

## **Infants born in a non-maternity hospital: The role of the National Neonatal Transport Programme (NNTP)**

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### **Abstract**

#### ***Aims***

There is only one tertiary maternity hospital co-located with a tertiary subspecialist hospital in the Republic of Ireland, and so pregnant women may deliver in a non-maternity hospital if they require tertiary subspecialist care. Since 2015 National Neonatal Transport Programme (NNTP) attend deliveries in non-maternity hospitals on request when available.

#### ***Methods***

This was a retrospective review of five years of NNTP records, 2015-2019, with cases identified using the NNTP database.

#### ***Results***

The NNTP attended 33 (82.5%) of 40 deliveries in Dublin non-maternity tertiary hospitals, of 50 nationwide. All babies were delivered via caesarean section. Median gestation at birth was 35 weeks and the median birthweight recorded was 2.79kg. Eighteen (58%) babies required respiratory support on transport. The main reason for maternal delivery in a tertiary adult hospital was maternal cardiac disease, with placenta accrete spectrum the second most common reason.

#### ***Conclusion***

Non-maternity hospital births account for 1.1% of NNTP workload. One quarter of the transports were unplanned – due to sudden requirement for delivery. Twenty-seven (82%) cases were undertaken during the day shift. Each call took on average almost a third of a shift (3h26min).

## **Introduction**

Expectant mothers with serious underlying medical or surgical conditions may - on occasion - have to be delivered in a specialist non-maternity hospital. This causes logistical problems. The process necessitates that in addition to obstetrics, a neonatal nursing and medical team needs need to be in attendance. There is only one tertiary maternity hospital co-located with a tertiary hospital in the Republic of Ireland<sup>1</sup>, therefore pregnant women who require tertiary subspecialist or ICU care may deliver in a non-maternity hospital when required. These patients include women with significant pre-pregnancy co-morbidities such as cardiac disease and cystic fibrosis, women with high-risk pregnancy-related co-morbidities like placenta accreta, and women who become very unwell during pregnancy. There is minimal data available on the neonatal workload associated with deliveries in non-maternity hospitals in Ireland.

Children transferred by a specialist service have better outcomes than those who are not<sup>2</sup>, and babies born to unwell mothers are at risk of neonatal morbidities and mortality.<sup>3</sup> Since 2015, the National Neonatal Transport Programme (NNTP), with midwifery and obstetric teams from affiliated maternity units, attend deliveries outside maternity hospitals on request subject to availability. The NNTP is a 24/7 service operated out of the three Dublin maternity hospitals.<sup>4</sup> This study describes the workload undertaken by the NNTP in the provision of this service.

## **Methods**

The study period was 5 years, 2015 – 2019. Cases were identified using the NNTP database. The details of each case were examined retrospectively. Nursing and medical records were checked in order to ensure full ascertainment of cases. Data collected included the following: the underlying maternal condition, mode of delivery, infant gestation and birthweight, and APGAR score. Similarly, all neonatal transports from non-maternity hospitals for the same period, as reported on NNTP's national neonatal daily activity census, were also reviewed.

Each non-maternity hospital that facilitates delivery of a baby maintains a resuscitaire, and other equipment, however the NNTP team bring a specialised ambulance with power, air and oxygen, as well as a high tech transport incubator and equipment and medication for full resuscitation and stabilisation of the unwell newborn.

## **Results**

The NNTP attended 33 deliveries in non-maternity hospitals for neonatal care, accounting for 1.1% of the 2885 transports completed by the NNTP in this timeframe.

Analysis of NICU census records identified seven other transports from Dublin non-maternity hospitals in this timeframe meaning that the NNTP attended 82% of all Dublin deliveries.

NICU census records also demonstrated 10 other transports from non-maternity hospitals outside of Dublin – namely from University Hospital Limerick to University Maternity Hospital Limerick. One of these cases did not result in the birth of a baby, and another case was to the emergency department of a non-maternity hospital to a preterm baby who had been born at home.

<b>Maternal diagnosis recorded</b>	<b>N = 29</b>	<b>100%</b>
Cardiac diagnosis	13	45%
Placenta Accreta Spectrum	6	21%
Neurological/neurosurgical	3	10%
Severe Cystic Fibrosis	2	6%
Severe pneumonia	1	3%
Bowel obstruction	1	3%
Behçet's disease	1	3%
Sickle cell crisis	1	3%
Splenic Aneurysm	1	3%
Metastatic cancer	1	3%

**Table 1: Maternal morbidities**

The most common maternal diagnosis (45%, n=13) was maternal cardiac disease, which included cardiomyopathy as well as repaired congenital heart disease. Placenta accreta spectrum including placenta accreta, increta and percreta accounted for 21% (n=6) reasons for delivery in a non-maternity centre.

	<b>Median</b>	<b>Range</b>
Birth gestation	35 weeks	27 – 38 weeks
Birth weight	2.79kg	2.12-3.29kg
Weight not measured	13	45%
	<b>Median</b>	<b>Range</b>
APGAR at 1 minute	9	2- 10
APGAR at 5 minutes	9	5 - 10
APGAR at 10 minutes	9	8 -10
	<b>Number</b>	<b>%</b>
Birth by LSCS	31	100%
Gender recorded	28	90%
Male	16	57%
Female	12	43%

**Table 2: Neonatal characteristics**

The median gestation at birth was 35 weeks (27 – 38 weeks) and the median birthweight was 2.79kg (2.12-3.29kg). Of note only 45% (n= 13) birthweights were recorded on documentation. All births were by LSCS.

<b>Intervention</b>	<b>N=31</b>	<b>%</b>
Intubation and ventilation	4	12.5%
Nasal CPAP	13	41%
Supplemental Oxygen	1	3%
No respiratory support	13	41%
Vitamin K recorded	17	53%
IV cannula and fluids	26	81%
Formula feed prior to transport	2	6%
Breastfeed prior to transport	1	3%

**Table 3:** Neonatal interventions

Twenty-four (75%) cases had evidence of being planned the preceding day. 28 of these calls were initiated during the day shift – between 07:00 and 20:00. Twenty-three (72%) births had a neonatal consultant, NICU registrar and NICU nurse present. Nine (28%) births were attended by an NICU registrar and nurse. The median time spent on the transport was 3 hours and 26 minutes (range: 1 hour 35 mins to 5 hours 10 minutes). The most time-consuming part of the service was setting up and waiting for the delivery of the baby.

## **Discussion**

The delivery of a mother in a non-maternity hospital is an uncommon but high acuity exercise. It requires considerable planning. In addition to skilled, experienced neonatal staff, the NNTP must bring all of the equipment necessary to manage the infant after birth. All eventualities must be covered.

Improved medical care has enabled women with medical conditions including repaired congenital heart disease to achieve and survive pregnancy, and so the number of women who require delivery in a tertiary non-maternity centre may continue to increase.

All of the babies in this cohort were delivered by LSCS for maternal reasons. We do not have complete records of the type of anaesthesia used, however most but not all cases were undertaken under general anaesthesia. This can have an adverse effect on the respiratory status of the baby and may account for some of the broad range of APGAR scores at one minute in our cohort.

We feel that the low rate of recorded vitamin K administration was due to poor documentation, although we have no evidence that it was not forgotten.

We do not have any records of the Rhesus status of the mother and baby – however that is normally attended to by the midwife that attends for maternal care.

Unfortunately, there are no facilities to provide postnatal neonatal care with the mother in the tertiary non-maternity hospitals and so baby and mother are unavoidably separated. In one hospital the clinical photography team record the baby's birth with photographs and videos, while in every hospital effort is made to get photos of baby for their parents. Recent visiting restrictions have improved the provision of information and photos and videos to parents remotely from the NICU using systems like vCreate and AngelEye. Babies have been brought to visit their mothers prior to current infection control concerns.

This is the first known quantification of the neonatal workload associated with births attended by a neonatal team in non-maternity hospitals in the Republic of Ireland. This is limited to the cases attended by NNTP and does not include cases for which the NNTP did not attend. For logistical reasons the NNTP are unable to provide this service to hospitals outside of the Dublin area given the acute nature of our service. This data supports the utility of co-location of a maternity hospital with a tertiary sub-specialist adult hospital, however given the wide range of cases (neurosurgical, cardiac and haematology) there is no single centre in Dublin that is a national referral centre for all subspecialties and so maintaining expertise in non-maternity hospital deliveries is important. This data also supports maintaining this service provided by the NNTP, as referenced in the National Model of Care.<sup>5</sup> The lack of consistent measurement of birth weight was likely due to the lack of weighing scales in the non-maternity hospitals and that can be improved. A checklist to include documentation for these deliveries could be developed between the NNTP and involved maternity hospitals in order to optimise documentation for these high-risk cases.

**Declaration of Conflicts of Interest:**

There are no conflicts of interest to declare.

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