

## V11.2 NPIC/QAS

### Special Quarterly Report: Linked Analysis – Neonatal Abstinence Syndrome

#### I. Background

The use of drugs and alcohol during pregnancy has been shown in several studies to affect the health and well-being of the neonate. Many factors come into play with the clinical presentation of neonatal drug withdrawal depending on the type of drug, timing and amount of the last maternal use, polysubstance use during pregnancy and the metabolism and excretion of the drug. Neonatal Abstinence Syndrome (NAS) has been defined as a complex disorder, with a constellation of behavioral and physiological signs and symptoms that are remarkably similar despite differences in properties of the causative agent.<sup>1</sup> Dr Karol Kaltenbach, PhD, director of Maternal Addiction, Treatment, Education and Research at Jefferson Medical College in Philadelphia points out that the term for NAS infants should be “prenatally exposed”, not “addicted” since the infants do not meet addiction criteria.<sup>2</sup> The 2006-2007 combined National Survey of Drug Use and Health identified that 5.2% of pregnant women between the ages of 15-44 reported past-month illicit drug use and 11.6% reported current alcohol consumption.<sup>3</sup> These statistics clearly point out the significant risk of in utero exposure to drugs and alcohol and the need for early identification and treatment of NAS.

NAS usually is seen with withdrawal from opioids such as heroin or methadone but also other narcotics, benzodiazepines, barbiturates and alcohol can bring about symptoms of NAS. Onset is usually 2 to 3 days from birth with clinical manifestations presenting in 60 to 80% of infants exposed to heroin or methadone. Clinical manifestations include central nervous system disturbances, including seizures, gastrointestinal, metabolic and autoimmune deficiencies. Neurobehavioral symptoms of infants with prenatal opiate exposure include excessive sucking, jitteriness hypertonia, high pitched cry, difficulty being comforted and irritability.<sup>4</sup> A review of current literature comparing the impact of opioids and cocaine use during pregnancy on the acute and long term outcomes of children from birth to 3 years of age, identified that less severe sequelae are being seen in the cocaine exposed infants than was previously anticipated.<sup>5</sup> Maternal cocaine abuse has been associated with decreased birth weight, length and head circumference. In addition, many studies show subtle impairments in neurobehavioral outcomes but very limited evidence shows motor development impairment.<sup>6</sup> Long term effects from these deficits are unclear and needs further study.

Methadone maintenance has been the usual form of treatment for several years. The evidence to determine the relationship between methadone dosage and NAS is conflicting. A retrospective cohort study of pregnant women treated with methadone and their neonates was conducted between 1996 to 2001. Four dose groups of daily methadone were compared involving 386 pregnancies and 388 infants during the study period. Overall, 68% of the infants were treated for NAS. No correlation was found between maternal methadone dose and rate of NAS. No significant differences were found among gestational age at delivery, birth weight, head

circumference and rate of preterm birth in neonates exposed to maternal methadone at any of the dosing level that ranged from < 80 mg/d to > 160mg/d. Higher doses of methadone were associated with decreased illicit opiate abuse at delivery.<sup>7</sup> A retrospective cohort study was undertaken between 2000-2007 to examine the relationship among methadone treatment, perinatal outcomes and NAS. The study involved 61,030 births with 618 (1%) of women on methadone at delivery. Methadone exposure was associated with an increased risk of very preterm birth, small for gestational age, low Apgar scores, admission to the neonatal unit and diagnosis of a major congenital anomaly. This study found a relationship between maternal methadone dose at delivery and NAS.<sup>8</sup> The researchers from this study noted, “It is important not to view NAS in isolation. NAS is a short-term, treatable condition. Although it is an important outcome, it is not the only one to consider when decisions are being made about optimal methadone doses in pregnancy. Continued stability or cessation of drug use and associated risk behaviors take precedence over endeavors to minimize NAS.”<sup>9</sup>

Buprenorphine is an alternative to methadone that has been considered an acceptable treatment option for opioid dependence in pregnant women by the Maternal Opioid Treatment: Human Experimental Research (MOTHER) project.<sup>10</sup> This multicenter, randomized controlled trial compared the two drugs on five primary neonatal outcome measures: the number of neonates requiring treatment for NAS, peak NAS scores, total amount of morphine needed for treatment of NAS, length of hospital stay and head circumference. There were significant differences between groups for two primary outcomes. On average, neonates exposed to buprenorphine required 89% less morphine than did neonates exposed to methadone and spent on average 43% less time in the hospital.<sup>11</sup> Seven secondary neonatal outcomes were examined in number of days during which medication was given for NAS, weight and length at birth, preterm birth, gestational age at delivery, and 1 and 5 minute Apgar scores. Groups differed on one of the neonatal secondary measures. The group exposed to buprenorphine on average, spent 58% less time in the hospital receiving medication than did the methadone exposed group.<sup>12</sup> The researchers summarized findings by stating: “Although there were no significant differences in the overall rates of NAS among infants exposed to buprenorphine and those exposed to methadone, the benefits of buprenorphine in reducing the severity of NAS among neonates with this complication suggest it should be considered a first-line treatment option in pregnancy.”<sup>13</sup>

Early identification of infants at risk for NAS is critical in providing timely assessment and treatment of symptoms. A recent study comparing three screening approaches (mother’s self report, urine toxicology screening and meconium screening) has concluded that the use of a toxicology screening protocol at birth appears to be beneficial for identifying neonates with NAS.<sup>14</sup> The findings identified the underreporting of illicit drug use by mothers. A pre-intervention group was screened for substances on the basis of physician practice while the post-intervention group utilized specific criteria for toxicology screening. The pre-intervention group identified a total of 21 infants with symptoms of NAS while the post-intervention group identified 70 infants with symptoms of NAS. Pregnancy provides an opportunity for intervention with mothers with addiction issues; timely recognition and treatment during pregnancy can minimize the impact of maternal substance use on neonates. Widely used

screening tools for behavioral health issues include: CAGE- AID (substance use), the PHQ -9 (depression), and the GAD -7 (anxiety).

The severity of NAS can be assessed on screening tools that measure and observe responses to the withdrawal. The Finnegan scale, a frequently used assessment tool for NAS, incorporates CNS signs, metabolic/vasomotor/ respiratory and gastrointestinal signs with variable sign- dependent rating scales. “Despite its widespread use, the psychometric properties of the Finnegan tool have not been published”.<sup>15</sup> Scoring tools help guide treatment and pharmacological interventions. Care of the neonate with NAS is based on reducing withdrawal symptoms and promoting physiological stability. Screening tools are one of the measures to determine overall improvement in the neonate’s well being and readiness for discharge.

While this literature search did not find specific guidelines for discharge criteria for infants with NAS, the need for symptom alleviation/management, along with positive scoring assessments for NAS would constitute important elements in decision-making for discharge. The importance of post-discharge follow-up is critical for the well being of mother and infant. Treatment of addiction is an ongoing challenge for patients and health care providers. The need for comprehensive program support to facilitate recovery of women with addiction issues will be a key factor in decreasing the incidence of NAS.

## II. Description of the Table and Graphs

The **V11.2 Special Report - Linked Analysis: Neonatal Abstinence Syndrome (NAS)** provides you with data related to neonatal abstinence syndrome for inborns, including a linked inborn/mother analysis and relevant maternal variables. Corresponding to regional differences in drug availability, there were regional differences in the rates of NAS for our member hospitals. Hospitals in the Northeast (e.g., Massachusetts, Pennsylvania) as well as hospitals in Florida evidenced the highest rates of NAS (as high as 2.1%). The information displayed represents data for your hospital compared to your subgroup average and to the database as a whole. This report includes data for discharge date range 7/1/2010 – 6/30/2011.

**Section A: Overview** displays the count of total deliveries, total inborns, total inborns linked to a mother (using the mother’s medical record number that appears on the baby’s record as part of the hospital’s NPIC/QAS data submission) and linked inborns as a percent of total deliveries. Section A also displays the total number of inborns coded with NAS (ICD -9 diagnosis code 779.5) and inborns with NAS as a percent of total inborns.

**Section B: Inborn Analysis** includes information related to average length of stay, average total charge, birthweight and gestational age, discharge status and selected conditions common to NAS babies.

**Section B1: Average Length of Stay (ALOS)** displays the overall average length of stay and range for all inborns, and inborns with and without NAS. This section also shows the average length of stay and range in the newborn nursery and in the special care nursery.

**Section B2: Average Total Charge** displays the average total charge for all inborns, and subdivided into inborns with NAS and inborns without NAS.

**Section B3: Birthweight Distribution** shows the total number of cases with very low (1-1499 grams), low (1500-2499 grams), normal ( $\geq 2500$  grams), and missing birthweight for all inborns and inborns with NAS. The percent of total is also displayed for each category.

**Section B4: Gestational Age Distribution** displays the total number of cases less than 24 weeks, 24-30 weeks, 31-36 weeks,  $\geq 37$  weeks, and missing gestational age for all inborns and inborns with NAS. The percent of total is also displayed for each category.

**Section B5: Discharge Status** shows the total count of cases with discharge status coded to home, short term general or children's hospital, home health, died, and all other discharge dispositions, for all inborns and inborns with NAS. The percent of total is also displayed for each category.

**Section B6. Selected Conditions** displays for all inborns and inborns with NAS the total number of cases coded with feeding problems in newborn (779.31), intrauterine growth restriction (764.9), failure to thrive (779.34), convulsions in newborns (779.0), and other unspecified cerebral irritability (779.1), all conditions that may be identified in NAS babies. The percent of total for each condition is also displayed and the conditions are ranked by the database average for all inborns in descending order.

**Section C. Linked Inborn/Mother Analysis** shows the total inborns with NAS and the total inborns with NAS that are linked to a mother. This section also displays the inborns with NAS that are linked to a mother as a percent of total inborns with NAS. (If your hospital's NPIC/QAS data submission does not provide mother's medical record on the baby's record, we will not be able to link mother/baby records. Your report will only display your subgroup and the data base averages.)

**Section C1. Drug Dependence/Drug Abuse (not mutually exclusive)\*\*** displays the total inborns coded with NAS that are linked to a mother coded with Drug Dependence (648.3x) and the total inborns with NAS that are linked to a mother coded with Non-dependent abuse of drugs (305.2x-305.9x). The percent of total for each category is also displayed.

**Section C2. Alcohol Dependence/Alcohol Abuse (not mutually exclusive)\*\*** shows the total inborns with NAS linked to a mother coded with Alcohol dependence syndrome (303.xx), total inborns with NAS linked to a mother coded with Alcohol abuse (305.0x) and the total inborns with NAS linked to a mother with no coded drug/alcohol dependency and

no coded drug/alcohol abuse. For each category, the percent of total linked inborns with NAS is also displayed.

**Section C3. Total inborns with NAS linked to a mother coded with drug dependence** displays the total count of inborns with NAS linked to a mother with diagnosis code 304.xx and the percent of total linked inborns with NAS. The total case counts for this category and percent of total are also displayed by type of drug dependence ; Opioid dependence (304.0), opioid/other dependence (304.7), sedative hypnotic or anxiolytic dependence (304.1), cocaine dependence (304.2), amphetamine and other psychostimulant dependence (304.4), and all other drug dependence codes under 304.xx.

**Section C4. Other Behavioral Health Issues (not mutually exclusive)\*\*** displays the total inborns with NAS linked to a mother with dysthymic disorder (300.4x), episodic mood disorders (296.xx), anxiety states (300.0x), and personality disorders (301.xx). For each category, the percent of total linked inborns with NAS is also displayed.

\*\* Cases coded with drug or alcohol dependence/ abuse, and behavioral health issues are not mutually exclusive. Some cases may have multiple codes on the data submission; therefore percent of total may exceed 100%.

**Graphs 1-3** display ALOS or rate data for your hospital and the other hospitals in your subgroup with a 95% confidence interval (CI). The database average for inborns with NAS is represented by the dotted line, the subgroup average for inborns without NAS is the dashed line, and the database average for inborns without NAS is the solid line. If your ALOS or rate passes through any of the lines your ALOS/rate is **not significantly** different from the average. If it does not pass through, your rate is **significantly** different- either above or below average.

**Graph 1: Neonatal Abstinence Syndrome Average Length of Stay (ALOS)**

**Graph 2: Neonatal Abstinence Syndrome Rate of Normal Birthweight Inborns ( $\geq 2,500$  grams) – Inborns with NAS**

**Graph 3: Neonatal Abstinence Syndrome Rate of Gestational Age  $\geq 37$  weeks – Inborns with NAS**

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### III. References

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13. Ibid, Pg e9
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15. Ibid, pg. e4

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**Linked Analysis: Neonatal Abstinence Syndrome**

	<b>Hospital SAMPLE</b>	<b>Subgroup Average</b>	<b>Database Average</b>
<b>A. Overview</b>			
Total Deliveries	2,914	4,122	4,244
Total Inborns	2,958	4,211	4,314
Total Inborns linked to a mother	2,897	3,904	4,083
Inborns linked to a mother as a percent of total deliveries	99.4%	93.4%	94.0%
Total Inborns with Neonatal Abstinence Syndrome (NAS) - dx code 779.5	45	23	18
Inborns with NAS as a percent of total inborns	1.5%	0.6%	0.4%
<b>B. Inborn Analysis</b>			
<b>B1. Average Length of Stay (ALOS)</b>	<b>ALOS (Range)</b>	<b>ALOS (Range)</b>	<b>ALOS (Range)</b>
Overall			
All Inborns	5.2 (1 - 145)	5.1 (1 - 256)	4.3 (1 - 276)
Inborns with NAS	30.8 (3 - 87)	20.1 (1 - 102)	21.3 (1 - 162)
Inborns without NAS	4.8 (1 - 145)	5.0 (1 - 256)	4.2 (1 - 276)
Newborn nursery			
All Inborns	2.7 (1 - 42)	2.4 (1 - 125)	2.3 (1 - 125)
Inborns with NAS	7.5 (1 - 42)	4.4 (1 - 49)	4.4 (1 - 84)
Inborns without NAS	2.6 (1 - 12)	2.4 (1 - 125)	2.3 (1 - 125)
Special Care nursery			
Inborns with NAS	35.6 (9 - 87)	15.7 (1 - 102)	17.6 (1 - 162)
Inborns without NAS	23.6 (1 - 145)	17.8 (1 - 256)	14.3 (1 - 276)
<b>B2. Average Total Charge</b>			
All Inborns	\$26,825	\$24,211	\$15,318
Inborns with NAS	\$177,106	\$110,378	\$93,275
Inborns without NAS	\$24,503	\$23,723	\$15,046

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	Hospital SAMPLE		Subgroup Average		Database Average	
	Total	%	Average	%	Average	%
<b>B3. Birthweight Distribution</b>						
All Inborns						
Very low birthweight (1 - 1,499 grams)	79	2.7%	112	3.0%	98	2.3%
Low birthweight (1,500 - 2,499 grams)	248	8.4%	354	8.6%	339	7.9%
Normal (≥ 2,500 grams)	2,630	88.9%	3,706	87.5%	3,820	88.8%
Missing	1	0.0%	38	0.9%	58	1.0%
Inborns with NAS						
Very low birthweight (1 - 1,499 grams)	0	0.0%	1	4.5%	1	7.1%
Low birthweight (1,500 - 2,499 grams)	11	24.4%	5	24.9%	4	23.2%
Normal (≥ 2,500 grams)	34	75.6%	16	68.9%	13	61.1%
Missing	0	0.0%	0	1.7%	0	2.8%
<b>B4. Gestational Age Distribution</b>						
All Inborns						
Less than 24 weeks	12	0.4%	18	0.5%	14	0.3%
24-30 weeks	51	1.7%	81	2.1%	71	1.6%
31-36 weeks	277	9.4%	441	10.6%	418	9.6%
≥ 37 weeks	61	2.1%	2,803	66.0%	2,753	61.1%
Missing	2,557	86.4%	868	20.8%	1,058	27.4%
Inborns with NAS						
Less than 24 weeks	0	0.0%	0	0.0%	0	0.1%
24-30 weeks	1	2.2%	1	3.0%	1	3.6%
31-36 weeks	9	20.0%	6	25.6%	4	22.9%
≥ 37 weeks	6	13.3%	11	51.4%	11	49.7%
Missing	29	64.4%	5	20.0%	3	18.0%

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	Hospital SAMPLE		Subgroup Average		Database Average	
	Total	%	Average	%	Average	%
<b>B5. Discharge Status</b>						
All Inborns						
Home	1,517	51.3%	3,659	87.2%	3,991	92.5%
Short term general or children's hospital	5	0.2%	18	0.4%	21	0.6%
Home health care	1,415	47.8%	487	11.2%	247	5.5%
Died	20	0.7%	27	0.8%	23	0.6%
All other discharge dispositions	1	0.0%	19	0.5%	33	0.8%
Inborns with NAS						
Home	3	6.7%	14	68.2%	11	68.1%
Short term general or children's hospital	0	0.0%	0	1.5%	0	4.5%
Home health care	42	93.3%	8	27.7%	6	15.7%
Died	0	0.0%	0	0.2%	0	0.2%
All other discharge dispositions	0	0.0%	1	2.5%	1	5.7%
<b>B6. Selected Conditions (ranked by All Inborns Database Average in descending order)</b>						
All Inborns						
779.31 - Feeding problems in newborn	230	7.8%	113	3.2%	190	4.1%
764.9 - Intrauterine Growth Restriction	7	0.2%	40	0.9%	37	0.9%
779.34 - Failure to thrive	0	0.0%	3	0.1%	2	0.1%
779.0 - Convulsions in newborns (fits & seizures)	4	0.1%	6	0.2%	6	0.1%
779.1 - Other unspecified cerebral irritability	0	0.0%	1	0.0%	0	0.0%
Inborns with NAS						
779.31 - Feeding problems in newborn	15	33.3%	3	17.0%	3	17.3%
764.9 - Intrauterine Growth Restriction	0	0.0%	1	5.5%	1	5.2%
779.34 - Failure to thrive	0	0.0%	0	1.2%	0	0.4%
779.0 - Convulsions in newborns (fits & seizures)	0	0.0%	0	1.3%	0	0.5%
779.1 - Other unspecified cerebral irritability	0	0.0%	0	0.6%	0	0.5%

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	<b>Hospital SAMPLE</b>		<b>Subgroup Average</b>		<b>Database Average</b>	
<b>C. Linked Inborn/Mother Analysis</b>						
Total inborns with NAS	45		23		18	
Total inborns with NAS linked to a mother	37		18		16	
Inborns with NAS linked to a mother as a percent of total inborns with NAS	82.2%		86.2%		83.1%	
<b>C1. Drug Dependence/Drug Abuse (not mutually exclusive)</b>						
	<b>Total</b>	<b>%</b>	<b>Average</b>	<b>%</b>	<b>Average</b>	<b>%</b>
Total inborns with NAS linked to a mother coded with Drug dependence (dx code 648.3x)	18	48.7%	6	24.7%	6	28.5%
Total inborns with NAS linked to a mother coded with Non-dependent abuse of drugs (dx codes 305.2x - 305.9x)	9	24.3%	4	27.4%	3	21.1%
<b>C2. Alcohol Dependence/Alcohol Abuse (not mutually exclusive)</b>						
	<b>Total</b>	<b>%</b>	<b>Average</b>	<b>%</b>	<b>Average</b>	<b>%</b>
Total inborns with NAS linked to a mother coded with Alcohol dependence syndrome (dx code 303.xx)	0	0.0%	0	0.0%	0	0.2%
Total inborns with NAS linked to a mother coded with Alcohol abuse (dx code 305.0x)	1	2.7%	0	2.0%	0	1.3%
Total inborns with NAS linked to a mother with no coded drug/alcohol dependency and no coded drug/alcohol abuse	10	27.0%	8	45.1%	7	43.6%

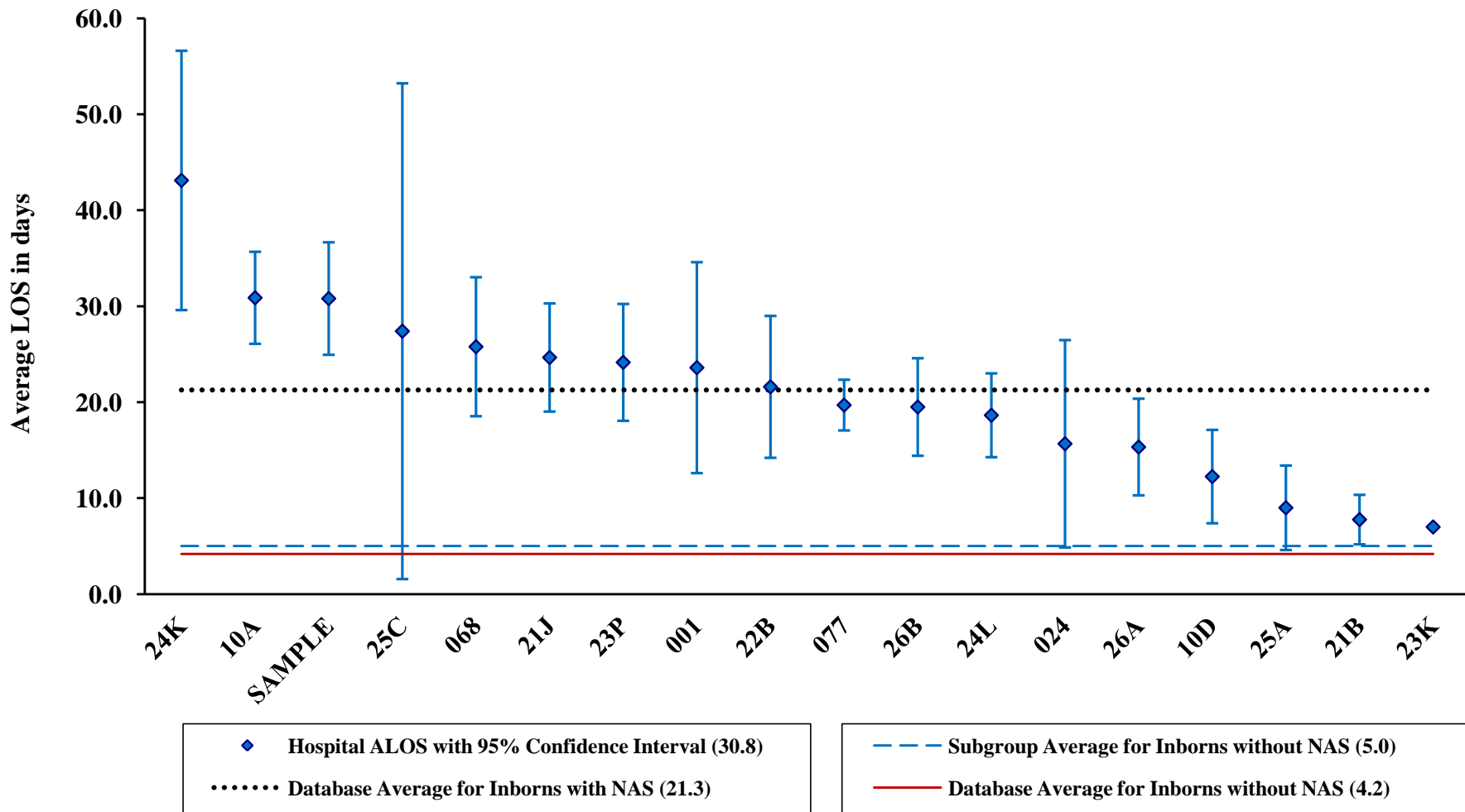
Shaded areas represent linked data.

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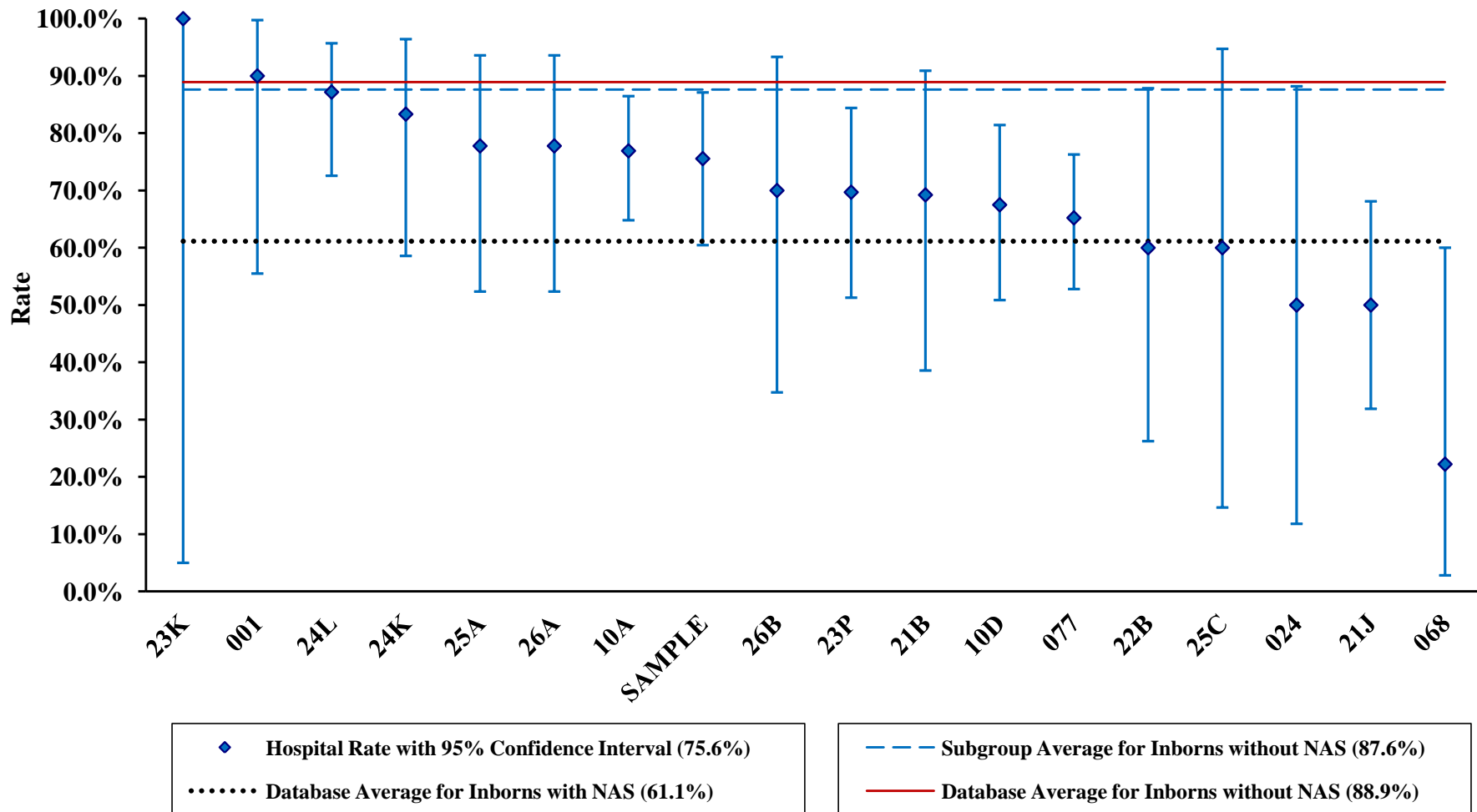
	Hospital SAMPLE		Subgroup Average		Database Average	
<b>Linked Inborn/Mother Analysis (continued)</b>						
<b>C3. Total inborns with NAS linked to a mother coded with Drug dependence (dx code 304.xx)</b>	<b>Total</b>	<b>%</b>	<b>Average</b>	<b>%</b>	<b>Average</b>	<b>%</b>
304.xx - Drug dependence	18	48.7%	6	28.6%	7	30.7%
304.0 - Opioid type dependence	15	83.3%	5	82.3%	6	85.4%
304.7 - Opioid/other dependence	2	11.1%	0	2.3%	0	2.3%
304.1 - Sedative, hypnotic or anxiolytic dependence	1	5.6%	0	0.9%	0	0.5%
304.2 - Cocaine dependence	0	0.0%	0	1.5%	0	1.2%
304.4 - Amphetamine and other psychostimulant dependence	0	0.0%	0	0.0%	0	0.4%
All other drug dependence codes under 304.xx	0	0.0%	0	14.1%	0	11.3%
<b>C4. Other Behavioral Health Issues (not mutually exclusive)</b>	<b>Total</b>	<b>%</b>	<b>Average</b>	<b>%</b>	<b>Average</b>	<b>%</b>
Total inborns with NAS linked to a mother coded with Dysthymic disorder (dx code 300.4x)	5	13.5%	2	6.1%	1	5.5%
Total inborns with NAS linked to a mother coded with Episodic mood disorders (dx code 296.xx)	5	13.5%	2	10.7%	1	7.2%
Total inborns with NAS linked to a mother coded with Anxiety states (dx code 300.0x)	2	5.4%	1	5.5%	1	4.3%
Total inborns with NAS linked to a mother coded with Personality disorders (dx code 301.xx)	1	2.7%	0	0.1%	0	0.1%

Shaded areas represent linked data.

**Graph 1: Neonatal Abstinence Syndrome  
Average Length of Stay (ALOS) - Inborns with NAS  
NPIC ID: SAMPLE**



**Graph 2: Neonatal Abstinence Syndrome**  
**Rate of Normal Birthweight Inborns ( $\geq 2,500$  grams) - Inborns with NAS**  
**NPIC ID: SAMPLE**



**Graph 3: Neonatal Abstinence Syndrome  
Rate of Gestational Age  $\geq$  37 weeks - Inborns with NAS  
NPIC ID: SAMPLE**

