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IMPACT OF NURSE STAFFING RATIOS ON PATIENT MORTALITY RATES

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Abstract

The research does not consistently show statistically significant inverse correlations between levels of nurse staffing and hospital mortality. The link can be effectively addressed in critical care settings owing to the presence of patients with severe medical conditions and high death rates, the need for intensive nursing care, and the availability of specific tools to compensate for individual risk factors. This research presents a literature analysis examining the relationship between staffing levels of critical care nurses and patient mortality. A comprehensive search was conducted on major electronic databases, such as MEDLINE, EMBASE, and the Cumulative Index of Nursing and Allied Health Literature. The search phrases included critical/intensive care, health care quality, hospital mortality, personnel staffing and scheduling, and hospital nursing staff. The examined studies did not provide any clear evidence of the influence of nurse staffing levels on patients' hospital mortality in critical care settings. Methodological obstacles that may have hindered accurate evaluation of the relationship include difficulties in measuring exposure status and the presence of uncontrolled confounding variables. The absence of correlation also suggests that hospital mortality may not be sufficiently responsive to identify the impacts of inadequate nurse staffing levels in critical care environments.

Keywords: mortality rate, nurse, review, hospital nursing staff, patient.

1. Introduction

Nursing is a crucial determinant of the quality of patient care in hospitals. However, it is still difficult to show the measurable effects of excellent nursing care in order to make their contribution more apparent. Prior study has mostly focused on the negative consequences experienced by patients as a result of the level of care given by nurses (Flood & Diers 1988). Mortality is widely regarded as the most reliable and frequently utilized measure for evaluating the quality of inpatient care in previous studies (Pierce 1997, Buerhaus & Needleman 2000). However, it has faced criticism for its limited ability to capture the overall performance of hospitals as an outcome (Dubois et al. 1987, Jessee & Schranz 1990, Brooten & Naylor 1995). Nevertheless, with the recent rise in the acuity level of hospitalized patients, it is possible that

fatality rates have become more responsive to the quality of treatment delivered in the hospital, particularly in cases when the mortality rate is already high.

Staffing levels are considered the fundamental issue that directly impacts the quality of nursing care and patient outcomes. Insufficient staffing not only hinders the delivery of planned care, but also increases the risk of human mistake, which may endanger patient safety (Beckmann et al. 1998). Previous study on the correlation between nurse staffing and patient care outcomes, namely patient mortality, has not shown definitive results despite ongoing interest in the topic. The research conducted by Knaus et al. in 1986 initially suggested a potential connection between risk-adjusted death rates and the presence of 'no difficulty in procuring appropriate nurse staffing' among critical care patients.

A research conducted by Hartz et al. in 1989 found evidence of a negative correlation between the amount of nurse staffing and death rates in hospitals. The study focused on examining the impact of hospital features on mortality rates. However, other research (Silber et al. 1995, Blegen et al. 1998, Bond et al. 1999, Robertson & Hassan 1999) did not find this connection. Recent research examining differences in mortality rates amongst hospitals in the United States of America (USA) did not uncover a significant correlation, according to Needleman et al. (2002) and Cho et al. (2003). However, Aiken et al. (2002, 2003) provided evidence that supports this link.

The most recent systematic analysis on this subject, conducted in acute care hospital settings (excluding critical care units), did not find consistent favorable benefits of higher nurse staffing levels on mortality when proper adjustments for competence and patient mix were not made (Lang et al. 2004). Evaluating the impact of nurse staffing levels on patient outcomes may be challenging in randomized controlled trials owing to logistical constraints and ethical considerations. Thus, doing a review of observational studies is the most optimal approach to investigate this subject and provide valuable information for designing future investigations. The ICU is an appropriate healthcare environment to investigate the link between high patient acuity and fatality rates, high intensity of necessary nursing care, and the availability of standardized procedures to alter individual mortality risk.

This research aims to provide a comprehensive overview of existing literature and conduct a meta-analysis to examine the correlation between nurse staffing levels and patient mortality in critical care settings, both during and after treatment.

2. Nurse staffing on patient mortality

This study was done to examine the influence of nurse staffing on patient mortality in critical care settings as reported in the published literature. Nine observational studies were examined, and the findings from these studies did not provide sufficient evidence to support the idea that there is a direct relationship between nurse staffing levels and the death of critically ill patients throughout their hospital stay. While the unadjusted risk ratio suggested that there is a negative relationship between nurse staffing and hospital mortality (meaning that more nurse staffing is linked to lower mortality rates), this relationship was not seen in eight out of the nine studies that took into account other variables.

One significant constraint of this evaluation is the limited number of primary papers that were included. Furthermore, four researches originated from the same geographic area in the United States, namely Maryland. While there were variations in the patient group across two of the four researches conducted in Maryland, all four investigations used a comparable technique. The authors of these four studies have acknowledged several limitations, including the possibility of coding errors in administrative databases, incomplete adjustment for patient mortality risk, concerns about the validity and reliability of nurse staffing measures, and unaccounted effects of nursing skill-mix and pre- and post-ICU care. In addition to limitations within individual research, the lack of consistency in defining nurse staffing metrics and variability in the sets of variables utilized in the analysis hindered the numerical integration of the data.

Aiken et al. (2003) found that for every additional patient assigned to a nurse, there was a 7% higher chance of dying within 30 days of being admitted to acute care settings. The average number of patients per nurse was five, and the overall mortality rate was 2.0%. The effect of increasing the number of patients assigned to each nurse is likely to be more significant in critical care units, since these units have both the lowest nurse-to-patient ratio (NPR) and the lowest patient survival rates among all acute care units.

Imposing limitations on the kind of unit also enhances the precision of measuring levels of exposure. Typically, decisions about the allocation of nurses are determined at the unit level. Assessing nurse staffing at a hospital level, rather than on a unit basis, may be too simplistic since it fails to differentiate between bedside nurses who directly interact with patients and other nurses employed by the institution. In recent research (Aiken et al. 2002), efforts were made to address this issue. However, it is possible that the problem may not be fully solvable, because combining personnel levels from different units might make it difficult to see the desired relationship.

In addition, due to the increased severity of patients' conditions, most intensive care units (ICUs) and other critical care sections are primarily staffed by registered nurses (RNs) with little support from nursing assistants (Blegen & Vaughn 1998). Therefore, by restricting the setting to critical care settings where Registered Nurses (RNs) are mostly employed, it would partially mitigate the possible confounding impact of nurse skill-mix.

Finally, information on case mix adjustment is often accessible in these types of environments. Controlling the effect of case mix is critical due to its significant impact on patient prognosis and personnel needs. Utilizing standardized instruments such as APACHE II or III (Knaus et al. 1985, 1991), Mortality Predictive Model (MPM) (Lemeshow et al. 1987), SAPS-II (Le Gall et al. 1993), or similar tools enables researchers to do patient risk adjustment during analysis.

3. Discussion

The examined studies used various measures of NPR, such as NPR during day or night shifts, averaging across all shifts, or examining if there is a decline in NPR in the evening. The reason for examining nurse staffing at nighttime is the heightened significance of nursing care when

there is a decline in medical and other staffing levels. The decision to use the NPR during the day as a relevant staffing metric was made because of the connection between the NPR during the day and the length of stay in the hospital (LOS) (Pronovost et al. 1999). Further investigation is necessary to determine the optimal metric for assessing nurse staffing levels in relation to timeliness.

Another issue with the nurse staffing assessment is the manner in which this metric was addressed in the study. Four research used dichotomous categories to classify the NPR, while three studies treated the NPR as a continuous variable. Dichotomization may occur because of the limited variability in this measure and/or the absence of a proportional or linear relationship between different exposure levels and the result. Person et al. (2004) provided a rationale for using classified nurse staffing levels based on the premise of unmet linearity. Establishing a specific threshold to distinguish between 'high' and 'low' staffing levels is subjective and there is no generally recommended figure for this (Lang et al., 2004). Consolidating the NPR from several initial categories into fewer levels assumes that there is little variation among the combined categories in terms of their effect on mortality. Verification of this hypothesis using the provided data would have ensured the suitability of the selected threshold levels

With the exception of three research, the duration of the study periods exceeded 32 months, reaching a high of 5 years. The appropriateness of using a single, unchanging metric of nurse staffing levels across an extended research period may be subject to scrutiny. Furthermore, using a combined unit-level metric for individual patients may result in bias, often referred to as the ecological fallacy. The act of combining data necessarily obscures differences among patients within the group. It is important to mention that the only research that discovered a separate connection between ICU staffing and mortality, while taking other factors into account, was a study conducted at a single medical center where staffing levels were assigned to each patient individually (Tarnow-Mordi et al. 2000).

The impact of unmeasured and/or uncontrolled confounding variables should not be underestimated. Ensuring comparability across ICUs in multi-centre research requires addressing key variations in possible confounding variables that are linked to both nurse staffing and patient mortality. These factors should be taken into consideration throughout the analysis. An example of a component that might complicate the situation is the level of medical personnel available. The study conducted by Pronovost et al. in 2002 demonstrated that this factor is independently linked to hospital mortality in ICU patients. If there is a relationship between high-intensity physician staffing (such as required intensivist consultation or closed ICU) and nurse staffing levels, it is possible that the association of interest may have been influenced by other factors until it has been corrected for. While the reviewed studies did not demonstrate this, it is possible that hospitals with high intensity medical staffing but low nurse staffing levels, without adjusting for medical staffing factors in the analysis, could inaccurately depict a reverse association between nurse staffing and mortality.

Furthermore, the significance of the contributions made by other staff members cannot be disregarded. Collaboration across different disciplines in the treatment of critically sick patients

in intensive care units (ICUs) is a common and expected practice. The lack of nurses may have been offset by the inclusion of extra ICU personnel from other healthcare fields, such as respiratory therapists and other allied healthcare specialists. The extent of contribution or distribution of work across different disciplines is likely to differ depending on the unit. Quantifying the staffing levels of professions other than nurses may be more challenging, which is why it may have been left unmeasured and unregulated. It is important to mention that the research which found a statistically significant independent connection was the one examining mortality in relation to staffing levels, not limited to nursing personnel (Tarnow-Mordi 2000).

Another significant variable that has to be accounted for is the patient's chance of death. The use of administrative databases did not enable the acquisition of highly dependable metrics for assessing the severity of medical problems. ICUs with a higher number of nursing personnel are likely to be the ones that handle the most critically sick patients who have a higher risk of fatality. Consequently, if patient risk is not adequately taken into account, ICUs with high staffing levels are likely to show greater fatality rates, even if the reverse is really the case. Out of the nine studies that were analyzed, only three of them used risk-adjusted mortality obtained using a systematic grading method. The other variables were derived from the administrative or project databases and were modified using multiple regression analysis. Measurement mistakes in confounding factors, even if they are not systematic, may lead to biased associations in either direction. This means that utilizing the crude estimate of patient mortality risk for risk adjustment can be a significant issue.

Moreover, as hospital mortality was selected as the primary outcome in all the ICU studies examined, the medical treatment patients received outside of the ICU might potentially be an additional confounding factor. Although some individuals recognized that 30-day mortality is often used as a benchmark for hospital mortality, the decision to focus on in-hospital mortality was made because of its direct correlation to the nursing care given during patients' hospitalization. The examined studies did not adequately differentiate or consider the treatments and care that patients received both within and outside of critical care settings. Excluding ICU death as a patient outcome in ICU research seems reasonable, as the choice to discharge patients from the ICU has a significant impact on the overall result. Nevertheless, failing to include the potential variations in pre-ICU or post-ICU treatments/care based on nurse staffing levels across various units in the research locations might introduce bias to the observed connection.

The evaluation of results in critical care has always concentrated on the measure of death. The benefits of using mortality data include the accessibility of the date and its objective definition that is not influenced by societal factors. The likelihood of underreporting or inaccurate reporting is quite improbable. Although other potential outcomes such as 'failure to rescue' and adverse events are believed to be more responsive to nurse staffing levels in certain patient groups (Unruh 2003), our analysis indicates that mortality may not be sufficiently responsive to measure the effect of nurse staffing levels. It is crucial to establish patient outcome measures that have strong and clear definitions, and can be feasibly collected across different institutions. In addition to mortality and adverse events, it is important to investigate outcomes

that demonstrate the beneficial effects of intensive nursing care in critical care settings (Brooks et al., 1995; Hayes et al., 2000; Black et al., 2001).

4. Conclusion

This evaluation recognized methodological obstacles in the kind of research examined: difficulties in accurately measuring nurse staffing levels, unaccounted for, inaccurately recorded, and/or uncontrolled variables that might affect the results, and the possibility that the chosen end measure (mortality) may not be sensitive enough. Without resolving these challenges and conducting research with rigorous scientific methodology, it is not possible to provide an impartial assessment of the impact of nurse staffing on patient outcomes.

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