VERY PRETERM BIRTH BEFORE ARRIVAL AT HOSPITAL

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Contributors
RAB designed the study, wrote the ethics, analysed the data, and wrote the draft manuscript. LWD, JAD and PGD supervised and contributed to the study design,

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statistical analysis, and edited the manuscript. JS and MJS provided input into the
discussion and edited the manuscript. Each author has reviewed the manuscript and
approved submission of this version. The authors take full responsibility for the
manuscript.

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ABSTRACT

Background: Our aim was to report perinatal characteristics of very preterm births before arrival (BBAs) at a hospital, and perinatal and infant mortality rates up to one year, comparing BBAs with births in a hospital.

Materials and Methods: A population-based cohort study of 22-31 weeks’ gestation births in the state of Victoria, Australia from 1990-2009. BBAs were defined as unintentional births at home or on route to hospital. Perinatal data were obtained from the Department of Health and Human Services, Victoria. Perinatal and infant mortality data comparing BBAs with births in hospitals were analysed by logistic regression, adjusted for gestational age, birthweight and sex.

Results: 133 BBAs were recorded: 51 (38%) stillbirths and 82 (62%) livebirths. Compared with births in a hospital, BBAs were less mature (26.3 weeks [SD 2.9] versus 27.7 weeks [SD 2.8]), p<0.001) and a higher proportion were born to teenagers: 13% versus 5% (adjusted Odds Ratio [aOR] 2.86, p<0.001). BBAs were significantly more likely to be stillborn (aOR 2.13, 95% confidence interval [CI] 1.41,
3.23, p<0.001) die within 28 days of livebirth (aOR 2.97, 95% CI 1.54, 5.73, p=0.001) or die within a year of livebirth (aOR 2.87, 95% CI 1.51, 5.46, p=0.001) compared with hospital births. Overall, 54 BBAs survived to one year (41% all BBAs, 67% liveborn BBAs), compared with 69% of hospital births (87% of livebirths).

Conclusions: Very preterm birth before arrival is more common in teenagers and is associated with significantly increased risks of perinatal and infant mortality compared with birth in a hospital.

Introduction

Unintentional birth before arrival (BBA) at a hospital is a relatively rare event, reported at rates of 0.4% of all births in Australia and 0.2% in Victoria. However, compared with birth in a hospital and planned home birth, unintentional birth before arrival at hospital is associated with increased risks of perinatal mortality and neonatal morbidity, even at term gestation. Births occurring very preterm (<32 weeks’ gestation) and extremely preterm (<28 weeks’ gestation) are at even greater risk of adverse outcomes.

There is a paucity of literature reporting perinatal characteristics and outcomes of very preterm BBA births in Australia and internationally. Moreover, as most births before arrival occur at term or near-term gestation, outcomes cannot be generalised to the preterm population. The aim of our study was to report prevalence, characteristics and outcomes of extremely preterm and very preterm BBAs in the state of Victoria, Australia over two decades, comparing BBAs with births in a hospital.

Materials and Methods

Definitions

Births before arrival (BBAs) at hospital were defined as unintentional births in a residential home, or in transit to a hospital in a motor vehicle or ambulance, with or without a healthcare professional present. Births in a hospital were coded as hospital births. Hospital births included births in tertiary perinatal centres, non-tertiary maternity services, and non-obstetric hospitals.
Inclusion criteria were all births (stillbirths and livebirths) in Victoria, Australia at 22+0 and 31+6 weeks’ gestation between 1 January 1990 and 31 December 2009. Terminations of pregnancy were excluded. Livebirths with major congenital anomalies who died within one year were excluded in the mortality analysis, as birthplace would not have altered their outcome.

Neonatal death was defined as death of a liveborn infant within 28 days of livebirth. Post-neonatal infant death was defined as death occurring after 28 completed days up to one year after livebirth.10

Data sources
Perinatal data for all stillbirths, livebirths, neonatal deaths and infant deaths were sourced from the Clinical Councils Unit at the Department of Health and Human Services, Victoria, who conduct and administer the Victorian Perinatal Data Collection on behalf of the Consultative Council on Obstetric and Paediatric Mortality and Morbidity (CCOPMM).

Ethics
Ethical approval for the study was obtained from the CCOPMM, Victorian Government Department of Health and Human Services, Study ID RR13-31.

Statistical analysis
Data were analysed in STATA™ (Version 14.2, StataCorp, College Station, Texas, USA). Characteristics of BBAs and hospital births were compared using the Students t-test and univariable logistic regression. Stillbirth, neonatal mortality and infant mortality data, comparing BBAs with hospital births were analysed by logistic regression, adjusted for gestational age, birth weight and sex. Adjusted odds ratios (aOR), 95% confidence intervals (CIs) and p-values for each risk factor were calculated.

The perinatal mortality rate was calculated as the total number of stillbirths and neonatal deaths (excluding lethal anomalies), divided by the total number of births for the same period. Perinatal mortality is reported as a ratio per 1000 births.

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Neonatal mortality was calculated as the total number of deaths within 28 days of livebirth (excluding lethal anomalies) reported as a ratio per 1000 livebirths.

Results
Overall, 16,910 births at 22 to 31 weeks’ gestation were recorded in Victoria across the 20-year period (Figure 1). Of these, 133 (0.8%) were births before arrival at a hospital and 16,777 (99.2%) were hospital births. Hospital births were predominantly in tertiary perinatal centres, (n=13,309, 79%). A further 3,375 (20%) hospital births were in non-tertiary maternity services and 93 were in non-obstetric hospitals.

Maternal characteristics comparing BBAs with births in a hospital are reported in Table 1. Mothers of BBAs were three times more likely to be a teenager compared with mothers who gave birth in a hospital, and more likely to have a singleton pregnancy. Although all BBAs were born vaginally after onset of spontaneous preterm labour, their mothers were less likely to have preterm pre-labour rupture of membranes compared with women who gave birth in a hospital.

Twenty-one percent of births before arrival were associated with an antepartum haemorrhage (APH). This was not statistically different from the proportion of births in a hospital associated with an APH (24%). However, BBAs were at significantly increased risk of stillbirth following an APH (57%) compared with hospital births (16%); (OR 7.12, 95% CI 3.37, 15.22, p<0.001).

Infant characteristics
BBAs were less mature than hospital births and had lower mean birth weights. This trend was seen in both stillbirths and livebirths. Liveborn BBAs, free of lethal anomalies had a mean gestational age of 27 weeks (SD 2.7) whereas livebirths in a hospital had a mean gestational age of 28 weeks (SD 2.5), p<0.001 (Table 1).

Apgar scores were recorded for 47 live born BBAs whose births were attended by a paramedic crew or other healthcare professional. BBAs were six times more likely to
have an Apgar score less than 7 at five minutes of age compared with hospital born peers.

Compared with hospital births, a higher proportion of BBAs were extremely preterm. Nearly 60% of BBAs were <28 weeks’ gestation (78/133) compared with 42% of hospital births. Of the livebirths, 51% of BBAs were <28 weeks’ gestation compared with 35% of hospital births.

**Perinatal and infant mortality**

BBAs were significantly more likely to be stillborn, die within 28 days of livebirth and die within a year of livebirth (Table 2). The perinatal mortality rate for BBAs was 583 per 1000 births compared with 288 per 1000 for hospital births (excluding 405 livebirths with lethal congenital anomalies). Overall, 77/132 (58%) BBAs were stillborn or died within a year. In comparison, 4,710/16,373 (29%) hospital births were stillborn or died within a year.

Outcomes for BBAs versus hospital births by gestational age sub-group (22-27 weeks and 28-31 weeks’ gestation) are illustrated in forest plots in Figures 2A and 2B respectively.

The perinatal mortality rate in 22-27 week infants was 782 per 1000 births before arrival versus 539 per 1000 hospital births (Table 3). Of the 41 BBA livebirths, free of lethal anomalies, 25 (61%) died before one year of age. Infant mortality rates following live birth before arrival at hospital were 100% at 22 weeks, 83% at 23 weeks, 100% at 24 weeks, 69% at 25 weeks, 50% at 26 weeks and 15% at 27 weeks’ gestation.

The overall perinatal mortality rate for births at 28-31 weeks’ gestation was 296 per 1000 BBA births versus 111 per 1000 hospital births (Table 3). BBAs at 28-31 weeks’ gestation had significantly higher stillbirth rates (25%) compared with hospital births (9%). However, there were no statistically significant differences in infant mortality rates following live birth comparing BBAs (5%) with hospital births (3%). Of the 40 live born 28-31 week BBAs, two (5%) died within a year.
Time of death

Time of death data was available from 2001 onwards. Seventy-three percent of liveborn BBAs died within 6 hours of birth. Of these, more than 80% occurred before the infant could be admitted to a special or intensive care nursery. All neonatal deaths of BBAs occurred within three days of live birth.

BBA survivors one year after birth

Of the 133 births before arrival, 54 (41%) were alive at one year (67% live born BBAs, free of lethal anomalies). There were only five BBAs survivors born <27 weeks’ gestation.

Changes in rates of births before arrival over time

Although the absolute number of BBAs increased as the birth rate in Victoria increased, there were no significant changes in the proportion of births before arrival over time. The proportions of BBAs ranged between 0.8% and 1.1% of all births <32 weeks’ gestation over the 20-year period.

Discussion

In our study, unplanned birth at home or in transit to hospital was associated with more than double the risk of stillbirth, neonatal death and infant death compared with birth in a hospital before 32 weeks’ gestation. Although the overall proportion of BBAs was small in comparison with hospital births (0.8% versus 99.2%), perinatal and infant mortality rates in these infants were substantially higher than in hospital births, especially for births <28 weeks’ gestation. Risk factors independently associated with birth before arrival at hospital were being a teenage mother and having a singleton pregnancy. Older maternal age (>40 years) and older multiparous status were not independent risk factors associated with birth before arrival.

Risk factors associated with birth before arrival at hospital reported in local and international literature include young maternal age,9 higher parity,13 older multiparous women, illicit drug use, lower education14 and little or no antenatal care.13,15,16 Lack of, or sub-optimal antenatal care attendance and concealment of pregnancy are also cited as key risk factors associated with perinatal mortality in BBAs.2,17 However, all
these studies reported outcomes of all BBAs, most of which were term or near-term gestation, as opposed to the group we studied who were <32 weeks’ gestation.

In our study, women with preterm pre-labour rupture of membranes (PPROM) were more likely to give birth in a hospital, indicating women are aware, or are instructed to proceed to hospital following PPROM. Signs and symptoms of preterm labour in the absence of PPROM may be less obvious to primigravid women who have not experienced labour. This study highlights the importance of educating women about signs of preterm labour, especially when it occurs before 32 weeks’ gestation and without rupture of membranes.

Given the precipitous nature of unplanned birth before arrival at a hospital, women who deliver preterm at home or in transit are disadvantaged by lack of antenatal corticosteroid exposure, tocolytics to suppress preterm labour, fetal monitoring and choices about mode of delivery. If birth is further complicated by an obstetric emergency, such as placental abruption, cord prolapse, or breech presentation, prognosis is extremely poor. Obtaining accurate obstetric complication and birth data for BBA births is extremely difficult as these births often occur without a healthcare professional present. In this study, we found a higher incidence of stillbirth in births before arrival complicated by an antepartum haemorrhage compared with hospital births. Other complications during birth were not recorded in the data available.

We hypothesise that the increased rates of stillbirth in the BBA population reflect a higher proportion of undiagnosed fetal deaths in-utero in days or weeks prior to birth, as >85% of these will spontaneously labor. Ambulance paramedics in Victoria are unable to monitor fetal heart rate, so cannot determine if a fetus is alive in labour or has died prior to the onset of labour. It is also possible some livebirths were coded as stillbirths if there were no signs of life when the paramedics arrived on scene, and the parents reported not witnessing the infant cry or move or seeing pulsation of the umbilical cord. Similar coding errors have been reported internationally.

From the data available, we could not determine the proportion of births before arrival that occurred with, versus without, a healthcare professional present. However, Apgar score data indicated a paramedic or other healthcare professional was present at 57%
of births. We found BBAs were six times more likely to have an Apgar score <7 at five minutes of age compared with livebirths in a hospital. This finding was not unexpected. Preterm BBAs are born in an environment lacking appropriate resources to provide optimum care during and immediately after birth. Even if birth occurs with a paramedic crew in attendance, limited equipment is available for resuscitation, thermoregulation, ventilation, fluid administration and monitoring. Hypothermia is a common morbidity associated with birth before arrival, irrespective of gestational age or birth weight.\[4,6,8,17,19\] We have previously reported an eleven-fold increase in mortality in extremely preterm BBAs transferred to a tertiary centre by ambulance paramedics and admitted to neonatal intensive care (NICU) in Victoria.\[20\] The current study identified that a significant proportion of BBAs died before they could be admitted to a nursery, and a high proportion of those who survived to nursery admission died within six hours of birth.

An enquiry into deaths of BBAs in Norway in 1999-2013 concluded poor outcomes in BBAs were seldom due to sub-optimal performance of healthcare providers immediately around the time of birth.\[2\] Although providing additional training for paramedics on management of birth has been advocated as a strategy to improve outcomes,\[6,21\] the effectiveness of training for an event rarely encountered, with limited opportunities to consolidate skills, is questionable. Instead, the focus in Victoria has been to improve survival and quality of survival by maximising opportunities for infants <33 weeks’ gestation to be born in tertiary perinatal centres.\[22,23\] In 2010, Ambulance Victoria and the state-wide Paediatric Infant Perinatal Emergency Retrieval service (PIPER, Victoria) collaborated to develop Clinical Practice Guidelines for obstetric and neonatal emergencies in the pre-hospital environment.\[24\] Women with threatened preterm labour <33 weeks’ gestation are now preferentially transferred to a tertiary centre, bypassing non-tertiary maternity services on route, unless birth is imminent. The impact of this policy is yet to be formally evaluated. One potential risk is an increase in births in transit that may have otherwise delivered in a non-tertiary hospital. However, the advantages of avoiding double transfer (ambulance to non-tertiary hospital, then PIPER transfer from non-tertiary to tertiary) or birth in a tertiary perinatal centre, arguably outweigh these risks. For women residing in regional Victoria, safe in-utero transfer to a tertiary centre is more difficult, because of the distances to travel, which may be several hundred kilometers.
The distance between a woman’s home and the closest maternity hospital is cited as an additional risk factor for birth before arrival at hospital,\textsuperscript{7,9,19,25} as has closure of small regional hospitals in Australia\textsuperscript{26} and internationally.\textsuperscript{3} Despite the closure of 47% of birthing services in Victoria, including 77% of regional birthing services between 1990 and 2009, we did not find significant changes in the proportion of preterm births <32 weeks’ gestation before arrival at hospital over time.

**Strengths**

Our study is the first to report outcomes of a population-based cohort of preterm BBA births <32 weeks’ gestation over a 20-year period in a defined geographical region. We have identified that BBAs are less likely to be born alive and less likely to survive compared with births occurring in a hospital at equivalent gestational ages. This information is highly relevant to paramedics providing first response care and to healthcare providers receiving these women on arrival at a hospital.

**Limitations**

Identifying perinatal characteristics independently associated with birth before arrival at hospital was limited by lack of data regarding maternal socio-economic status, antenatal care attendance, illicit drug use, education level and distance between maternal residence and the closest hospital.

Although previous preterm birth is a known risk factor for a subsequent preterm birth\textsuperscript{20} these data were not recorded in the Victorian Perinatal Data Collection (VPDC) during the years of this study.

Without access to individual patient records from the Ambulance Service, we could not report timing between onset of signs of labour, calling an ambulance, time of first assessment by the ambulance crew and time of birth. These data would help determine the proportion of births before arrival that could not have been potentially avoided had the woman sought medical assistance at the first sign of preterm labour.

**Conclusion**

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Preterm birth <32 weeks’ gestation before arrival at a hospital occurred in less than 1% of all births <32 weeks’ gestation in Victoria, but was associated with significantly increased risks of perinatal and infant mortality compared with births in a hospital. While it is inevitable that birth before arrival will continue to occur, educating women to identify signs of preterm labour and to seek help early, may help reduce the number of births before arrival and associated morbidity and mortality.

Acknowledgements
The authors wish to thank Dr Mary-Ann Davey at the Clinical Council’s Unit, Health Service Programs Branch, Victorian Department of Health and Human Services for providing the denominators for all 22-31 weeks’ gestation stillbirths, livebirths, and infant deaths in Victoria in 1990-2009.

Contributors
RAB designed the study, wrote the ethics, analysed the data, and wrote the draft manuscript. LWD, JAD and PGD supervised and contributed to the study design, statistical analysis, and edited the manuscript. JS and MJS provided input into the discussion and edited the manuscript. Each author has reviewed the manuscript and approved submission of this version. The authors take full responsibility for the manuscript.

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Competing interests
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None declared.

**Table Legends**

Table 1: Perinatal characteristics of births at 22-31 weeks’ gestation, comparing births before arrival with hospital births.

Table 2: Outcome by one year, comparing births before arrival with hospital births.

Table 3: Outcomes of 22-27 and 28-31 weeks’ gestation births, comparing births before arrival with hospital births

**Figure Legends**

Figure 1: Outcomes of all births at 22-31 weeks’ gestation

Figure 2: Odds ratios and 95% confidence intervals for outcomes of 22-27 (2A) and 28-31 (2B) weeks’ gestation births, comparing births before arrival with hospital births.
REFERENCES


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Table 1: Perinatal characteristics of births at 22-31 weeks’ gestation, comparing births before arrival with hospital births

<table>
<thead>
<tr>
<th></th>
<th>BBA n=133</th>
<th>Born in hospital n=16,777</th>
<th>OR (95% CI)</th>
<th>p=</th>
<th>Adjusted OR† (95% CI)</th>
<th>p=</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Multigravida</strong></td>
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<td></td>
<td>73 (55%)</td>
<td>8,370/16,774 (50%)</td>
<td>1.22 (0.87, 1.72)</td>
<td>0.25</td>
<td>1.32 (0.93, 1.88)</td>
<td>0.12</td>
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<tr>
<td><strong>Teenage mother</strong></td>
<td></td>
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<td></td>
<td>17/131 (13%)</td>
<td>782/16,775 (4.7%)</td>
<td>3.05 (1.82, 5.10)</td>
<td>&lt;0.001</td>
<td>2.86 (1.68, 4.86)</td>
<td>&lt;0.001</td>
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<td><strong>Singleton pregnancy</strong></td>
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<td></td>
<td>110 (83%)</td>
<td>12,381 (74%)</td>
<td>1.70 (1.08, 2.67)</td>
<td>0.02</td>
<td>1.77 (1.10, 2.87)</td>
<td>0.02</td>
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<td><strong>Any APH</strong></td>
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<td></td>
<td>28 (21%)</td>
<td>4,036 (24%)</td>
<td>0.84 (0.55, 1.28)</td>
<td>0.42</td>
<td>0.79 (0.52, 1.22)</td>
<td>0.29</td>
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<tr>
<td><strong>Pre-labour rupture of membranes</strong></td>
<td></td>
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<tr>
<td></td>
<td>17 (13%)</td>
<td>4,632 (28%)</td>
<td>0.38 (0.23, 0.64)</td>
<td>&lt;0.001</td>
<td>0.34 (0.20, 0.58)</td>
<td>&lt;0.001</td>
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<tr>
<td><strong>Spontaneous preterm labour</strong></td>
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<tr>
<td></td>
<td>133 (100%)</td>
<td>9,593 (57%)</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
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<tr>
<td><strong>Vaginal birth</strong></td>
<td></td>
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<tr>
<td></td>
<td>133 (100%)</td>
<td>9,137/16,751 (55%)</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
<td>NC</td>
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<td><strong>Male sex</strong></td>
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<td></td>
<td>69/132 (52%)</td>
<td>9,063/16,760 (54%)</td>
<td>0.93 (0.66, 1.30)</td>
<td>0.66</td>
<td>0.95 (0.67, 1.35)</td>
<td>0.76</td>
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<td><strong>Congenital anomaly</strong></td>
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<td></td>
<td>12 (9%)</td>
<td>2,145 (13%)</td>
<td>0.68 (0.37, 1.23)</td>
<td>0.20</td>
<td>0.62 (0.33, 1.16)</td>
<td>0.14</td>
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<tr>
<td>Liveborn free of lethal congenital anomaly</td>
<td>81 (61%)</td>
<td>13,274 (79%)</td>
<td>0.37 (0.26, 0.53)</td>
<td>&lt;0.001</td>
<td>0.48 (0.32, 0.74)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Apgar score &lt;7 at 5 minutes of age††</td>
<td>28/47 (60%)</td>
<td>2,498/13,193 (19%)</td>
<td>6.31 (3.52, 11.32)</td>
<td>&lt;0.001</td>
<td>7.08 (3.60, 13.95)</td>
<td>&lt;0.001</td>
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<tr>
<td>Mean Difference (95% CI) p= t-test</td>
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<tr>
<td>Gestational age in weeks Mean (SD)- All births</td>
<td>26.3 (2.9)</td>
<td>27.7 (2.8)</td>
<td>1.4 (0.90, 1.87)</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gestational age in weeks Mean (SD)- Livebirths††</td>
<td>27.1 (2.7)</td>
<td>28.2 (2.5)</td>
<td>1.1 (0.58, 1.69)</td>
<td>0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birthweight grams Mean (SD)- Livebirths††</td>
<td>1,125 (516) (3 missing data)</td>
<td>1,197 (435) (74 missing data)</td>
<td>72 (-24.9, 168.9)</td>
<td>0.15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data are n (%) unless otherwise specified. † Adjusted for gestational age, birthweight and sex; ‡‡ Livebirths, excluding lethal congenital anomalies
Table 2: Outcomes by one year, comparing births before arrival with hospital births

<table>
<thead>
<tr>
<th></th>
<th>BBA n=133</th>
<th>Born in a hospital n=16,777</th>
<th>OR (95% CI)</th>
<th>p=</th>
<th>Adjusted* aOR (95% CI)</th>
<th>p=</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stillborn</strong></td>
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<tr>
<td>All 22-31 week births N=16,910</td>
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<td></td>
</tr>
<tr>
<td>Stillborn</td>
<td>51 (38%)</td>
<td>3,099 (18.5%)</td>
<td>2.75 (1.93, 3.90)</td>
<td>&lt;0.001</td>
<td>2.13 (1.41, 3.23)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Stillborn with anomaly</td>
<td>5/51 (10%)</td>
<td>420/3,099 (13.5%)</td>
<td>0.69 (0.27, 1.75)</td>
<td>0.44</td>
<td>0.67 (0.24, 1.88)</td>
<td>0.45</td>
</tr>
<tr>
<td><strong>Livebirths, no lethal anomaly N=13,355</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neonatal death*</td>
<td>26 (32%)</td>
<td>1,611 (12%)</td>
<td>3.42 (2.14, 5.47)</td>
<td>&lt;0.001</td>
<td>2.97 (1.54, 5.73)</td>
<td>0.001</td>
</tr>
<tr>
<td>Perinatal death (SB+ NND*)</td>
<td>77/132 (58%)</td>
<td>4710/16,373 (29%)</td>
<td>3.47 (2.45, 4.91)</td>
<td>&lt;0.001</td>
<td>3.25 (2.05, 5.14)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Post-neonatal infant death*</td>
<td>1</td>
<td>139 (1%)</td>
<td>1.18 (0.16, 8.55)</td>
<td>0.87</td>
<td>1.09 (0.15, 7.92)</td>
<td>0.93</td>
</tr>
<tr>
<td>Died before one year*</td>
<td>27 (33%)</td>
<td>1,750 (13%)</td>
<td>3.29 (2.07, 5.24)</td>
<td>&lt;0.001</td>
<td>2.87 (1.51, 5.46)</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Data are n (%) unless otherwise specified; * Adjusted for gestational age, birthweight and sex

* Excluding 405 livebirths with a lethal congenital anomaly

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Table 3: Outcomes of 22-27 and 28-31 weeks’ gestation births, comparing births before arrival with hospital births

<table>
<thead>
<tr>
<th></th>
<th>BBA n=78</th>
<th>Born in a hospital n=6,978</th>
<th>aOR† (95% CI)</th>
<th>p=</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All 22-27 week births</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N=7,056</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stillborn</td>
<td>37 (47%)</td>
<td>2,249 (32%)</td>
<td>1.61 (0.96, 2.68)</td>
<td>0.07</td>
</tr>
<tr>
<td><strong>Livebirths, no lethal anomaly</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N=4,551</td>
<td>n=41</td>
<td>n=4,510</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neonatal death*</td>
<td>24 (59%)</td>
<td>1,394 (31%)</td>
<td>4.76 (2.20, 10.28)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Perinatal death*</td>
<td>61 (78%)</td>
<td>3,643 (54%)</td>
<td>3.20 (1.67, 6.11)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Died before one year*</td>
<td>25 (61%)</td>
<td>1,485 (33%)</td>
<td>4.74 (2.20, 10.20)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Data are n (%) unless otherwise specified; † Adjusted for gestational age, birthweight and sex; *Excluding 186 livebirths with lethal anomalies

<table>
<thead>
<tr>
<th></th>
<th>BBA n=55</th>
<th>Born in a hospital n=9,799</th>
<th>aOR† (95% CI)</th>
<th>p=</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All 28-31 week births</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N=9,854</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stillborn</td>
<td>14 (25%)</td>
<td>850 (9%)</td>
<td>3.93 (2.06, 7.48)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Livebirths, no lethal anomaly</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N=8,805</td>
<td>n=40</td>
<td>n=8,764</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neonatal death*</td>
<td>2 (5%)</td>
<td>217 (2.5%)</td>
<td>1.99 (0.47, 8.46)</td>
<td>0.35</td>
</tr>
<tr>
<td>Perinatal death*</td>
<td>16 (30%)</td>
<td>1,067 (11%)</td>
<td>3.58 (1.93, 6.66)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Died before one year* | 2 (5%) | 265 (3%) | 1.66 (0.39, 7.02) | 0.49

Data are n (%) unless otherwise specified; † Adjusted for gestational age, birthweight and sex; *Excluding 219 livebirths with lethal anomalies
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Author/s:
Boland, RA; Davis, PG; Dawson, JA; Stewart, MJ; Smith, J; Doyle, LW

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