ABSTRACT

A Cross-Sectional Study to Examine the Effects of the Nurse Work Environment on Outcomes of Very Low Birth Weight Infants

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Importance: Extensive variation in rates of mortality, and morbidity, including severe intraventricular hemorrhage, exists across NICUs. The neonatal nurse is essential to the care of very low birth weight infants in these units. Extensive evidence in the adult population supports the association of the nurse work environment, nurse qualifications and nurse staffing with patient outcomes. The relationship of these elements, at the NICU unit level, with the outcomes of in-hospital mortality, intraventricular hemorrhage and length of stay for very low birth weight infants, has not been previously evaluated.

Objectives: To examine the relationships among the nurse work environment, nurse qualifications and nurse staffing, within the neonatal intensive care units and VLBW outcomes.

Design, Setting and Patients: This cross-sectional secondary analysis linked data from the RN survey from the Multi-State Nursing Care and Patient Safety Study 2005-2008 to administrative state discharge data of VLBW infants with birth weights 500-1499 grams in California, Pennsylvania, New Jersey and Florida. The nurse work environment, nurse education, certification and patient-to-nurse ratios were aggregated to the hospital level from RN survey responses. Risk-adjusted odds ratios and incident rate ratios were determined by logistic regression and negative binomial regression.

Main Outcomes and Measures: The primary study outcomes were in-hospital mortality, severe intraventricular hemorrhage and length of stay.
Results: There were 17,771 VLBW infants in 170 NICUs. Mortality was 10.8%, severe intraventricular hemorrhage was 5.2% and length of stay 46 days, all varied by category of the work environment. The range of work environment scores across the NICUS was 1.93-3.79. Based on these scores NICUs were categorized as having poor, average and best work environments; 44 NICUs were categorized as best and 36 NICUs were categorized as poor. Patient-to-nurse ratios varied by work environment category. Proportions of BSN educated and nurses with specialty certification did not vary across work environments. In NICUs with poor vs. better environments mortality was 11% vs. 9.8%. In poor compared to better environments sIVH was 6.4% vs. 4.5%. Average length of stay in poor vs. better environments was 53 days and 36 days respectively. In regression models, controlling for patient and hospital characteristics (race, sex, insurance, NICU volume and hospital teaching status), each one unit (1 SD) increase in the work environment score was associated with a 4% lower odds of death (OR = 0.96, 95% CI 0.88-1.05, p=0.36), 23% lower odds of severe IVH (OR 0.88 95% CI 0.79-0.99, p= 0.043) and 4% shorter length of stay (OR 0.96, 95% CI 0.93-0.995, p=0.026). NICUs with the best work environments and higher proportions of BSN educated nurses were associated with lower odds of death (OR 0.94, 95% CI 0.89-0.99, p=0.045) and shorter lengths of stay (IRR 0.97, CI 0.94-0.99 p= 0.01) for very low birth weight infants.

Conclusions: These results indicate that outcomes of VLBW infants vary by the nurse work environment category. VLBW infants cared for in better work environments have significantly lower risk-adjusted rates of severe IVH and shorter lengths of stay. Improving the nurse work environment and increasing the proportion of BSN educated nurses are actionable interventions to improve nursing quality and reduce poor outcomes for very low birth weight infants in neonatal intensive care units.