




Nordic survey showed wide variation in discharge practices for very preterm infants

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Abstract

Aim: We aimed to describe clinical practices and criteria for discharge of very preterm infants in Nordic neonatal units.

Methods: Medical directors of all 89 level-2 and level-3 units in Denmark, Finland, Iceland, Norway and Sweden were invited by e-mail to complete a web-based multiple-choice survey with the option to make additional free-text comments.

Results: We received responses from 83/89 units (93%). In all responding units, discharge readiness was based mainly on clinical assessment with varying criteria. In addition, 36% used formal tests of cardiorespiratory stability and 59% used criteria related to infant weight or growth. For discharge with feeding tube, parental ability to speak the national language or English was mandatory in 45% of units, with large variation among countries. Post-discharge home visits and video-consultations were provided by 59% and 51%, respectively. In 54% of units, parental preparation for discharge were not initiated until the last two weeks of hospital stay.

Conclusion: Discharge readiness was based mainly on clinical assessment, with criteria varying among units despite similar population characteristics and care structures. This variation indicates a lack of evidence base and may unnecessarily delay discharge; further studies of this matter are needed. Earlier parental preparation and use of interpreters might facilitate earlier discharge.

KEYWORDS

early discharge, length of stay, neonatal home care, preterm infant, telemedicine

Abbreviations: ECG, electrocardiogram; KMC, kangaroo mother care; LOS, length of stay; NICU, neonatal intensive care unit; PMA, postmenstrual age.

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1 | INTRODUCTION

Criteria and routines for hospital discharge of preterm infants have gradually changed in recent decades, favouring discharge at a lower postmenstrual age (PMA) and weight.^{1,2} This has to some extent been driven by a lack of staff and hospital facilities,^{3,4} but also by the development of home-based neonatal care and by increasing early parental involvement and presence in the neonatal intensive care unit (NICU).⁵⁻⁷ Compared with NICU care, neonatal home care might improve health by reducing parent-infant separation, facilitating parent-infant bonding and increasing parental empowerment.^{1,5,8} Earlier discharge to home-based care could be beneficial but requires an understanding of the criteria and preparations important for safe discharge, and of how to assess infant and parent readiness.^{3,9-15}

Cardiorespiratory stability^{14,16} is considered a prerequisite for discharge and determines when continuous monitoring of heart rate or oxygen saturation can be discontinued.¹² Clinical evaluation of cardiorespiratory stability is usually done by bedside observation and documentation of apnoeas and bradycardias, sometimes complemented with more formal pre-discharge tests. One such test is the car seat test and another uses the structured evaluation of data from ECG and oximetry monitored for a set period.¹⁷ Often, the decision to discontinue continuous monitoring is based on a combination of monitoring data, the infant's gestational age at birth, postmenstrual age, caffeine treatment and conditions related to neurological and/or pulmonary function.¹⁷ Other parameters, such as the infant's ability to feed and grow, are often evaluated in discharge planning but should not postpone discharge since home care may potentially improve breastfeeding.^{5,13}

Transitioning to home-based care might add to parental stress if discharge planning and preparations are not well executed.^{3,18-22} Parental pre-discharge preparation programmes ensure that parents administer medications and other therapies correctly, are able to safely manage non-acute medical problems, and know when to seek medical attention.^{5,13,18,23,24} The use of institutional guidelines and policies can standardise this process and decrease variability.^{23,25}

After discharge, assigned staff should be available to guide parents in infant care and to follow up.^{1,3,18,26} Home visits, and in more recent years video consultations, have been shown to bridge the gap between hospital and home care, helping parents establish independent parenthood.^{1,8,27}

This survey aimed to assess discharge routines and criteria, related assessment tools and post-discharge support for very preterm infants in the Nordic countries.

2 | METHODS

A cross-sectional web-based multiple-choice survey with 27 questions was designed based on literature and clinical experience (Appendix S1). Free-text options were provided for additional comments and clarifications. The questions addressed the discharge of

Key notes

- This study investigated discharge criteria, assessment tools and post-discharge support for very preterm infants in Nordic countries.
- Discharge readiness was based mainly on clinical assessment with varying criteria and post-discharge home visits or video-consultations were largely implemented, but language barriers delayed discharge.
- Variation in discharge criteria indicates a lack of evidence base and removal of criteria related to weight, earlier parental preparation and use of interpreters might facilitate earlier discharge.

very preterm infants, born before 32 weeks of gestation, from the NICU to home care and covered discharge criteria, discharge process, support after discharge and the responding physicians' view of the existing versus ideal discharge process.

An invitation with a link to the survey, created using REDCap (Research Electronic Data Capture), was e-mailed to the directors of all 89 neonatal units in Denmark, Finland, Iceland, Norway and Sweden. By completing the questionnaire, the respondents agreed to participate in the study. Ethical approval was sought but considered unnecessary by the Swedish Ethical Review Authority (Dnr: 2021-02793). Data were first collected between 27 September and 18 October 2021, with reminders sent via e-mail between 10 January and 27 February 2022. The units were categorised as level 2 or 3 depending on the lowest gestational age of infants they would routinely admit, that is, 28+0 versus 22+0 weeks + days, respectively. Quantitative data were analysed using descriptive statistics and free-text comments were used in further interpreting answers and assessing accuracy in data analysis.

3 | RESULTS

In total, 83/89 units (93%) completed the survey (Table 1; Appendix S2), answering all questions unless otherwise stated. There were no differences in discharge criteria between the 60 level 2 and the 23 level 3 units.

3.1 | Definitions and criteria for discharge

Among responding physicians, 84% considered the criteria used in their unit sufficient to determine when it would be safe to discharge an infant born very preterm. Written guidelines were used in 52% of units, including specified PMA in 70%, specified weight in 41%, control of breathing in 86%, thermoregulation in 79%, feeding skills and weight gain in 93%, social situation including language skills in 57% and parent skills/family competence in 84% (Figure 1). Units

with written guidelines regarding PMA used 34+0 or 35+0 weeks + days as the lower limit for discharge, except one unit in Sweden (PMA 33+0) and one in Denmark (PMA 37+0).

The results below refer to criteria and definitions used in clinical assessments, regardless of the presence or absence of written guidelines.

3.2 | Control of breathing

In total, 58% of units had a standard definition of apnoea; approximately half (56%) of these used more than one of the five definitions given in the questionnaire and 9% had additional definitions. Short feeding-related apnoea was deemed acceptable for discharge by 53% of all units. Evaluation of respiratory stability by clinical bedside monitoring and observation only, without additional pre-discharge tests, was routine in 63%. A car seat test was used by 4/16 units (25%) in Finland, 1/18 units (5%) in Norway and 3/30 units (10%) in Sweden, but not at all in Denmark (0/18) or

TABLE 1 Number of participating units and response rates related to country and level of care.

	Level 2	Level 3	Total (%)
Denmark	14	4	18/18 (100)
Finland	11	5	16/17 (94)
Iceland	0	1	1/1 (100)
Norway	12	6	18/20 (90)
Sweden ^a	23	7	30/33 (91)
All Nordic countries	60	23	83/89 (93)

^aIn Sweden, the three units of Karolinska University Hospital gave a single combined response, as did the two units in Malmö/Lund.

Iceland (0/1). Different tests using ECG and oxygen saturation, registered for a set period and analysed in a structured way, were used by 33% of units in Denmark and Sweden, 38% in Finland, 100% in Iceland and 22% in Norway. Only three units (4%), one each in Denmark, Finland and Sweden, routinely discharged infants with caffeine, and used this routine for all infants going home before PMA 35 weeks. In 13% of units, infants were sometimes discharged with caffeine, in 77% caffeine treatment was always terminated before discharge, and five units (6%) did not respond to this question. The number of days infants needed to be without caffeine with stable respiration before discharge ranged from one to eight, with a median value of 3 days. Home monitoring was provided on a regular basis by 11% of units if the infant had not reached PMA 35 weeks, and an additional 70% provided home monitoring in special cases.

3.3 | Feeding skills and weight gain

More than half (59%) of the units used one or several discharge criteria related to weight (Figure 2). A specified minimum weight for discharge, ranging from 1500 to 2500 g, was used by 19%. Steady weight gain was used as a discharge criterion by 31% of units, with variations in definition such as: 25 g/d, 17–20 g/kg/d, ± 1 SD from birth weight, based on individual PMA (17–32 g/d) and following the growth curve. A specified intake from breast or bottle was required by 27% of units, with the amount ranging from 5% to 50% of total feeding. Full breast or bottle feeding with the feeding tube removed was a prerequisite for discharge in 14% of units. Most physicians considered home to be the best place for a stable preterm infant to grow and develop and agreed or strongly agreed that early discharge promotes breastfeeding (Table 2).

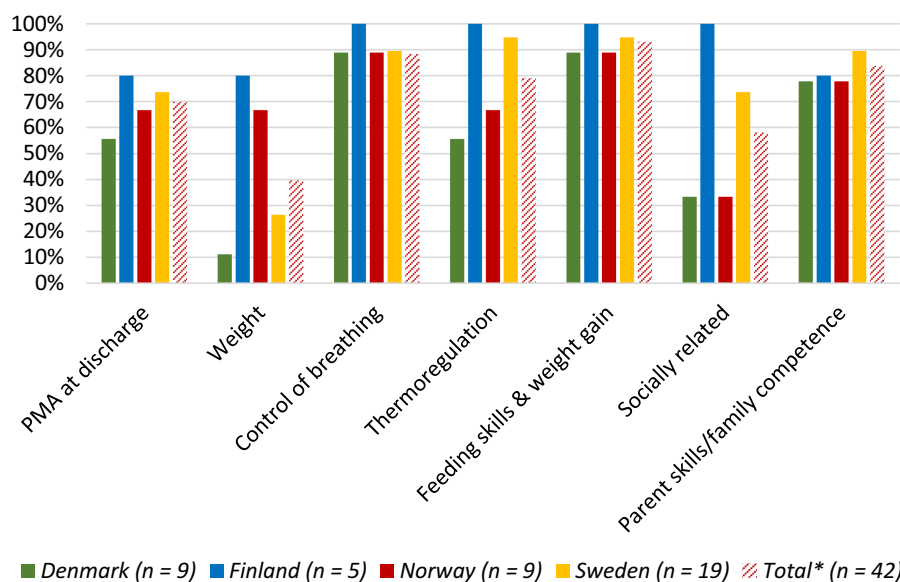


FIGURE 1 Percent of units with written discharge guidelines (total $n=42^*/83$) covering criteria in the specified category (*Iceland not included because it had only one unit).

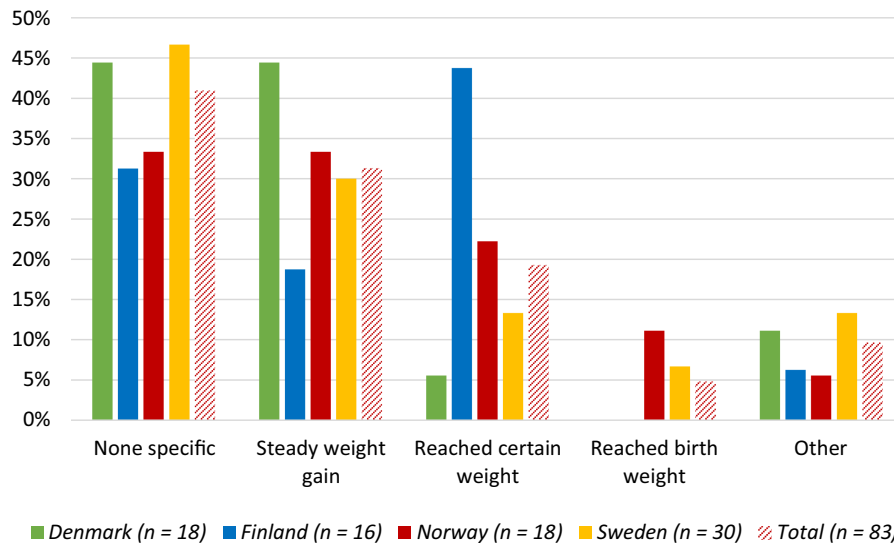


FIGURE 2 Percent of units with weight related criteria (clinical and/or written) for discharge of very preterm infants before term age. Iceland not included because it had only one unit.

TABLE 2 Responding physicians' views of the existing versus ideal discharge process.

	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)	No response (%)
I think our criteria for determining respiratory and circulatory stability are sufficient to discern when it is medically safe to discharge the infant	0	7	5	53	31	4
I think home is the best place for the respiratory and circulatory stable preterm infant to grow and develop	1	1	7	30	59	1
I think the home environment and early discharge have a positive effect on parents' sense of empowerment in regard to caring for and understanding their infant's needs	0	2	6	41	49	1
I think daily visual contact via digital platforms/ video tools would make it possible to discharge the infant earlier	2	29	39	19	8	2
I think routines for kangaroo mother care at home would make it possible to discharge the infant earlier	7	1	17	53	16	6
I think early discharge promotes breastfeeding	1	5	25	51	17	1

3.4 | Thermoregulation

The infant's ability to maintain normal body temperature without a heating mattress was used as a criterion for discharge in all but three units, which instead used the criterion 'normal temperature when cared for skin to skin by a parent'.

3.5 | Social criteria

Social criteria for discharge to early neonatal home care were used by 59% of all units, with variation among countries as shown in Figure 3. These criteria included one or more of the following:

language skills defined as ability to speak the national Nordic language or English, access to a car, living within a certain distance of the hospital and not smoking. Language skills were the most used social criteria, used by 46% of all units with variation as follows: in Denmark 83%, Norway 28% and Sweden 60% of units. In Finland and Iceland, language criteria were not used as such.

3.6 | The discharge process

To evaluate infant readiness for discharge, all units used doctors' and nurses' clinical assessments, while parents' clinical assessment of infant readiness was considered by fewer than half (42%). Evaluation of

parents' readiness for discharge was done in most units by means of nurses' assessment (95%) and/or by asking parents about their readiness (80%). Structured team evaluation of parental readiness was applied in 18% of units and self-evaluation tools for parents in 13%.

3.7 | Information to families

In 69% of units, families were introduced to the possibility of discharge to home care during the first week after admission, while 28% postponed the first information until 1–2 weeks before discharge. More than half (54%) did not start detailed planning including the pre-discharge training of parents until the last 2 weeks of hospital stay, while 16% started during the first week after admission. Practical training covered hygiene practices to minimise risk of infection (94%), feeding tube handling (92%) and breast pump handling/stimulation of lactation (100%). Additional information was given regarding sudden infant death syndrome prevention (82%), supine sleep position (95%), car seat safety (52%), basic life support (73%) and smoking cessation (35%).

3.8 | Support after discharge

All but three units provided home care that included regular hospital check-ups (1–3/week), home visits or a combination of both. Regular home visits were provided by 59% of units (Table 3), and in 76% of these, home care was staffed by registered nurses only. Eight units

used a combination of registered and assistant nurses, and four units located in Denmark, Norway and Sweden used assistant nurses only. An additional 17% of all units provided home visits in rare cases, based on the family's individual needs.

Virtual home care including video consultation was provided by 59% of all units, although seven units did so only in rare cases (Table 3). Only six units reported using interpreter services in video consultations. Home monitoring, defined as pulse oximetry, ECG or apnoea monitoring, was regularly provided by 10% of units for infants discharged before PMA 35 weeks, while 71% of all units used home monitoring only in special cases.

Readmission to the neonatal unit after discharge was possible in 77% of units (Table 3). Physicians estimated that the most common cause of readmission was insufficient weight gain/nutritional difficulties (27%) and/or suspected infection (20%). More than half (59%) could not specify the most common cause because readmissions were rare.

4 | DISCUSSION

Parental presence in the NICU and the early involvement of parents in the care of their very preterm infants facilitate early discharge to the home. This is appreciated by parents and is generally thought to be beneficial for breastfeeding and keeping the family together. However, little is known about the differences among neonatal units in the discharge process or about the evaluation of infant discharge readiness in this new landscape of home-based care.

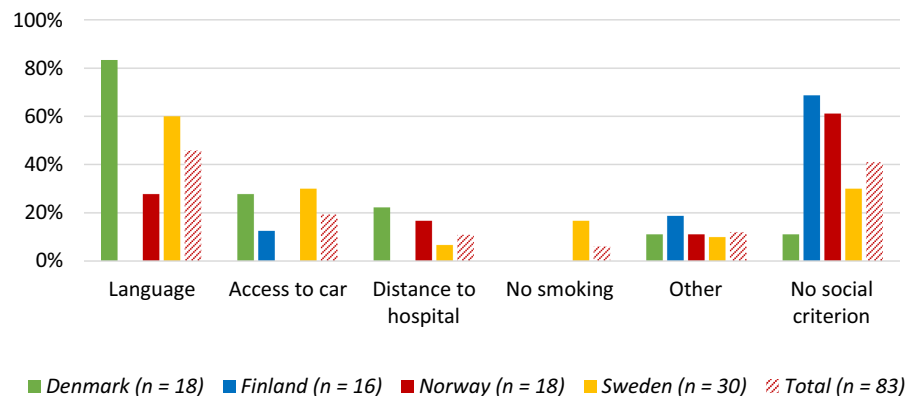


FIGURE 3 Percent of units with socially related criteria (clinical and/or written) for discharge of very preterm infants before term age. Iceland not included because it had only one unit.

TABLE 3 Availability of post-discharge home visits, video-based home care and the possibility of readmission for very preterm infants in the Nordic countries.

	Denmark	Finland	Iceland	Norway	Sweden	All
Number of responding units	18	16	1	18	30	83
Home visits after hospital discharge (%)	7 (39)	9 (56)	0 (0)	10 (56)	23 (77)	49 (59)
Video-based home care (%)	12 (67)	5 (31)	0 (0)	8 (44)	17 (57)	42 (51) ^a
Readmission to NICU possible (%)	17 (94)	6 (38)	1 (100)	13 (72)	27 (90)	64 (77)

Note: Data are the number and per cent of responding units in each country.

^aAn additional seven units provided video-based home care in rare cases.

We report on a comprehensive survey, including 93% of Nordic neonatal level 2 and level 3 units, demonstrating large variations in discharge practices for very preterm infants both among and within countries. We found that in the absence of national guidelines, with variation in the definition of apnoea and little use of tools to evaluate cardiorespiratory stability, very preterm infants' readiness for discharge was based mainly on the staff's bedside observations and experience. The combination of varying local criteria, traditions and experience of individual physicians may, as described by Merritt et al.,²⁸ result in unequal care in terms of the length of hospital stay (LOS). A recent study by Seaton et al.²⁹ demonstrated between-network differences in LOS of up to 3 weeks for babies born before 29 gestational weeks. In that study, Finland had the shortest LOS, 5 days fewer than Sweden, which was the reference.

We found no difference in discharge criteria between level 2 and level 3 units. This is probably because when time of discharge is approaching, even for extremely preterm infants, there is no longer any difference between the care given in units designated as level 2 or level 3. Additionally, regional collaboration is common including pre-discharge transfer of infants from level 3 to level 2 units, and discharge preparations therefore need to be synchronised.

Discharge criteria that do not increase safety or enhance care quality should be omitted. Once respiratory and temperature stability is achieved, the additional value of criteria related to infant weight or feeding skills is questionable, since home-based care has been shown to positively affect breastfeeding and growth.^{1,22} Further analysis of adverse events and actual gestational age at discharge could help to evaluate whether the removal of criteria linked to infant weight, nutrition and PMA at discharge would affect safety. Further research is also needed to evaluate parental preferences regarding the use of cardiorespiratory monitoring at home and its impact on LOS and safety.

The discharge process should optimally be tailored to the needs of the family, with respect to socioeconomic factors, competence, supporting network and ability to communicate.^{3,5,13,25,26,30} Our survey showed that this is currently not the case, as many families were excluded from early discharge to neonatal home care because of limited language skills. This discriminatory practice occurred in a majority of Swedish and Danish units, but was not reported from Finland. Increased use of interpreters and digital communication tools is needed to overcome language barriers and achieve more equal home care.

Parents have described the discharge process as going through phases, and have argued that being suddenly faced with going home or being rushed through information provision could add to stress.^{15,18,22} Our study showed that even though initial information was given soon after admission, detailed and extensive planning and education were often postponed until the last one to 2 weeks before discharge. As early parental involvement in infant care and rooming-in are standard in many Nordic NICUs, a continuous training process in cooperation with parents with a clear focus on going home could be implemented.^{5,22} This could potentially enable parents

to participate more in assessing their infants' discharge readiness, thereby also enhancing the parents' readiness.

Nurse-staffed home care was widely used and included home visits in three out of five units, but only half of all units had implemented virtual home care with video consultations. Virtual home care could be further developed to facilitate more equal access, since home visits are resource demanding and difficult or even impossible when families live far from the hospital.

4.1 | Strengths and limitations

Given our survey's response rate of 93%, the present results probably give a valid overview of discharge practices in Nordic neonatal units. The questionnaire was designed in cooperation with clinically experienced physicians and researchers representing each country, to guarantee that current practice would be covered in the answer alternatives. All respondents were physicians, and the results might have differed if nurses and/or parents had also participated. The use of a multiple-choice questionnaire entailed limitations, because the response alternatives were predetermined and interpretation could differ among responding physicians. This was taken into consideration by giving respondents the opportunity to add free-text comments. Many respondents did so for questions about nutrition and weight, and we accounted for this additional information in the results. Although access to post-discharge support varied within and among the studied countries, post-discharge support is likely even more variable in other countries. Therefore, our results should be generalised cautiously.

5 | CONCLUSION

With similar healthcare systems in the Nordic countries, the variation in discharge criteria and practices seen in Nordic NICUs implies a lack of evidence regarding safe discharge criteria that do not unnecessarily prolong hospital stay. There is a need to further explore the optimal discharge criteria and process. For future studies, the unit-to-unit variation in discharge criteria should be compared with data on LOS and adverse events, to determine which discharge criteria have the greatest impact on LOS and which could be safely removed. Criteria that constitute unnecessary barriers to home care should be identified; this study pointed out language skills and weight at discharge.

All but three units offered nurse-staffed home-based neonatal care and approximately half had implemented video appointments. This enables families to receive skilled support at home, but access could be even further improved by increased use of interpreters and digital tools. Our study also showed that there is room to increase the parents' role and early involvement in discharge planning; to reduce stress and improve parental discharge readiness.

Regardless of the criteria used or the structure of the discharge process, physicians reported that readmissions were rare and adverse events few.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

Original data are available from the corresponding author upon reasonable request.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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