

Article type : Brief Report

**The distance between the delivery room and neonatal intensive care unit had no impact on the respiratory management of preterm infants at birth**

Daniele Trevisanuto, MD daniele.trevisanuto@gmail.com, Department of Women's and Children's Health, School of Medicine, Padua University, Azienda Ospedaliera di Padova, Padua, Italy.

Francesca Rech Morassutti, MD, rechmo.f@gmail.com, Department of Women's and Children's Health, School of Medicine, Padua University, Azienda Ospedaliera di Padova, Padua, Italy.

Nicoletta Doglioni, MD, PhD, nicolettadoglioni@yahoo.it, Department of Women's and Children's Health, School of Medicine, Padua University, Azienda Ospedaliera di Padova, Padua, Italy.

Cristina Contessotto Avilés, crisconte@hotmail.com, University Hospital Virgen de la Arrixaca, Murcia, Spain.

Alfonso Galderisi, MD, alfonsoalderisi@gmail.com, Department of Women's and Children's Health, School of Medicine, Padua University, Azienda Ospedaliera di Padova, Padua, Italy.

This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/apa.14107

This article is protected by copyright. All rights reserved.

Francesco Cavallin, MS, cescocava@libero.it, Independent Statistician, Padua, Italy.

**Corresponding Author:**

Daniele Trevisanuto, MD

Department of Women and Children Health

Medical School, University of Padua

Azienda Ospedaliera Padova

Via Giustiniani, 3

35128 Padua, Italy

Tel. 39 049 8213545

Fax 39 049 8213502

E-mail daniele.trevisanuto@gmail.com

**Abbreviations**

CPAP, Continuous positive airway pressure; ELBW, Extremely low birth weight; IQR, interquartile range; NICU, Neonatal intensive care unit.

The respiratory management of extremely low birth weight (ELBW) infants is crucial during the postnatal stabilisation phase, as it has potential short and long-term consequences (1). Ideally, the neonatal intensive care unit (NICU) should be located near the delivery area (1). We hypothesised that a longer distance between the delivery room and NICU could encourage clinicians to favour invasive respiratory support for ELBW infants to maximise their safe transport to the NICU.

This study was conducted at the Padua University Hospital, Italy, from January 2005 to December 2013. The hospital's local protocol on the resuscitation of babies at birth is based on the European Resuscitation Council Guidelines and the European Consensus Guidelines on the management of respiratory distress syndrome (3,4). Our department has two delivery areas that are different distances from the NICU. The closest is on the floor below the NICU and easily accessed using one elevator. The furthest is in another building and staff have to use an underground corridor of 80 meters and three elevators to reach the NICU (Figure 1). The average transit times from the closest and furthest delivery rooms to the NICU are about five and ten minutes. The delivery room management of neonates and NICU transfers are handled by the same team using a dedicated neonatal transport incubator.

We retrospectively reviewed the medical records of all infants with a gestational age of up to 28 weeks and, or a birth weight of up to 1,000g who were admitted to the NICU during the study period. They were divided in two groups based on the delivery room they were born in. The primary outcome was invasive respiratory support at the time of the infant's NICU admission. The secondary outcomes included: temperature at admission, duration of mechanical ventilation and supplemental oxygen, mortality, age at discharge, intraventricular haemorrhage, respiratory distress syndrome, bronchopulmonary dysplasia, apnoea of prematurity, hypoglycaemia, convulsions and sepsis.

Invasive and non-invasive respiratory supports were defined as intubation/mechanical ventilation and nasal continuous positive airway pressure (CPAP) or nasal intermittent positive pressure ventilation, respectively.

The study comprised 470 ELBW infants with a median gestational age of 27 weeks and interquartile range (IQR) of 25-28 and a median birth weight of 820g (IQR 630-955g). Of these, 329 were born in the closest delivery room and 141 in the furthest delivery room. The patient characteristics were similar between the two groups, apart from differences in the age at admission, mode of delivery,

birth weight and Apgar score at five minutes (Table S1). On NICU admission, 279 infants (59.4%) required invasive respiratory support, 145 (30.9%) required non-invasive respiratory support, namely nasal CPAP, and 46 (9.8%) were breathing spontaneously.

Respiratory management was similar between the groups ( $p=0.32$ ) (Table S2), but changed during the study period ( $p=0.002$ ) (Figure S1). The multivariable analysis (Table S3) showed that the effect of delivery room on the need for invasive respiratory support was not statistically significant ( $p=0.78$ ). However, gestational age, with an odds ratio (OR) of 0.57, 95% confidence interval (95% CI) of 0.48-0.68, birth weight (OR 0.86, 95% CI 0.76-0.98) and the five-minute Apgar score (OR 0.30, 95% CI 0.22-0.41) were protective factors. The secondary outcomes were similar between the groups (Table S2).

The percentage of newborn infants managed with invasive respiratory support was high compared to other studies, but comparable to an Italian survey (5,6) and the Vermont Oxford Network.

Although we included a large number of ELBW infants over a long period of time, this was a retrospective, observational study, which limited the strength of the results. Modern hospital designs suggest delivery rooms are directly connected to NICUs, unlike ours, and this limits the generalisability of our findings to hospitals with similar design issues.

Neonates with the highest risks need intensive care, that starts antenatally and is continued with equal or greater attention from the delivery room to NICU. A short distance between these has been recommended, to minimise potential problems during transport and optimise human and equipment resources (1).

Our study found that the delivery room respiratory management of ELBW infants was not influenced by the distance to the NICU and that the outcomes were similar in both groups. Further studies are needed to define the ideal design of maternal and neonatal areas in hospitals. In addition to clinical aspects, these also need to take into account the patient's proximity to other services and provide facilities that promote patient and family centred care.

#### **Funding**

This study did not receive any specific funding.

#### **Conflicts of interest**

The authors have no conflicts of interest to report.

#### **REFERENCES**

1. Subramaniam P, Ho JJ, Davis PG. Prophylactic nasal continuous positive airway pressure for preventing morbidity and mortality in very preterm infants. *Cochrane Database Syst Rev* 2016; (6): CD001243.
2. American Academy of Pediatrics/American College of Obstetricians and Gynecologists. *Guidelines for Perinatal Care*. 7th ed. Elk Grove Village: IL/Washington, DC, 2012.
3. Wyllie J, Bruinenberg J, Roehr CC, Rüdiger M, Trevisanuto D, Urlesberger B. European Resuscitation Council Guidelines for Resuscitation 2015: Section 7. Resuscitation and support of transition of babies at birth. *Resuscitation* 2015; 95: 249-63.

4. Sweet DG, Carnielli V, Greisen G, Hallman M, Ozek E, Plavka R, et al. European Consensus Guidelines on the Management of Respiratory Distress Syndrome - 2016 Update. *Neonatology* 2017; 111: 107-25.
5. Trevisanuto D, Satariano I, Doglioni N, Criscoli G, Cavallin F, Gizzi C, et al. Changes over time in delivery room management of extremely low birth weight infants in Italy. *Resuscitation* 2014; 85: 1072-6.
6. Trevisanuto D, Satariano I, Doglioni N, Criscoli G, Cavallin F, Gizzi C, et al. Delivery room management of extremely low birthweight infants shows marked geographical variations in Italy. *Acta Paediatr* 2014; 103: 605-11.

## FIGURES

**Figure 1.** Location of delivery rooms and NICU at the Department of Women's and Children's Health of the University of Padova, Padova, Italy. (yellow boxes = elevators)

**Figure S1.** Delivery room respiratory management over time.

