

Quantifying the Where and How Long of Newborn Care

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In this issue of *Pediatrics*, Goldin et al¹ report their exploration of a “resource use inflection point” (RU-IP) for infants in 43 NICUs. They define the RU-IP as the day of stay on which daily charges dropped to <10% of the first-day NICU room cost and remained there through just before discharge. Most of their patient sample remained in the hospital even after the RU-IP was reached, and 24% of NICU days occurred after this point.

In this study, two important issues are highlighted. First, the authors document substantial variation in the timing of discharge between institutions, as defined by the number of days after reaching this milestone of lower resource use (and, implicitly, lower illness acuity). Assuming that the patient populations in these institutions were similar, such variation would suggest that there is potential to reduce resource use by standardizing discharge criteria and practices, as has been done in many other areas of medicine. Second, researchers in this publication join others who argue that shifting the cost curve for neonatal intensive care will require more than a focus on overuse of specific drugs or tests, as we have emphasized.² In this newer paradigm, the focus should be on optimizing where and for how long less-acutely ill infants are treated.³

Matching recovering patients to an optimal “dose” of care, neither too intensive nor too long, requires systems to apply rules to determine when de-escalation is appropriate. Typically, payers and policymakers have done so by asking, “Is this patient’s length of

stay similar to others like her?” Goldin et al¹ imply a more concrete question: “Does this patient still use resources similar to those used by a sick person?” Unfortunately, both of those questions fail to consider the complexity of the decision to transfer or discharge an infant.

Most clinicians and policy makers appreciate that neonatal intensive care is costly. What is less-well understood is that NICU costs are not only quantitatively but also qualitatively different from those in other areas of critical care. Newborns have initial physiologic instability related to specific conditions, such as surfactant deficiency, sepsis, or congenital anomalies, but when these have been treated or have resolved, there often remains a relatively long period of developmental immaturity, during which it is necessary to continuously monitor respiratory drive, thermoregulation, and feeding sufficiency. Such monitoring does not require highly expensive interventions such as drugs or surgeries, but it does require personnel. For this reason, nursing time has repeatedly been shown to be the most important driver of NICU costs overall,⁴ and the expenditure remains relatively constant throughout the long convalescent portion of care. This ongoing cost of personnel during the birth admission explains in part why length of stay is of such interest to payers.⁵ Discharge timing is also affected by nonbiological factors, such as family resources, the system’s ability for follow-through care, and characteristics of the hospital.

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Tools that focus on changes in resource use therefore might not identify infants who are ready to leave the NICU.

What then are the features that we need in a diagnostic test for the appropriate level and duration of neonatal care? To start, such a test should focus on safety. Interestingly, we have relatively little ability to predict the natural course of even the most basic neonatal biological processes such as respiratory or feeding immaturity. In addition to encouraging the work toward this understanding, it is critical that studies guarantee full capture of infants who might be readmitted or transferred. Second, a test should acknowledge explicitly that there are different sites and levels of care available, rather than just continued admission versus discharge. Only a small number of such tools have been published in neonatology,^{6,7} but the quantitative prediction of flow within a regionalized health system is an evolving field made technically possible by advances in computing resources.⁸ Third, a test should have soundly demonstrated test characteristics, expressed as sensitivity and specificity for important outcomes. Finally, it should be acknowledged that discharge is a complex amalgam of biology, system capability, robustness of the

preparation process, and family resources and preferences.

Undertaking a new, quantitative phase of thinking about length and locus of stay will not be an easy undertaking. Authors of systematic reviews of predictive models show that they are able to explain only a modest percentage of the variability for length of stay within the current system.^{9,10} Such an undertaking, however, is critical for us to be both responsible stewards of the precious resources we have for pediatric care and clinicians responsible for the safety of these vulnerable infants and their families.

ABBREVIATION

RU-IP: resource use inflection point

REFERENCES

1. Goldin A, Raval M, Thum C, et al. The resource utilization inflection point for safe NICU discharge. *Pediatrics*. 2020; 146(2):e20193708
2. Ho T, Dukhovny D, Zupancic JA, Goldmann DA, Horbar JD, Pursley DM. Choosing wisely in newborn medicine: five opportunities to increase value. *Pediatrics*. 2015;136(2). Available at: www.pediatrics.org/cgi/content/full/136/2/e482
3. Edwards EM, Horbar JD. Variation in use by NICU types in the United States. *Pediatrics*. 2018;142(5):e20180457
4. Rogowski J. Measuring the cost of neonatal and perinatal care. *Pediatrics*. 1999;103(1 Suppl E):329–335
5. Zupancic JA, Richardson DK, O'Brien BJ, Schmidt B, Weinstein MC. Daily cost prediction model in neonatal intensive care. *Int J Technol Assess Health Care*. 2003;19(2):330–338
6. Kunz SN, Dukhovny D, Profit J, Mao W, Miedema D, Zupancic JAF. Predicting successful neonatal retro-transfer to a lower level of care. *J Pediatr*. 2019; 205:272–276.e1
7. Escobar GJ, Shaheen SM, Breed EM, et al. Richardson score predicts short-term adverse respiratory outcomes in newborns ≥ 34 weeks gestation. *J Pediatr*. 2004;145(6): 754–760
8. Kunz SN, Zupancic JAF, Rigdon J, et al. Network analysis: a novel method for mapping neonatal acute transport patterns in California. *J Perinatol*. 2017; 37(6):702–708
9. Seaton SE, Barker L, Jenkins D, Draper ES, Abrams KR, Manktelow BN. What factors predict length of stay in a neonatal unit: a systematic review. *BMJ Open*. 2016;6(10):e010466
10. Lu M, Sajobi T, Lucyk K, Lorenzetti D, Quan H. Systematic review of risk adjustment models of hospital length of stay (LOS). *Med Care*. 2015;53(4): 355–365

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