Interinstitutional Variability in Home Care Interventions after Neonatal Intensive Care Unit Discharge

Home O_2 therapy in preterm infants with bronchopulmonary dysplasia (BPD) may facilitate early discharge from the neonatal intensive care unit (NICU), but creates additional stressors for families. No clinical trial has documented the long-term benefits of home O_2 therapy in infants with BPD in the current era of widespread antenatal steroid use and early surfactant therapy. Published guidelines from the American Academy of Pediatrics and American Thoracic Society recommend considering home O_2 therapy for infants with an O_2 saturation <92%-95% in room air, but there is significant variability in home O_2 use among neonatologists.[1,2]

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In this issue of *The Journal*, Lagatta et al[3] report on rates of home O_2 use in preterm infants born between 23 and 31 weeks gestation and cared for in NICUs managed by the Pediatrix Medical Group during 2009. Of the 7881 infants in their study, 1305 (16.6%) were discharged to home on O_2 therapy. Among infants with BPD, those discharged to home on O_2 were of significantly younger postmenstrual age (PMA) at discharge. Risk factors that increased the likelihood of discharge to home with O_2 included early PMA at birth (59.2% of infants born at 23-24 weeks PMA vs 7.3% of infants born at 29-31 weeks PMA), small for gestational age status, mechanical ventilation in the first 3 days of life, higher fraction of inspired O_2 requirement in the first 3 days of life, patent ductus arteriosus, antenatal steroid use, and presence of congenital anomalies. Not surprisingly, however, institutional variation was one of the strongest determinants of home O_2 use, accounting for 4- to 5-fold differences in the frequency of use. Rates of home O_2 therapy ranged from 7% to 95% in infants with BPD, even after adjusting for institutional differences in patient mix and individual clinical risk factors, including altitude.[3]

The strengths of the study of Lagatta et al include the large sample size generated from NICUs in geographically diverse locations, the analysis of a cohort of infants who received care complying with current standards, and the similarity of results from other neonatal networks. The Pediatrix Clinical Data Warehouse is a deidentified dataset that includes details of admission, clinical course, and discharge for a large sample size of patients cared for in 280 NICUs in geographically diverse locations in 33 states, with an ethnically diverse population (48% non-Hispanic white, 26% non-Hispanic black, 17% Hispanic, 9% other).[3] By focusing on discharges in 2009, the authors were able to analyze a cohort of infants whose management was guided by clinical practice likely comparable to 2011 standards. In terms of generalizability of these results to other clinical sites, including academic health centers, it is reassuring that their gestational age–specific rates of home O_2 use are comparable with similar reports from the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development's Neonatal Research Network showing higher rates of home O_2 use in infants of lower birth weight: 15% in very low birth weight infants in 1995-1996 and 11% in very low birth weight infants in 1997-2002.[4,5] As further reassurance of generalizability of these results, the Vermont Oxford Network also reported similar rates of home O_2 use in very low birth weight infants.[6] Of note, however, the institutional variability in home O_2 use rates reported by Lagatta et al (7%-95%) appears to be greater than that reported by the Neonatal Research Network over the last decade (2%-36% in 1995-1996 and <1%-37% in 1997-2002).[4,5] The reasons for this variability cannot be ascertained from the Pediatrix Clinical Data Warehouse.

Although individual institutions typically have general discharge criteria for infants born preterm, adherence to these criteria is not necessarily uniform. Furthermore, there are no uniform interinstitutional criteria. Thus, the wide variability seen in retrospective chart and database reviews conducted to analyze the frequency of use of an individual assessment or treatment option is not surprising. In such studies, assessing the dynamic interactions between various clinical and other factors that affect the single intervention being studied can be very difficult. Lagatta et al acknowledge that the information available in the Pediatrix Clinical Data Warehouse is not sufficiently detailed to permit analysis of all factors potentially affecting perceived home O_2 needs, including the extent of efforts to wean from O_2 before discharge, use of physiological testing to define BPD or O_2 saturation targets, and other factors affecting length of stay.[3] There likely are several additional preceding or concurrent factors in individual infants, such as persistence of apnea of prematurity symptoms, caffeine use, results of cardiorespiratory monitoring, and plan for home monitoring, which influence the perceived need for home O_2, either directly or indirectly through an effect on PMA at discharge.

Persistence of clinical symptoms related to apnea of prematurity and the resultant intermittent hypoxia is a major factor affecting PMA at discharge and likely the perceived

BPD	Bronchopulmonary dysplasia
NICU	Neonatal intensive care unit
PMA	Postmenstrual age

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need for interventions at home.[7,8] There is wide variability in the rates of diagnosis of apnea and in PMA at discharge.[9] Individual NICUs have established the number of symptom-free days required for discharge, but this also depends on other clinical variables and varies considerably between institutions.[10] In a recent national survey, most sites required at least 5 symptom-free days before discharge, but the range was 1-8 days.[11]

Caffeine is commonly given to preterm infants for apnea of prematurity–related symptoms, to facilitate weaning from assisted ventilation, and/or for neuroprotection.[12] The number of infants in this study discharged on O_2 who were previously treated with caffeine is unknown, as is the duration of that treatment and any potential impact on age at discharge or the perceived need for home O_2.[3] Although caffeine is not commonly continued beyond NICU discharge, a recent national survey reported that 10% of preterm infants with a birth weight <1500 g were discharged on caffeine; the institutional range was very wide, however (0-100%).[11]

PMA at discharge, and thus the need for other home care options, also vary, depending on whether apnea-related symptoms are assessed by routine clinical and bedside observation alone or predischarge cardiorespiratory recordings are used. In this same national survey, 26% of NICUs used predischarge cardiorespiratory recordings.[11] These recordings may identify clinically nonapparent events, including intermittent hypoxia, that affect length of stay and the perceived need for home O_2.[8]

There is also significant institutional variation in the rates of use of home cardiorespiratory monitors and pulse oximeters. In a national survey, 22% of preterm infants with a birth weight <1500 g were discharged on a monitor, but the institutional range was wide (0-100%).[11] Only 2% of infants were discharged with a pulse oximeter, but again the range was wide (0-40%).[11] In the study of Lagatta et al, the number of infants discharged with home monitoring is unknown, as is the impact of that intervention on length of stay and the perceived need for home O_2.

Lagatta et al have capitalized on the large and robust Pediatrix Clinical Data Warehouse to provide new insight into the use of home O_2 and some of the associated variables. As a result, we can more readily identify what additional information should be included in the database to help determine why there is so much variability. The dynamic interactions between various assessment and treatment options drive the decision for or against home O_2. Hopefully in the future, data repositories such as the Clinical Data Warehouse will be expanded to better capture some of these variables. Nevertheless, significant interinstitutional variability in predischarge clinical practice algorithms that affect length of stay and perceived home care needs likely will persist, at least until we gain more knowledge of whether certain approaches are more effective than others. For example, does home O_2 improve growth or other clinical or neurodevelopmental outcomes? Is extended treatment with caffeine an additional or alternative best practice option?

This is clearly not the end of the story with regard to the use of home O_2, but we are now better informed. An expanded database able to capture more details about predischarge and home care interventions in addition to O_2, and ultimately also neurodevelopmental outcome data, is clearly needed. Compiling such a database is an ambitious and difficult challenge, but these new data should help guide future studies. ■

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