Challenges to Measuring Variation in Readmission Rates of Neonatal Intensive Care Patients

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ABSTRACT

OBJECTIVE: To examine the viability of a hospital readmission quality metric for infants requiring neonatal intensive care.

METHODS: Two cohorts were constructed. First, a cohort was constructed from infants born in California from 1995 to 2009 at 23 to 34 weeks' gestation, using birth certificates linked to maternal and infant inpatient records (N = 343,625). Second, the Medicaid Analytic eXtract (MAX) identified Medicaid-enrolled infants admitted to the neonatal intensive care unit (NICU) during their birth hospitalization in 18 states during 2006 to 2008 (N = 254,722). Hospital and state-level unadjusted readmission rates and rates adjusted for gestational age, birth weight, insurance status, gender, and common complications of preterm birth were calculated.

RESULTS: Within California, there were wide variations in hospital-level readmission rates that were not completely explained through risk adjustment. Similar unadjusted variation was seen between states using MAX data, but risk adjustment and calculation of hospital-level rates were not possible because of missing gestational age, birth weight, and birth hospital data.

CONCLUSIONS: The California cohort shows significant variation in hospital-level readmission rates after risk adjustment, supporting the premise that readmission rates of prematurely born infants may reflect care quality. However, state data do not include term and early term infants requiring neonatal intensive care. MAX allows for multistate comparisons of all infants requiring NICU care. However, there were extensive missing data in the few states with sufficient information on managed care patients to calculate state-level measures. Constructing a valid readmission measure for NICU care across diverse states and regions requires improved data collection, including potential linkage between MAX data and vital statistics records.

KEYWORDS: Medicaid; neonatal intensive care; readmission

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PREVENTING HOSPITAL READMISSIONS is an area of emphasis for both insurers and public health professionals,[1,2] especially in adult medicine, as the Center for Medicare and Medicaid Services has begun a readmission reduction program focused on variations in hospital readmission rates.[3] Additionally, the Affordable Care Act includes provisions for financial incentives for improvements in care quality, with a particular focus on readmissions,[4] and similar incentives are being explored for children enrolled in Medicaid or Children's Health Insurance Program (CHIP) through the Children's Health Insurance Program Reauthorization Act of 2009 (CHIPRA) Quality Demonstration Grant Program.[5]

In pediatric medicine, there are groups of high-risk patients for whom hospital readmissions occur frequently. One such group is children discharged from the neonatal intensive care unit (NICU). Premature infants have an approximately 3-fold increase in risk of hospital readmission after discharge compared to term infants, with higher rates in infants of younger gestational age.[6] These hospital readmissions contribute to the higher health care costs and utilization seen in prematurely born infants.[7,8] A limited number of studies show variation in readmission rates in 1 Canadian province[9] and selected groups of hospitals.[10,11] Differences in rates, though, may result from differences in illness severity[12,13] or other patient characteristics[12–14] across hospitals. There are no studies that show an association between changes in processes of care, especially around hospital discharge, and patient outcomes.[15] Also, there are no studies of readmissions in this population among a wide number of states.

NICU patients are a difficult group to study because 1) they may be more likely to be missing unique identifiers such as social security numbers; 2) their relatively high transfer rates require a data set with admissions linked by patient; 3) clinical data are important for adequate adjustment for case mix[6]; 4) prematurely born infants are a heterogeneous group that vary in gestational age and the prevalence of common chronic complications of preterm birth such as bronchopulmonary dysplasia (BPD), intraventricular hemorrhage (IVH), and retinopathy of prematurity (ROP), that affect the risk of hospital readmission[6,12]; and 5) it is not clear what time frames after discharge should be examined. As a result, there are several challenges to using readmissions as a quality measure: the difficulty of procuring data from a

wide range of states and hospitals for adequate comparison; the ability to construct a complete cohort of children receiving care at a specific neonatal intensive care unit; and access to clinical data for a risk-adjustment model that meets face validity of the end users.

In order to assess quality and incentivize improvement, government institutions must monitor patient outcomes, identify poorly performing or high-performing institutions, and determine financial implications with value-based pricing. Ensuring adequate fidelity of the information presented is critical to these goals. Databases used by policy makers have different strengths and weaknesses (Table 1). The goal of this study is to examine unadjusted and risk-adjusted rates of hospital readmission at 5 time points for infants likely to receive treatment in the NICU based on either gestational age or procedure codes indicating treatment outside of well-baby care, using 2 potential data sets: 1 with complete clinical data (state data from California) and 1 without these clinical data (Medicaid/CHIP patients in MAX), and examine how these data sets address the above challenges.

METHODS

CHALLENGE 1: DATA FROM A WIDE RANGE OF STATES AND HOSPITALS

CALIFORNIA LINKED DATA SET

Two separate cohorts of infants were constructed for this project. The first cohort consisted of infants born in California at a gestational age between 23 and 34 weeks between 1995 and 2009. The department of health linked these infants' birth certificates to death certificates using name and date of birth, and then de-identified the records. Then, over 98% of these records were linked to maternal and newborn hospital records using prior methods.[16,17] Over 80% of the unmatched live birth or fetal death certificate records were missing the delivery hospital, suggesting a birth at home or a birthing center. The unmatched records had similar gestational age and racial/ethnic distributions to the matched records. Because this data set contains records for all hospitals in California, we can measure readmissions at any California hospital, not simply readmissions to the discharging hospital. To ensure that there were enough patients per hospital to make reliable estimates of the readmission rate,[18] we limited the analyses to those hospitals that discharged over 50 eligible patients per year (N = 154). This cohort serves as a gold standard with variables necessary for risk adjustment from prior studies even if limited to infants delivered within a specific range of gestational ages.

MEDICAID ANALYTIC EXTRACT

The quality of the California data set is atypical because of the financial and time costs needed for its construction. Thus, the second cohort utilized the Medicaid Analytic eXtract (MAX), a data set derived from the Medicaid Statistical Information System, which is collected at the individual level by state Medicaid programs and standardized into MAX for interstate comparison by CMS. This data

Table 1. Data Sources for Population-Health Assessment of Health Care Quality

Data Source	Advantages	Disadvantages	Examples
Prospective cohorts	• High data accuracy • Complete data for evaluation	• Limited to specific hospitals or health care providers • Limited time frame • Cost	National Institute of Child Health and Human Development Neonatal Research Network (NICHD NRN)
Electronic medical record databases	• Complete data for region • Less onerous data collection	• Reliance on accurate data entry by providers • Requires creation of fields for specific data of interest; otherwise relies on notation by providers in text fields • Requires access to and proficiency with technology • Variation in data dictionaries and structure across data sets • Cost	Kaiser Permanente health information system
Linked administrative data (birth certificates + claims)	• Population-based data for specific region (states)	• Cost to construct data sets • Clinical data limited to fields commonly collected by birth certificates and in claims data • Reliance on accurate coding of claims data and accurate completion of birth certificates, both of which require validation	California data set: birth certificates linked to maternal and infant inpatient records
Administrative claims data (billing data from states, insurance data)	• Large population across geographic regions (national)	• Limited to no clinical data • Reliance on accurate coding by providers, which requires validation • Insurance data sets are only from a subset of the population treated by states or hospitals	Medicaid Analytic eXtract