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Neonatal Abstinence Syndrome in Montana Newborns, 2000-2013¹

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Neonatal abstinence syndrome (NAS) is a collection of clinical findings associated with physical dependence on drugs and subsequent withdrawal in newborns.² NAS is most commonly seen with opioid exposure, but can be seen after exposure to other drugs. A national study of Medicaid recipients found that the proportion of women who filled a prescription for an opioid during pregnancy increased from 18.5% to 22.8% from 2000 to 2007; however, the proportion ranges from 9.5% to 41.6% among states.³ Other states have seen similar dramatic increases in the use of opioids in pregnancy and concomitant increases in NAS.⁴

We examined inpatient admissions for newborns in hospital to Montana residents from 2000 to 2013.⁵ We considered a newborn to have NAS if it was coded in any of the primary or up to eight secondary diagnosis fields.⁶ Because of the billing nature of hospital discharge data, NAS is coded to justify more extensive care. As a result, it is well-ascertained in hospital discharge files. NAS is not coded on the Montana Birth Certificate; however, it is recorded as a complication as part of the discharge record. Because hospital discharge data is not identified, we were unable to link the discharge records of the infant with the discharge records of the mother or the birth certificate.

There were 432 newborn infants with NAS from 2000 to 2013. The rate of NAS in Montana newborns increased from 0.8 per 1,000 live births in 2000 to 9.0 per 1,000 (95% confidence interval 7.3% - 10.9%) in 2013 (Figure 1), a tenfold increase. There was a consistent increase from 2006 to 2012, and then a substantial upturn between 2012 and 2013. The American Academy of Pediatrics (AAP) revised NAS diagnostic guidelines in 2012; the revision may explain part of the large increase seen in 2013.⁷ In spite of the substantial increase in the rate, in absolute numbers there were only 96 babies coded with NAS in 2013, out of more than 12,000 live births.

¹ The Montana Hospital Discharge Data System (MHDDS) receives annual de-identified hospital discharge data sets through a Memorandum of Agreement with the Montana Hospital Association. Most hospitals in Montana participate in voluntary reporting from their Uniform Billing forms, version 2004. The MHDDS receives information on more than 90% of inpatient admissions in the state. It does not receive data on outpatient procedures at this time.

² Neonatal Abstinence Syndrome: How States Can Help Advance the Knowledge Base for Primary Prevention and Best Practices of Care Association of State and Territorial Health Officials, 2014 available at <http://www.astho.org/Prevention/NAS-Neonatal-Abstinence-Report/>

³ Desai J et al. 2004. Increase in prescription opioid use during pregnancy among Medicaid-enrolled women. *Obstet Gynecol* 123:997-1002.

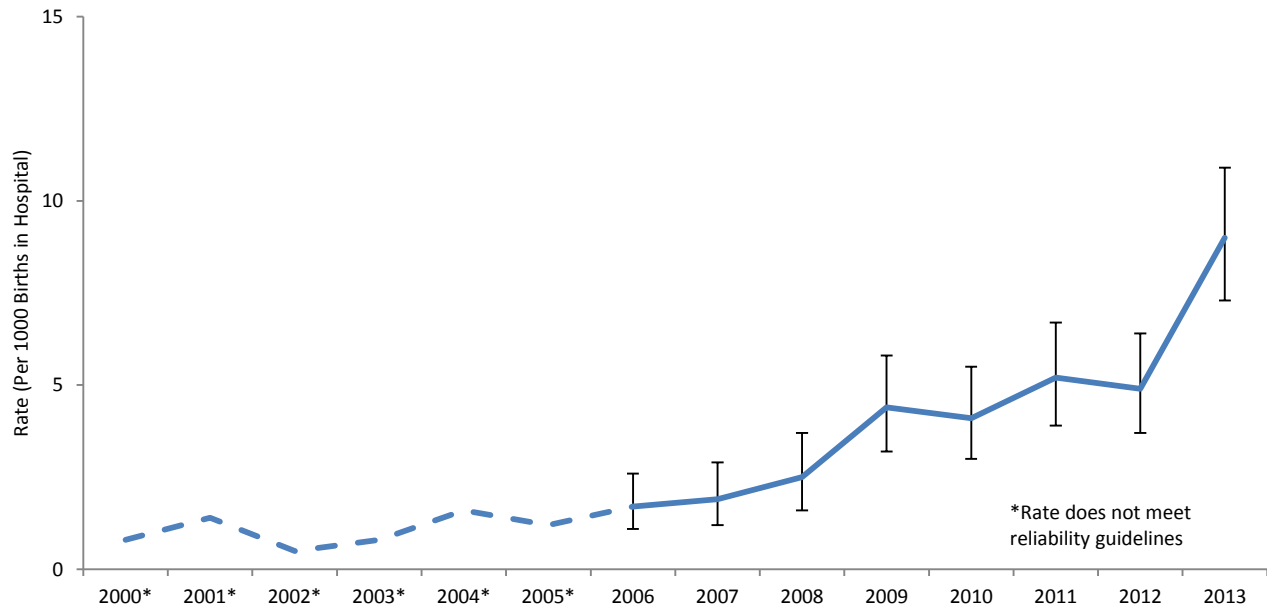
⁴ Epstein R et al. 2013. Increasing pregnancy-related use of prescribed opioid analgesics. *Ann Epidemiol* 23:498-503; Warren M. 2015. Implementation of a statewide surveillance system for Neonatal Abstinence Syndrome – Tennessee 2013. *MMWR* 64:125-128; Lind J et al. 2015. Infant and maternal characteristics in Neonatal Abstinence Syndrome – Selected hospitals in Florida, 2010-2011. *MMWR* 64:213-216.

⁵ Newborns were identified by Major Diagnostic Category = 15

⁶ <http://www.icd9data.com/>; ICD-9-CM: 779.5

⁷ Hudak M et al. 2012. Neonatal Drug Withdrawal. *Pediatrics* 101:e540-e560.

Figure 1. Rate of Newborns with Drug Withdrawal Syndrome (ICD-9-CM: 779.5), Montana Resident Liveborns, 2000-2013



Data on hospitalization charges were added to the MHDDS in 2009. For the interval 2009 - 2013, mean charges for newborns with NAS were \$34,000 versus \$6,800 for newborns without NAS. Mean length of stay for newborns with NAS was 12.1 days, almost four times the mean of 3.1 days for newborns without NAS. Twenty percent of newborns with NAS were of low birth weight (< 2500 grams) compared to 8.6% of newborns without NAS; and 26.1% of newborns with NAS were premature (< 39 weeks), compared to 13.2% of newborns without NAS. Low birth weight and prematurity both contribute to long hospital stays and increased costs even in the absence of NAS. Infants born with NAS also often have respiratory complications and feeding difficulties and may require intensive nursing care, and between 60% and 80% require pharmacologic management.⁸

The rate of NAS for male newborns was 6.2 per 1,000; which was statistically significantly higher than the rate for female newborns (4.7 per 1,000).⁹ A Maryland study of 65 women enrolled in substance treatment programs found that methadone-exposed male infants have more severe expression of NAS symptoms; other studies have found no differences in NAS expression by sex of the infant.¹⁰

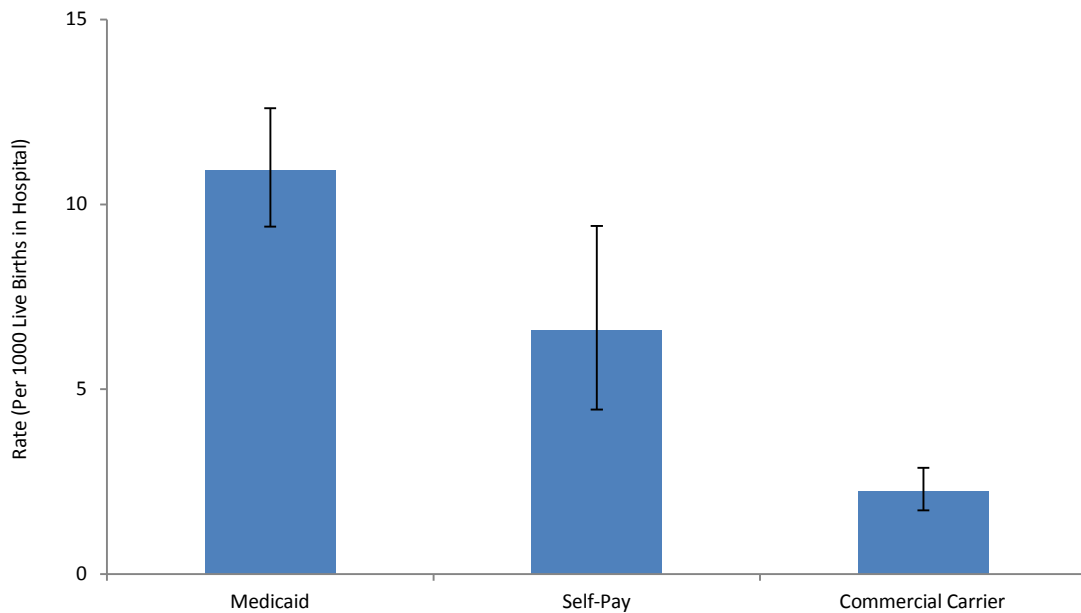
Sixty-percent of infants with NAS had Montana Medicaid as the primary payer. Comparing rates of NAS by primary payer, the highest rate of NAS was for newborns whose births were paid by Medicaid, 10.9 per 1,000 births, compared to 6.6 per 1,000 for self-pay and 2.2 per 1,000 for commercial insurance (Figure 2).

⁸ Patrick SW et al. 2009. Neonatal Abstinence Syndrome and associated health care expenditures, United States, 2000-2009. *JAMA* 307:1934-1940; Siu A, Robinson CA. 2014. Neonatal Abstinence Syndrome: Essentials for the practitioner. *J Pediatr Pharmacol Ther* 19:147-155.

⁹ $\alpha=.05$

¹⁰ Jansson L et al. 2010. Infant autonomic functions and neonatal abstinence syndrome. *Drug Alcohol Depend* 109:198-204; Holbrook A, Kaltenbach K. 2010. Gender and NAS: does sex matter? *Drug Alcohol Depend* 112:156-159; Under A et al. 2011. Are male neonates more vulnerable to neonatal abstinence syndrome than female neonates? *Gen Med* 8:355-364.

Figure 2. Rate of Newborns with Neonatal Abstinence Syndrome (ICD-9-CM: 779.5), by Primary Payer, Montana Resident Liveborns, 2000-2013



Although there are relatively few NAS infants born in Montana (299 or 0.5% of all live births in 2009 - 2013), the charges just to Medicaid for care of these infants were \$6.3 million. If these newborns had been born without NAS and their charges had been equal to the average newborn, they would have incurred charges of only \$1.2 million. In addition to costs associated with treating newborns with NAS, these infants may experience ongoing complications, including cognitive and physical delays.¹¹ These constitute a burden on the individual and family as well as society.

For information about the Montana Hospital Discharge Data System, please contact Cody L Custis, Epidemiologist, at (406) 444-6947 or ccustis@mt.gov

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Please visit our website at <http://dphhs.mt.gov/publichealth/Epidemiology/OESS-MHDDS>

¹¹ Logan B et al. 2013. Neonatal Abstinence Syndrome: Treatment and pediatric outcomes. *Clin Obstet Gynecol* 56:186-192; McGlone L, Mactier H. 2015. Infants of opioid-dependent mothers: neurodevelopment at 6 months. *Early Hum Dev* 91:19-21; Bandstra ES et al. 2010. Prenatal drug exposure: infant and toddler outcomes. *J Addict Dis* 29:245-258; Covington CY et al. 2002. Birth to age 7 growth of children prenatally exposed to drugs: a prospective cohort study. *Neurotoxicol Teratol* 24:489-496.