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NURSING TURNOVER AND HOSPITAL EFFICIENCY:

AN ORGANIZATION LEVEL ANALYSIS

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ABSTRACT

This study tests the competing arguments that organizational turnover rates are positively associated with organizational inefficiency or, alternatively, that turnover rates are positively related to organizational inefficiency only in those organizations experiencing very high or very low rates of turnover. The findings strongly support the former argument: in a national sample of 407 hospitals, turnover among registered nurses was found to be positively and linearly associated with both operating and personnel costs per adjusted admission. However, subset analyses based on hospital size, location, and teaching status, suggest that the strength of the turnover-cost relationship is contingent upon the type of institution in which turnover occurs.

The majority of turnover studies, whether conducted in the health care sector or industrial sector, explicitly identify turnover as a dependent variable to be explained. Much of this research is predicated on a set of assumptions and beliefs among scholars and managers that employee turnover adversely influences effectiveness and productivity in organizations (Bluedorn 1982, Dalton and Todor 1979, Muchinsky and Tuttle 1979). For example, effectiveness, or the attainment of organizational goals, may be hindered when turnover decreases job performance and familiarity with standard operating procedures. Similarly productivity, the ratio of outputs to inputs, is thought to decrease under conditions of high turnover as costs of recruiting and training new employees increase, while outputs are reduced during orientation and familiarization with the new job.

Whereas most of these assumptions regarding the adverse consequences of turnover have been inviolate for years, recent writings have begun to question some of the underlying premises behind the notion that turnover is inherently bad for the organization (Dalton et al. 1979, 1981, Muchinsky and Morrow 1980, Staw 1980, Staw and Oldham 1978). For example, Dalton and Todor (1979) have advanced a convincing thesis that some degree of turnover tends to be healthy for the organization. Turnover at moderate levels infuses "new blood", fresh ideas, and keeps the organization from becoming stagnant. Similarly, traditional assumptions about turnover and its relationship to cost and productivity have been questioned. Efficiencies may result from replacing full-time employees who leave the organization with part-time personnel or with entry level personnel, thereby reducing personnel and benefits costs. Although there has been recent consideration of turnover and performance at the individual level (see Dreher 1982, McEvay and Casico, Sheridan 1985), there have been almost no empirical studies of the organizational consequences of turnover that would either reinforce traditional conceptions of turnover as a negative attribute of organizational behavior, or affirm more recent notions of turnover as leading to positive consequences for the organization.

In this light, the goal of the current study is to examine the relationship between voluntary turnover rates of hospital registered nurses (RNs) and hospital operating efficiency. Our focus on RN turnover stems from several considerations. First, personnel costs, on average, make up sixty percent of the operating budget of most hospitals. By far, the largest component of this cost is that associated with registered nurses. Second, unlike many occupational groups in hospitals, nurses directly participate in the core technology of hospitals -- the delivery of hands-on patient care. Thus, RNs are central to the production process and are both involved and accountable for productivity as it pertains to patient care (Fottler et al. 1988).

The study tests the competing arguments that 1) higher voluntary turnover rates among RNs are inversely associated with hospital efficiency or, 2) voluntary turnover rates and efficiency are related in curvilinear fashion owing to potential beneficial effects of turnover at moderate levels. The investigation will also attempt to differentiate whether efficiencies/inefficiencies incurred from turnover are associated with personnel expenditures or operational (productivity) expenses. By distinguishing between these two domains of activity, we will be able to shed more precise light on how nursing turnover impacts organizational operations. Finally, the study will develop and test arguments related to the organizational conditions under which nursing turnover affects hospital efficiency. This phase of the investigation will examine the moderating effects of organizational size and technological complexity on the turnover-efficiency relationship.

On a practical level, findings on the relationship between organizational rates of turnover and organizational efficiency contribute to management's ability to identify optimal levels of turnover rates so that better decisions about human resource utilization can be made (Dalton and Tudor 1982, Terborg and Lee 1984, Abelson and Basinger 1984). Of particular importance in such considerations are the costs associated with various turnover rates relative to those associated with different strategies for reducing turnover. Results of the current investigation should therefore provide hospital decision makers with more concrete information on the operational consequences of turnover so as to better design, fund, and implement appropriate intervention strategies to prevent RN exit from hospitals. Conversely, if RN turnover is found not to be related to hospital

efficiency, or if costs of interventions exceed those of turnover, hospital administrators will have evidence to support continued use of supply side solutions to address nursing turnover in their institutions.

THEORY AND HYPOTHESES

Levels of Analysis

Researchers have tended to focus on turnover either at the individual level, following the tradition of industrial psychology, or from the economic perspective of aggregating turnover rates over groups of organizations or industries (Johnson and Vaughn 1982, Long 1951, Mirvis 1977, Cawsey and Wedley 1979). The few studies that have examined nursing turnover and its consequences have had a common focus on the cost associated with the departure and replacement of the individual nurse. Dane (1972), in a comprehensive study, found that RN replacement costs were between 438 and 830 dollars for orientation and training. These costs were derived from breaking down the average cost related to the steps necessary to obtain a replacement. These included initiation of need, interviewing of applicants, physical examinations, orientation and training, the non-productivity of new employees during the orientation and training period, paperwork processing, and overtime required from other employees to take up slack caused by turnover. In a less extensive study, Tuchi and Carr (1971) estimated that replacing either an LPN or LVN would cost $1,335 and $1,133 respectively. More recent writings on the subject have been based largely on anecdotal or case study information and suggest that costs of recruiting and orienting a professional nurse to a hospital may range from $3,000 to $5,000 (Donovan 1980; Weisman et al. 1979, 1980).

Despite increasing emphasis in the theoretical literature, there has been little empirical consideration of the relationship of turnover rates at the organizational level and organizational operating efficiency in the aggregate (Baysinger and Mobley 1983, Bluedorn 1982, Mobley 1982). Conceptualizing turnover and its consequences at the organization level places the emphasis not on individual employee decisions, but on turnover and turnover effects as properties of the organization itself. From a theoretical perspective, the issue of level of analysis is central because

functional relationships involving turnover may differ between individual and organizational levels (Terborg and Lee 1984, Wallace 1983). For example, if individual turnover is associated with increased cost of recruitment, training, and reduced productivity, it does not necessarily follow that turnover rates at the organization level will be positively correlated with personnel or production costs for the organization as a whole. Indeed, progress in personnel and industrial relations will be limited until researchers are able to establish vertical synthesis across levels of analysis (Heneman 1969, Terborg and Lee 1984).

From a managerial perspective, the analysis of turnover as an organizational attribute has a number of advantages. Conceptualizing and measuring turnover at the organization level shifts the explanation of the consequences of turnover from the individual to the organization and thus opens the way for administrative intervention through changes in organizational design and staffing arrangements (Pfeffer and O'Reilly 1987, Scott and Shortell 1988). It is also one aspect of human resources management that is commonly monitored for both intervention and for making personnel policy projections. Finally, the information necessary to study turnover and its consequences at the organization level of analysis does not require a measurement of perceptions, thoughts, and feelings of people which may be less reliable than recording the organizational and environmental context in which employee decision making occurs (Pfeffer and O'Reilly 1987).

Turnover Rates and Organizational Performance

If we accept the theoretical and applied utility of examining turnover and its consequences at the organization level, what processes might account for such relationships? Arguments regarding the relationship of organizational turnover rates and organizational performance are based frequently on the premise that turnover disrupts the input/throughput/output cycle of organizational production and thereby reduces efficiency (Gouldner 1957, Grusky 1963, Staw 1980). Under the open systems perspective, organizations obtain energy from the environment to transform inputs into outputs. These outputs are introduced into the environment thereby stimulating further energy exchange. A primary organizational function is to perpetuate this

process or, alternatively, to prevent entropy or dissipation of energy exchange. Countering the entropic process in social systems is achieved not only by sustained acquisition of energy from the external environment, but also from the ability to maintain the structures necessary to effectively stabilize the exchange process. Social systems are structured so as to create a "unity in their completion or closure" and a balance between energy intake and organizational activities (Katz and Kahn 1966). The ability of these social system structures to maintain stability or constancy in energy exchange is central to the notion of organizational homeostasis or equilibrium. Maintenance structures that focus on ensuring stability or predictability in exchange relationships are built on a common set of norms. New entrants, therefore, must be socialized into the norms of the organization. High turnover rates cause organizations to potentially expend more energy in maintaining the input-throughput-output process than they take in from the environment. Turnover is likely to prevent new structures from emerging that have any degree of permanence and at very high rates, it becomes increasingly difficult to counteract such disruption through the organization's maintenance mechanisms (Katz and Kahn 1966, Staw 1980).

A second but related theoretical argument regarding the relationship of turnover rates and performance is based on the notion that turnover is part of a more generic problem of organizational control (Price 1977). To be effective, organizations must maintain members willing and able to perform the work necessary to produce the output of the organization. High rates of turnover affect the basis of organizational control by eliminating the normative foundation on which much control is exercised. "Norms specifying work to be done cannot be obeyed unless an organization can maintain its members. The greater the expenditures of scarce resources to maintain its membership, the more an organization must neglect the work necessary to produce its basic output" (Price and Mueller 1981). Inability to maintain norms is a control problem facing all organizations. However, high rates of turnover exacerbate the problem and result in diversion of resources from basic production into controlling membership, a process counterproductive to organizational effectiveness (Hage and Aiken 1974).

The logic of these arguments suggest that there is a positive, linear relationship between

turnover rates and disruption and control problems in organizations: the greater the turnover, the greater the disruption and control difficulties. Because of the negative relationship between disruption, control problems and efficiency, the implication is that turnover has an indirect, linear and negative impact on efficiency: the greater the turnover, the lower the efficiency since disruption and control problems should decrease efficiency. Applying these theoretical arguments to the hospital, we would expect general organizational inefficiency to increase with increasing rates of turnover among hospital RN staff. Thus,

Hypothesis 1: RN turnover rates in hospitals are positively associated with hospital operating inefficiencies.

A competing argument suggests that the relationship between turnover and organizational productivity is not positive and linear, but curvilinear. Such claims are based on the premise that at certain levels, turnover in organizations has positive consequences for organizational performance. Serious discussions of positive outcomes of turnover have only recently begun to appear in the literature (Price 1977; Muchinsky and Tuttle 1979; Staw 1980; Bluedorn 1980).

One of the positive organizational consequences of turnover relates to its potential impact on personnel and fringe benefit costs. Higher levels of turnover in organizations may produce lower payroll and fringe benefit costs because the rates of pay for new hires are often substantially lower than rates for experienced employees (Jeswald 1974). As employees exit the organization in large numbers, management may replace them with new hires at entry level wages. Similarly, eligibility for some fringe benefits does not occur until seniority is established. Thus, replacing leavers with entry level personnel affords organizations savings on insurance premiums, vacation pay, sick pay and other related benefits.

With respect to productivity, the long-held assumption that turnover and organizational productivity are negatively related is now being questioned by a number of writers (Dalton and Todor 1979, Staw, 1980). If organizations replace departing employees with new arrivals who are more highly motivated and who possess better job skills than their longer-tenured, exiting counterparts, productivity may, in fact, increase. Further, in certain types of organizations where

physical or psychological demands are high on employees (e.g., hospital nursing), low levels of turnover and long lengths of service can be detrimental to organizational productivity as employees become more dysfunctional over time (Muchinsky and Morrow, 1980).

In the hospital setting, specifically, high nursing turnover may make it easier for the hospital administration to introduce cost effective changes since traditional or long standing operating procedures are eroded by the movement of employees into and out of hospitals. Such arguments gain additional credibility in environments characterized by rapid change and uncertainty, which require responsive adaptation on the part of hospitals (Rakich et al. 1977, Mobley 1982, Seybolt 1984). Although the few empirical studies conducted on turnover and its consequences for organizational performance are far from conclusive (Grusky 1963, Wells and Pelz 1966, Eitzen and Yetman 1972, Leviatan 1978, Allen et al. 1979), the relationship most consistently supported by these and related studies is an inverted U-shaped one in which organizational performance is highest at intermediate levels of turnover. Extending these theoretical and empirical studies to hospitals, we hypothesize that:

Hypothesis 2: Relative to hospitals with high or low turnover rates among staff registered nurses, hospitals with moderate rates of turnover will experience greater operating efficiencies.

To this point our discussion of turnover rates and organizational efficiency has been general. However, organizations are not homogeneous and may vary both in their susceptibility to turnover and in the manner in which turnover impacts efficiency (Bluedorn 1982). Specifically, we expect the relationship of organizational efficiency and turnover rates to be moderated by certain contextual attributes of organizations.

We anticipate that the effects of turnover rate on organizational efficiency will be more pronounced in those institutions where organizational structure and technologies are complex. Bluedorn (1982), for example, has argued that organizations operating with non-routine technologies require more decisions based on experience, judgement and intuition, all of which require lengthy learning periods. Routine technologies, on the other hand, are characterized by

few exceptions in the work process as well as by tasks that are highly analyzable. These depend to a lesser extent on organization- or task-specific learning. Thus, relative to those organizations possessing more routine technologies, turnover is likely to be more disruptive in organizations possessing non-routine technologies since the learning periods associated with effectively operating in such contexts are longer.

In complex, technologically advanced hospitals, RN turnover will result in higher costs since it becomes relatively more difficult to integrate new nurses into technically demanding jobs and to familiarize them with the involved operational and administrative protocols characteristic of complex institutions. The departure of experienced nurses from such organizations will have a relatively larger impact on productivity since they are less "substitutable" than RNs working in less complex hospitals. That is, it becomes more expensive for hospitals to replace a highly trained and experienced nurse in more technologically advanced hospitals.

For purposes of this analysis we make the assumption that teaching hospitals have more complex patient care technologies than non-teaching hospitals. This assumption is based on the premise that teaching hospitals treat a sicker group of patients that demand more intensive, complex medical interventions and more intensive nursing care. Teaching hospitals are also more likely to engage in untried or "experimental" medical care procedures that require much more discretionary judgement on the part of health care professionals working in these institutions (Daft and Becker 1978). Hence,

Hypothesis 3: The association between nursing turnover rates and hospital operating efficiency will be stronger in teaching hospitals than in non-teaching hospitals.

A second context variable that may potentially moderate the turnover-organizational efficiency relationship is size. Students of organizational adaptation suggest that smaller organizations possess less slack and are thus less capable of absorbing the negative effects of external or internal disruptions such as turnover on their operations (Bluedorn 1982). Similarly, smaller sized organizations are likely to feel a greater impact of turnover because the effects of

exits are magnified by the reduced scale of the organization. That is, turnover is likely to be more salient (disruptive or positive) when played out against a smaller organizational context than a larger one because staff members in smaller organizations make a disproportionately higher contribution to the production function of the organization. Conversely, as organizations grow and become more differentiated, they are better able to absorb the impact of turnover since individual staff members are relatively less important in terms of their contribution to overall organizational productivity. Thus, we expect smaller hospitals to feel the impact of turnover to a greater degree than larger hospitals.

Hypothesis 4: The association between nursing turnover rates and hospital operating efficiency will be stronger in smaller hospitals than in larger hospitals.

Clearly, organizational efficiency is affected by a number of variables besides turnover. Research on hospital efficiency, specifically, has been extensive and grounded primarily in the discipline of health economics (Davis 1974, Sloan and Steinwald 1980). This research has focused on modeling hospital cost functions, including the inputs, outputs and contextual factors that influence efficiency and costs. These studies have emphasized the precarious nature of hospital operations resulting particularly from exogenous factors related to multiple environments (markets). Less emphasis in these cost function models has been placed on the internal organizational characteristics of the hospital, particularly human resource characteristics such as employee turnover.

To isolate the relationship between organizational efficiency and voluntary turnover rates, characteristics of the organization and its environment are included in the model as control variables. By also including in the model other potentially confounding factors such as wage rates, level of competition, product mix and organizational technology, we can estimate the effect of turnover rates on organizational costs "holding" constant these other factors. For example, hospitals treating a "sicker" mix of patients are likely to incur greater costs and thus may appear less efficient. To the extent that casemix severity is also related to RN turnover (e.g. nurses

treating sicker patients "burn out" more easily), it may account for all or part of any empirical association between voluntary turnover rate and efficiency. In the regression model, the association of turnover and operating efficiency will net out any effect of casemix.

Clearly, any number of variables may potentially affect hospital efficiency. To guide our selection, we used two criteria: 1) support in the health economics literature for an association with hospital cost and 2) potential as a competing or alternative explanation of the RN turnover-hospital cost relationship. For example, geographic region has been demonstrated to have an association with costs (e.g. hospitals in the Northeast experience higher cost than those in the South) and with nursing turnover (e.g. higher in the West). It is important to emphasize that our model is not intended to represent a hospital cost function--that is to include all demand and supply factor variables related to cost. Our purpose is restricted to examining the relationship of RN turnover rates and hospital costs per unit of output, while controlling for those hospital and environmental variables that represent potential alternative explanations of this relationship.

Our control variables were divided into two categories: 1) organizational characteristics, and 2) environmental characteristics. The organizational control variables included organizational size, ownership/control (e.g. for-profit, government), teaching status, operating capacity, and input complexity/uncertainty. The environmental controls included geographic region, urban/rural status, regulatory intensity by state, local economic climate, area wage rates, competition (organizational), and competition (labor supply). These variables are discussed in detail under measurement.

METHOD

Data Sources

Multiple sources of data were used in this study. The primary data set, which defined the study sample of American hospitals was the Nurse Personnel Survey, conducted by the American Hospital Association (AHA) in 1981. This survey gathered aggregate (hospital level) information about vacancies and turnover among hospital nursing personnel. The Nursing Personnel Survey

questionnaire was addressed to the Chief Executive Officer of each hospital with the expectation that the Personnel Director's Office would assist in completing it. Because of the objective nature of the survey items, subjectivity bias was not a consideration in the data collection process. Telephone follow-up by AHA staff was conducted to ascertain the reliability and accuracy of the data.

Data from six additional sources were merged to the Nursing Personnel Survey data file. The 1982 AHA annual survey of hospitals provided information on the financial characteristics and the general organizational structure of hospitals. Published state regulatory characteristics were obtained to assess regulatory climate (Urban and Bice 1981). The Area Resource File (Bureau of Health Professions 1985) provided data about the external environment of the hospital specified at the county level. The HCFA Medicare Case Mix File (1982) provided data on hospital case mix and the Hospital Neighbor File was used to construct measures of hospital competition (Luft and Merki 1985).

Sample

The Nursing Personnel Survey was sent to a twenty percent random sample (1233 hospitals), drawn from a universe of approximately 6110 community hospitals throughout the country. It was sent to the hospitals in three waves with a telephone follow-up by AHA. AHA Regional Directors were asked to encourage member hospitals to complete and return the questionnaire. This effort yielded a sample of 732 hospitals (a 59.9 percent response rate). The AHA's preliminary analysis of the Nursing Personnel Survey indicated that the response rate was somewhat adversely affected by the survey's length and by the complexity of the vacancy and turnover question (complete responses were required for four continuous quarters of the calendar year).

For the purposes of this analysis, a "subsample" of AHA's sample was drawn based on whether or not hospitals reported four consecutive quarters of turnover data (January 1, 1980 to December 31, 1980) for full-time registered nurses (RNs). The final usable sample was 407 hospitals.

To insure that this "subsample" was representative, a comparison was made to the original AHA hospital sample (N = 1233) with regard to hospital size, region of the country, and ownership of the hospital. The subsample and the original sample were closely matched on two of these characteristics, size and ownership. However, in the subsample there was a slight over-representation of hospitals in the Northeast region of the country.

Measurement

Table One presents measures of all study variables and their descriptive statistics.

Insert Table 1 About Here

The primary independent variable for the study was voluntary turnover rate of full-time registered nurses. The numerator of this rate is based on the number of full time registered nurses who voluntarily resigned from their positions from January 1, 1980 through December 31, 1980 (four calendar year quarters). Individuals who were promoted, retired, fired, died or left due to disability were not included in this voluntary turnover calculation. The denominator of the rate consists of the mean number of registered nurses on staff over the four quarters during the same period. Both turnover and staffing level data were reported separately for each quarter (see Appendix). The overall turnover measure was calculated by the investigators. A key strength of our turnover measure is its ability to differentiate voluntary from involuntary exits, thus isolating that aspect of turnover that relates theoretically to organizational efficiency. Specifically, voluntary exits captures the concept of withdrawal from the organization. Because such exits are initiated by the individual, the organization has less direct control over this type of action relative to involuntary separation and therefore the consequences of voluntary turnover, positive or negative, are more problematic (Muchinsky and Tuttle, 1979; Porter and Steers, 1973).

The mean turnover rate of the sample of 407 hospitals is 26 percent. Hospitals located in rural areas and those with no residency teaching programs display the lowest mean turnover rate (25 percent). Small hospitals (< 100 beds), church owned hospitals and those with residency

programs have relatively high rates (30, 29, and 29 percent, respectively). Those hospitals located in the South and West reported the highest turnover rate (30 percent) of the four regional categories (Table 2).

Insert Table 2 About Here

To assess the relationship between turnover and organizational efficiency, a consistent output criterion is required (Bluedorn, 1982). For purposes of this analysis, organizational efficiency will be used as our general output criterion, defined as the ratio of an organization's output to input. This ratio defines increasing efficiency as greater output produced by the same amount of input or the same amount of output produced with less input. For general acute care hospitals, the basic unit of output is the hospital admission. Inputs are measured by both personnel and non-personnel operating costs associated with the production of a unit of output. Such costs include raw materials and the labor transaction expenses, energy etc. used to produce the output.

Two separate measures of hospital efficiency were used as the dependent variables in the analysis: 1) Personnel costs per adjusted hospital admission and 2) total non payroll operating costs per adjusted hospital admission. The 1982 AHA annual survey provided data on total operating expenses, total payroll expenses, total benefit expenses, total number of inpatient admissions and inpatient and outpatient revenues for fiscal year 1981. Total operating expenses minus pay and benefit expenses was used to measure non-payroll hospital operating costs of the hospital. Payroll and benefits expenses were combined to measure personnel costs. Expense data for both measures were standardized by dividing by total hospital admissions. An additional adjustment (1 + the ratio of hospital outpatient revenues to inpatient revenues) was made to hospital admissions in order to take into account the volume of outpatient services. Finally, the natural log of each expense variable was taken to meet the assumptions of normality required by ordinary least squares regression (Chattergee and Price 1977). The two measures of efficiency are

correlated at r = .70.

Six measures of internal hospital characteristics were included as control variables in the multivariate model. Size of the hospital was defined as the number of hospital beds set up and staffed for use (Cohen 1967, Carr and Feldstein 1967). Ownership of the hospital was defined as whether the hospital was an investor owned (for-profit), church-owned (not-for-profit), operated by state or local government, or operated as a voluntary, not-for-profit hospital (Berry 1970). The voluntary, not-for-profit category was designated the reference group in the multivariate model. A categorical variable, teaching status, measured the existence of a medical residency training program (Sloan, et al. 1983, Hadley 1983). Efficient use of resources (especially capital expense items) is represented by the average hospital occupancy rate. The variable average hospital length of stay represented a proxy for patient acuity (Robinson and Luft 1985). Differences in severity of illness were also controlled for by the HCFA Medicare Casemix Index (Federal Register 1983). This index scales case mix complexity for individual hospitals to a base of one for hospitals with average case complexity. Higher values reflect a more complex case mix while lower values reflect a simpler case mix (Watts and Klastorin 1980).

Six environmental variables were also included as control variables. Two measures of hospital location were used: region and urban/rural status. Region of the country was measured by a series of dummy variables corresponding to four geographical regions of the country (South, West, Northeast and North-Central); the Northeast category was omitted as the reference group in the regression analysis. Whether the hospital is located in an urban SMSA or rural non-SMSA area was measured by a dummy variable (Urban = 1, Rural = 0)(Finch and Christianson 1981).

The Regulatory Intensity Index (RI) gauges the number and stringency of state regulatory programs affecting hospitals in 1980 (Urban and Bice 1980, Sloan and Steinwald 1980, Morrisey et al. 1984). The indicators of RI refer to the characteristics of four regulatory programs: 1) certificate of need (CON), 2) Section 1122, 3) rate review and 4) utilization review. Twelve dichotomously specified variables were used to capture these four regulatory areas. The final RI index is a scaler, interval measure derived from factor analysis and ordinary least squares

regression.

Per capita income (1980) measures the economic resources of the county. Local economic trends impact the demand for hospital services and the rates for reimbursement for medical services. Hospital competition is measured as the number of hospitals within a 15 mile geographic radius of the focal hospital and reflects the extent of hospital competition for physician services (Luft and Merki 1985, Robinson and Luft 1988, Joskov 1980). Local supply of staff RN resources is measured as the ratio of the number of registered nurses per hospital bed in the county. Finally, area wage rate is measured as the mean starting hourly wage for new diploma and associate graduates (RN) in the focal hospital (Cohen 1967). Correlations among all study variables are presented in Table 3.

Insert Table 3 About Here

RESULTS

The first phase of the data analysis employed ordinary least squares regression (OLS) to examine the effects of RN turnover rate on hospital efficiency, controlling for a variety of alternative environmental and hospital explanations of the turnover-efficiency relationship. The respective data collection points for the turnover (1980) and cost data (1981) ensure that turnover activity was lagged by one year to hospital costs. This temporal ordering is isomorphic with the theory that turnover affects operating efficiency and, to some extent, obviates the reverse causal argument that efficiency (perhaps a proxy for quality of management) determines turnover.

To assess the validity of the competing hypotheses, concerning the form of the relationship of turnover rate and organization efficiency, two versions of the model were tested. Model 1 contained turnover rate expressed as a linear term in the regression equation. To test the argument that the relationship between turnover and organizational efficiency is curvilinear, both a linear and a quadratic turnover rate term were included in regression model. To reduce

collinearity between these terms, the linear and quadratic turnover rate variables were expressed as deviations from their means (Neter et al. 1985). This procedure resulted in a decreased correlation between the turnover terms of from .89 (without using deviation values) to .64 (using deviation values).

In explaining log personnel costs per adjusted admission, Model 1 was significant at the $p < .001$ level and accounted for 61% of the explained variance. Consistent with previous research on hospital cost, length of stay, teaching status, urban location, hospital size and RN wage rate displayed a positive and statistically significant association with log pay and benefits per adjusted admission. Less intuitive were the positive and significant coefficients that obtained for RN supply/competition and average occupancy of hospitals in the local market area. Several significant differences also obtained among hospitals in different regions and ownership categories.

Controlling for environmental and hospital organizational characteristics, the linear turnover rate term exhibited both a positive and statistically significant relationship with log of personnel costs per adjusted admissions ($p < .01$). These results provide initial support for hypothesis 1 which predicted greater operating inefficiencies in those hospitals that experienced high RN turnover rates. To assess the marginal contribution of turnover rate to explaining personnel costs, we applied a standard F test to the marginal contribution to the model R^2 resulting from the addition of the turnover variable to the model after all control variables had been included.[1] Results of this test suggested that the marginal contribution of turnover was significant at $p < .05$ ($F = 5.65$).

To examine whether turnover assumed a non-linear relationship with operating efficiency, the polynomial (squared) form of the turnover rate variable was added to the basic model. Results from Model 2 suggest that while the turnover rate variable continued to assume a positive and statistically significant association with log personnel and benefit costs per adjusted admission, the polynomial term was not significant. Further, the F test to assess marginal contribution of the linear and polynomial expressions of turnover rate was not statistically significant ($F = 1.35$).

These results fail to support the thesis that the relationship between organizational turnover and operating efficiency is curvilinear.

Insert Table 4 About Here

Table 4 also displays the results of the analysis of turnover rate on non-personnel, operating costs per adjusted admission. Model 1 was significant at $p < .0001$, but accounted for less variance in the dependent variable than the model explaining personnel and benefit costs per adjusted admission (.48 adjusted R^2). Six of the seventeen environmental and hospital controls displayed a positive and significant association with non-personnel operating costs per adjusted admission. Average length of stay, teaching status, RN wage rate, urban location, and RN supply/competition were significant predictors of the dependent variable. Unlike the previous model, however, occupancy rate was not a significant predictor of the dependent variable. In addition, for-profit hospitals, relative to secular not-for-profit hospitals, experienced higher non-personnel operating costs, a finding opposite that of the previous analysis on payroll and benefits per adjusted admission.

The linear form of turnover rate contained in Model 1 displayed a positive and statistically significant ($p < .001$) relationship to non-personnel operating expenses per adjusted admission. The marginal increase in explained variance resulting from the addition of the turnover rate variable was highly significant at $p < .001$ ($F = 14.45$). These results provide further support for Hypothesis 1 which predicted a positive and linear relationship between turnover rates and operating inefficiencies. When the polynomial form of the turnover rate variable was added to the model (Model 2), the linear form of the turnover rate variable continued to maintain a statistically significant association with the dependent variable. However, the polynomial term was not significant. Again, these results suggest lack of support for Hypothesis 2.

Hypotheses 3 and 4 predicted that the strength of turnover on hospital efficiency would be differentially felt in hospitals of different size and technological complexity. The second phase of

the analysis, therefore, was conducted to assess whether or not the effects of turnover on hospital efficiency were stronger in different types of institutions. A subgrouping approach to assessing moderating effects is thought to be appropriate when evaluating hypothesized differences in the strength (as opposed to form) of a relationship (Arnold 1982) and provides a more straightforward means of assessing the "practical importance" of an interaction (Cohen and Cohen 1975, Pedhazur 1982). The basic model, containing environmental, hospital and the linear turnover rate variables, was applied separately to different subsets of observations organized around different categories of hospital size and teaching status. The full sample was partitioned by variable category (e.g., small, medium, and large hospitals) and the criterion variable removed from the model in order to perform the subset analysis. For example, to assess whether hospital size moderates the turnover-efficiency relationship, the sample was subset into three groups of hospitals corresponding to the following categories: less than 100 beds, 100-300 beds, and more than 300 beds. The full model, minus the bed size variable, was then run for each of these three subsamples. Turnover coefficients were then compared across subsamples and tests of the differences in partial correlation coefficients conducted.[2] Results of these analyses are displayed in Table 5. Only the coefficients for the turnover rate variable are displayed, although these coefficients reflect the efficiency-turnover relationship net of the effects of environmental and hospital characteristics.

Insert Table 5 About Here

Hypothesis 3 posited that the effects of turnover rate on hospital operating efficiency would be stronger in teaching than in non-teaching hospitals. This hypothesis was not supported. In fact, while RN turnover rate in non-teaching hospitals exhibited a statistically significant association with both personnel costs per adjusted admission and non-personnel, operating costs per adjusted admission, turnover rate was unrelated to both these efficiency measures in teaching institutions. Z-tests applied to assess the relative magnitude of turnover effects in the teaching and non-teaching hospital models confirm that turnover effects were indeed stronger in non-

teaching institutions.

Subset analyses regarding the moderating effects of hospital size also revealed findings that departed somewhat from our predictions. Hypothesis 4 predicted that the effects of RN turnover would be more strongly felt in smaller hospitals relative to larger hospitals. Consistent with Hypothesis 4, turnover rates in small hospitals appear to have a statistically significant effect on both pay and benefits per adjusted admission and non-payroll operating costs per adjusted admission. Turnover was not statistically significant in the models run for medium size hospitals. Apparently, as hospitals move from the smallest size category to the midrange size category, turnover has a decreased impact on hospital operating efficiency. However, the models applied to the largest hospital bedsize category reveal that for non-payroll, operating expenses per adjusted admission, turnover again has a positive and significant effect. Z-tests comparing the relative strength of the partial correlation coefficients across the three subgroups corroborate these findings. Thus, it appears that turnover does operate differentially on hospital operational efficiency across size categories. However, the pattern of this relationship does not conform strictly to that proposed in Hypothesis 4.

DISCUSSION AND CONCLUSIONS

Economic models of hospital efficiency emphasize supply and demand characteristics. For example, the importance of case mix and length of stay in predicting cost per adjusted hospital admission is well documented in the literature (Robinson and Luft 1988). Our findings extend these models by suggesting that organizational or human resource factors such as turnover of registered nurses have a significant marginal effect on hospital costs even after these other sources of variation are controlled.

In general, our findings support the long-held assumption that nursing turnover is costly to the institution. A positive and linear relationship between turnover rates and hospital efficiency was detected for both personnel costs and non-personnel operating costs in a sample of 407 hospitals. Conversely, no support was found for the thesis that a curvilinear relationship exists

between turnover rates and organizational efficiency. This pattern of findings is consistent with individual level studies of turnover and their effects on organizational costs, suggesting a degree of isomorphism between organizational and individual level analyses of the turnover phenomenon. However, it may be premature to conclude that turnover at the organization level is simply an aggregate function of individual level turnover and its consequences. The results of our study also suggest that the relationship between turnover rates and organizational efficiency differs as a function of at least two contextual attributes of organizations: size and technology. The moderating effects of these contextual variables on the turnover rate-organizational efficiency relationship may not have an analog at the individual level of analysis.

The subset analysis revealed that turnover was unrelated to either measure of efficiency in hospitals characterized by high complexity, but significantly related to decreased efficiency in hospitals of low complexity. The findings are inconsistent with Hypothesis 3. Perhaps, having a residency program tends to dilute the effect of turnover on efficiency by providing additional staff resources and stability of cultural norms in the form of a substitutable or alternative work force. These physicians-in-training may easily assume, for example, some of the tasks that registered nurses normally handle, thus providing continuity in the work process when turnover rates are high.

Consistent with Hypothesis 4, turnover was inversely associated with efficiency in small hospitals for both personnel and non-personnel operating costs. Although turnover was not expected to relate to efficiency in large hospitals, it did for non-personnel operating costs. It is not surprising that small hospitals would be adversely affected by turnover as the effects of losing a few nurses from a small staff will assume greater significance than if more nurses exit from a larger staff. However, large hospitals are more likely to have union contracts which may specify staffing ratios within the hospital. In order to meet these obligations, administrators are forced to spend more resources on recruitment of new staff. Some of these recruitment strategies are expensive (e.g. bonuses, other enticements, use of contract services) and these costs are reflected in operating costs of the institution.

Alternatively, both larger hospitals and those which are technologically more complex also have more slack (Bloom et al. 1990; Bluedorn 1982). When there are greater staff resources than needed, substitution of personnel can occur and in the short run will not effect the efficiency of the organization. If shortages occur over long periods of time, however, reductions of morale may occur which may lead to additional turnover.

Contrary to recent theoretical discussions in the literature that low levels of turnover can be as dysfunctional as high levels, our data indicate that turnover is linearly related to hospital efficiency. Low rates of turnover are associated, in other words, with higher efficiency in hospital operations. It was suggested that low rates might be dysfunctional due to retention of employees whose voluntary exiting might substitute for involuntary exiting, thus resulting in an influx of new ideas and energy into the organization - negative entropy. Perhaps the existence of highly stable and stagnant staffs are not as wide spread as believed. It is also likely that public organizations, where involuntary exiting is less common and where budget cutting (cutbacks) is more likely to occur, are a better organizational type to look at as an instance of this problem. It is also possible that the problems caused by higher rates of turnover in some parts of the organization actually mask the deleterious effects of lower rates occurring in other work units within the organization.

Results of the organization level analyses indicated that turnover affects hospital operating costs to a greater degree than personnel costs. This may reflect the crucial role of registered nurses in the production of patient care services in the hospital. Registered nurses regulate the implementation of physician orders for patient care and have direct control over the schedule, use of ancillary services and treatments involved in providing patient care. A higher RN turnover rate could lead to several staffing situations that could decrease the efficiency of hospital care. First, there could be more new nursing staff or temporary registry staff to fill in for vacant positions. This staff would not have ongoing working relationships with other hospital personnel and would be unfamiliar with the internal work processes specific to the hospital organization. Second, if vacancies due to high turnover rates are not readily filled, high workloads for staff registered nurses could lead to a breakdown in the usual work processes due to understaffing pressures.

These staffing scenarios could result in wastage of supplies, less than optimal use of ancillary services, poor communication among hospital personnel and duplication of procedures, all of which could lead to less efficient production of health care as reflected in higher operating costs.

In a broader sense, the findings of this study suggest that human resources management may be integrally linked to objectives of cost efficiency and productivity. In the health care industry, in particular, emphases on human resources management and cost containment are often at odds and are portrayed in somewhat polarized terms. For example, it is believed that attention to providing hospital employees with greater decision making autonomy, flexibility in work conditions, and more organic job designs are antithetical to efficiency. Our findings, however, suggest that such strategies, particularly those aimed at retaining nurses, may improve efficiency in the hospital setting.

Because the study is cross-sectional, however, the possibility exists that a reverse causal sequence is operating. An alternative explanation suggests that higher turnover rates among nurses in hospitals are indicative of organizational decline as expressed in poor levels of productivity. That is, turnover may not cause operating inefficiencies as much these inefficiencies may be proxies for poor management or organizational health which lead to higher turnover. Although plausible, it should be noted that the literature on organizational decline focuses on exits among the management staff of organizations as opposed to production employees. Further, hospital management, unlike management of other organizations, probably has less direct control over production efficiencies since most of the production in health care organizations is the responsibility of autonomous or semi-autonomous professional workers.

The issue of causality aside, turnover has been linked to an organization's general health and effectiveness (Pfeffer and O'Reilly 1987; Scott and Shortell 1988). The positive relationship between high turnover rates and high operating costs found in this study provides evidence that organizations with high turnover rates are fiscally less healthy. High turnover rates if continued over long periods, and exacerbated by high RN vacancy rates, could result in decreased effectiveness in providing health care as well as less efficient production of services. Extended

periods of high vacancy rates can also have deleterious effects on the nursing staff's morale leading to either decreased job satisfaction or burn out. This becomes increasingly likely when the nursing staff must work frequent double shifts or continuously spend time orienting new and/or temporary staff. Poor morale and tired staff can also lead to the less efficient production of services.

Future research should explore other contextual and structural attributes that might moderate the effects of turnover rate on organizational operating efficiency. Those that are deserving of particular attention include organizational age or life cycle stage, professionalization or skill level of the work force, and environmental conditions related to the competitive climate and labor supply effecting organizational operations. Finally, consideration should be given to applying the test of our model to other types of organizations. While the focus on one industry (hospitals) serves to control for a number of exogenous factors affecting the turnover-efficiency relationship, generalizing findings to other types of organizations may be problematic. Specifically, there may be attributes of health care organizations and/or nurses that are peculiar to hospitals and the health care sector. For example, with the exception of public education, there are few organizations in which employees performing core functions are accountable to other professionals working in the organization (physicians), organizational management, and to external professional norms and standards. To the extent that turnover among registered nurses is disruptive to this rather baroque system of accountability, one must consider whether or not analogous situations in other types of organizations exist and, secondly, whether or not the dynamics between organizational turnover and operating efficiencies are similar.

The current study has not focused specifically on the processes by which turnover rates and organizations affect operating efficiency. Theoretically, these explanations point to a disruption of the production process, entropy, and/or diversion of resources to control or pattern maintainence functions as opposed to production. Because of data limitations, these processes could not be explicitly modeled. Additional research needs to focus attention on these theoretical process constructs and their relationship to both turnover rates and organizational outcomes. Only then will we have confidence that the causal processes discussed in this paper are working in a manner

to link turnover rates to operational outcomes, and in a manner analogous to individual level exit behavior.

Nursing retention will present unique challenges to the management of hospitals and other health care organizations in the future. The capacity to recruit and retain those nurses qualified to carry out critical patient care functions, on the one hand, and the increasing pressures to achieve operating efficiencies, on the other, have historically operated as somewhat conflicting goals. As our findings demonstrate, however, high turnover rates among hospital RNs may directly influence hospital costs, thus providing health care managers with stronger direct incentives to implement strategies designed to reduce turnover rates through retention of staff RNs. The development and evaluation of such strategies are a clear priority for future research.

Endnotes

1. $$F = \frac{(R^2y.ab - R^2y.a)/b}{(1 - R^2y.ab)/(N - a - b - 1)}$$

Where $R^2y.ab$ is the incremental R^2 based on the regression containing the control and turnover rate variables. $R^2y.a$ is the R^2 based on the regression containing only the control variables. "a" and "b" are, respectively, the number of variables in the control variable set and the number of turnover variables (Cohen 1968).

2. Because hypotheses 3 and 4 argue that the strength (as opposed to form) of the turnover rate-organizational efficiency relationship will differ as a function of hospital context variables, we employed tests of the differences of partial correlation coefficients for different values of the moderator (Arnold 1982, Cohen and Cohen 1975). Two versions of the same test were used. The first is appropriate when comparing differences in degree of a relationship when the moderating variable has two values (e.g. teaching hospital vs. non-teaching hospital). This test takes the following form.

$$z = (z'_1 - z'_2) \Big/ \sqrt{\frac{1}{n_1 - 3} + \frac{1}{n_2 - 3}}$$

where z'_1 = Fisher's z transformation of partial correlation coefficient of turnover rate and organizational efficiency in group 1,

z'_2 = Fisher's z transformation of partial correlation coefficient of turnover rate and organizational efficiency in group 2,

n_1 = sample size in group 1,

n_2 = sample size in group 2, and

z is distributed N(0/1).

In the situation where more than three subgroups exist (small, medium, and large hospitals), the same test was applied to the three possible group pairings (e.g. small-large, large-medium, etc.).

TABLE 1

Variables, Measures and Descriptive Statistics
(N = 407)

Variable Name	Measure	Mean	S.D.
Turnover			
1. RN Turnover Rate	1980 Full-time Voluntary Turnover Rate	0.26	0.20
Hospital Characteristics			
2. Organization Size	Total Number of Beds Set-up and Staffed for Use	230.28	180.85
3. Hospital Ownership	Religious, Not-for-Profit	0.13	0.33
	Government	0.57	0.50
	Secular, Not-for-Profit (Reference)	0.24	0.43
	For-Profit	0.06	0.24
4. Teaching Hospital	Offers Residency Training Program (0 = no, 1 = yes)	0.24	0.43
5. Length of Stay	Average Hospital Length of Stay	9.18	9.85
6. Occupancy Rate	Average Occupancy	0.74	0.14
7. Case Mix	Medicare Case Mix Index	1.02	0.16
8. RN Wage Rate	Mean Starting Hourly Wage for Associate, Diploma and B.S. Graduates	7.45	0.84
Environmental Characteristics			
9. Region of Country	South	0.32	0.47
	West	0.09	0.29
	North Central	0.27	0.45
	North East (Reference)	0.32	0.47
10. Urban Location	Located in SMSA (0 = no, 1 = yes)	0.63	0.48
11. Regulatory Intensity	Regulatory Intensity Index of State	0.20	0.95
12. Per Capita Income	1980 Per Capita Income in County	9063.20	1857.73
13. Hospital Competition	Number of Hospitals in 15 Mile Radius of Focal Hospital	12.43	19.84
14. RN Supply	Number of RNs in County/Number of Hospital Beds in County	0.52	0.20
Hospital Operating Efficiency			
15. Personnel Costs/Admissions	Log Total Pay and Benefits/ Total Adjusted Admissions	2.95	1.20
16. Non-Personnel Operating Costs/Admissions	Log Total Operating Expenses - Pay and Benefits/Total Adjusted Admissions	2.82	1.18

TABLE 2

Turnover Rate by Hospital Size, Location, Ownership, and Teaching Status

	N	Mean Turnover Rate	Standard Deviation
All Sample Hospitals	407	0.26	0.20
Size			
Greater than 300 beds	115	0.24	0.11
100-300 beds	173	0.25	0.15
Less than 100 beds	119	0.29	0.30
Location (Region)			
South	130	0.30	0.23
West	37	0.30	0.20
North Central	111	0.26	0.20
Northeast	129	0.22	0.15
Location (SMSA)			
Urban	258	0.27	0.19
Rural	149	0.25	0.22
Ownership			
Religious, Not-for-Profit	52	0.30	0.24
For Profit	26	0.32	0.24
Not-for-Profit	233	0.25	0.18
Government	96	0.26	0.21
Teaching Hospital			
Residency Training Program	99	0.29	0.17
No Residency Training Program	308	0.25	0.21

Table 3
Pearson Correlation Matrix[1]

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	Log personnel costs/adj. adm.	-																					
2	Log operating costs/adj. adm.	79	-																				
3	RN turnover rate	06	20	-																			
4	Number of beds	48	35	-05	-																		
	Ownership																						
5	Religious	06	06	07	06	-																	
6	For-Profit	-13	14	08	-11	-10	-																
7	Government	-16	-16	01	-12	-21	-15	-															
8	Secular nfp	16	03	-09	12	-44	-30	-64	-														
9	Teaching Hospital	46	36	07	53	02	-15	-11	15	-													
10	Length of stay	42	29	-04	12	-02	-02	02	00	03	-												
11	Occupancy rate	37	24	-17	44	11	-14	-18	15	24	11	-											
12	Casemix	26	25	00	37	10	-02	-11	04	28	-04	27	-										
13	Average Wage rate	30	32	07	14	11	10	-10	-03	15	-02	-03	10	-									
	Region																						
14	South	-34	-13	12	-09	-03	23	29	-35	-18	-11	-07	-17	-25	-								
15	West	-01	07	07	-15	08	09	03	-12	-06	-08	-26	01	38	-22	-							
16	North Central	00	-09	-01	01	03	-14	-03	07	-01	02	-12	-04	09	-42	-19	-						
17	North East	35	17	-16	17	-06	-16	-28	35	23	15	35	21	-08	-47	-22	-42	-					
18	Urban	49	52	03	39	15	09	-31	12	38	-01	26	23	31	-17	01	-06	22	-				
19	Regulatory	38	20	-10	14	-01	-18	-27	32	23	10	27	21	16	-66	07	03	59	24	-			
	Intensity																						
20	Per Capita income	46	46	01	33	06	14	-33	18	25	01	21	23	46	-32	14	10	13	60	29	-		
21	# hosp/15mi radius	40	38	04	29	04	08	-21	11	29	01	19	16	46	-20	08	-05	20	41	32	55	-	
22	RNs/hosp beds county	47	42	-01	36	01	03	-30	23	32	-05	35	35	25	-39	09	-14	47	53	42	62	33	-

[1] decimal points ommitted

TABLE 4

OLS Regression Results:
Effects of RN Turnover Rate on Hospital Operating Efficiency
(Unstandardized Regression Coefficients, Standard Errors in Parentheses[a])

	Variable	Log Personnel Costs/Adj. Admissions				Log Operating Costs/Adj. Admissions			
		Model 1		Model 2		Model 1		Model 2	
		B	S.E	B	S.E.	B	S.E.	B	S.E.
1.	Turnover Rate[a]	.11**	(.03)	.11**	(.04)	.17***	(.04)	.21***	(.05)
2.	Turnover Rate Squared[a]	--.--	--.--	.001	(.07)	--.--	--.--	-.11	(.08)
3.	Organization size	.01E2**	(.04E3)	.01E2**	(.04E3)	.01E3	(.05E3)	.03E4	(.05E3)
4.	Hospital Ownership								
	Church	-.02E1	(.02)	-.02E1	(.02)	-.06E1	(.02)	-.05E1	(.02)
	Government	.03	(.02)	.03	(.02)	.01	(.02)	.01	(.02)
	For Profit	-.07*	(.03)	-.07*	(.03)	.07*	(.03)	.07*	(.03)
5.	Teaching	.07***	(.02)	.07***	(.02)	.06**	(.02)	.06**	(.02)
6.	Length of Stay	.01***	(.07E2)	.08E1***	(.07E2)	.06E1***	(.07E2)	.06E1***	(.07E2)
7.	Occupancy Rate	.15**	(.06)	.15**	(.06)	.09	(.06)	.08	(.06)
8.	Case Mix	.02	(.04)	.02	(.04)	.08	(.05)	.08	(.05)
9.	Avg. Wage (RNs)	.02*	(.01)	.03*	(.01)	.02*	(.01)	.02*	(.01)
10.	Region of County								
	South	-.05	(.03)	-.05	(.03)	.03	(.03)	.03	(.03)
	West	-.02	(.03)	-.02	(.03)	.03	(.03)	.03	(.03)
	North Central	-.02	(.02)	-.02	(.02)	-.06E3	(.02)	-.02E1	(.02)
11.	Urban	.08***	(.02)	.08***	(.02)	.10***	(.02)	.10***	(.02)
12.	Regulatory Intensity	.01	(.01)	.01	(.01)	.02E2	(.01)	.02E1	(.01)
13.	Per Capita Income	.08E4	(.06E4)	-.08E4	(.05E4)	.05E4	(.06E4)	.05E4	(.06E4)
14.	Hospital Competition	.08E2**	(.04E2)	.08E2	(.04E2)	.08E2	(.05E2)	.08E2	(.05E2)
15.	RN Competition	.12**	(.05)	.12*	(.05)	.14**	(.06)	.14*	(.06)
	Intercept	2.32***	(.09)	2.34***	(.09)	2.19***	(.10)	2.26***	(.10)
	Adj. R^2	0.61		.61		.48		.48	
	df 18/388	19/387		18/388				19/387	
	F Value	36.73***		34.7***		21.74***		20.8***	

[a] deviation from sample mean value used to reduce collinearity between linear and quadratic term

* $p < .05$ ** $p < .01$ *** $p < .001$

Table 5

OLS Regression Results:
Moderated Effects of Nursing Turnover Rate on Hospital Operating Efficiency

	Dependent Variable	N	Adj. $R^{(2)}$	Turnover Rate $B^{(3)}$	S.E.$^{(3)}$	T-Value
Hospital Size						
Large (>300 beds)	PB$^{(1)}$	115	.65	.07	.09	0.72
	OP$^{(2)}$	115	.44	.27	.11	2.56**
Medium (100-300)	PB	173	.71	.01	.06	0.22
	OP	173	.55	.10	.07	1.45
Small (<100 beds)	PB	119	.44	.09	.05	1.82*
	OP	119	.40	.12	.05	2.25**
Medical Residency Training Program						
Teaching Hospital$^{(4)}$	PB	99	.59	-.03	.09	-0.28
	OP	99	.41	.04	.10	0.41
Non-Teaching Hospital	PB	308	.55	.08	.04	2.29**
	OP	308	.43	.16	.04	4.04***

(1) Log Pay and Benefit Costs per Adjusted Admission

(2) Log Operating Costs per Adjusted Admission

(3) Turnover Rate Coefficients Control for Hospital & Environmental Characteristics. Full Model Results Available from Authors.

(4) For-Profit Hospital Variable Omitted from Model Applied to Teaching Hospitals. No For-Profit Teaching Hospitals Exist in the Sample.

* $p < .10$
** $p < .05$
*** $p < .01$

APPENDIX

Staff Nurse Turnover

For each of the quarters during the reporting period (October 1, 1979 through March 31, 1981), please supply the information requested for full- and part-time nursing personnel in the categories listed to the left.

	Reporting Year 1979-80								Reporting Year 1980-81				
	Oct. 1, 1979 - Dec. 31, 1979		Jan. 1, 1980- Mar. 31, 1980		Apr. 1, 1980- June 30, 1980		July 1, 1980- Sept. 30, 1980		Oct. 1, 1980- Dec. 31, 1980		Jan. 1, 1981- Mar. 31, 1981		
	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
REGISTERED NURSES													
A. Total budgeted positions for staff nurses													Card 13 (1-9)
1. Total	___	___	___	___	___	___	___	___	___	___	___	___	10-57
2. New this quarter	___	___	___	___	___	___	___	___	___	___	___	___	Card 14 (1-9) 10-45
B. Staff nurses on payroll													Card 15 (1-9)
1. Total	___	___	___	___	___	___	___	___	___	___	___	___	10-57
2 Newly hired this quarter	___	___	___	___	___	___	___	___	___	___	___	___	Card 16 (1-9) 10-45
C. Staff nurse turnover													
1. Promotion or change in status (e.g. full to part-time)	___	___	___	___	___	___	___	___	___	___	___	___	Card 17 (1-9) 10-45
2. Hospital terminated for cause or failure on State board examination	___	___	___	___	___	___	___	___	___	___	___	___	Card 18 (1-9) 10-45
3. Retired, died, or left for disability	___	___	___	___	___	___	___	___	___	___	___	___	Card 19 (1-9) 10-45
4. Voluntarily resigned for reasons other than the three above	___	___	___	___	___	___	___	___	___	___	___	___	Card 20 (1-9) 10-45

REFERENCES

Abelson, M.A., & Baysinger, B.D. 1984. Optimal and dysfunctional turnover: Toward an organizational level model. *Academy of Management Review*, 9: 331-341.

Allen, M.P., Panian, S.K., & Lotz, R.E. 1979. Managerial succession and organizational performance: A recalcitrant problem revisited. *Administrative Science Quarterly*, 24: 167-180.

Arnold, H.J. 1982. Moderator variables: A clarification of conceptual, analytic, and psychometric issues. *Organizational Behavior and Human Performance*, 29: 143-174.

Baysinger, B.D., & Mobley, W.H. 1983. Employee turnover: Individual and organizational analyses. In K.M. Rowland & G.R. Ferris (Eds.), *Research in personnel and human resources management*, 269-319. Greenwich, Conn.: JAI Press.

Bluedorn, A.C. 1982. The theories of turnover: Causes, effects, and meaning. In S. Bacharach (Ed.), *Research in the sociology of organizations*, 75-128. Greenwich, Conn: JAI Press.

Carr, J.W., & Feldstein, P.J. 1967. The relationship of cost to hospital size. *Inquiry*, 4 (1): 45-65.

Cawsey, T.F., & Wedley, W.C. 1979. Labor turnover costs: Measurement and control. *Personnel Journal*, 58: 90-95.

Chattergee, S., & Price, B. 1977. *Regression analysis by example*. New York: John Wiley & Sons.

Cohen, H.A. 1967. Variation in cost among hospitals of different sizes. *Southern Economic Journal*, 33: 355-366.

Cohen, J., & Cohen, P. 1975. *Applied multiple regression/correlation analysis for the behavioral sciences*. Hillsdale, NJ: Erlbaum.

Daft, R.L., Becker, S.W. 1978. *Innovation in organizations*. New York: Elsevier.

Dalton, D.R., Krackhardt, D.M., & Porter, L.W. 1981. Functional turnover: An empirical assessment. *Journal of Applied Psychology*, 66: 117-132.

Dalton, D.R., & Todor, W.D. 1979. Turnover turned over: An expanded and positive perspective. *Academy of Management Review*, 4 (2): 225-235.

Dalton, D.R., & Todor, W.D. 1982. Turnover: A lucrative hard dollar phenomenon. *Academy of Management Review*, 7: 212-218.

Dane, J.H. 1972. A model for estimating nursing turnover costs. *Hospitals, JAHA*, 46 (16 May): 65-69.

Donovan, L. 1980. The shortage. *RN*, 8: 21-27.

Dreher, G.F. 1982. The role of performance in the turnover process. *Academy of Management Journal*, 25: 137-147.

Eitzen, D.S., & Yetman, N.R. 1972. Managerial change, longevity and organizational effectiveness. *Administrative Science Quarterly*, 17: 110-116.

Federal Register. 1983. *HCFA: Case mix index*. (1 September): 39847-39870.

Finch, L.E., & Christianson, J.B. 1981. Rural hospital costs: An analysis with policy implications. *Public Health Reports*, 96 (5): 423-433.

Fottler, M.D., Hernandez, S.R., & Joiner, C.L. 1988. *Strategic management of human resources in health services organizations*. New York: John Wiley & Sons.

Gouldner, A.W. 1954. *Patterns of industrial bureaucracy*. Glencoe, Ill.: The Free Press.

Grusky, O. 1963. Managerial succession and organizational effectiveness. *American Journal of Sociology*, 69: 21-31.

Hadley, J. 1983. Teaching and hospital costs. *Journal of Health Economics*, 2 (1): 75-79.

Heneman, H.G. 1969. Toward a general conceptual system of industrial relations. How do we get there? In G.G. Somers (Ed.), *Essays in industrial relations theory*, 3-24. Ames, Iowa: Iowa State University Press.

Jeswald, T.A. 1974. The cost of absenteeism and turnover in a large organization. In W.C. Hamner & F.L. Schmidt (Eds.), *Contemporary problems in personnel: Readings for the seventies*, 352-357. Chicago: St. Clair Press.

Johnson, W.L., & Vaughn, J.C. 1982. Supply and demand relations and the shortage of nurses. *Nursing and Health Care*, 3 (9, November): 497-507.

Joskov, P.L. 1980. The effects of competition and regulation on hospital bed supply and the reservation quality of the hospital. *Bell Journal of Economics*, 11 (2): 421-447.

Katz, D., & Kahn, R.L. 1978. *The social psychology of organizations*. 2nd Ed. New York: John Wiley & Sons.

Leviatan, U. 1978. Organizational effects of managerial turnover in kibbutz production branches. *Human Relations*, 31: 1001-1018.

Long, J.R. 1951. Labor turnover under full employment. Birmingham, Al.: Research Board, Faculty of Commerce and Social Science, University of Birmingham.

Luft, H.S. & Merki, S.C. 1985. Competitive potential of hospitals and their neighbors. *Contemporary Policy Issues*, Winter: 89-102.

McEvoy, G.M., & Cascio, W.F. 1987. Do good or poor performers leave? A meta analysis of the relationship between performance and turnover. *Academy of Management Journal*, 30: 744-762.

Mirvis, P.M., & Lawler, E.E. 1977. Measuring the financial impact of employee attitudes. *Journal of Applied Psychology*, 62 (1): 1-8.

Mobley, W.H. 1982. *Employee turnover: Causes, consequences, and control*. Reading, Mass.: Addison-Wesley.

Morrisey, M.A., Conrad, D.A., Shortell, S.M., & Cook, K.S. 1984. Hospital rate review: A theory and empirical review. *Journal of Health Economics*, 3 (1): 25-47.

Muchinsky, P.M., & Morrow, P.C. 1980. A multidisciplinary model of voluntary employee turnover. *Journal of Vocational Behavior*, 17: 263-290.

Muchinsky, P.M., & Tuttle, M.L. 1979. Employee turnover: An empirical and methodological assessment. *Journal of Vocational Behavior*, 14: 43-77.

Neter, J., & Wasserman, W. 1985. *Applied linear statistical models*. 2nd ed. Homewood, Ill.: Dow Jones-Irwin.

Pedhazur, E.J. 1982. *Multiple regression in behavioral research*. New York: Holt, Rinehart & Winston.

Pfeffer, J., & O'Reilly, C.A. 1987. Hospital demography and turnover among nurses. *Industrial Relations*,

Porter, L.W., & Steers, R.M. 1973. Organizational, work and personal factors in employee turnover and absenteeism. *Psychological Bulletin*, 80: 151-176.

Price, J.L. 1977. *The study of turnover*. Ames, Iowa: Iowa State University Press.

Price, J., & Mueller, C. 1981. *Professional turnover: The case of nurses*. New York: S.P. Medical and Scientific Books.

Rakich, J., Longest, B., & O'Donovan, T. 1977. *Managing health care organizations*. Philadelphia: W.B. Saunders.

Robinson, J.C. & Luft, H.S. 1985. The impact of hospital market structure on patient volume, average length of stay and cost of care. *Journal of Health Economics* 4: 333-356.

Robinson, J.C., & Luft, H.S. 1988. Competition, regulation, and hospital costs, 1982 to 1986. *Journal of American Medical Association*, 260 (18): 2676-2681.

Scott, W.R., & Shortell, S.M. 1988. Organizational performance: Managing for efficiency and effectiveness. In S.M. Shortell & A.D. Kaluzny (Eds.), *Health Care Management*, 2nd Ed. New York: John John Wiley & Sons & Sons.

Seybolt, J.W., & Ross, S.C. 1984. The retention of high performing personnel. Proceedings: 16th Annual Meeting of the American Institute for Decision Sciences.

Sheridan, J.E. 1985. A catastrophe model of employee withdrawal leading to low job performance, high absenteeism and job turnover during the first year of employment. *Academy of Management Journal*, 28: 88-109.

Sloan, F.A., & Steinwald, B. 1980. *Insurance regulation and hospital costs*. Lexington, MA: D.C. Heath.

Sloan, F.A., Feldman, R.D., & Steinwald, B. 1983. Effects of teaching on hospital costs. *Journal of Health Economics*, 2 (1): 1-28.

Staw, B.M. 1980. The consequences of turnover. *Journal of Occupational Behavior*, 1: 253-273.

Staw, B.M., & Oldham, G.R. 1978. Reconsidering our dependent variables: A critique and empirical study. *Academy of Management Journal*, 21: 539-559.

Terborg, J.R., & Lee, T.W. 1984. A predictive study of organizational turnover rates. *Academy of Management Journal*, 27 (4): 793-810.

Tuchi, B., & Carr, B. 1971. Labor turnover. *Hospitals, JAHA*, 46 (June): 75-78.

Urban, N., & Bice, T. 1980. A methodology for measuring regulatory intensity in the hospital industry. Unpublished Manuscript.

Wallace, M.J. 1983. Methodology, research practice, and progress in personnel and industrial relations. *Academy of Management Review*, 8: 6-13.

Watts, C.A.,& Klastorin, T.D. 1980. The impact of case mix on hospital costs: A comparative analysis. *Inquiry*, 17 (4): 357-367.

Weisman, C., Alexander, C. & Chase, G. 1980. Job satisfaction and turnover among hospital nurses: A longitudinal study. *Health Services Research*, 15 (4): 341-364.

Weisman, C., Alexander, C., & Chase, G. 1981. Determinants of hospital staff nurse turnover. *Medical Care*, 19: 431-443.

Wells, W.P., & Pelz, D.C. 1966. *Scientists in organization*. New York: John Wiley & Sons.