EMERGING EVIDENCE TO EFFECTIVELY TREAT NEONATAL ABSTINENCE SYNDROME (NAS) WITH HIGHER QUALITY AND LOWER COST: LESSONS FROM MASSACHUSETTS

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INTRODUCTION

- The growing opioid epidemic not only results in increased morbidity and mortality for addicted individuals, but also for infants exposed to opioids in utero.
- Neonatal abstinence syndrome (NAS) is a clinical syndrome resulting from the abrupt discontinuation of exposure to substances in utero, including opiates such as heroin, prescription opiate pain relievers, and medication-assisted treatment (MAT) including methadone and buprenorphine.
- NAS is a constellation of symptoms that includes low birth weight, respiratory distress, feeding difficulty, tremors, increased irritability and crying, diarrhea, and occasionally seizures.[1, 2, 3]
- The number of infants affected by NAS has increased sevenfold between 2004 – 2013,[4] and is particularly prevalent in Massachusetts (Figure 1). In 2009, the rate of NAS in Massachusetts was approximately three times higher than the national average of 3.4 per 1000 births.[5]
- Treatment of newborns with NAS is substantially more expensive than uncomplicated deliveries. Costs are largely associated with total length of stay (LOS) including time spent in higher intensity settings of care such as the neonatal intensive care unit (NICU). Emerging evidence suggests that lower intensity treatment protocols both reduce expenditures as well as improve neonatal outcomes.

OBJECTIVES

- To better understand emerging and promising quality improvement (QI) practices for the treatment of NAS in the United States and Canada.
- To identify barriers to accessing high quality and integrated care for infants with NAS as well as pregnant and post-partum opioid-dependent women.
- To promote new and innovative delivery system models that enhance patient engagement and increase access to services among vulnerable populations.
- To develop a state-led investment opportunity designed to reduce cost and increase quality of care for pregnant and post-partum opioid-dependent women and infants with NAS.

STUDY DESIGN

- A search of relevant literature was performed between June-August 2015 and repeated in May 2016 using PubMed database and Google Scholar. Primary search terms included: 'neonatal abstinence syndrome,' 'NAS,' 'substance exposed newborns,' 'quality improvement,' and 'evidence-based.'
- Descriptive analysis of 2014 NAS hospital discharges included in the Massachusetts Center for Health Information and Analysis (CHIA) Hospital Inpatient Discharge Database.
- Twenty-two semi-structured interviews (in-person, phone, email communication) were conducted with 32 participants to identify promising practices and gather recommendations for improvements in care to opioid-dependent pregnant women and infants with NAS. Participants in this study included stakeholders from state government agencies, non-profit organizations, community and teaching hospitals, and other providers who deliver care to opioid-dependent women and infants with NAS.

RESULTS

TABLE 1: Literature review

LOCATION	INTERVENTION	RESULTS
Boston Medical Center (Boston, MA)[6]	**QI INITIATIVE:** resident education, modified pharmacological treatment protocol, nursing re-education to standardize scoring, sleep sacks January 2013 – June 2014 **(n=92)**	LOS for infants treated pharmacologically for NAS decreased from **25.1 to 21.6 DAYS** Percentage of infants requiring a secondary agent decreased from **39.7% to 28.0%**
Children's Hospital at Dartmouth (Lebanon, NH)[7]	▪ March 2012 – October 2014 (n=160) ▪ QI initiative: nursing re-education, parental prenatal education, cuddlers, parent symptom diary, rooming-in	▪ Percentage of infants treated pharmacologically for NAS decreased from 36% to 15% ▪ Average LOS for infants treated with morphine decreased from 18.2 to 13.6 days ▪ Average hospital costs per infant treated for NAS decreased from $20,225 to $11,318 ▪ Costs per infant at risk for NAS decreased from $10,191 to $5,259
Nationwide Children's Hospital (Columbus, OH)[8]	▪ January 2007 – December 2012 (n=199) ▪ QI initiative: creation of an NAS Taskforce, implementation of a standardized treatment protocol, nursing re-education to standardize scoring	▪ LOS decreased from 36 days in 2007 to 18 days in June 2012, sustained through December 2012
Vermont Oxford Network (VON) NAS Internet-Based Quality Improvement Collaborative (iNICQ)[9]	▪ 2012 – 2014 (n=3458) ▪ QI toolkit with evidence-based "potentially better practice," including: standardized process for management of infant at risk for NAS, standardized processes for assessing and reporting rates of substance exposure and NAS, emphasis on compassionate, non-judgmental care for mothers and infants affected by NAS ▪ Interactive webinars ▪ Virtual video ▪ Data collection ▪ Coaching and feedback	▪ Data collected through cross-sectional audits in February 2013, August 2013, February 2014, and August 2014 ▪ Mean number NAS-related guidelines increased from 3.7 to 5.1 out of 6 at each institution (p<0.001) ▪ Median length of pharmacologic treatment decreased from 16 days to 15 days (p=0.02) ▪ LOS decreased from 21 days to 19 days (p=0.002) ▪ Decrease in the proportion of infants discharged on pharmacologic therapy for NAS from 39.7% to 36.5% (p=0.02)
Yale-New Haven Children's Hospital (New Haven, CT)[10]	▪ 2011 – 2015 ▪ QI initiative: non-pharmacologic interventions including low-stimulation rooms, swaddling, feeding on demand, rocking	▪ LOS decreased from 28 days (baseline data 2003-2006) to 8.5 days (2014-2015) for patients in the NICU and 6.5 days for patients with no NICU stay ▪ Morphine treatment decreased from 98% at baseline to 44% in 2014-2015 ▪ Maximum dose of morphine administered halved over the intervention ▪ Total savings of $5.4 million since 2011 (attributed to decreased LOS and reduction in morphine treatment)

FIGURE 1: Discharges of infants with NAS by hospital, Massachusetts, 2014

Source: HPC Analysis – CHIA, Hospital Inpatient Discharge Database, 2014–
Only includes hospitals with 12 or more NAS discharges

Incidence of NAS among newborns in Massachusetts increased from **<3 to >16 per 1000 hospital births/year** between 2004 and 2013.

Source: Gupta M and Picarillo A. "Neonatal abstinence syndrome (NAS): improvement efforts in Massachusetts." neoQIC. January 2015.

TABLE 2: Emerging and promising practices for the treatment of NAS and opioid-dependent women

Strategies to promote engagement and retention in addiction treatment for opioid-dependent women	▪ Coordinate and integrate care between behavioral health care providers, obstetrics providers, neonatologists, and pediatricians prior to discharge to better deliver care in the community setting. ▪ Educate pregnant women prenatally that inpatient providers are legally obligated to notify the Department of Children and Families for substance exposed newborns in Massachusetts. Promote warm handoffs with Children and Family Service Agencies when possible to coordinate clinical care and legal requirements across treatment plans and settings. ▪ Implement support groups to provide support and education for pregnant and post-partum women struggling with or in treatment for addiction. ▪ Use of peers to provide emotional support from prenatal to postnatal care and to increase communication across providers.
Improving the Quality of NAS Treatment in the Inpatient Setting	▪ Integrate prenatal care and addiction treatment at the same location to address multiple treatment needs simultaneously ▪ Work with pregnant women to prepare for meeting the needs of their newborns (i.e., intensive NAS education for parents). ▪ Keep mothers and infants together for the first 24 - 48 hours in a private room. ▪ Provide care in separate, stand-alone clinics which allow for mothers to spend time with infants in quiet, private rooms as opposed to placing infants in the NICU. ▪ Improve education for providers on use of non-pharmacologic treatment approaches (e.g., rooming-in, breastfeeding, low light exposure, swaddling) and how to interface with patients and families who have infants with NAS. Improve education for pregnant women and families on how to meet the needs of infants with NAS. ▪ Ongoing education of nursing staff on Finnegan scoring to improve inter-coder reliability on an infant's NAS symptoms. ▪ Involve mothers in Finnegan scoring of infant to promote symptom awareness and maternal empowerment (e.g., symptom diary).

CONCLUSIONS

The rate of NAS has been increasing steadily in Massachusetts. As found in these semi-structured interviews and prior research,[11] reducing use of pharmacologic treatment for NAS enables providers to appropriately and efficiently treat infants with NAS in lower acuity and lower cost settings such as the pediatric unit rather than the NICU.

Strategies such as allowing an infant to "room-in" with the mother, frequent feeding including use of breast milk when medically appropriate, swaddling, and minimizing exposure to stimuli (e.g., low-noise, dim lighting) result in both reduced LOS and lower acuity treatment, substantially decreasing total cost of care (TCOC).

POLICY IMPLICATIONS

- To promote adoption of cost-effective and high quality treatment of NAS in Massachusetts, state government agencies are investing up to $6.5 million in hospital quality improvement initiatives that drive towards reducing TCOC between delivery and discharge ($3.5 million) and on initiatives to increase collaboration between hospitals and outpatient providers to improve retention in addiction treatment among pregnant and post-partum women ($3 million). Other states, in particular state Medicaid agencies, should consider similar investments.
- Payment models that incentivize providers to adopt non-pharmacologic treatment approaches could reduce the burden of the growing rate of NAS on health care expenditures associated with the opioid epidemic. State Medicaid agencies should explore development of bundled payment methodologies for care for woman and NAS infant dyads to incentivize lower spending and higher quality care.
- Policymakers should continue to promote and conduct program evaluations to demonstrate the cost-effectiveness and improved outcomes of local NAS program efforts.
- States should carefully monitor NAS rates and ensure appropriate training and protocol development in health care delivery systems to enable leading practice care.

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1. Patrick SW, Schumacher RE, Benneyworth BD, Krans EE, McAllister JM, Davis MM. Neonatal abstinence syndrome and associated health care expenditures: United States, 2000-2009. JAMA. 2012; 307(18):1934-40.
2. Lee KG. Neonatal abstinence syndrome. National Institute of Health, U.S. National Library of Medicine, MedlinePlus. https://www.nlm.nih.gov/medlineplus/ency/article/007313.htm. January 31, 2014.
3. Kocherlakota P. Neonatal abstinence syndrome. Pediatrics. 2014; 134(2):547-561
4. Peltz G, Anand KS. Long-Acting Opioids for Treating Neonatal Abstinence Syndrome: A High Price for a Short Stay? JAMA. 2015; 314(19):2023-2024.
5. Gupta M and Picarillo A. Neonatal abstinence syndrome (NAS): improvement efforts in Massachusetts. NeoQIC Meeting. January 2015.
6. Wolfgang T, Wachman E, Minear S, Schiff D, Slomkowski J, Moses J. "Reducing length of stay for infants with neonatal abstinence syndrome: a quality improvement project." Presented at: Pediatric Academic Societies; San Diego, CA; April 25 to April 28, 2015. https://www.pas-meeting.org/attendee/programguide.pdf.
7. Holmes, AV. Improved family-centered care at lower cost: Rooming-in to treat neonatal abstinence syndrome. January 28, 2016 https://www.aamc.org/download/453368/data/20160129_allisonholmespresentation.pdf
8. Asti L, Magers J, Keels E, Wispe J, McClead R. A quality improvement project to reduce length of stay for neonatal abstinence syndrome. Pediatrics. 2015; 135(6):e1494-e1500.
9. Patrick SW, Schumacher RE, Horbar JD, Buus-Frank ME, Edwards EM, Morrow KA, Ferrelli KR, Picarillo AP, Gupta M, Soll RF. Improving Care for Neonatal Abstinence Syndrome. Pediatrics. 2016; 137(5):e20153835.
10. Ray G. Yale-New Haven Children's Hospital Honored with Top Pediatric Quality Award for Improving Care Delivery to Neonatal Abstinence Syndrome Patients. Children's Hospital Association. March 8, 2016. https://www.childrenshospitals.org/Newsroom/Press-Releases/2016/Yale-New-Haven-Childrens-Hospital-Honored-with-Top-Pediatric-Quality-Award
11. Patrick SW, Davis MM, Lehman CU, Cooper WO. Increasing incidence and geographic distribution of neonatal abstinence syndrome: United States 2009 to 2012. Journal of Perinatology. 2015; 35(8):650-655.

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