Supplementary Material 1

Literature Review on Neonatal mortality

Our literature review summarised twenty-four papers that estimated the mortality of neonatal infants. The research showed a large difference between studies in terms of population, characteristics, outcomes, hospital type and unit. The studies consider very pre-term infants, [1-8] analysed births with less than 32 weeks of gestational age, with some [9, 10] focusing on less than 30 and 29 weeks of gestational age, and others [11-13] on less than 28 weeks of gestational age. Only one paper [14] included extremely preterm infants (25 weeks of gestational age) while seven studies did not report in detail the gestational age [15-21].

The impact of unit volume in neonatal care and mortality was discussed by nine studies [4, 6, 16, 17, 19, 21-24]. In these studies, most used Logistic regression to estimate the outcome, and three used an instrumental variable approach [4, 23, 25].

The availability of staff in a unit can influence the mortality in neonatal mortality, but only four [4, 6, 16, 23] of overall studies considered the staff availability of nurse, consultants or both in the mortality model.

Table 1 below summarises the studies considered and reports information on: Country, Gestational age, Birthweight, Population, Outcomes, Unit type, Volume, Data, Nursing/Staff, Costs, Hospital type, Methods, Other, Covariates.
<table>
<thead>
<tr>
<th>#</th>
<th>Paper</th>
<th>Year</th>
<th>Country</th>
<th>Gest. age</th>
<th>Birthweight (gr)</th>
<th>Population</th>
<th>Unit type</th>
<th>Volume</th>
<th>Data (year)</th>
<th>Nursing / Staff</th>
<th>Costs</th>
<th>Hospital type</th>
<th>Methods</th>
<th>Other</th>
<th>Covariates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tucker et al [1]</td>
<td>2002</td>
<td>UK</td>
<td>Not rep.</td>
<td>&lt;1500</td>
<td>13401</td>
<td>Neonatal mortality</td>
<td>High (1/s), Medium (55-177), Low (1-15)</td>
<td>1996-2000</td>
<td>Consultant availability and nursing provision</td>
<td>Yes</td>
<td>No</td>
<td>Generalized estimating equations models</td>
<td>Yes, consultation days, gestational weeks completed, birthweight z-score, birthweight prenatal estimate z-score, baseline defects of acidosis, stillborn, died before term</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Gale et al [22]</td>
<td>2012</td>
<td>England</td>
<td>27-28.5</td>
<td>&lt;500, 500-999, 1000-1499, 1500-1999, &lt;2000</td>
<td>CESR project and NDAU data</td>
<td>Proportion of births in HV neonatal care, IC days, Acute and late postnatal transfer, Multiple and singleton births that had transfers before 28 days, Neonatal survival at 28 days, Transfers at 24 hours after birth, neonatal unit designation level and neonatal intensive care activity of hospital of birth</td>
<td>All</td>
<td>2 epochs: 1988-2000, 2009-2010 from NDAU</td>
<td>No</td>
<td>No</td>
<td>Not reported</td>
<td>Logistic regression</td>
<td>Evaluation of two different epochs</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Johansson et al [1]</td>
<td>2004</td>
<td>Sweden</td>
<td>24-31</td>
<td>Not rep.</td>
<td>2253</td>
<td>Singleton infants</td>
<td>Infant mortality</td>
<td>No</td>
<td>Not reported</td>
<td>No</td>
<td>No</td>
<td>University - General</td>
<td>Not clear</td>
<td>Antenatal maternal characteristics (illness, diabetes, hypertension, chronic diseases</td>
</tr>
<tr>
<td>5</td>
<td>Gale et al [14]</td>
<td>2010</td>
<td>England</td>
<td>&lt;35</td>
<td>&lt;1500</td>
<td>1564</td>
<td>Survival to term</td>
<td>NCU</td>
<td>Not reported</td>
<td>2008-2009</td>
<td>No</td>
<td>No</td>
<td>Logistic regression</td>
<td>Yes, consultation days, gestational weeks completed, birthweight z-score, birthweight prenatal estimate z-score, baseline defects of acidosis, stillborn, died before term</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Watson et al [27]</td>
<td>2014</td>
<td>England</td>
<td>&lt;35</td>
<td>Not rep.</td>
<td>28 days mortality, any in-hospital mortality, surgery for necrotising enterocolitis, treatment for respiratory of prematurity (ROP), Bronchopulmonary dysplasia (BPD)</td>
<td>Level 3 (NICU), Level 4 (NICU) and high, High Volume NICU</td>
<td>High Volume NICU</td>
<td>2009/2011</td>
<td>No</td>
<td>No</td>
<td>Not reported</td>
<td>Instrumental variables</td>
<td>Gestational age at birth, gestational age squared, birthweight z-score (birth weight standardized by GA), antenatal steroids, sex, infant year of birth and the residence of the mother if it is in the lowest decile of IMD 2007 score</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Watson et al [27]</td>
<td>2016</td>
<td>England</td>
<td>Not rep.</td>
<td>1-13 units</td>
<td>Monthly in hospital intensive care units</td>
<td>Level 3 (NICU), Level 4 (NICU) and high, High Volume NICU</td>
<td>Yes, volume of unit as covariate</td>
<td>2008-2012</td>
<td>Yes</td>
<td>No</td>
<td>Not reported</td>
<td>Multivariate logistic regression</td>
<td>Gestational age at birth, gestational age squared, birthweight z-score (birth weight standardized by GA), the monthly volume of neonatal unit (to capture nurse workload), antenatal steroids, sex, infant year of birth and month of birth</td>
<td></td>
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<tr>
<td>9</td>
<td>Motebartes et al [28]</td>
<td>2013</td>
<td>England</td>
<td>&lt;22</td>
<td>Not rep.</td>
<td>2091</td>
<td>Probability of survival</td>
<td>NCU</td>
<td>No</td>
<td>2009-2011</td>
<td>No</td>
<td>No</td>
<td>Not reported</td>
<td>Logistic regression</td>
<td>Gestational age in days, birthweight and gender</td>
</tr>
<tr>
<td>10</td>
<td>Haefeli et al [31]</td>
<td>2013</td>
<td>England</td>
<td>24-28</td>
<td>Not rep.</td>
<td>2724</td>
<td>Cause-specific hazard for discharge in-unit neonatal death for all babies that were in neonatal care for the first 7 days of life</td>
<td>N.R.</td>
<td>No</td>
<td>2006-2010</td>
<td>No</td>
<td>No</td>
<td>Not reported</td>
<td>Flexible parametric survival model, using restricted cubic splines</td>
<td>Gestational age at birth, gender, z-scores for birthweight</td>
</tr>
<tr>
<td>11</td>
<td>Cihovens et al [27]</td>
<td>2002</td>
<td>USA (California)</td>
<td>Not rep.</td>
<td>&lt;2000</td>
<td>16732</td>
<td>Neonatal related mortality</td>
<td>NCU and other levels</td>
<td>The volume has a significant difference on mortality for the large units</td>
<td>1982-1993</td>
<td>Hospital without NICU, no Intensive Care, intermediate NICU, intermediate intensive care community NICU, expanded intermediate intensive care regional NICU</td>
<td>Risk adjusted mortality model based on logistic regression</td>
<td>Singleton infants with less than 530 gr of BW, BW is infants with less than 2000 grams. Considers different levels of care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Reicmen et al [4]</td>
<td>2007</td>
<td>Finland</td>
<td>&lt;32</td>
<td>&lt;=1500</td>
<td>2291</td>
<td>One-year mortality</td>
<td>Level II (control) and Level III (University hospital)</td>
<td>The volume has a lower risk than central one</td>
<td>2000-2003</td>
<td>Indirectly (live office and non-office hours)</td>
<td>No</td>
<td>University and central hospital</td>
<td>Logistic regression</td>
<td>Hospital level, gestational age, birthweight, time of birth (office and non-office hours), gender, birth weight, maternal age, parity, hypertension</td>
</tr>
</tbody>
</table>
The study evaluates the trend in mortality morbidities and treatment for VPT and VLBW infants over 12 years. The study examines the relationship between volume of VLBW on mortality (morbidity) Type of care, Level III hospital and VLBW mortality. The study shows the effect of volume of VLBW infants varies between NICU levels. The study evaluates the trend in mortality morbidities and treatment for VPT and VLBW infants over 12 years. The study examines the relationship between volume of VLBW on mortality (morbidity) Type of care, Level III hospital and VLBW mortality. The study shows the effect of volume of VLBW infants varies between NICU levels. The study evaluates the trend in mortality morbidities and treatment for VPT and VLBW infants over 12 years. The study examines the relationship between volume of VLBW on mortality (morbidity) Type of care, Level III hospital and VLBW mortality. The study shows the effect of volume of VLBW infants varies between NICU levels. The study evaluates the trend in mortality morbidities and treatment for VPT and VLBW infants over 12 years. The study examines the relationship between volume of VLBW on mortality (morbidity) Type of care, Level III hospital and VLBW mortality. The study shows the effect of volume of VLBW infants varies between NICU levels. The study evaluates the trend in mortality morbidities and treatment for VPT and VLBW infants over 12 years. The study examines the relationship between volume of VLBW on mortality (morbidity) Type of care, Level III hospital and VLBW mortality. The study shows the effect of volume of VLBW infants varies between NICU levels. The study evaluates the trend in mortality morbidities and treatment for VPT and VLBW infants over 12 years. The study examines the relationship between volume of VLBW on mortality (morbidity) Type of care, Level III hospital and VLBW mortality. The study shows the effect of volume of VLBW infants varies between NICU levels.
REFERENCES


