

Improving the identification of quality and value in newborn care in Texas

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Summary

Neonatal intensive care has been highly successful in reducing death and illness in newborns, particularly in very premature infants. This achievement has led to tremendous growth in the availability and size of Neonatal Intensive Care Units (NICU), although the number of newborns has remained about the same. These units are classified by professional guidelines (or by regulation in some states) as Level I through IV, with Level I indicating a “normal” newborn nursery and Level IV indicating the capacity to care for the most complex and severely ill newborns. Today, the most common NICU admission (i.e. Levels II – IV) is a newborn with mild prematurity or another less severe problem. In some hospitals many of these babies are cared for in Level I or II units. These trends have led to several unanswered questions about NICU care: Which newborns are admitted to NICUs today, and at what level of care, what are their problems, and how much do the admission patterns vary across health systems? We know that NICUs designed for the most severely ill (Level III and IV) may be poorly suited to provide family-centered care for more mildly ill newborns. Do the benefits outweigh risks of intensive care when newborns are not critically ill? Cost is also a growing problem. NICU care is the single most expensive episode of care for the under-65 population. What are the costs of NICU care for different types of patients, and is better care sometimes less expensive? These research questions have not been studied.

This project will use Medicaid claims data to conduct the first study of the medical care of an entire newborn population (i.e. Texas Medicaid insured) including both the mildly and severely ill. Using methods developed by the *Dartmouth Atlas of Health Care*, we will examine regional and provider variation in NICU availability, the use and outcomes of NICU care, and associated costs for all newborns insured by Texas Medicaid. The findings will identify new opportunities for improvement in the quality of care at the same or lower cost.

Background

While neonatal intensive care has been highly successful at reducing newborn mortality and morbidity(1), the quality of care is uneven(2) and has been inadequately studied. Improving the value of care has been elusive as well, as there have been few research efforts in measuring the outcomes-adjusted efficiency of neonatal intensive care units (NICUs). Today parents are faced with real, but invisible variation in the life chances of their newborns while payers (and families) are exposed to differences in costs that may be poorly linked to quality.

Improvement in newborn outcomes through the use of intensive care services in the early 1970s led to a robust growth in the NICU capacity.(3) In the past 30 years, the U.S. birth cohort has remained relatively steady as the number of neonatologists has grown, and continues to grow.

(Table 1) The supply of intensive care beds also increased; the most recently available data show that between 1991 and 2003 the number of NICU beds per extremely low birth weight (<1,000 grams) increased by 24%. (unpublished data)

Table 1. Growth in the number of neonatologists

	1981	1989	1996	2005	2011
Live births in millions	3.63	4.04	3.90	4.14	3.95
Neonatologists	504	1507	2311	3140	3629
Live births per neonatologist per year					
< 1,000 grams	39	17	11	10	8
< 2,500 grams	490	189	123	108	88
All live births	7201	2681	1687	1358	1088

Neonatal intensive care has developed into a standard and widely available clinical service, but research into the value of its care has lagged and remains incomplete. The problem is partly one of methodology and partly of data availability. Most health services and quality research has examined care within a NICU episode. This usually limits the research to newborns less than 1500 grams who are admitted to a NICU.(4) These studies, and the associated improvement efforts, have led to better outcomes for the most premature newborns (virtually all of whom are admitted to NICUs), but have left unexamined the effect of care on larger and less ill infants, some of whom are admitted to Level III or IV units (i.e. high levels of intensive care), some of whom receive care in Level II units (i.e. “step down” or with lower intensive care capabilities), and others who may be cared for in “normal” newborn nurseries (i.e. Level I). As early as 1995, these less ill newborns were estimated to represent 61% of all NICU admissions. More recent data has not been published, but with recent growth in NICU capacity, the proportion is likely to be higher. (3)

Relatively little is known about the epidemiology of NICU and newborn care using the entire live birth cohort as the population at-risk (i.e. the full range of newborns and newborn illness). Through studying the total live birth cohort one can observe trends in patterns of NICU care over time and in variation in quality and costs for both premature and full term neonates.(5) Previous research lays the foundation for these future studies. Neonatal intensive care capacity (i.e. neonatologists and beds per capita) is known to vary markedly among states and medical care regions, independent of risk factors predicting need for neonatal intensive care(6); moreover, growth in capacity has not occurred in areas with higher risk. (unpublished data) This misdistribution of resources raises important questions about efficiency, which in this proposal is defined as quality (or outcomes) divided by costs. Higher capacity has a weak association with lower 28 and 180 day mortality.(7) Although a higher availability of NICU beds has little effect on utilization for very sick newborns, it seems to increase admission rates for those less ill.(8) Finally, financial incentives are likely to be an important factor driving the growth in Level IV, III and II services to less ill infants.(9, 10) Paying for the volume of services, whether it be “pure fee-for service”, per diem by level of care, or by DRG, has been shown to increase unnecessary and unwanted care in adults.(11) It is important to determine if there are similar untoward effects in the care of newborns.

Specific Aims

We propose the first population-based study of Medicaid-insured newborn and neonatal intensive care through studying the total live birth cohort insured by Texas Medicaid. Proposed analyses will

examine overall and regional variation in newborn care, specifically the illness-adjusted (e.g. birth weight and other perinatal risk factors and diagnoses) use of intensive care (i.e. defined as Levels II or III care) by different newborn conditions and associated utilization and health outcomes. Patient and provider factors associated with the variation in NICU use will be studied to reveal the potential opportunities for improvement in care. The specific aims are:

1. To measure the risk-adjusted probability of newborn discharges (Levels II, III, and IV) across neonatal intensive care regions.
2. For those newborns discharged from Level II, III, and IV units, to measure regional and hospital variation in risk-adjusted utilization of NICU services (e.g. length of stay, level of care, imaging, allowed charges) and outcomes including inpatient mortality and post-discharge readmissions, and ER use.
3. To collaborate with Texas state health agencies and health care providers to develop a sustainable system of monitoring the care, outcomes, and costs of newborn services for the Medicaid insured.

Methods

Data Sources and Study Populations

This study would use Texas data for Medicaid insured populations for the period 2009 - 2013. Medicaid is the payer for ~55% of all live births in Texas, or about 208,000 births per year for a total study population of ~1 million birth-years. It is expected that at least about 11.7 % of births will be preterm (<37 weeks gestation), a population that has a high chance of being admitted to a NICU (either Level II, III, IV). This is an estimate because admission rates have not been previously published, one motivation for this study. (12) The chance of admission, and the level of the unit (as well as the mixture of days in each level) is expected to vary by hospital of delivery and final (i.e. after any transfers) hospital of care. In addition to preterm gestation, other newborn problems that often lead to a NICU admission are substance exposure, large for gestational age, a diabetic mother, and congenital anomalies. All of these latter categories include infants of heterogeneous illness severity. Some will be ill enough to be always admitted to a NICU, but admission will be discretionary (i.e. dependent on the hospital) for many others.

The Medicaid data that will be used in this study are available at the UTSPH/BCBSTX Research Program in Payment Systems and Policy, University of Texas School of Public Health, Houston, where Professors Luisa Franzini and Cecilia Ganduglia Cazaban are Director and Associate Director respectively. Dr. Franzini has a history of research collaborations with The Dartmouth Institute including leading a project in a current NIH P01 grant (unrelated to perinatal care).

The Medicaid data include six distinct types of data:

- a. Claims data: fee-for-service
- b. Encounter data: managed care or HMO
- c. Client data: patient enrollment
- d. Diagnosis data: contains additional diagnosis data for fee-for-service only
- e. Provider data: identifies name and type of provider
- f. Vendor drug data: pharmacy and prescription data

Patients are uniquely identified with IDs that allow linkages of patients' medical events across time and place of service. While, the newborn claims will contain essential information on diagnoses, procedures, and place of service, linkage of newborn to maternal claims may be useful for two purposes: 1) to detect all live births and neonatal intensive care events in the event that newborn

care is initially paid through the mother's insurance ID, and 2) to detect maternal perinatal risk factors that may not be coded on the newborn claims. Although the project team has extensive experience with analyses using medical claims, every dataset has unknown characteristics, particular related to the study population and medical care events of interest. The project will draw upon the knowledge and experience of State of Texas health care agencies and the team at the University of Texas School of Public Health, Houston. Still, it is expected that the project team will need to become familiar with the data during the first project year.

Claims coding quality

This project is dependent on the accuracy of diagnostic coding of newborn claims in order to adjust for birth weight, and other risk factors. There have been no recent published studies regarding neonatal claims accuracy, but the California Perinatal Quality Care Collaborative (Dr. Jeff Gold, Collaborative PI and consultant to this project) has compared diagnoses on inpatient claims with birth certificate data and clinical data collected routinely for the collaborative. These analyses are complex, but demonstrate that if using the clinical data as a gold standard, then claims data is usually as accurate (e.g. birth weight) or more accurate (e.g. maternal risk factors) than birth certificate data. This means that the project will have sufficient information from the claims to conduct necessary stratification and risk adjustment.

Measurement of variation in NICU services

While the project will develop Texas-wide measures of health care in Medicaid-insured newborns, measurement across small areas, or hospitals, has been demonstrated to offer valuable insights into both local delivery patterns, and overall the determinants of utilization and outcomes. Research on variation in health care is most closely identified with John Wennberg, MD beginning with studies of variation in medical services in Vermont in the late 1960s (13) and then other states and Medicare populations in the 1980s. In the early 1990s, Dr. Wennberg initiated the *Dartmouth Atlas of Health Care* project with his colleagues at Dartmouth (including Dr. Goodman of this proposal), leading to further development of ideas into the causes and remedies of variation, and greatly expanding the scientific basis of variation studies through the group's publication of over 250 peer reviewed journal articles, as well as numerous Atlas reports. (www.dartmouthatlas.org) Similar research has been conducted in children's health care, (14, 15) although at a much slower pace than in Medicare because of the limitations of available claims datasets.

Of particular interest is the variation that is unlikely to be from patient health needs or family care preferences, also termed "unwarranted variation." This variation represents health system performance and the opportunity for improvement. Measurement of variation in neonatal intensive care is central to this proposal because it offers the State of Texas five types of useful information:

- First, it provides information about the delivery of newborn care, particularly neonatal intensive care, for a population primarily cared for by a single or limited set of providers within the study regions. That is, properly defined small areas (although the actual size depends on the local or regional nature of the medical services) are geographic representations of health care markets where the newborn patterns of care principally reflect the practice styles of within area hospitals and doctors. When the measurement is at hospital level, such as birth weight adjusted length of NICU stays, then the attribution of a population of newborns to a responsible provider (i.e. the hospital) is highly specific. Specificity of attribution helps identify the accountable health system, the locus for possible improvement.

- Second, it will raise important questions about the reasonableness of current patterns of practice and this, in turn, stimulates both provider engagement and professional self-examination.
- Third, it shows what is attainable, by accident or design, in quality and efficiency, and can offer benchmarks that guide clinical improvement and public policies.
- Fourth, it generates hypotheses regarding the causes of the variation, and the data can be used to test these hypotheses.
- Fifth and finally, it can be used to develop public reporting of performance measures, and these are known to accelerate the pace of change.⁽¹⁶⁾ *This proposal, however, does not include public reporting as an objective, unless there is a clear interest by the State of Texas to move in this direction.* The project team will seek guidance from Department leadership regarding the possible specificity of reporting including the publication of maps that depict one or more aspects of the variation in reports and journal manuscripts.

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