

Statewide Initiative to Reduce Postnatal Growth Restriction among Infants <31 Weeks of Gestation

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Objective To decrease the incidence of postnatal growth restriction, defined as discharge weight <10th percentile for postmenstrual age, among preterm infants cared for in New York State Regional Perinatal Centers.

Study design The quality improvement cohort consisted of infants <31 weeks of gestation admitted to a New York State Regional Perinatal Center within 48 hours of birth who survived to hospital discharge. Using quality improvement principles from the Institute for Healthcare Improvement and experience derived from successfully reducing central line–associated blood stream infections statewide, the New York State Perinatal Quality Collaborative sought to improve neonatal growth by adopting better nutritional practices identified through literature review and collaborative learning. New York State Regional Perinatal Center neonatologists were surveyed to characterize practice changes during the project. The primary outcome—the incidence of postnatal growth restriction—was compared across the study period from baseline (2010) to the final (2013) years of the project. Secondary outcomes included differences in z-score between birth and discharge weights and head circumferences.

Results We achieved a 19% reduction, from 32.6% to 26.3%, in postnatal growth restriction before hospital discharge. Reductions in the difference in z-score between birth and discharge weights were significant, and differences in z-score between birth and discharge head circumference approached significance. In survey data, regional perinatal center neonatologists targeted change in initiation of feedings, earlier breast milk fortification, and evaluation of feeding tolerance.

Conclusions Statewide collaborative quality improvement can achieve significant improvement in neonatal growth outcomes that, in other studies, have been associated with improved neurodevelopment in later infancy. (*J Pediatr* 2018;■■■:■■■-■■■).

Although advances in neonatal care have led to greater survival of very preterm infants, the incidence of postnatal growth restriction (defined as discharge <10th percentile for postmenstrual age [PMA]) remains high.¹⁻⁴ Studies have shown that greater somatic and head growth before 40 weeks PMA are associated with better neurodevelopmental outcome in preterm infants.⁴⁻⁷ In a report from the National Institute of Child Health and Human Development Neonatal Research Network, infants with better growth had lower rates of cerebral palsy and rehospitalization, and higher scores on mental and physical developmental testing.⁴ In 2010, the New York State (NYS) Perinatal Quality Collaborative (NYSPQC), consisting of the NYS Department of Health and 18 regional perinatal centers (RPCs), identified an incidence of postnatal growth restriction in excess of 32% among preterm infants <31 weeks of gestation. In response, the NYSPQC embarked on a statewide project with the primary aim to decrease the incidence of postnatal growth restriction to promote healthier neurologic outcomes through better somatic and head growth.^{4-6,8}

The NYSPQC's framework for improvement was developed from quality improvement (QI) principles described in the Institute for Healthcare Improvement Breakthrough Series⁹ and from experience gained in a successful QI project which reduced central line–associated blood stream infections (CLABSI) throughout NYS.¹⁰ Using the Institute for Healthcare Improvement collaborative learning model and analysis of existing variation in nutritional practices and growth outcomes,¹ the NYSPQC aimed to improve neonatal growth and nutritional

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CLABSI	Central line–associated blood stream infection
GA	Gestational age
HC	Head circumference
NICU	Neonatal intensive care unit
NYS	New York State
NYSPQC	New York State Perinatal Quality Collaborative
PMA	Postmenstrual age
QI	Quality improvement
RPC	Regional perinatal center

practices by encouraging and assisting RPCs to standardize—at the level of the individual neonatal intensive care unit (NICU)—their enteral nutrition practices, to test changes in nutrition practices on a small scale using rapid plan-do-study-act cycles, and to monitor nutritional outcomes.

Methods

Project participants included the NYSPQC led by the NYS Department of Health's Division of Family Health in collaboration with all 18 NYS RPCs.¹¹ The National Institute for Children's Healthcare Quality served as a project partner in designing, implementing, and assessing the project interventions and outcomes. The project cohort was defined as all surviving neonates of <31 completed weeks of gestation, born within or transferred to a NYS RPC within 48 hours of birth between January 1, 2010, and December 31, 2013 (48 months).

Interventions and Collaborative Process

Using a collaborative learning model,¹² the NYSPQC sought to improve nutritional practices within individual RPCs by (1) literature review to identify evidence-based nutritional practices, and (2) analysis of variation in growth outcomes among individual RPCs to identify practices associated with better growth. RPC-specific nutritional practices were assessed using a survey of NYS neonatologists at the project outset (2010). Survey responses were summarized by RPC then analyzed to predict RPC-specific growth outcomes as previously reported.¹ (3) Coaching calls and collaborative learning sessions were undertaken to promote practices associated with better nutrition, growth and strategies to facilitate change. (4) A second survey of NYS RPC neonatologists at project end in 2013 assessed the QI process and changes in nutritional practices and practice protocols. Each RPC was solely responsible to develop and implement standardized practices within its own NICU.

Data Sources and Outcomes

The project cohort was identified and data on demographics, enteral nutrition, and growth were collected using pre-defined clinical definitions as described previously¹ from the Statewide Perinatal Data System NICU Module, a database of neonatal outcomes and clinical care practices to which all NYS RPCs are mandated to report.

To identify nutritional practices associated with better growth as potential interventions for improvement, a survey of enteral nutrition practices and use of protocols was developed by the authors and distributed to all neonatologists practicing at NYS RPCs in 2010.¹ Survey results were then grouped by center and correlated with center-specific growth outcomes from that year to identify nutritional practices associated with better growth. These analyses were previously published¹ and showed that neonatologists at centers with better growth outcomes reported earlier initiation of trophic feedings, earlier advancement of feedings and earlier attainment of full enteral feedings, greater use of breast milk and earlier breast milk fortification, and discontinuation of Total Parenteral Nutrition (TPN) at a higher feeding volume. During the QI project reported herein, learning

sessions and coaching calls were designed to facilitate the implementation of these nutritional practices across all centers, and neonatologists were encouraged to target these practices for improvement during plan-do-study-act cycles.

In the second quarter of 2013, NYS neonatologists were surveyed with the goal to assess the QI process and changes in nutritional practices and protocols occurring over the course of the project. Questions developed by the NYS Department of Health were pretested by a focus group of senior neonatology consultants. The 2013 survey provided data on use of trophic feedings (defined as feedings of <20 mL/kg/day without advancement in volume to promote gut maturation), nutritional feedings (defined as advancing feedings toward target enteral nutrition), and on project leadership, process of change, and methods of tracking adherence to practice protocols.

The primary outcome of our project was the incidence of postnatal growth restriction defined as a discharge weight of ≤10th percentile for PMA.^{13,14} As secondary outcomes, to assess the growth of individual patients, we calculated differences in z-scores between birth and discharge for weight and head circumference (HC) measurements. Additional outcomes included necrotizing enterocolitis (NEC), bowel perforation, nosocomial sepsis, duration of hospital stay, use of breast milk at first feeding, age of attainment of full feedings (defined as discontinuation of TPN), and PMA at hospital discharge. Although better growth has been associated with better neurodevelopmental outcomes, direct assessment of neurodevelopment was beyond the scope of this project.

Statistical Analyses

Data were analyzed using SAS, version 9.4 (Cary, North Carolina). Percentiles and z-scores were calculated using published methods.¹³⁻¹⁵ A survey of neonatologists practicing at NYS RPCs was used to characterize changes in practice during the project. Data from infants admitted in 2010, during project planning but before initiating interventions, served as baseline data and were compared with data from subsequent years using the χ^2 test for dichotomous variables, ANOVA to compare means of normally distributed data, and the Kruskal-Wallis test to compare medians if the data were not normally distributed (eg, age at full feedings). $P < .05$ was considered statistically significant; P values between .05 and .10 were considered trends.

To identify independent predictors of discharge weights and HCs of <10th percentile and changes in weight and HC z-score between birth and discharge, multivariable logistic regression analyses were performed. In model building, variables significantly associated with outcome in bivariate analyses were analyzed as independent variables; these included gestational age (GA; in weeks), project year, and feeding practices associated with the first feeding and the attainment of full feedings (Table I). Because GA and weight were highly correlated, only GA was included in the multivariable models.

Results

The project cohort consisted of 5479 infants (Figure 1; available at www.jpeds.com), ranging from 1266 to 1417 infants

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