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October 11, 2018

Steven T. James
House Clerk
State House Room 145
Boston, MA 02133

William F. Welch
Senate Clerk
State House Room 335
Boston, MA 02133

Dear Mr. Clerk,

Pursuant to Section 67A and 67C of Chapter 111 of the General Laws, as amended by Chapter 253 of the Acts of 2012, please find enclosed a report from the Department of Public Health entitled *Preterm Hospital Discharge and Quality Improvement.*

Sincerely,

Monica Bharel, MD, MPH
Commissioner
Department of Public Health

Charles D. Baker
Governor

Karyn Polito
Lieutenant Governor

Marylou Sudders
Secretary

Monica Bharel, MD, MPH
Commissioner

Preterm Hospital Discharge and Quality Improvement

2018 Annual Report

October 2018

Massachusetts Department of Public Health

Legislative Mandate

The report below is issued pursuant to Subsection (b) of Section 67A of Chapter 111 of the Massachusetts General Laws (M.G.L.) which reads as follows:

> *(b) The department shall submit an annual report to the general court not later than October 1 on the status of premature and high risk infants. The report shall include: (i) a description of the progress in implementing section 67C; (ii) information about the incidence and cause of re-hospitalizations of infants born premature within their first 6 months of life; and (iii) recommendations for improvement of newborn health outcomes and ensuring continued health quality improvement, including recommendations concerning technological needs to improve monitoring of premature infants after discharge from the hospital and transition to a health care provider.*

For reference, M.G.L. c. 111 section 67C reads in relevant part as follows:

> *(a) The department of public health shall provide programs for the prevention, care, and follow-up of premature and other designated high risk infants and establish criteria for services to be provided. The expenses for the transportation of said infants to hospitals equipped to care for them and the expenses of initial hospitalization shall be paid by the department where such costs are not reimbursed by a third party payer. Said payments shall be made in accordance with rates established by the executive office of health and human services. Said payments shall be made only at the request of the parents or guardians of said infants to the department. The department shall apply financial eligibility guidelines to said programs and expenses.*
>
> *(b) The department shall, in consultation with the department's multidisciplinary perinatal advisory committee, develop standardized procedures for hospital discharge and follow-up care for premature infants and shall ensure that standardized and coordinated processes are followed as premature infants leave the hospital from a well baby nursery, step down or transitional nursery or neonatal intensive care unit and transition to follow-up care by a health care or homecare provider.*
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> *(c) The department and its advisory committee shall utilize national evidence-based guidance, including, but not limited to, from the Centers for Medicare and Medicaid Services' Neonatal Outcomes Improvement Project or the Institute for Healthcare Improvement's national initiative for children's healthcare quality to establish hospital discharge follow-up care processes.*
>
> *(d) The department shall utilize existing perinatal databases, such as the pregnancy to early life longitudinal database to develop a statewide report on the causes and incidence of re-hospitalizations of infants that were born premature and who are within their first 6 months of life. The department's perinatal*

advisory committee shall use such report in developing their standardized procedures.

Annual Report for Preterm Hospital Discharge and Quality Improvement

Executive Summary

Preterm birth, defined as the birth of an infant before 37 weeks gestation, is the most frequent cause of infant mortality and morbidity and is a leading cause of long-term neurological disabilities in children.[1] In 2005, it is estimated that preterm births cost the U.S. health care system more than $26 billion.[2] Prolonged Neonatal Intensive Care Unit (NICU) stays, rehospitalization, and other post-discharge health care use constitutes a significant portion of preterm infant care costs. According to preliminary birth data for 2016 from the National Vital Statistics Report, 9.84% of 3,941,109 births in the United States were preterm.[3] In the United States employer-sponsored health plans paid at least $6 billion extra for infants born preterm during 2013, one-quarter of which was associated with the 6% of preterm infants who had major birth defects. [4]

The American Academy of Pediatrics (AAP) reports that "infants born preterm with low birth weight who require neonatal intensive care experience a much higher rate of hospital readmission and death during the first year after birth compared with healthy term infants. Careful preparation for discharge and good follow-up care after discharge may reduce these risks."[5]

For this annual report, the Department of Public Health (the "Department") is sharing data about birth outcomes for births that occurred in Massachusetts during calendar year 2015; this is the most recent year of data that the Department has completed linkages and then comprehensively analyzed. This report is the second annual report under M.G.L. c. 111 section 67A that has been shared with the legislature since the Acts of 2012 were passed. The report first shares updates regarding the work to implement national, evidence-based guidelines for care transitions, then describes the incidence of preterm and high-risk infants and finally summarizes ongoing work and recommendations.

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[1]International classification of diseases and related health problems.10th revision. Geneva: World Health Organization; 1992

[2]Centers for Disease Control and Prevention.2014 Preterm Birth.http://www.cdc.gov/reproductivehealth/MaternalInfantHealth/PretermBirth.htm

[3]Hamilton BE, Martin JA, Osterman MJK, et al. Births: Provisional data for 2016. Vital statistics rapid release; no 2. Hyattsville, MD: National Center for Health Statistics. June 2017. Available from: https://www.cdc. gov/nchs/data/vsrr/ report002.pdf.

[4] Grosse SD, Waitzman NJ, Yang N, Abe K, Barfield WD. Employer-Sponsored Plan Expenditures for Infants Born Preterm. Pediatrics. 2017 Oct;140(4). pii: e20171078. doi: 10.1542/peds.2017-1078. PubMed PMID: 28933347; PubMed Central PMCID: PMC6029853

[5]American Academy of Pediatrics, Committee on Fetus and Newborn. Hospital discharge of the high-risk neonate. Pediatrics, 2008.**122**(5):1119-1126.

I. Implementation of Section 67C

The Department continues to seek input from the Perinatal Advisory Committee (the "PAC") and work to convene this group. The Department, with input from the PAC, has issued guidance in 2015 to hospitals with maternal newborn services. The Recommendations for the Discharge and Follow-up Care of Preterm and High-Risk Infants guidance outlines best practices, provides evidence-based resources and sample, comprehensive discharge plans.

The PAC also consistently discusses and reviews the continuation of three types of waivers in hospitals with Level II (special care nursery) maternal newborn services, Gestational Age; Continuous Positive Airway Pressure (CPAP); and Short Term Mechanical Ventilation (STMV) in order to ensure the quality of care standards have been met. Each of these waivers permit individual hospitals to care for infants that are of younger gestational age or require more respiratory support either non-invasively or invasively than is written in regulation. The PAC helps to ensure that the clinical requirements outlined in each waiver align with best practices and are appropriate to continue.

II. Re-hospitalizations of infants born premature within their first six months of life

Incidence and causes of rehospitalization among premature infants born in Massachusetts in calendar year 2015

This section addresses the status of preterm and high-risk infants. The results shown are based on data analyses from the Pregnancy to Early Life Longitudinal (PELL) Data System that the Department manages. PELL is a unique, longitudinal, population-based reproductive health data system that enables Massachusetts to monitor the health and well-being of mothers and infants over time and to assess the effectiveness of state maternal and child health programs and policies. The core PELL dataset comprises Massachusetts birth certificates and fetal deaths records from 1998-2015, linked to the corresponding hospital discharge records of birth for the mother and infant. This core dataset is further linked longitudinally to non-birth related health services utilization data, using hospital discharge records, observational stays and emergency department visits for the mother and the child.

In order to address hospital discharges and quality improvement for preterm and high-risk infants, the Department has analyzed core PELL data linked longitudinally with non-birth hospital discharges for all infants born in 2015. As more recent birth cohorts are linked longitudinally with their corresponding non-birth hospital discharges, this report will be updated and shared with the legislature.

Methodology

The Department analyzed the frequency and causes of rehospitalizations among infants during the first six months of life using PELL data for the 2015 birth cohort. All analyses were restricted to live-born infants born in Massachusetts hospitals to Massachusetts resident mothers. Rehospitalization was defined as readmission to the same or a different hospital within the first six months (less than 180 days) of life after the infant was discharged home. Infants readmitted on the same day they were discharged were regarded as transfers; transfers were not counted as rehospitalizations.

Preterm infants were defined as infants born at less than 37 weeks gestation. Full-term infants were defined as equal or greater than 37 weeks gestation. For the purpose of this analysis, high-risk infants were defined as full-term but small for gestational age (SGA) in accordance with M.G.L. c. 111 section 67A (a), which reads, "Within 10 days after the birth of any infant weighing 2500 grams or less or any infant with a high-risk problem as defined by the department." The SGA classification of birth weight percentiles by gestational age is a more accurate definition of high-risk among infants compared to the fixed birth weight of 2500 grams, which does not account for gestational age. In this

analysis, normal birth weight and SGA categories were calculated using the 10th percentile.[6]

Based on the annual report requirements as outlined in statute, the Department examined the incidence and causes of rehospitalization for the following three categories among infants born in 2015:

(1) Full-term infants (equal or greater than 37 weeks) with normal birth weight based on their gestational age;

(2) Preterm infants (less than 37 weeks) regardless of their birth weight; and

(3) High-risk infants defined as full-term but SGA.

Causes of rehospitalizations were based on the primary diagnosis recorded in each hospital discharge record from the hospitalization following and separate from the birth using the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes.

Results

In 2015, 70,357 live infants were born to Massachusetts resident mothers. These data do not include infants with unknown gestational age and/or birth weight (n=105). The 70,357 births were analyzed according to the three categories defined above: full-term with normal birth weight represented 82.4% (n= 57,993); preterm infants represented 8.5% (n= 6,003); and full term high-risk infants represented 9.0% (n= 6,361) (Table 1).

Table 1. Number and Percentage of Massachusetts (1) Term, Normal Weight, (2) Preterm and (3) High Risk (Term SGA) Live Births 2015

	N	%
Term, Normal Weight	57,993	82.4%
Preterm	6,003	8.5%
High Risk (Term, SGA)	6,361	9.0%
Total	70,357	100.0%

*Total does not include 105 reported births where gestational age and/or birth weight are unknown.

Of the 70,357 reported live births, 2,943 infants (4.2%) were rehospitalized at least once within the first six months of life. Rehospitalization varied by identified categories: 7.5%

[6] Hughes, M. M., Black, R. E., & Katz, J. (2017). 2500-g Low Birth Weight Cutoff: History and Implications for Future Research and Policy. *Maternal and Child Health Journal*, *21*(2), 283–289. http://doi.org/10.1007/s10995-016-2131-9

of preterm infants and 4.3% of high risk infants were rehospitalized while 3.8% of full-term normal birth weight infants required hospitalization (Table 2).

Table 2. Number and Percentage of Massachusetts (1) Term, Normal Weight, (2) Preterm and (3) High Risk (Term SGA) Live Births in 2015 Rehospitalized Within the First Six Months of Life

	Total	Rehospitalization	
		N	%
Term, Normal Weight	57,993	2,221	3.8%
Preterm	6,003	448	7.5%
High Risk (Term, SGA)	6,361	274	4.3%
Total	70,357	2,943	4.2%

*Total does not include 105 reported births where gestational age and/or birth weight are unknown.

The causes of rehospitalization, as defined by the primary ICD-9-CM diagnosis in the non-birth hospital discharge records, were analyzed by occurrence instead of by infant; for example, if an infant was rehospitalized twice within six months of life, both causes of rehospitalization were counted in this analysis. As a result, the total numbers of rehospitalizations for preterm and high-risk infants exceed the numbers of infants who were rehospitalized in these categories. The top three causes of rehospitalization (n=550 occurrences) among preterm infants were: (1) Certain Conditions Originating in the Perinatal Period (28.5%); (2) Diseases of the Respiratory System (25.8%); and (3) Congenital Anomalies (7.1%) (Table 3-1).

Similarly, the most frequently reported primary ICD-9-CM diagnosis codes resulting in rehospitalization of high-risk infants (n = 319 occurrences) were (1) Certain Conditions Originating in the Perinatal Period (22.9%); (2) Diseases of the Respiratory System (20.7%); and (3) Congenital Anomalies (15.0%) (Table 3-2).

As a comparison, the most frequently reported primary ICD-9-CM diagnosis codes resulting in rehospitalization of full-term infants with normal birth weight (n = 2473 occurrences) were (1) Certain Conditions Originating in the Perinatal Period (32.4%); (2) Diseases of the Respiratory System (21.4%); and (3) Congenital Anomalies (10.8%) (Table 3-3).

Detailed information about the causes of rehospitalization for preterm and high-risk infants within their first six months of life is presented in Tables 3-1 and 3-2. Detailed information about the causes of rehospitalization for full-term infants with normal birth weight within their first six months of life is presented in Table 3-3.

Summary

In comparing 2014 data to 2015 data, preterm live births to Massachusetts resident mothers decreased slightly but statistically significantly from 8.8% to 8.5%. The percentage of high risk infants (full-term but SGA) increased slightly from 8.8% to 9.0%. The proportion of infants who were hospitalized within the first six months of life was 4.4% compared to 4.1% in 2014; this is a statistically significant decrease. Overall causes for rehospitalization within the first six months of life were varied but the total number of rehospitalizations was consistent from 2014 to 2015. The percentage of rehospitalizations due to diseases of the respiratory system decreased from 27.6% in 2014 to 25.8% in 2015 among preterm infants and from 24.3% in 2014 to 22.9% in 2015 among high risk infants mostly due to a decrease in acute respiratory infections. The percentage of rehospitalizations due to certain conditions originating in the perinatal period decreased from 30.7% in 2014 to 28.5% in 2015 among preterm infants and from 28.4% in 2014 to 22.9% in 2015 among high-risk infants. The percentage of congenital anomalies increased from 12.3% in 2014 to 15.0% in 2015 among high-risk infants and was similar in 2014 and 2015 among preterm group.

III. Recommendations for improvement of newborn health outcomes

The Department is committed to the improvement of newborn health outcomes and continues to engage with health care providers and members of the PAC to identify evidence-based recommendations that will result in sustained quality. The Department is focused on three strategies to improve these health outcomes, regulatory monitoring, primary prevention of preterm births and secondary prevention of preterm births.

To ensure that standardized and coordinated processes are followed as preterm infants leave the hospital and transition to follow-up care by a health care or homecare provider, the Department's health care facility surveyors monitor facility compliance with regulatory requirements through onsite surveys at hospitals, off-site communications, and complaint investigations, as necessary. In the instances during a survey when an issue has been identified, the hospital submits a plan of correction to the Department that must be approved by health care facility surveyors. Additionally, the Department and the PAC will continue to ensure guidelines and recommendations shared with stakeholders are appropriate for preterm infants during hospital discharge and follow-up care.

Massachusetts continues to work on reducing preterm birth rates in the Commonwealth. The Department collaborates with the Massachusetts Perinatal Neonatal Quality Improvement Network (PNQIN) and the March of Dimes to guide perinatal quality improvement efforts across hospitals. PNQIN is an umbrella collaborative that brings together the Neonatal Quality Improvement Collaborative of Massachusetts (NeoQIC) and the Massachusetts Perinatal Quality Collaborative (MPQC), two statewide organizations that seek to engage health care providers, community organizations, and public health groups in neonatal and perinatal quality improvement initiatives. One of the MPQC earliest projects involved tracking recent trends in elective (non-medically indicated) deliveries prior to 39 weeks of gestation and birth outcomes across the state and understanding the impact of preterm deliveries on birth outcomes. In addition, the Department, through the Healthcare Associated Infections (HAI) program within the Bureau of Health Care Safety and Quality, continues to assist the Neonatal Quality Improvement Collaborative (NeoQIC) of Massachusetts with data collection and analysis. NeoQIC is a voluntary organization, open to all hospitals in Massachusetts with Level III NICUs, that supports quality improvement in the health care of newborns through the open sharing of information and practices.

The Department has also been a leader in the Collaborative Improvement and Innovation Network (CoIIN) to Reduce Infant Mortality, which is funded by the Health Resources and Service Administration (HRSA). The CoIIN is a multiyear national movement engaging federal, state and local leaders, public and private agencies, professionals and communities to employ quality improvement, innovation and collaborative learning to reduce infant mortality and improve birth outcomes. Three strategic areas of focus selected by the Department-led Massachusetts CoIIN team are Social Determinants of Health, Prevention of Preterm and Early Term Births, and promotion of safe sleep

practices. The CoIIN teams are working to incorporate evidence-based policies and programs and place-based strategies to improve social determinants of health and equity in birth outcomes. Through participation in the Infant Mortality CoIIN, the Department convened a workgroup to address the effect of pre- and early-term birth on infant mortality.

In 2017, the workgroup conducted two surveys on the effect of pre- and early-term birth on infant mortality. One survey targeted patients who have experienced a preterm birth to learn more about their experience with the health care system in order to identify opportunities for improvement. The second survey targeted obstetric providers to understand barriers to the administration of progesterone (17P) to eligible pregnant women who have experienced a pre-term birth. 17P is a progesterone medicine that can help prevent preterm birth in some pregnant women who have already had a preterm birth[7]. These results will be used to inform future steps for improving efficient 17P administration to eligible women in MA, including both immediate actions, such as providing education materials for patients about 17P, as well as structural changes, such as removing the requirement for prior authorization. The workgroup developed a provider progesterone toolkit that includes a list of progesterone therapies covered by public and private health plans operating in Massachusetts; a sample hospital policy on progesterone; a hospital practice/self-assessment tool; and educational materials and best practices. The educational materials have been distributed to providers at PNQIN and other stakeholder events during the past year.

The Department utilized competitive funds from the Centers for Disease Control and Prevention to add new questions related to progesterone administration on the birth certificate. All hospitals are expected to collect information on the new items for births starting July 16, 2018. This is an important milestone as collecting data by hospital will allow us to compare hospitals across the state and do some hospital-based QI projects.

[7] http://www.astho.org/Maternal-and-Child-Health/17P-Fact-Sheet/

Table 3-1. Causes of Rehospitalization Within First Six Months of Life: Preterm Infants, Born in 2015

Causes		N	%
Diseases of the respiratory system (ICD-9-CM Codes 460-519, ICD-10-CM Codes J00-J99) (N=412, 25.8%)	Acute respiratory infections	115	20.9%
	Pneumonia and influenza	9	1.6%
	Pneumoconioses and other lung diseases due to external agents	1	0.2%
	Other diseases of respiratory system	17	3.1%
Certain conditions originating in the perinatal period (ICD-9-CM Codes 760-779, ICD-10-CM Codes P00-P96) (N=157, 28.5%)	Neonatal jaundice	40	7.3%
	Infections specific to the perinatal period	11	2.0%
	Other respiratory conditions of fetus and newborn	25	4.5%
	Respiratory distress syndrome	5	0.9%
	Disorders relating to short gestation and low birthweight	33	6.0%
	Endocrine and metabolic disturbances specific to the fetus and newborn	1	0.2%
	Hemolytic disease of fetus or newborn, due to isoimmunization	4	0.7%
	Perinatal disorders of digestive system	4	0.7%
	Conditions involving the integument and temperature regulation of fetus and newborn	13	2.4%
	Birth Trauma	1	0.2%
	Other and ill-defined conditions originating in the perinatal period	20	3.6%
Congenital Anomalies (ICD-9-CM codes 740-759, ICD-10-CM codes Q00-Q99)		39	7.1%
Other Causes		212	38.5%
Total		550	100.0%

Table 3-2. Causes of Rehospitalization Within First Six Months of Life: High Risk Infants (Full-term, SGA), born in 2015

Causes		N	%
Diseases of the respiratory system (ICD-9-CM Codes 460-519, ICD-10-CM Codes J00-J99) (N=66, 20.7%)	Acute respiratory infections	56	17.6%
	Pneumonia and influenza	3	0.9%
	Pneumoconioses and other lung diseases due to external agents	1	0.3%
	Other Diseases of The Upper Respiratory Tract	1	0.3%
	Other diseases of respiratory system	5	1.6%
Certain conditions originating in the perinatal period (ICD-9-CM Codes 760-779, ICD-10-CM Codes P00-P96) (N=73, 22.9%)	Neonatal jaundice	24	7.5%
	Infections specific to the perinatal period	5	1.6%
	Other respiratory conditions of fetus and newborn	4	1.3%
	Disorders relating to short gestation and low birthweight	5	1.6%
	Endocrine and metabolic disturbances specific to the fetus and newborn	2	0.6%
	Hemolytic disease of fetus or newborn, due to isoimmunization	1	0.3%
	Perinatal disorders of digestive system	3	0.9%
	Conditions involving the integument and temperature regulation of fetus and newborn	17	5.3%
	Birth Trauma	1	0.3%
	Other and ill-defined conditions originating in the perinatal period	11	3.4%
Congenital Anomalies (ICD-9-CM codes 740-759, ICD-10-CM codes Q00-Q99)		48	15.0%
Other Causes		132	41.4%
Total		319	100.0%

Table 3-3. Causes of Rehospitalization Within First Six Months of Life: Full-term Infants with Normal Birth Weight, born in 2015

Causes		N	%
Diseases of the respiratory system (ICD-9-CM Codes 460-519, ICD-10-CM Codes J00-J99) (N=529, 21.4%)	Acute respiratory infections	479	19.4%
	Pneumonia and Influenza	28	1.1%
	Pneumoconioses and other lung diseases due to external agents	5	0.2%
	Other diseases of respiratory system	17	0.7%
Certain conditions originating in the perinatal period (ICD-9-CM Codes 760-779, ICD-10-CM Codes P00-P96) (N=801, 32.4%)	Neonatal jaundice	304	12.3%
	Infections specific to the perinatal period	120	4.9%
	Other respiratory conditions of fetus and newborn	43	1.7%
	Respiratory distress syndrome	7	0.3%
	Disorders relating to short gestation and low birthweight	21	0.8%
	Endocrine and metabolic disturbances specific to the fetus and newborn	20	0.8%
	Hemolytic disease of fetus or newborn, due to isoimmunization	21	0.8%
	Perinatal disorders of digestive system	19	0.8%
	Conditions involving the integument and temperature regulation of fetus and newborn	106	4.3%
	Other and ill-defined conditions originating in the perinatal period	140	5.7%
Congenital Anomalies (ICD-9-CM codes 740-759, ICD-10-CM codes Q00-Q99)		268	10.8%
Other Causes		875	35.4%
Total		2473	100.0%