Examining Infant Health Outcomes Impacted by South Carolina’s Regionalized System of Perinatal Care

Dissertation by Michael G. Smith, MSPH

ABSTRACT

Perinatal regionalization systems have been shown to reduce the risk of neonatal mortality when very low birth weight infants are delivered in Level III hospitals with neonatal intensive care units, sub-specialist staffing, and adequate experience caring for high-risk pregnancies and neonates. However, studies to date examining the association between delivery in Level III hospitals and neonatal mortality have not accounted for censoring due to fetal deaths. Furthermore, studies of perinatal regionalization to date have not adequately assessed the association between delivery hospital level of care and the infant’s hospital length of stay. This dissertation examined 8,594 very low birth weight live births and fetal deaths occurring in South Carolina hospitals from 2004-2013 to assess the association between birth in a non-Level III hospital and neonatal mortality accounting for censoring due to fetal death through the use of marginal structural models. Subsequently, a simulation study was conducted to identify the most appropriate statistical regression models to analyze highly skewed outcomes such as hospital length of stay. Finally, Laplace regression was used to assess the association between delivery hospital level of care and hospital length of stay among 6,301 live born very low birth weight infants delivered in South Carolina hospitals from 2004-2013. These analyses found that very low birth weight infants delivered in a non-Level III hospital had a statistically significantly greater risk of neonatal death than similar infants delivered in a Level III hospital (aRR=1.81, 95% CI: 1.52, 2.15). Furthermore, Laplace regression was
determined to be the most effective method for analyzing highly skewed outcomes when the underlying distribution giving rise to the outcome is not confidently known. Finally, hospital length of stay was found to be statistically significantly shorter for very low birth weight infants delivered at Level I or Level II hospitals than similar infants born in Level III hospitals for relatively short lengths of stay (5\textsuperscript{th} and 10\textsuperscript{th} conditional centiles); significantly shorter for very low birth weight infants delivered at Level II hospitals than similar infants born in Level III hospitals for relatively central lengths of stay (25\textsuperscript{th}, 50\textsuperscript{th}, and 75\textsuperscript{th} conditional quantiles); but no statistically significantly different hospital lengths of stay were observed across levels of care for relatively long lengths of stay (90\textsuperscript{th} and 95\textsuperscript{th} conditional centiles). The potential cost savings due to shorter hospital stays among relative short and central hospital lengths of stay do not outweigh the increase risk of neonatal mortality when very low birth weight infants are delivered in non-Level III hospitals. Therefore, it is recommended that South Carolina maintain the perinatal regionalization system and seek to ensure that every possible high-risk pregnancy has the opportunity to deliver at a hospital with a neonatal intensive care unit.