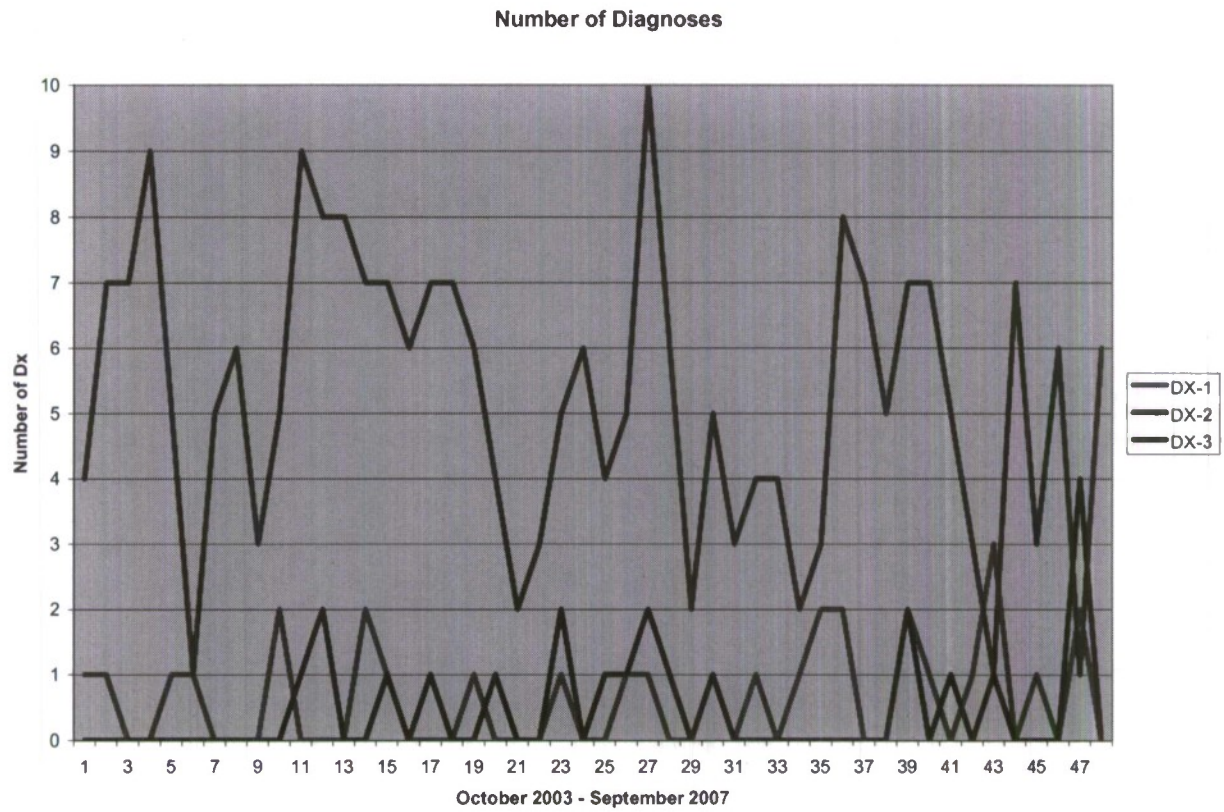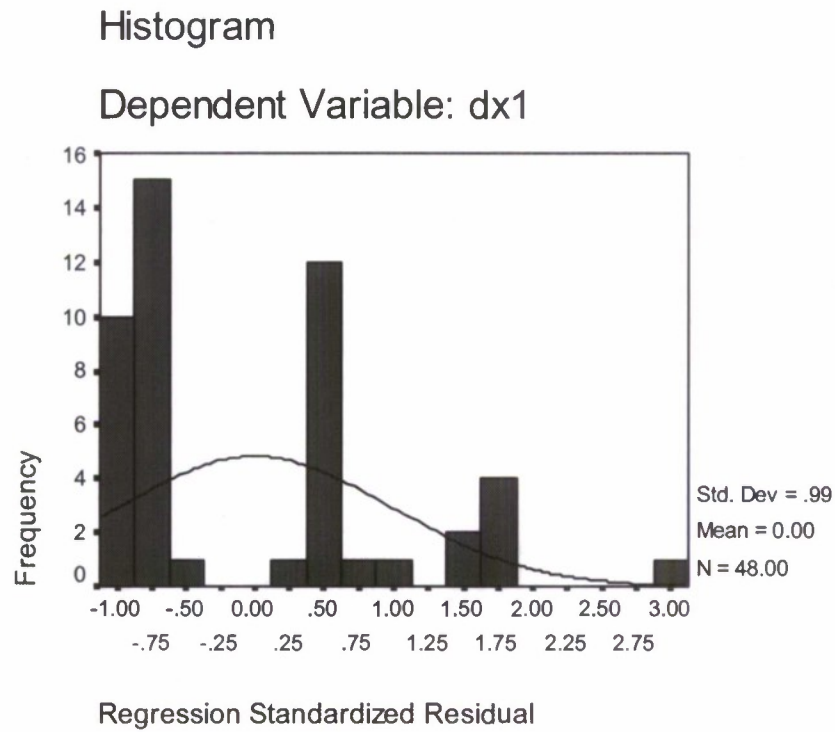| *Model*	*Sum of Squares*	*df*	*MS*	*F*	*Sig.*
Regression	0.063	1	0.063	0.09	0.765
Residual	31.854	46	0.692		
Total	31.917	47			

Chart 1
FTE Staffing FY 04-07.

FTE Nurse Staffing and Inpatient Bed Days

Chart 2
Number of Diagnoses 1, 2, & 3.

Number of Diagnoses

Histogram

Dependent Variable: dx1

Std. Dev = .99
Mean = 0.00
N = 48.00

Regression Standardized Residual

Figure 1. *Histogram of nurse to inpatient proportion and post operative wound infection.*

Normal P-P Plot of Regression Stand

Dependent Variable: dx1

Observed Cum Prob
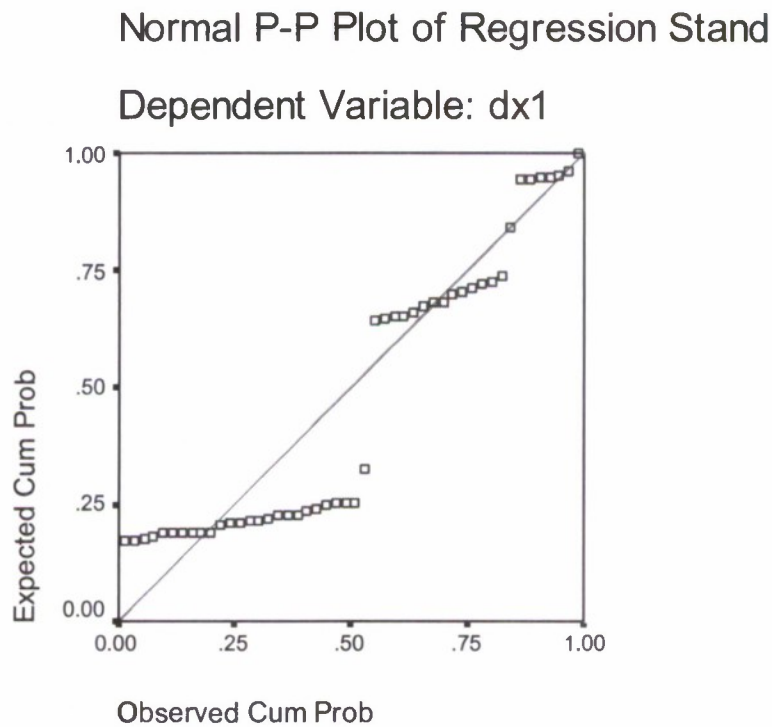
Figure 2. *P-P Plot of nurse to inpatient proportion and post operative wound infection.*

Histogram

Dependent Variable: dx2

Std. Dev = .99
Mean = 0.00
N = 48.00

Regression Standardized Residual
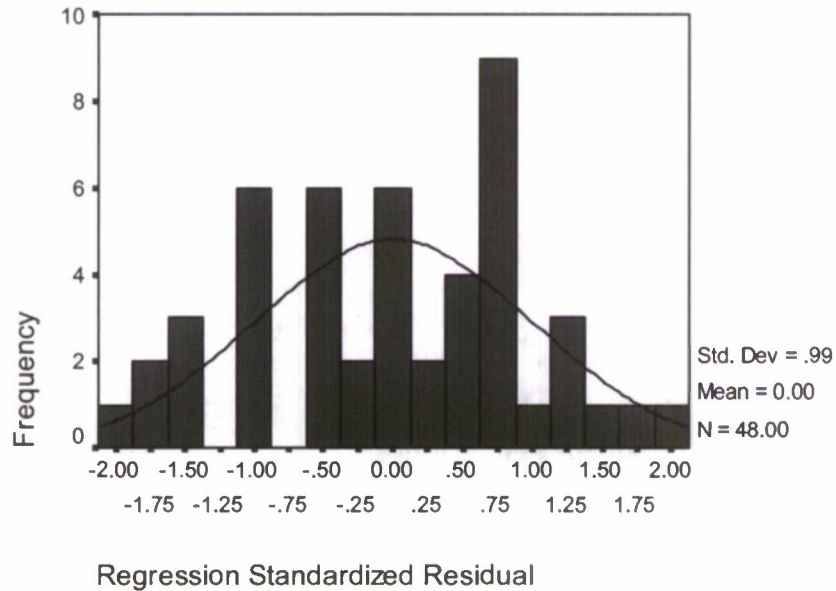
Figure 3. *Histogram of nurse to inpatient proportion and pneumonia.*

Normal P-P Plot of Regression Stand

Dependent Variable: dx2
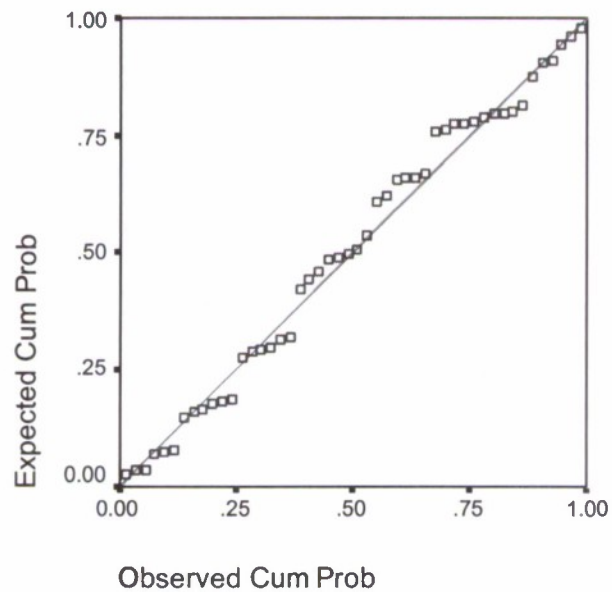

Observed Cum Prob

Figure 4. *P-P Plot of nurse to inpatient proportion and pneumonia.*

Histogram

Dependent Variable: dx3
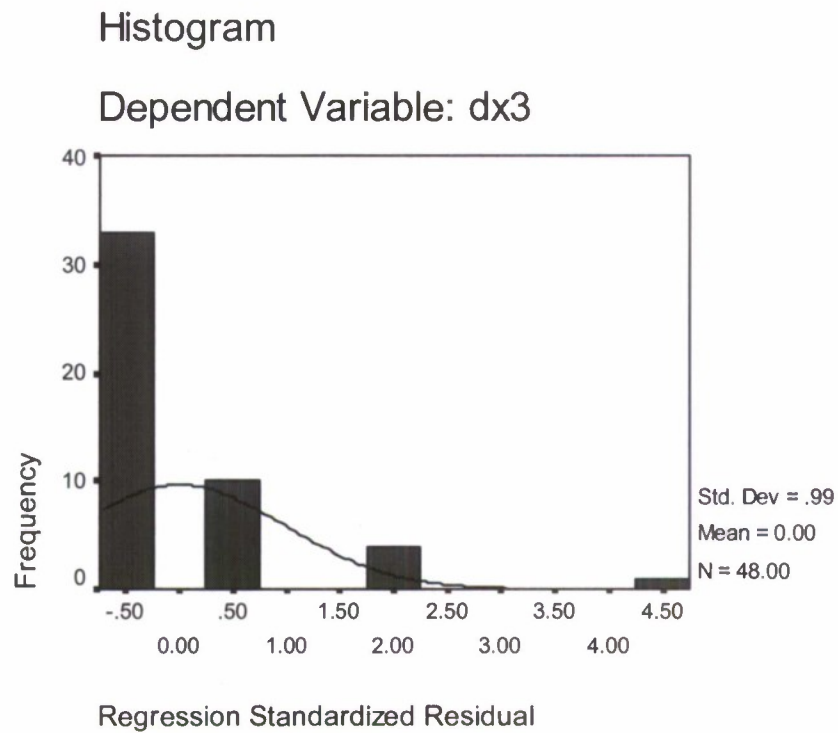
Figure 5. *Histogram of nurse to inpatient proportion and decubitus ulcers.*

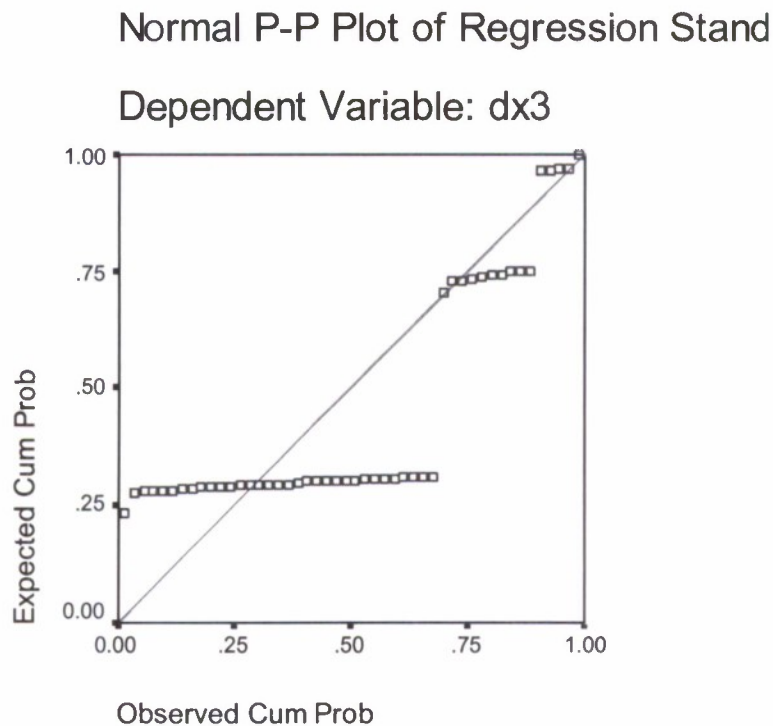## Normal P-P Plot of Regression Stand

Dependent Variable: dx3

Figure 6. *P-P Plot of nurse to inpatient proportion and decubitus ulcer.*