V15.1 NPIC/QAS Special Quarterly Report:
Linked Analysis – Neonatal Abstinence Syndrome

I. Background/Incidence

This report is an update to the special report provided in December 2011 (volume 11.2); provided in light of the increased incidence of Neonatal Abstinence Syndrome (NAS). 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. 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[1]. A retrospective serial, cross-sectional analysis was undertaken to U.S. trends in the incidence of NAS, maternal opiate use and health care expenditures associated with NAS. The Kids' Inpatient Database (KID) was used to identify newborns with NAS by ICD-9-CM code between 2000 and 2009[2]. The study indicated that between 2000 and 2009 the incidence of NAS increased from 1.20% to 3.39% per 1000 hospital births per year. Antenatal maternal opiate use increased from 1.19% to 5.63% per 1000 hospital births per year. Mean hospital charges for discharges with NAS increased from $39,400 in 2000 to $53,400 in 2009. By 2009, 77.6% of charges were attributed to state Medicaid programs. No significant differences in mean LOS was seen for NAS cases over time (approximately 16 days), but it was considerably longer than for other infants (approximately 3 days) [3].

NPIC/QAS Educational Webinar

Dr. Deborah Tuttle
from Christiana Care Health System
will be presenting a webinar on

Neonatal Abstinence Syndrome

In January, 2016
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for updates on educational programs!

II. Clinical Manifestations

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[4]. 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[5]. 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[6]. Long term effects from these deficits are unclear and need further study. Results from the analysis by Patrick et. al., showed that in 2009 newborns with NAS were more likely than all other hospital births to have a low birthweight (19.1% vs 7.0%) and have more respiratory complications (30.9% vs 8.9%)[7].

III. Clinical Services

Methadone maintenance has been the usual form of treatment for several years. 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[8]. 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[9]. 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[10]. 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"[11]. In a study involving 129 neonates born to opioid-dependent women who were receiving treatment with either methadone or buprenorphine, overall methadone–exposed infants had more severe NAS signs. [12]

Determining the relationship between methadone dosage and NAS is conflicting. A retrospective cohort study of pregnant women treated with methadone and their neonates was conducted from 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[13]. A systematic review and meta-analysis of methadone and NAS was undertaken to assess the relationship between maternal methadone dose in pregnancy and incidence of NAS. The report did not find a consistent statistically significant difference in the incidence of NAS in infants of opioid-dependent pregnant women maintained on differing doses of methadone[14].

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[15]. 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.

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[16]. Scoring tools help guide treatment and pharmacological interventions. Care of the neonate with NAS is based on reducing withdrawal symptoms and promoting physiological stability. The British Journal of Midwifery (2012) reported use of a clinical practice guideline for infants with NAS[17]. Following implementation of the protocol, there was a significant decrease in overall NAS score and an overall reduction in LOS for post-intervention neonates with NAS. Some studies have suggested that care of infants with NAS in settings outside of NICU and outpatient management reduces costs and LOS[18,19]. It has been suggested that breastfeeding, if not contraindicated, may decrease the severity of NAS, delay its onset, and decrease the need for pharmacological treatment[20]. The Agency for Healthcare Research and Quality (AHRQ) published guidelines in 2010 for drug-dependent women on methadone who desired to breastfeed. The women must have a plan for post partum addiction counseling, a negative toxicology test at delivery, no contradiction to breastfeeding and have endorsed achievement and maintenance of sobriety prior to and post delivery[21].

Treatment of an addiction is an ongoing challenge for patients and health care providers. The need for comprehensive on-going support to facilitate recovery of women with addiction issues will be a key factor in decreasing the incidence of NAS.

IV. Description of the Tables and Graphs

The **V15.1 Special Report - Linked Analysis: Neonatal Abstinence Syndrome (NAS)** provides you with data related to neonatal abstinence syndrome for inborns, including a 5 year trend graph, 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 Region evidenced the highest rates of NAS. The information displayed represents data for your hospital compared to your subgroup average and to the database as a whole. Other than the trend graph, this report includes data for discharge date range 4/1/2014 – 3/31/2015.

Section A: Overview displays the count of total deliveries, total inborns, total inborns linked to a mother and linked inborns as a percent of total deliveries. Section A includes the total number of inborns coded with NAS (ICD -9 diagnosis code 779.5), inborns with NAS as a percent of total inborns, and similar information concerning neonatal transfers in. The average rate of NAS for hospitals grouped within four regions (i.e., Northeast, Mid/South Atlantic, Central, Pacific) is displayed.

Please note: For some hospitals we are seeing lower than expected numbers of neonatal transfers based on the type of facility. We think this may be the result of miscoded admission source information in the data submitted to us. Please contact your Hospital Liaison/Data Coordinator or mservices@npic.org if you think this is true for your facility.

Section B: Inborn Analysis includes information related to average length of stay, average total charge, birthweight and gestational age distribution, discharge status and selected conditions common to NAS babies. Data are displayed comparing your hospital to your subgroup average and to the NPIC/QAS database average.

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

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

Section B3: Birthweight Distribution shows the total number of cases with very low (1-1,499 grams), low (1,500-2,499 grams), normal (≥ 2,500 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, ≥ 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 care, 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); convulsions in newborns (779.0); failure to thrive (779.34); 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 NPIC/QAS Database average 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 a sufficient link, your report will only display your subgroup and the data base averages.) Data are displayed comparing your hospital to your subgroup average and to the NPIC/QAS database average.

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. 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.

Graph 1: Inborns with NAS 2010 – 2015 (Q1) with Trendlines displays the rate of Inborns with NAS from 2010 – 2014 and Q1 2015 for your hospital and for the NPIC/QAS trend hospitals.

Graphs 2-4 display ALOS or rate data for your hospital, other hospitals in your subgroup, and the NPIC/QAS database 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 the CI for 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 from that comparison - either significantly above or below that average.

Graph 2: Neonatal Abstinence Syndrome Average Length of Stay (ALOS) – Inborns with NAS

Graph 3: Neonatal Abstinence Syndrome Rate of Normal Birthweight Inborns (≥ 2,500 grams) – Inborns with NAS

Graph 4: Neonatal Abstinence Syndrome Rate of Gestational Age ≥ 37weeks – Inborns with NAS

Questions regarding this analysis should be directed to Sandra Boyle, Director of Data Services (sboyle@npic.org) or Janet Muri, President (jmuri@npic.org) at 401-274-0650.

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Linked Analysis: Neonatal Abstinence Syndrome

	Hospital SAMPLE	Subgroup Average	Database Average
A. Overview			
Total Deliveries	2,637	4,104	3,972
Total Inborns	2,696	4,203	4,048
Total Inborns linked to a mother	2,545	4,112	3,830
Inborns linked to a mother as a percent of total deliveries	96.5%	99.3%	94.6%
Total Inborns with Neonatal Abstinence Syndrome (NAS) - dx code 779.5	31	30	23
Inborns with NAS as a percent of total inborns	1.2%	0.7%	0.6%
Total Transfers In	14	69	44
Total Transfers In with Neonatal Abstinence Syndrome (NAS) - dx code 779.5	2	8	3
Transfers In with NAS as a percent of total Transfers In	14.3%	6.1%	4.1%
Average rate of Inborns with NAS by Region:			
Northeast			0.8%
Mid/South Atlantic			0.6%
Central			0.6%
Pacific			0.4%

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	Hospital SAMPLE		Subgroup Average		Database Average	
B. Inborn Analysis						
B1. Average Length of Stay (ALOS)	**Total**	**ALOS**	**Average**	**ALOS**	**Average**	**ALOS**
Overall						
All Inborns	2,696	5.2	4,203	5.2	4,048	4.3
Inborns with NAS	31	19.6	30	21.0	23	19.9
Inborns without NAS	2,665	5.1	4,199	5.1	4,118	4.2
Newborn nursery only						
All Inborns	1,998	2.1	3,422	2.3	3,196	2.2
Inborns with NAS	4	18.0	4	5.3	5	4.4
Inborns without NAS	1,994	2.1	3,417	2.3	3,190	2.2
Special Care nursery *						
All Inborns	689	13.8	771	16.8	574	13.4
Inborns with NAS	27	18.9	26	20.2	17	18.1
Inborns without NAS	662	13.5	745	16.8	556	13.2
B2. Average Total Charge						
All Inborns	$17,764		$29,521		$17,551	
Inborns with NAS	$55,033		$138,614		$92,742	
Inborns without NAS	$17,330		$28,958		$17,177	

* Special care discharges are those having NICU and/or NINT days/charges > 0

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Linked Analysis: Neonatal Abstinence Syndrome

	Hospital SAMPLE		Subgroup Average		Database Average	
B3. Birthweight Distribution	**Total**	**%**	**Average**	**%**	**Average**	**%**
All Inborns						
Very low birthweight (1 - 1,499 grams)	105	3.9%	112	2.9%	85	2.1%
Low birthweight (1,500 - 2,499 grams)	304	11.3%	379	9.4%	311	7.6%
Normal (≥ 2,500 grams)	2,283	84.7%	3,702	87.4%	3,626	89.9%
Missing	4	0.2%	10	0.2%	25	0.5%
Inborns with NAS						
Very low birthweight (1 - 1,499 grams)	1	3.2%	1	2.2%	1	2.0%
Low birthweight (1,500 - 2,499 grams)	9	29.0%	7	23.2%	4	18.6%
Normal (≥ 2,500 grams)	21	67.7%	23	74.5%	18	74.3%
Missing	0	0.0%	0	0.1%	0	1.0%
B4. Gestational Age Distribution	**Total**	**%**	**Average**	**%**	**Average**	**%**
All Inborns						
Less than 24 weeks	14	0.5%	14	0.4%	12	0.3%
24-30 weeks	81	3.0%	91	2.4%	66	1.6%
31-36 weeks	356	13.2%	454	11.1%	379	9.1%
≥ 37 weeks	2,215	82.2%	3,106	73.2%	3,071	70.4%
Missing	30	1.1%	538	13.0%	520	18.7%
Inborns with NAS						
Less than 24 weeks	0	0.0%	0	0.1%	0	0.0%
24-30 weeks	0	0.0%	1	1.9%	0	1.9%
31-36 weeks	10	32.3%	6	23.3%	4	20.5%
≥ 37 weeks	21	67.7%	19	61.6%	16	57.0%
Missing	0	0.0%	5	13.2%	3	16.6%

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Linked Analysis: Neonatal Abstinence Syndrome

	Hospital SAMPLE		Subgroup Average		Database Average	
B5. Discharge Status	**Total**	**%**	**Average**	**%**	**Average**	**%**
All Inborns						
Home	2,648	98.2%	3,936	93.6%	3,868	95.6%
Short term general or children's hospital	13	0.5%	14	0.4%	21	0.7%
Home health care	4	0.2%	206	4.9%	116	2.6%
Died	26	1.0%	26	0.7%	19	0.5%
All other discharge dispositions	5	0.2%	20	0.5%	24	0.7%
Inborns with NAS						
Home	30	96.8%	24	80.7%	16	80.6%
Short term general or children's hospital	1	3.2%	1	1.2%	1	2.6%
Home health care	0	0.0%	5	12.3%	5	9.5%
Died	0	0.0%	0	0.0%	0	0.2%
All other discharge dispositions	0	0.0%	1	5.8%	1	3.1%
B6. Selected Conditions (ranked by All Inborns Database Average in descending order)	**Total**	**%**	**Average**	**%**	**Average**	**%**
All Inborns						
779.31 - Feeding problems in newborn	50	1.9%	177	5.0%	186	4.5%
764.9 - Intrauterine Growth Restriction	41	1.5%	52	1.3%	41	1.0%
779.0 - Convulsions in newborns (fits & seizures)	4	0.2%	8	0.2%	6	0.1%
779.34 - Failure to thrive	3	0.1%	4	0.1%	3	0.1%
779.1 - Other unspecified cerebral irritability	0	0.0%	0	0.0%	0	0.0%
Inborns with NAS						
779.31 - Feeding problems in newborn	4	12.9%	5	19.5%	4	19.4%
764.9 - Intrauterine Growth Restriction	4	12.9%	1	3.2%	1	3.2%
779.0 - Convulsions in newborns (fits & seizures)	0	0.0%	0	1.7%	0	1.5%
779.34 - Failure to thrive	1	3.2%	0	0.6%	0	0.3%
779.1 - Other unspecified cerebral irritability	0	0.0%	0	0.0%	0	0.1%

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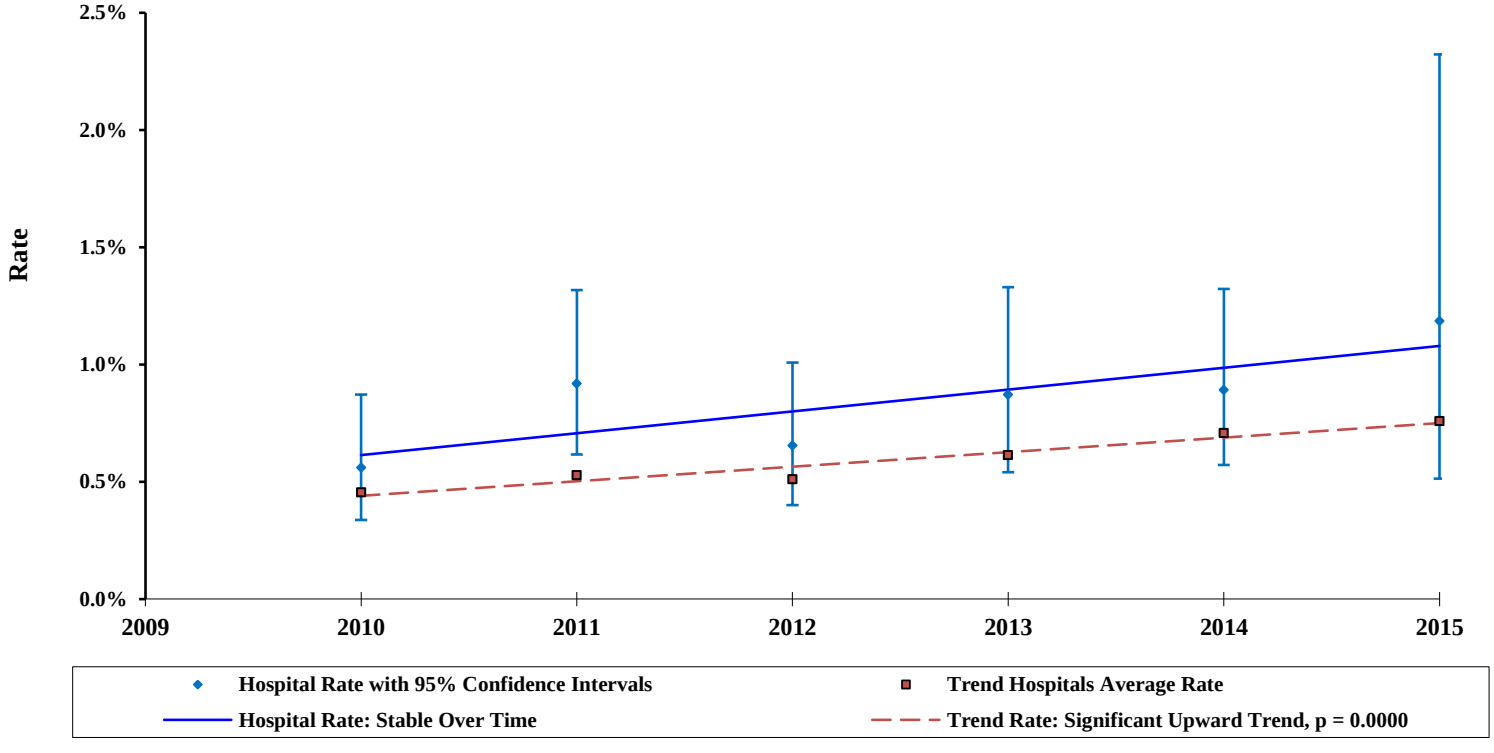
	Hospital SAMPLE		Subgroup Average		Database Average	
C. Linked Inborn/Mother Analysis						
Total inborns with NAS	31		30		23	
Total inborns with NAS linked to a mother	28		26		21	
Inborns with NAS linked to a mother as a percent of total inborns with NAS	90.3%		92.4%		82.5%	
C1. Drug Dependence/Drug Abuse (not mutually exclusive)	**Total**	**%**	**Average**	**%**	**Average**	**%**
Total inborns with NAS linked to a mother coded with Drug dependence (dx code 648.3x)	2	7.1%	7	27.4%	8	29.6%
Total inborns with NAS linked to a mother coded with Non-dependent abuse of drugs (dx codes 305.2x - 305.9x)	6	21.4%	9	34.1%	6	27.4%
C2. Total inborns with NAS linked to a mother coded with Drug dependence (dx code 304.xx)	**Total**	**%**	**Average**	**%**	**Average**	**%**
304.xx - Drug dependence	3	10.7%	8	29.7%	9	31.9%
304.0 - Opioid type dependence	3	100.0%	7	87.6%	8	85.9%
304.7 - Opioid/other dependence	0	0.0%	0	1.5%	0	3.2%
304.1 - Sedative, hypnotic or anxiolytic dependence	0	0.0%	0	0.0%	0	0.7%
304.2 - Cocaine dependence	0	0.0%	0	0.4%	0	2.2%
304.4 - Amphetamine and other psychostimulant dependence	0	0.0%	0	1.0%	0	0.6%
All other drug dependence codes under 304.xx	0	0.0%	1	3.3%	0	8.2%

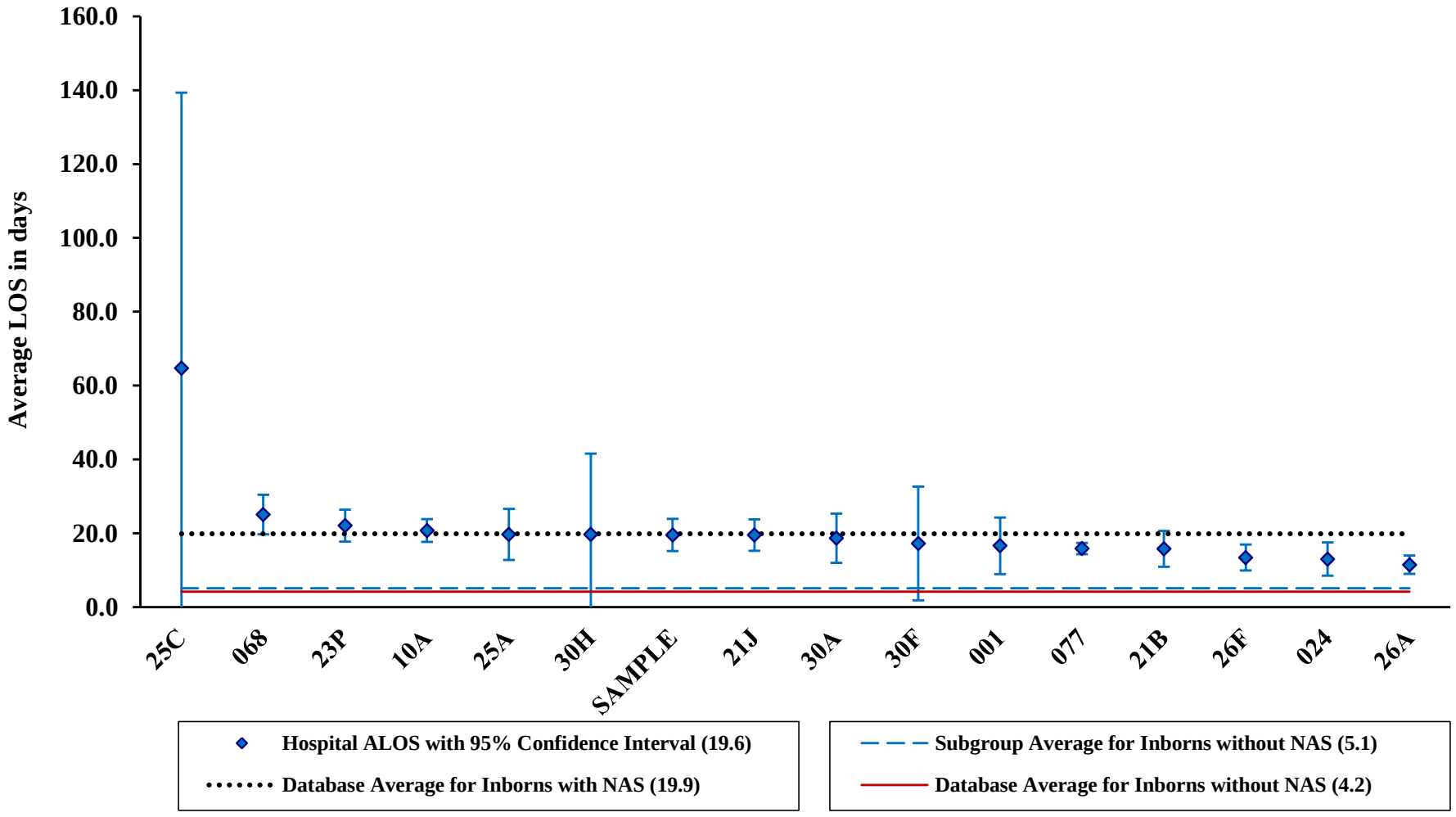
Shaded areas represent linked data.

Graph 1: Inborns with Neonatal Abstinence Syndrome 2010 - 2015 (Q1) with Trendlines
NPIC ID: SAMPLE

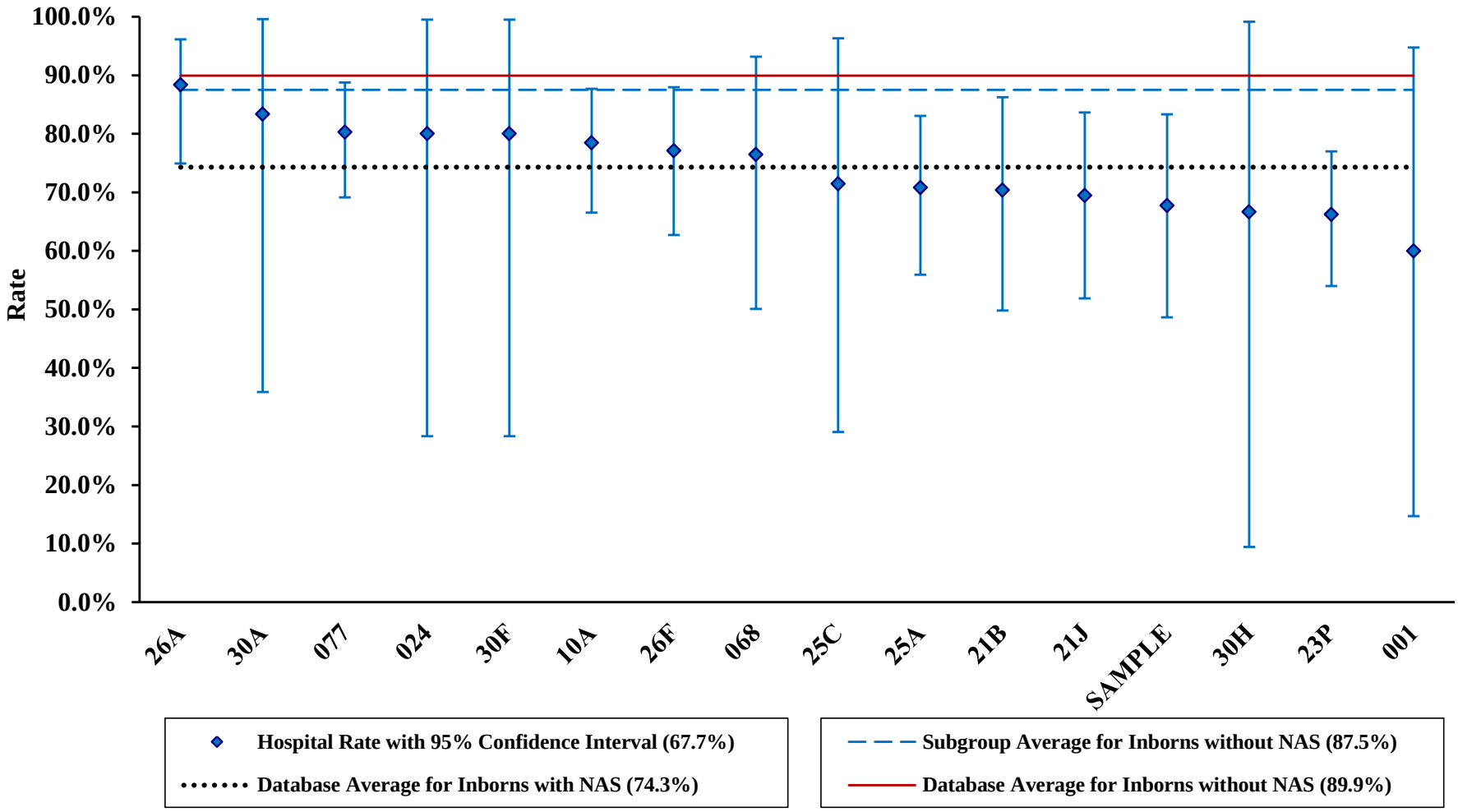


	2010	2011	2012	2013	2014	2015 (Q1)
Trend Rate	0.45%	0.53%	0.51%	0.61%	0.71%	0.76%
Hospital Rate	0.56%	0.92%	0.65%	0.87%	0.89%	1.19%
Hospital Numerator	19	29	20	21	24	8
Hospital Denominator	3396	3156	3058	2409	2695	675
Lower CI	0.34%	0.62%	0.40%	0.54%	0.57%	0.51%
Upper CI	0.87%	1.32%	1.01%	1.33%	1.32%	2.32%

Graph 2: Neonatal Abstinence Syndrome
Average Length of Stay (ALOS) - Inborns with NAS
NPIC ID: SAMPLE



Graph 3: Neonatal Abstinence Syndrome
Rate of Normal Birthweight Inborns (≥ 2,500 grams) - Inborns with NAS
NPIC ID: SAMPLE



Graph 4: Neonatal Abstinence Syndrome
Rate of Gestational Age ≥ 37 weeks - Inborns with NAS
NPIC ID: SAMPLE