Running Head: Predictors of Negative Patient Outcomes

Are Landstuhl Regional Medical Center's Nurse Staffing Levels Predictors to Negative Patient Outcomes?

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As the use of managed care companies expands and Medicare reimbursements are reduced, organizations seek various ways to reduce costs on inpatient wards. Many health care organizations have chosen to increase the use of unlicensed assistive personnel in lieu of registered nurses on inpatient wards. This has lead professional nursing organizations to express concerns that patient safety was being compromised andpatient care quality was diminishing in an effort to cut cost. Upon review of a 13-month period of admissions at Landstuhl Regional Medical Center, it is concluded that staffing levels had very little effect on patient outcomes that are considered nursing staff level sensitive. Though more detailed research is needed, it is believe that, in these cases, the patients would have developed the ensuing negative outcomes regardless of the level of nursing staff afforded them.

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Are Landstuhl Regional Medical Center's

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Abstract

As the use of managed care companies expands and Medicare reimbursements are reduced, organizations seek various ways to reduce costs on inpatient wards. Many health care organizations have chosen to increase the use of unlicensed assistive personnel in lieu of registered nurses on inpatient wards. This has lead professional nursing organizations to express concerns that patient safety was being compromised and patient care quality was diminishing in an effort to cut cost. Upon review of a 13-month period of admissions at Landstuhl Regional Medical Center, it is concluded that staffing levels had very little effect on patient outcomes that are considered nursing staff level sensitive. Though more detailed research is needed, it is believe that, in these cases, the patients would have developed the ensuing negative outcomes regardless of the level of nursing staff afforded them.

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Introduction

The effectiveness of nurse staffing is an issue recently brought to the forefront by healthcare professionals and organizations everywhere. Concerns are that staff restructuring, brought about in an effort to keep healthcare costs down, has had a negative impact on patient outcomes. These outcomes range from contracting post-surgical infections to, in limited cases, death.

Studies considering staffing and its relationship to patient outcomes have mainly centered on civilian healthcare organizations. However, military treatment facility (MTF) commanders have reason to be concerned. As with their civilian counterparts, MTF commanders face similar issues such as budget reductions, the expectation to maximize production while providing first-class quality healthcare, as well as meeting accreditation requirements. MTF commanders have the added burden of taking care of a more diversified population while dealing with military unique requirements that may reduce staffing levels faster than reserve personnel can backfill.

Regardless of the barriers, MTF commanders have the duty of ensuring the excellent access and quality that its beneficiaries require and have come to expect, while performing at a reasonable cost to the American taxpayer. With knowledge of how staffing levels impact patient outcomes, MTF commanders can better prepare their organizations to meet these requirements and expectations.

Conditions Which Prompted the Study

Patient Safety

The roots of concern for nurse staffing are founded in the published report, To Err is Human: Building a Safer Health System by the Institute of Medicine (IOM). This report estimated that between 44,000 and 98,000 Americans die each year as a result of preventable clinical errors. The report said that the majority of these errors were the results of overall systemic problems and not just poor performance by individual providers. The report then recommended a multi-pronged approach of regulatory, professional and economic incentives to prevent medical mistakes and improve patient safety. Many of these initiatives were later implemented.

In the area of regulation, the study authors suggested and later saw the Center for Medicaid and Medicare Services (CMS) published regulations, which required that more than 6,000 hospitals that participate in the Medicare program conduct medical error reduction programs that would include, among other interventions, mechanisms to reduce medication errors. One approach aimed at accomplishing this goal suggests that increasing nurse staffing could provide more clinical oversight and thereby reduce medication errors.

Professionally, the IOM report authors recommended the development and implementation of programs introducing health professionals to error analysis and the challenges of practicing in a technically complex environment. Exploring the use and testing of simulators and automation as education tools were recommended to provide a more quantified approach. They also suggested training in errors research and evaluation, and the development of patient safety expertise at the state level using the

CDC's Epidemic Intelligence Service as a model. Additionally, they recommended the convening of the accrediting, licensing, and certifying bodies of the healthcare professions to review information on medical errors in the context of current practice requirements and propose methods of strengthening the education of health professionals in the areas of medical error prevention and medical error evaluation.

In terms of economics, the authors suggested that larger healthcare payer organizations require health plans to promote patient safety. In line with this recommendation, the federal government and several private purchasers have raised the standard for participation by requiring that all health plans with which they contract, seek accreditation from an independent, national accrediting organization, such as the Joint Commission on Accreditation of Hospital Organizations (JCAHO), that includes evaluation of patient safety and programs to reduce errors in health care. The CMS, another major purchaser of health care, has plans to require hospitals in the Medicare program to have an effective internal error reporting system and an effective evidence-based error reduction program for all patients as necessary components for certification and accreditation.

JCAHO Requirements

Another impact of the IOM study was the initiation of a new requirement from JCAHO to ask healthcare organizations to assess the effectiveness of their staffing. The new requirement, which becomes effective in July of 2002, has medical organizations using both data from clinical /service screening indicators and human resource screening indicators to assess staffing effectiveness. JCAHO believes that looking at these

indicators in combination relate to patient outcomes which theoretically correlate with staffing effectiveness (www.jcaho.org/standard/staff_effect_camh.html).

The new requirement calls for the selection of at least four indicators: Two that are clinical/service related, and two that are human resources related. More than one indicator is chosen because no one indicator can directly correlate with staffing effectiveness. In evaluating staffing effectiveness, the Commission selects one or more indicators from its identified list of screening indicators (Appendix A). The other indicators are chosen by the healthcare organization and are based on its unique characteristics, services and specialties. The organization is to collect and analyze data for potential staffing effectiveness issues. Finally, the organization is required annually to report the aggregate data, any analysis of the data, and any actions taken to improve staffing (www.jcaho.org/standard/staff_effect_camh.html).

Use of Unlicensed Assistive Personnel

The cost of healthcare has risen significantly in the last decade. Various efforts have been initiated in an attempt to contain costs. Some actions have moved patients out of hospitals and into outpatient care settings. As a whole, this puts the more sick and/or complicated cases in the inpatient settings. Other initiatives have led to the redesign of the clinical workforce. The redesign efforts have included the increased use of nurse extenders as well as the restructuring of nursing roles. In both cases, the responsibilities of the nurse were expanded while not increasing the number of nurses to perform the required duties(Kerfoot, 1997).

Nurse extender positions were created to perform tasks normally completed by nurses, but not necessarily requiring someone with a nurse's skill level (Kerfoot, 1997).

The extenders come in numerous forms (i.e., Licensed Practical Nurse and Licensed Vocational Nurse), but the one receiving the most attention and significant use in hospitals are the Unlicensed Assistive Personnel (UAP). Healthcare organizations have used UAPs for some time and in significant numbers. In 1990, 97% of American Hospital Association Members indicated that they employed these nurse extenders. Use of UAPs to provide patient care is believed by many healthcare organizations as a way to reduce labor costs in the area of nursing care. However, there are growing perceptions that their over usage has had a negative impact on patient care quality and on patient outcomes (McClung, 2000).

Nursing Shortage

Sources offer different stances on the issue of a nursing shortage. However, there are a few things which are obvious. One is the well-documented aging nursing workforce. Another factor is that enrollment in nursing baccalaureate schools has dropped each year for the past five years. Finally, without a steady influx of nurses, studies indicate that the prospect for having an adequate supply in the future is bleak.

Concern has increasingly developed over the aging nursing population. The average present age of registered nurses is 44.3 years. Nurses under the age of 30, represent only 10 percent of the total nursing population (Moses, 1997). Over the next 20 years, the average age of the nursing workforce is expected to be between 50 and 69 years old. The total number of full-time equivalent RNs per capita is forecasted to peak around the year 2007 and decline there after as the largest groups of RNs retire. By the year 2020, the size of the RN workforce is projected to be 20% smaller than workforce requirements (Buerhous, 2000).

For several years, enrollment in schools of nursing has decreased. In fact, enrollment in baccalaureate nursing programs has consistently declined for the last five years. Data for the fall of 1999 indicated an average 4.6% decline in enrollment in every region in the country. There are many reasons for this decline. Principally, it seems to stem from the fact that nursing historically was and still is a female dominated profession. Consequently, changes in the U.S. work environment have opened many more opportunities for female workers that were not available to their older counterparts (Nevidjon, 2001). Another reason for the trend change is generational differences in attitude towards working evenings, nights, shift work and the concerns of balancing work and family life (Keaveney, 1997).

The number of employed registered nurses (RN) per capita has declined in recent years while the national unemployment rate for RNs has declined to 1 percent in 2000. Providers from around the country report growing difficulty in recruiting nurses to work in a range of settings, and surveys of providers in several states and localities indicate rising RN vacancy rates (GAO Report, July 2001). Projections show that by 2010, the supply of registered nurses will no longer exceed the demand for RNs. The years following show an ever-widening gap between the supply of registered nurses in relation to the demand (Geolot, 2000).

Statement of Question

This study will evaluate LRMC's nursing staff effectiveness as it relates to five clinical indicators noted by the 2000 Harvard Study on nursing sensitive indicators. The goal is to determine if LRMC's nurse staffing levels is a predictor of whether or not a patient develops one of the negative outcomes deemed nursing staff sensitive.

Literature Review

Outcomes that are considered sensitive to nurse staffing levels have various definitions. These conditions are labeled as perception responsive to nursing intervention or even variable patient or family caregiver conditions. However, most literature focuses on adverse clinical outcomes related to nursing. Reasons given for such outcomes are medication errors, patient falls, nosocomial infections, and pressure ulcers. Adverse clinical outcomes are prevalent in studies because they are easily identifiable, are noted in a patient's medical record, and can become issues of litigation. The literature also noted that many, if not most, of the adverse patient outcomes associated with nurses are not due to nurse incompetence, but to systemic problems related to organizations and the structure of nursing work (Needleman, Harvard Study, 2000).

Nurse staffing is a crucial part of the provision of healthcare. Having adequate nursing promotes recovery not only from the vantage point of the health system wanting to maximize its resources, but also from the psychological aspect of the patient's belief of getting appropriate care. Along these lines, the literature discusses the concern of having the proper mix and number of nursing providers. The issue then becomes how are these numbers derived. The American Nurses Association states in their Principles for Nurse

Staffing that:

> Nurse staffing patterns and the level of care provided should not depend on the type of payer. Evaluation of any staffing system should include quality of work life outcomes as well as patient outcomes and staffing should be based on achieving quality of patient care indices. Meeting organizational outcomes and ensuring that the quality of the nurse's work life is appropriate.

Many states have embraced the idea of staffing ratios, but deciding who should establish the ratios creates another complication. Should the decision lie with the healthcare industry, which has concerns of patient care and concerns of lost services due to increased costs from larger nursing staff, or with the nurses who have a concern for patient care, but are just as concerned with patient safety due to overworked nurses (Haynes, 2001). The answer has varied, as some states have opted to legislate the ratios of staffing from the viewpoint of the industry, while others have taken guidance from the nursing profession (Haynes, 2001).

Unlicensed Assistive Personnel (UAP)

Hospitals use UAPs in a variety of roles. They participate in both direct and indirect patient care activities. Direct care activities are delegated by the registered nurse and assist the patient in meeting basic human needs such as feeding, eating, drinking and grooming. This may also involve collecting and reporting data reporting these activities. Indirect nursing care encompasses maintaining the area where nursing care is given to include housekeeping, transporting and stocking supplies (Nursing World, 1997).

Results from studies on the impact of UAPs on labor costs and patient care quality vary. A 1990 Harrison Powers et al., study (as cited in McClung, 2000) reported that a patient care model that paired an RN and a nursing aide resulted in a gain in revenue of $929 per patient. This was potentially lost revenue if nursing units were closed due to lack of staff. Quality, however, suffered as evident by a nine-point drop in the hospital's quality indicators. Another study also in 1990, conducted by Eastaugh and Regan-Donovan (as cited in McClung, 2000), based the impact of its UAPs on the percentage of non-nursing tasks performed by nurses. It showed that this improved by twenty-eight percent over a two-year period. It also revealed a 12.5% increase in RN wages during the same timeframe. Because this figure is in constant dollars, it is difficult to determine the precise increase. A third study by Lengacher et al. (as cited in McClung, 2000) looked at the teaming of an RN with a multi-skilled UAP. The result was the ability to increase the RN to patient ratio from 1:5 to a 1:7. This patient care team achieved the goal of producing a "budget neutral" outcome. Additionally, this approach achieved the other goal of having no significant impact on quality indicators such as medication errors or patient and caregiver satisfaction.

The primary issue with the delegation of traditionally RN assigned tasks is the perception of a diminishing quality of care for patients. A reduction in Medicaid payments and the increased proliferation of managed care has led to cost reduction moves by hospitals that include cutting-back the number of RNs on wards. This fed the perception of many consumers that cost was driving staffing decisions and not the need to provide quality care. Worries were further increased with news stories of striking nurses who complained of excessive mandatory overtime that was believed to endanger patients.

As a result, state and federal legislatures began hearings on the issue of nursing ratios. This resulted in many states mandating specific RN to patient staffing.

Purpose

The main hypothesis for this study is that LRMC does provide effective staffing on its inpatient wards and that nursing staffing levels is a predictor of nursing sensitive indicators. As a result, LRMC will have an additional tool in determining if it is adequately staffing its inpatient wards. This would also assist in meeting the new Joint Commission requirement for staffing effectiveness indicators.

Method and Procedures

Nurse staffing at LRMC was analyzed by looking at the occurrence of secondary patient outcomes as noted in the aforementioned Harvard University study on nursing sensitive outcomes for Medicare patients (UGI Bleeding, Pneumonia, UTI, and Sepsis) and two clinical indicators noted from the Joint Commission (DVT/PE and Surgical Wound Infection). The data on patients was extracted from a 13-month period (1 Oct 2000-31 Oct 2001) in Landstuhl's patient data system, the Composite Health Care System (CHCS) by locating patients admitted to the hospital under one diagnosis, but developed one of the six outcomes during their inpatient stay.

The nurse care staffing information is based on data obtained from Landstuhl's Workload Management System for Nursing (WMSN). This report is obtained monthly from individual wards. The data reveals among other things, that the amount of time that nursing staff is available to see patients and the projected number of nursing care hours required for the patients on the ward. The time is split into actual hours based on a forty-hour workweek and full-time equivalents (FTEs) for the RNs and para-professional

nursing staff (i.e. Technicians, LPNs, and 91Ws). The focus of this study was on FTEs as it most closely relates to the number of individual staff members used. In determining the amount of nursing care time given to the each patient, the WMSNs data for each ward during the period was examined and a daily availability time for the RNs and para-professional was computed for each ward. The daily availability number was multiplied by the number of bed days for each patient based on the ward to which they were admitted. This data, along with demographic data from CHCS, was used to compose one patient record.

The population of hospital admissions from 1 Oct 2000-31 Oct 2001 totaled 6,615. A number of admissions that were not relevant to this study were removed. The breakout is listed in Appendix B. The final data set encompassed 2,679 patient admissions that focused on the wards where the secondary outcomes occurred. Each patient admission is a patient data record. A binary variable for each record which was coded "1" if the admission had one of the secondary diagnoses and "0" if not, was added to identify outcomes.

The following variables were selected as independent variables: Age, bed days, and FTEs for both RNs and the para-professional staff and the projected nursing care hours required. These are all continuous variables. The dependent variable is the binary value that indicates if the patient developed one of the secondary outcomes.

The statistics package SPSS© was used to perform the analysis of the data. A variety of statistics operations were used to analyze the data, but Spearman's Rho was used to examine associations and logistic regression was used to determine predictive associations and odds ratios.

Results

The breakout of the 2,679 admissions examined appeared to present a good representation of the admissions to LRMC. The patient ages ranged from newborn to eighty-nine years old. The bed days of the patients had a minimum of two days and a maximum of 28. The majority of the admissions reviewed were to the Labor and Delivery ward (1046). Next was 14 C/D, the Medical/Surgical Ward (wards 14 C/D, 8D, HS) with 959 patients. Following 14 C/D was the Intensive Care Unit (PICU, SICU, MICU, CICU, ICU wards) with 248, the Pediatric Ward with 225, the Neonate Intensive Care Unit with 99 and finally 7D(Post-Pardom) with 92 admissions.

The descriptive statistics indicated that 0.9% (25 patients) of the population examined developed one of the negative secondary outcomes during their admission (Table 1 show the distribution of negative outcomes). Forty-eight percent (12) of the patients with the secondary diagnosis were female, while the other 52% (13) were males. The majority of negative outcomes had bed days of less than seven days (17 patients). The remaining had bed days of eight (3 patients), eleven (3 patients), sixteen (1 patient) and seventeen (1 patient) days. Table 3 displays the correlations based on the Spearman's Rho. When looking at the relationship of the variables to whether or not there is a correlation to the negative outcome variable "Negative Outcome N/Y," all of the variables have significance at the ninety-nine percent level except for age. Therefore, age is not considered statistically significant and subsequently is not considered to have a correlation with the negative outcome variable.

Of the remaining variables, "Nursing Care Hours Required" (NCHR) and the variable indicating the number of LPN and Nursing Assistant FTEs per bed day

(LPN&NA FTEs) have the largest correlation coefficients with 0.085 and 0.082, respectively. The r^2 for the variables are .0072 for NCHR and .0067 for LPN&NA FTEs. The shared variance for both variables to the negative outcome variable is very small and indicates some relationship though a minimal one.

Table 2 is a descriptive statistics table that compares the positive outcome and the negative outcomes. When comparing the means of the outcomes, the patients with the negative outcomes consistently have the higher value. The patients who developed a negative outcome were older, had more bed days, more all around FTEs per bed day and were projected to require more nursing care hours than the patients with positive outcomes. This lends itself to the interpretation that the negative outcome patients had higher acuities and therefore needed more care.

Table 4 looks at the variance of the different variables as they relate to the negative outcome variable "Negative Outcome N/Y". It indicates statistical significance with all of the variables except age. Of the remaining variables, LPN&NA FTEs per Bd has the larger F Ratio value that indicates that it has a stronger relationship to the negative outcomes variable than the other variables. The relationship with the negative outcome variable has an overall minimal strength.

Table 5 contains the results of the logistic regression analysis. The results suggest that after controlling for admission ($r^2 = 0.100$) and age ($r^2 = 0.000$), more Registered Nurse and/or Licensed Practical Nurse/Nurse Assistant nursing hours is not predictive of negative outcomes ($r^2 < 0.006$). Additionally, the Exp(β), a proxy for an odds ratio, suggests that there is no significant association between nursing hours devoted to the patient, and the likelihood that the patient will have a negative outcome. In the complete

equation, the Exp(β) for the total number of nursing hours (1.101) suggests that for each devoted nursing hour, the odds of a negative outcome increase a very small 1.101 times. This supports the possibility of inflation in the determined number of nurses hours required because the presence of inflation would cloud the ability to determine the effects of different staffing levels.

Meaning of the Results

Examining the data obtained, one can infer that the patients with the negative outcomes would have developed the outcomes regardless of the amount of nursing staff provided. This conclusion is drawn on the basis of a number of suppositions. First, it is clear that the patients with the negative outcomes were identified as requiring more care by the nursing leadership. This is demonstrated by the high NCHR noted from the WMSNs data. In fact the NCHR for the patients with the negative outcomes is more than twice as large as that for the positive outcome patients. An issue with the NCHR is that the nurse who completes the sheet, which reflects the projected nursing care needs of each patient, finishes it before putting "hands on" the patient. The projected needs are a reflection of the number of patients on a particular ward, the type of patient (medical or surgical), any special requirements the patient may have and the experience of the nursing staff. Because these factors are considered prior to a "hands on" assessment of a patient, there may be an inflation of the required nursing care hours. The extent to which these numbers are inflated, if at all, and the impact that this has on the tallied required nursing care hours is beyond the scope of this study. However, it is a question of concern when developing a tool to help nurses determine ward-staffing requirements.

Another reason that patients may have developed the negative outcomes regardless of staffing is because, on average, the patients with the negative outcomes had more staffing then the patients with positive outcomes. The mean values of the RN and para-professional staff for the negative outcome patients are nearly double that of the positive outcome cases. Even if the staffing levels are a reflection of inflated requirements from the nursing care hour's requirement sheet, the nursing staff levels were still high. This also lends itself to the idea that the negative outcome patients were identified as needing more attention and the staff was increased accordingly.

Another example supporting this idea involves the development of UTIs. Reviewing the nursing notes for patients that had contracted a UTI seems to indicate vigilant observations on whether post surgical patients had produced urine throughout the admission to the nurse's ward. In the cases where catherization was required, most nursing notes indicated monitoring of urine produced or the condition of the cather if the patient did not void.

The final reason that these outcomes potentially would have developed regardless of staffing is the minimal time spent in the hospital. The majority of the negative outcome cases (60%) had four or less bed days. Though it is possible to develop an infection or contract pneumonia in less than four days, there is less of a likelihood that the individual would start exhibiting the signs of an infection so quickly. Contracting a virus may actually be reflected in a readmission to the hospital, a visit to the emergency room or primary care provider or for less serious cases, treated symptomatically at home with over-the-counter medications.

Discussion

As projected with the hypothesis, the data indicated that as a whole LRMC produces overwhelmingly positive results in its inpatient care (99.1%). Less than 1% of the admissions for the time period examined revealed a negative patient outcome identified as a potential indicator of inadequate nurse staffing. Of the twenty-five cases that did have a nursing sensitive indicator, nursing notes show that the nursing staff followed the correct procedures for preventing the indicators. Additionally, a comparison of the mean data of the positive and negative outcomes highlight a staffing difference that, on average, is nearly double in difference. This leads the author to believe that the negative outcomes would have occurred despite the staffing levels and may be the result of other factors not related to the data analyzed.

Limitations of the Study

The limitations of this study and the limitations of the data allowed only broad general conclusions to be drawn. Factors relating to the study limitation revolved around issues with automated data. Staffing data such as the nursing 24-hour report, which is a more accurate indicator of the amount of staffing a ward has during a given period, may have produced more specific and accurate outcomes. This data was not automated and would have proved too cumbersome and time-consuming for one individual to prepare for analysis. Automated data annotated in CHCS, to include nursing notes was inconsistent in format and detail. This lead to difficulties in revealing procedures followed for patient care and when it occurred. This information is available in the inpatient medical record, but would prove more useful to individuals attempting to analyze nursing care if it were consistent and readily accessible on CHCS. Efforts should

be considered by LRMC to improve data quality in CHCS. More consistency with automated data would prove useful in the analysis of patient care data.

Because of the data limitations, there are additional avenues available to approach the issue of staffing effectiveness. The results of this study should be used as a starting point for further research on the appropriate staff effectiveness indicators for LRMC.

Conclusion

In summarizing the results, the author concludes that with the staffing data used, the nursing staffing levels is not predictive of the development of outcomes in patients. The statistical results are some what suspect because of the small sample size produce this is a positive item for LRMC because it shows that during the reviewed period of time, it performed admirably in taking care of patients with very few of the noted negative patient outcomes. From a researcher's standpoint, it means that the results required great scrutiny and may only provide minimal assistance to the organization as it attempts to meet the new JCAHO requirements. The researcher will also have to perform further studies or pass these results on to another investigator to confirm the initial hypothesis.

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Appendix A

Proposed List of Joint Commission Screening Indicators

1. Overtime (HR)
2. Family complaints (C/S)
3. Patient Complaints (C/S)
4. Staff vacancy rate (HR)
5. Staff satisfaction (HR)
6. Patient falls (C/S)
7. Adverse drug event (C/S)
8. Staff turnover rate (HR)
9. Understaffing as compared to organization's staffing plan (HR)
10. Nursing care hours per patient day (HR)
11. Staff injuries on the job (HR)
12. Injuries to patients (C/S)
13. Skin breakdown (C/S)
14. On-call or per diem use (HR)
15. Sick time (HR)
16. Pneumonia (C/S)*
17. Postoperative infections (C/S)
18. Urinary tract infection (C/S)*
19. Upper gastrointestinal bleeding (C/S)*
20. Shock/cardiac arrest (C/S)*
21. Length of stay (C/S)*

**Needleman J. Buerhaus P. "Phase II Final Report: Nurse Staffing and Quality of Care in Inpatient Units in Acute Care Hospitals," April 20, 2001 (cosponsored by HCFA, AHRQ, NINR, NIG, NHRSADN).*

Appendix B

Deletions from the Admission Database

Cancelled Admissions	**152**
No Bed Days	
Transfer to Navy MTF	1
Transfer to Army MTF	1
Return to Duty	2
Discharge to Civilian Facility	2
Died during Inpatient Stay	3

Discharged Newborns	1046
Carded for Record Only	61
Absent Sick	101
Total	**1369**
Admissions to wards not considered	
Ward 10 C/D	170
Ward 9 C	762
Total	**932**
Admissions of 1 day or greater than 28 days	1577
Other admission ruled out	58
Grand Total	**3936**
Remaining Admissions	**2679**

Table 1

Distribution of Negative Outcomes

Type of outcome	Number of Observations
DVT/PE	1
Pneumonia	8
Sepsis	6
Surgical Wound Infection	4
UTI	6

Table 2

Descriptive Statistics for the Positive, Negative and Total Population Outcomes

	N	Mean	Std. Dev.	Std. Error	Min	Max
Age						
Pos Outcomes	2654	30.18	17.20	.33	0	89
Neg Outcomes	25	32.48	16.11	3.22	2	72
Total Pop	2679	30.20	17.19	.33	0	89
Bed Days						
Pos Outcomes	2654	4.09	3.57	.07	2	28
Neg Outcomes	25	5.92	4.29	.86	2	17

Total Pop	2679	4.11	3.58	.07	2	28
RN FTEs per Bed Day						
Pos Outcomes	2654	1.88	1.94	.04	.34	17.49
Neg Outcomes	25	3.33	2.76	.55	.34	10.62
Total Pop	2679	1.90	1.96	.04	.34	17.49
LPN & Nursing Assistant FTEs per Bed Day						
Pos Outcomes	2654	1.51	1.60	.03	.11	16.12
Neg Outcomes	25	3.09	2.54	.51	.30	9.79
Total Pop	2679	1.52	1.62	.03	.11	16.12
Total Nursing FTEs per Bed Day						
Pos Outcomes	2654	3.39	3.41	.07	.77	33.62
Neg Outcomes	25	6.41	5.30	1.06	.77	20.41
Total Pop	2679	3.42	3.45	.07	.77	33.62
Nursing Care Hrs Required						
Pos Outcomes	2654	9.07	13.86	.27	.0024	157.5737
Neg Outcomes	25	20.69	19.15	3.83	.0096	70.4935
Total Pop	2679	9.18	13.95	.27	.0024	157.5737

Table 3

Spearman's Rho Analysis of the Negative Outcome Variable (N=2679)

	Negative Outcome N/Y	Nursing Care Hrs Required	LPN&NA FTEs per Bd	Total FTEs per Bd	RN FTEs per Bd	Bed Days	Age
Negative Outcome Correlation Coefficient	1.000	.085*	.082*	.074*	.071*	.061*	.015
Sig. (2-tailed)		.000	.000	.000	.000	.002	.425

*p < .01(two tailed test).

Table 4

Variance Table amongst the Variables

	Sum of Squares	Degree of Freedom	Mean Square	F	Significance
Age					
Age					
Between Groups	130.75	1	130.75	.44	.506
Between Groups	130.75	1	130.75	.44	.506
Within Groups	791409.98	2677	295.63		
Within Groups	791409.98	2677	295.63		
Total	791540.72	2678			
Total	791540.72	2678			

Bed Days

Between Groups	82.90	1	82.90	6.48	.011
Between Groups	82.90	1	82.90	6.48	.011
Within Groups	34258.14	2677	12.80		
Within Groups	34258.14	2677	12.80		
Total	34341.04	2678			
Total	34341.04	2678			

RN FTEs per Bed Day

Between Groups	51.99	1	51.99	13.65	.000
Between Groups	51.99	1	51.99	13.65	.000
Within Groups	10198.34	2677	3.81		
Within Groups	10198.34	2677	3.81		
Total	10250.33	2678			
Total	10250.33	2678			

LPN & Nursing Assistant FTEs per Bed Day

Between Groups	61.74	1	61.74	23.72	.000
Between Groups	61.74	1	61.74	23.72	.000
Within Groups	6969.16	2677	2.60		
Within Groups	6969.16	2677	2.60		
Total	7030.90	2678			
Total	7030.90	2678			

Total FTEs per Bed Day

Between Groups	227.05	1	227.05	19.24	.000
Between Groups	227.05	1	227.05	19.24	.000
Within Groups	31596.43	2677	11.80		
Within Groups	31596.43	2677	11.80		
Total	31823.47	2678			
Total	31823.47	2678			

Nursing Care Hrs Required

Between Groups	3344.84	1	3344.84	17.28	.000
Between Groups	3344.84	1	3344.84	17.28	.000
Within Groups	518128.27	2677	193.55		
Within Groups	518128.27	2677	193.55		
Total	521473.10	2678			
Total	521473.10	2678			

$p < 0.01$(two tail).

Table 5

Results of the Logistic Regression Analysis

Variables	Cox R^2	Significance
Age	-0.000	0.000*
Initial Diagnosis (ICD-9)	0.100	0.000*
Age, ICD-9, & RN_FTEs	0.003	0.000*
Age, ICD-9, & LNNA_FTEs	0.005	0.000*
Age, ICD-9, & TOTAL_FTEs	0.004	0.000*

$p < 0.05$