



SPANISH ASSOCIATION OF PAEDIATRICS

## Hospital discharge criteria for very low birth weight newborns<sup>☆</sup>



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### KEYWORDS

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**Abstract** Hospital discharge criteria for the pre-term newborn are mainly based on physiological competences (thermoregulation, respiratory stability, and feeding skills), although family support and ability to care for the baby, as well as a well-planned discharge are also cornerstones to ensure a successful discharge.

In this article, the Committee of Standards of the Spanish Society of Neonatology reviews the current hospital discharge criteria in order for it to be useful as a clinical guide in Spanish neonatal units.

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**PALABRAS CLAVE**

Pretermo;  
Alta hospitalaria;  
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**Criterios de alta hospitalaria para el recién nacido de muy bajo peso al nacimiento**

**Resumen** Los criterios de alta del recién nacido pretermo se basan principalmente en los denominados criterios fisiológicos (termorregulación, estabilidad respiratoria y la capacidad para realizar alimentación oral), sin que podamos olvidar la importancia de la adquisición de competencias por parte de los padres para el cuidado de sus hijos y la necesidad de una adecuada planificación del alta como pilares de un alta con plenas garantías.

En este documento del Comité de Estándares de la Sociedad Española de Neonatología se revisan los criterios de alta del recién nacido pretermo con objeto de que pueda ser útil como guía en la planificación del alta y para unificar criterios entre las distintas Unidades de Neonatología.

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## Introduction

The increased survival of preterm (PT) infants in recent years means that at present more than 90% of PT infants delivered at 27 or more weeks' gestation are discharged from neonatal care units.<sup>1</sup>

Advances in neonatal care and the participation and competence of parents in the care of PT infants have led to changes in the discharge criteria for these patients in the past few years. Indicators such as the estimated delivery date or body weight are no longer the main criteria and have become secondary to the adequate stabilisation of the patient. At present, PT infants are frequently discharged with weights of less than 2 kg, as there is evidence that early discharge is safe if it is based on physiological criteria.<sup>2-4</sup>

The length of stay of PT infants in neonatal intensive care units (NICUs) and postmenstrual age (PMA) at discharge are inversely proportional to gestational age (GA) at birth. In addition to GA at birth, the presence of comorbidities (sepsis, necrotising enterocolitis [NEC], retinopathy of prematurity, bronchopulmonary dysplasia) is also associated with length of stay.<sup>5</sup> The mean length of stay also varies based on geographical location, cultural factors and the particular characteristics of each NICU. Table 1 summarises the data for weight at discharge and length of stay in days of the Spanish database of newborns with birth weights of less than 1500 g (SEN1500) in 2014.<sup>6</sup>

## Objective

The objective of these recommendations is to revise the discharge criteria for PT infants based on the currently available evidence. While these criteria are known and used in most NICUs in Spain, there is variability in how they are implemented in different units, so the recommendations of this Committee will attempt to unify the criteria to promote the standardisation of clinical practise in the discharge of very-low-birth-weight PT infants in Spain.

## Methods

To determine the level of the evidence available to address the questions that arise in the discharge of PT infants, we conducted a systematic literature review. We conducted the search through index terms and keyword free-text searching in 2 databases: Medline (consulted directly through PubMed using the index terms [Medical Subject Headings, MeSH] and keyword free-text searching) and the ISI Web of Knowledge (<http://isiwebofknowledge.com>), through the link [www.accesowok.fecyt.es](http://www.accesowok.fecyt.es) of the Fundación Española para la Ciencia y la Tecnología [FECYT]). As a complementary search strategy, we did backward searches of the references cited in each identified article.

To assess the level of the evidence obtained through the systematic review, we followed the classification adopted by the Centre of Evidence Based Medicine (<http://www.cebm.net>) (Table 2), and the grades for recommendations were based on the criteria of the Canadian Task Force on Preventive Health Care<sup>7</sup> (Table 3).

## Discharge criteria

### Infant competencies

The physiological criteria that are considered essential for discharge are thermoregulation, respiratory stability and adequate oral feeding skills.<sup>8-10</sup> While they are associated with overall maturity and postnatal development, all three may reach optimal levels at different PMAs and can be impacted by comorbidities and the perinatal clinical outcomes in the patient.

#### Thermoregulation

In PT infants, the ability to maintain temperature improves with increasing postnatal age, and is one of the competencies that must be ascertained in the patient prior to discharge. The main determinants of postnatal thermoregulation are GA, birth weight and postnatal age.<sup>11</sup>

The most widespread practice at present is transfer to a cot, so that when the infant seems ready to leave

**Table 1** Weight at discharge and length of stay in days by weeks of gestational age at birth of very-low-birth-weight preterm infants.

	Gestational age at birth (weeks)				Total (n = 2353)
	<24 (n = 8)	24–25 (n = 147)	26–27 (n = 372)	28–29 (n = 602)	≥30 (n = 1224)
Weight at discharge (g)	3355 (2980–3995)	2750 (2370–3140)	2580 (2255–3008)	2360 (2160–2736)	2145 (2000–2335)
Length of stay (days)	150 (127–198)	98 (88–120)	79 (67–94)	57 (48–70)	36 (28–47)

Data expressed as median (interquartile range). 2014 SEN1500 report. SEN1500 Network.  
Source: Figueras-Alloy et al.<sup>6</sup>.

**Table 2** Levels of evidence (Centre for Evidence-Based Medicine).

Level	Source of evidence
1a	SR (with homogeneity) of RCTs
1b	RCTs
2a	SR (with homogeneity) of cohort studies
2b	Cohort studies or low-quality RCTs
3a	SR (with homogeneity) of case-control studies
3b	Case-control studies
4	Case series (and poor quality cohort and case-control studies)
5	Expert opinion

RCT, randomised controlled trial; SR, systematic review.

the incubator, he or she is moved from a thermoneutral environment to one with a lower temperature that demands an increase in heat production to maintain body temperature. The associated increase in energy expenditure may delay weight gain.<sup>12</sup> In current practice, the timing of this transition is based on body weight, so that patients are transferred to the cot when they reach a weight of 1700–1800 g. However, this weight threshold is arbitrary and may delay transfer to the cot and sometimes discharge in patients that are sufficiently mature to maintain a stable temperature outside the incubator. Conversely, transferring patients to the cot before they are ready may lead to weight loss and thus to extended hospitalisation.<sup>11</sup>

A meta-analysis on this subject published by New et al. in 2011<sup>11</sup> identified four studies that compared the transfer to the cot of patients with weights of less than 1700 g with the transfer of patients with greater weights. This review did not find evidence of an association between the transfer of stable patients with weights of less than 1700 g out of the incubator and an increased risk of thermal instability or a decrease in weight gain. We ought to mention that patients transferred from the incubator with lower weights did not have longer hospitalisations. It is very likely that newly developed incubators that include specific software

**Table 3** Grades of recommendation.

A	There is good evidence to recommend the clinical preventive action
B	There is fair evidence to recommend the clinical preventive action
C	The existing evidence is conflicting and does not allow to make a recommendation for or against use of the clinical preventive action; however, other factors may influence decision-making
D	There is fair evidence to recommend against the clinical preventive action
E	There is good evidence to recommend against the clinical preventive action
I	There is insufficient evidence to make a recommendation; however, other factors may influence decision-making

Source: Care CTFoPH.<sup>7</sup>

for automatic gradual weaning programmes may help ease this transition.

*Recommendations:*

- The transfer from the incubator to the cot can be based on the stability of the patient, and can take place in patients with weights of less than 1700 g, although doing so does not guarantee an earlier discharge. *Level of evidence: 4. Grade of recommendation: C.*
- Patients can be discharged when they are capable of maintaining a normal body temperature (36–37 °C) when fully clothed in an open cot at a room temperature of 20–25 °C. *Level of evidence: 3b. Grade of recommendation: B.*

#### Oral feeding skills and adequate weight gain

*Human milk, fortification, and supplementation.* There is evidence of short- and long-term benefits of feeding human milk to PT infants. It has been associated with a lower incidence of sepsis and NEC,<sup>13</sup> and its benefits are not only realised during the hospital stay, but also become apparent in the long term,<sup>14</sup> with a decreased rate of readmission after discharge and better neurodevelopmental outcomes.<sup>15</sup> Furthermore, it improves clinical feeding tolerance, so that full enteral feeding can be achieved earlier.<sup>16</sup> Given the considerable benefits attributed to breastfeeding, the policy statement of the American Academy of Paediatrics (AAP) recommends that all PT infants being fed human milk, preferably their mother's or, if not available, from a donor.<sup>16</sup> Human milk should be fortified appropriately with protein, minerals and vitamins for PT infants weighing less than 1500 g at birth.

*Recommendation:* the administration of fresh maternal or donor human milk should be promoted and facilitated from the beginning of enteral feeding, and this milk will be fortified. *Level of evidence: 1. Grade of recommendation: A.*

*Transition to full enteral feeding.* Once patients can suck efficiently, they can be transitioned from feeding through a nasogastric tube to feeding through active bottle sucking or placing the infant directly on the breast.

The time that each patient needs to progress to full enteral feeding varies, and is determined by multiple patient-based factors (PMA, adequate coordination of sucking and swallowing, comorbidities and others) and the protocols applied in each unit. It seems that once the patient is ready, earlier transitioning is associated with earlier achievement of full enteral feeding.<sup>17,18</sup> Preterm infants may be ready to feed orally before the time that is currently established as the norm.<sup>17,19</sup> Determining whether the patient is ready for oral feeding requires the individual assessment of the maturity of the coordination of sucking and swallowing (understood as a process with oral, pharyngeal and oesophageal phases) as well as breathing, as opposed to assessing readiness based on PMA. To this end, a recently published study proposed a 5-stage descriptive scale based on the presence or absence of suction and expression components, as well as their rhythmicity.<sup>20</sup>

*Recommendation:* at present, there is insufficient evidence to provide unequivocal recommendations. The most widespread practice is to initiate oral feeding at 32–34

weeks' PMA with a trial-and-error approach, increasing feeds based on the maturity and coordination exhibited by the patient. This approach may change in the near future to a more individualised approach to determine feeding skills based on scales that assess suck-swallow-breathing coordination. *Level of evidence: 4. Grade of recommendation: C.*

*Does bottle-feeding interfere with the establishment of exclusive breastfeeding?* There is evidence suggesting that avoiding bottle-feeding from the start may be associated with an increase in the rate of exclusive breastfeeding at discharge and at 3 months post discharge,<sup>21</sup> although when this issue was explored by a systematic review and meta-analysis, and due to the heterogeneity of the studies on the subject, the evidence did not support stating that the use of bottles interferes with the successful establishment of breastfeeding.

*Recommendation:* The correct establishment of breastfeeding will be promoted, although currently there is not sufficient evidence to state that the use of bottles can interfere with it. *Level of evidence: 4. Grade of recommendation: C.*

*Scheduled versus cue-based feeding.* We need to take into account that feeding rules and schedules in many European and North American neonatal units derive from measures established in the early XX century, when standard neonatal care involved separating the child from the mother and strict rules regarding the scheduling of feeds (every 3–4 h).<sup>22</sup> Although this approach has been abandoned, some routine practices in today's neonatal units are still influenced by it.

While some studies in PT infants have demonstrated the feasibility of cue-based feeding and their ability to regulate their own intake, the overall trend in neonatal units and the advice given prior to discharge are conditioned, as we just discussed, by a "culture" focused on scheduled feeding and intake volume.<sup>23</sup> The concern and justification underlying this approach is that these patients may experience episodes of hypoglycaemia if feed volume is reduced or feeds are delayed,<sup>24</sup> which, if recurrent, may impair growth and neurologic outcomes.<sup>25</sup> A recent systematic review addressed this issue, given that cue-based feeding of preterm patients may help in the establishment of independent oral feeding, allow earlier hospital discharge and enhance neonatal care skills and satisfaction in parents.<sup>26</sup> The trials included in this review assessed only short-term outcomes, and their meta-analysis was limited by the quality of their data. When it came to patient discharge and length of stay, the review did not find an effect of either feeding approach on length of hospitalisation.

*Recommendation:* current evidence is insufficient to assert that feeding strategy (cue-based vs scheduled) affects weight gain and length of stay outcomes. *Level of evidence: 2b. Grade of recommendation: C.*

#### Respiratory stability

Preterm infants must be able to maintain respiratory stability while supine, the preferred position in which they should be placed, especially from 32 weeks' GA, so that they can become accustomed to it, as this is the position recommended for infants at home to prevent sudden infant death syndrome.<sup>10</sup>

### Apnoea of prematurity

Neonatal units often have patients with persistent episodes of apnoea (defined as an interruption of breathing lasting 20 s or more, or between 10 and 20 s if accompanied by bradycardia [heart rate < 80 bpm] or oxygen desaturation [ $Sat_{O_2} < 80\%$ ]) after the first weeks post birth, even at times when they could be considered ready for discharge based on the stability of other parameters and adequate weight gain. There is considerable variability between hospitals in the discharge of these patients, with a period of in-hospital observation to identify an apnoea-free interval prior to the discontinuation of monitoring and discharge. The specified duration of this interval varies, increasing with decreasing GA, and it may be advisable to establish an interval of 7–13 days (from greater to lesser GA) from the last event and after caffeine discontinuation to consider the patient apnoea-free.<sup>27</sup> *Level of evidence:* 2b, *Grade of recommendation:* C.

As for home monitoring, the existing evidence has failed to demonstrate an associated decrease in the length or costs of hospitalisation, and it does not support its routine use, as apnoea of prematurity is not considered a risk factor for sudden infant death syndrome.<sup>28,29</sup>

### Family competencies

As advances are made in the humanization of NICUs and developmental care, parents are increasingly involved in the care of PT infants, so that preparedness for discharge can be addressed from the moment of admission and developed in stages, increasing parental self-confidence and the certainty that the infant is ready to go home.<sup>1</sup>

*Recommendation:* parent-child interaction and the integration of parents in NICUs will be promoted so that they participate in the day-to-day of their children in the unit and develop the necessary competencies to care for them after discharge. *Level of evidence:* 1b. *Grade of recommendation:* B.

Table 4 summarises the recommendations for the discharge of PT infants.

### Discharge planning and home-care recommendations

Discharge from the NICU of a preterm infant requires close attention to the specific health problems the infant may face, as well as planning the multidisciplinary followup that may be required. Thoughtful and thorough discharge planning may reduce the risk of morbidity, mortality and readmission, which are frequent in this group of patients.<sup>9</sup> A checklist for the discharge of the PT infant may be very useful for this purpose (Table 5).

### Car seat challenge

One of the recommendations of the AAP is the performance prior to discharge of a test consisting in placing the infant in a car seat to assess the cardiorespiratory stability of patients in this type of surface. This recommendation was made on the basis of physiological monitoring studies that

**Table 4** Summary of the recommendations.

1. The transfer from the incubator to the cot can be based on the stability of the patient, and can take place in patients with weights of less than 1700 g, although doing so does not guarantee an earlier discharge. Level of evidence: 4. Grade of recommendation: C
2. Patients can be discharged when they are capable of maintaining a normal body temperature (36–37 °C) when fully clothed in an open cot at a room temperature of 20–25 °C. Level of evidence: 3b. Grade of recommendation: B
3. The administration of fresh maternal or donor human milk should be promoted and facilitated from the beginning of enteral feeding, and this milk will be fortified. Level of evidence: 1. Grade of recommendation: A
4. Oral feeding: at present, there are no evidence-based guidelines allowing us to give unequivocal recommendations. The most widespread practice is to initiate oral feeding at 32–34 weeks' postmenstrual age with a trial-and-error approach, increasing feeds based on the maturity and coordination exhibited by the patient. Level of evidence: 4. Grade of recommendation: C
5. The correct establishment of breastfeeding will be promoted, although currently there is not sufficient evidence to state that the use of bottles can interfere with it. Level of evidence: 4. Grade of recommendation: C
6. Current evidence is insufficient to assert that feeding strategy (cue-based vs scheduled) affects weight gain and length of stay outcomes. Level of evidence: 2b. Grade of recommendation: C
7. Observation of infant, following discontinuation of caffeine, for a period of 7 to 13 days (from greater to lesser GA) from the last event to consider the patient to be apnoea-free. Level of evidence: 2b. Grade of recommendation: C
8. Parent-child interaction and the integration of parents in NICUs will be promoted so that they participate in the day-to-day of their children in the unit and develop the necessary competencies to care for them after discharge. Level of evidence: 1b. Grade of recommendation: B
9. Routine performance of the "car seat challenge" is not recommended (level of evidence: 3, grade: C). In any case, it is recommended that parents or other caregivers are advised and trained in adequate use and technique prior to hospital discharge (level of evidence: 3, grade: C)

found that some preterm infants experienced episodes of desaturation, apnoea or bradycardia in car seats.<sup>30,31</sup> However, a systematic review of the data on which this recommendation was based did not identify any randomised controlled trials that assessed whether undertaking a car seat challenge is beneficial to preterm infants in preventing these episodes compared to not undertaking it.<sup>32</sup> A recent update of the recommendations of the Canadian Paediatric Society did not recommend the routine performance of the car seat challenge (*level of evidence:* 3, *grade:* C).<sup>33</sup> In any case, we do recommend advising and training parents or

**Table 5** Discharge checklist for the preterm infant.

Thermoregulation	The patient is able to maintain a normal body temperature (36–37 °C) when fully clothed in an open bed	<input type="checkbox"/>
Nutrition at discharge	The patient can meet his or her full energy requirements and achieve adequate weight gain through full enteral feeding. We must promote the establishment of adequate breastfeeding	<input type="checkbox"/>
Respiratory stability	The patient is able to maintain respiratory stability in the supine position	<input type="checkbox"/>
Apnoea of prematurity	An apnoea-free interval of at least one week (up to 2 weeks in PT infants of lesser GA) has been observed after caffeine discontinuation	<input type="checkbox"/>
Bronchopulmonary dysplasia	If the patient needs home oxygen therapy, an individualised social and family assessment will be performed to ensure that the family has the necessary resources (home oxygen, pulse oximetry, etc.). Parents will be trained to identify and intervene in high-risk situations	<input type="checkbox"/>
Retinopathy of prematurity	The patient has undergone a ROP screen and, when applicable, post-discharge follow-up ophthalmological care has been arranged	<input type="checkbox"/>
Neurologic risk	Referral to early intervention services and follow-up neurologic care based on the degree of neurologic risk or impairment. The neurologic follow-up must be coordinated with primary care and early intervention services.	<input type="checkbox"/>
Anaemia of prematurity	Adequate energy and iron intake and absence of clinical manifestations of anaemia	<input type="checkbox"/>
Vaccination	The patient has received the first dose of the HepB vaccine and, depending on the length of stay, other necessary doses of this and other vaccines based on the official immunisation schedule	<input type="checkbox"/>
RSV prophylaxis	If the patient qualifies for palivizumab, schedule the necessary post-discharge appointments	<input type="checkbox"/>
Hearing screen	Must be performed prior to discharge, and a referral given if hearing loss is detected	<input type="checkbox"/>
Family and environment	Absence of social or family risk factors, or arrangement of follow-up and support services	<input type="checkbox"/>

other caregivers so that they develop adequate practices and skills in the use of car seats prior to hospital discharge (*level of evidence: 3, grade: C*).<sup>33</sup>

### Growth monitoring

The patient's growth must be monitored after discharge, which is usually done by the primary care paediatrician (growth velocity for length, head circumference and weight), and it is important to check whether the patient does or does not exhibit catch-up growth, and how long it takes for this catchup to occur.

### Feeding, fortification and vitamin D

Prior to discharge, breast milk can be fortified if it is the sole nutrition provided to the patient, but this is not always feasible post discharge and there is insufficient evidence that such fortification has any effect on post-discharge growth rates.<sup>34</sup>

Supplementation post discharge can be accomplished by the addition of preterm formula to breastmilk.<sup>9</sup> It could be appropriate to continue supplementation with preterm formula until 6–9 months of corrected age, and extending this period to age 12 months could be contemplated in infants with comorbidities.<sup>9</sup> Infants that are exclusively or partially breastfed or consume less than 1 L of formula a day must be given vitamin D, which may be also indicated based on geographical latitude or maternal nutritional status.<sup>35</sup> The

recommended dose ranges between 400 and 1000 IU/day depending on whether vitamin D deficiency is detected in the PT infant.

### Oxygen

Patients discharged on home oxygen therapy should also be under cardiorespiratory monitoring (pulse oximetry), and parents should receive the necessary training to identify high-risk complications that may result from unexpected losses of supplemental oxygen.

If the patient is discharged home with a tracheostomy, the family must have developed the required skills and been provided with the necessary resources to perform suctioning and aspiration of secretions and replace the tracheostomy tube.

### Neurologic risk

The in-hospital or primary care followup of the patient will be determined based on neurologic risk and current protocols in each autonomous community. Patients must be referred to an early intervention centre near their homes.

At present, there is insufficient evidence to recommend the routine performance of brain MRI at term-equivalent age in preterm infants in the absence of perinatal comorbidities, and its use should be restricted to patients with neurologic impairment evinced through neurologic evaluation or abnormal findings in serial cranial ultrasound scans.<sup>36</sup>

## Anaemia of prematurity

This condition is an accentuation of the physiologic anaemia that occurs in term infants. The threshold for transfusion has not been clearly established for patients that are stable and may be discharged soon. The post-discharge followup of patients with anaemia involves monitoring for adequate energy and iron intake and the absence of manifestations associated with anaemia (persistent tachycardia, poor weight gain), and for evidence of a spontaneous increase in haemoglobin levels coupled with the presence of reticulocytosis.<sup>9</sup>

## Retinopathy of prematurity

An initial ophthalmological evaluation must be conducted during hospitalisation, and post-discharge follow-up appointments scheduled as needed.

## Hearing loss screen

Patients must have undergone the hearing screen prior to discharge, and an appropriate follow-up plan established in case neurosensory hearing loss is detected.

## Vaccinations and prophylaxis against respiratory syncytial virus

In addition to receiving the hepatitis B vaccine, patients identified as eligible for prophylactic treatment against respiratory syncytial virus should be granted access to this treatment, establishing a plan or dose schedule at the time of discharge to facilitate adherence to it.

## Conflicts of interest

The authors have no conflicts of interest to declare.

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