



Neonatal Abstinence Syndrome in a Rural State

Alexa Craig, MD, MSc



Cancer | Cardiology & Heart Surgery | Geriatrics | Gynecology
Nephrology | Orthopedics | Pulmonology | Urology



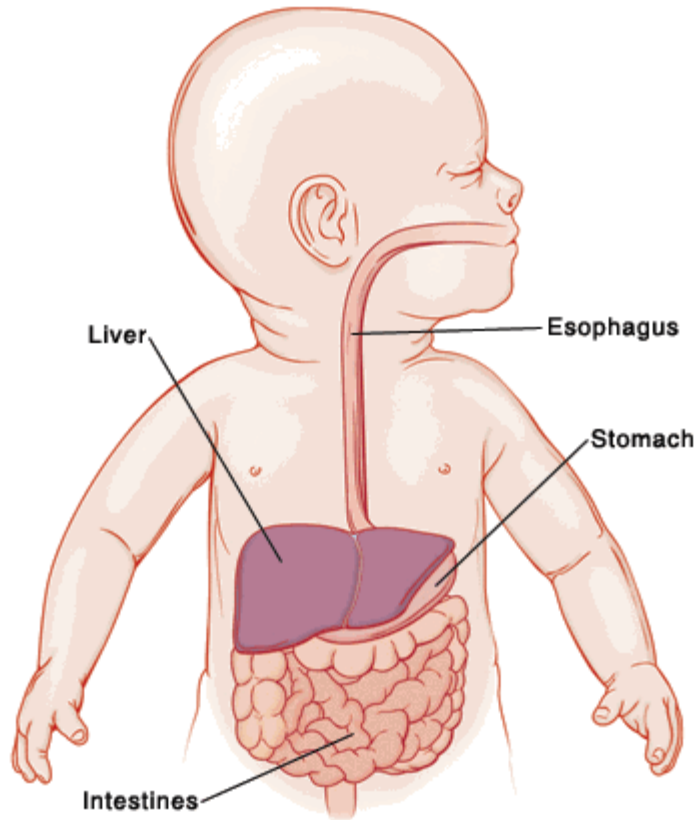
Disclosures

- Tufts Clinical and Translational Science Institute (KL2 TR001063)
- Maine Medical Center Research Institute
- Center for Nursing Research and Quality Outcomes
- Neurosciences Service Line and Department of Pediatrics

Objectives

- What is Neonatal Abstinence Syndrome?
- Facts and stats: newborns and opiates in Maine
- Innovation projects at Maine Medical Center
 - Qualitative work
 - Changing the paradigm of assessing NAS
 - Bonding study of mothers
 - Hepatitis C work
 - Head circumference and developmental outcomes
 - Foster care

Mu Receptors



Directly activated by positive reinforcement from opioid or indirectly by alcohol, cannabinoids, nicotine activation

Table 2. Clinical Manifestations and Outcomes of the Neonatal Abstinence Syndrome.*

Metabolic, vasomotor, and respiratory manifestations

Fever

Frequent yawning

Sneezing

Sweating

Nasal stuffiness

Respiratory rate >60 breaths per minute, with or without retractions

Mottling

Tachypnea

Gastrointestinal manifestations

Projectile vomiting

Regurgitation

Loose or watery stools

Weight loss

Poor feeding

Excessive sucking

Central nervous system manifestations

Tremors

High-pitched crying

Sleep disturbances

Increased muscle tone

Excoriation

Myoclonic jerks

Irritability

Seizures

Outcomes

Admission to neonatal intensive care unit

Pharmacologic treatment for 60–80% of infants

Prolonged hospitalization (average, 17 days)

Increased risk of birth complications (e.g., low birth weight, jaundice, and feeding difficulties)

Disrupted bonding

Child-safety concerns

* Data on manifestations are from Finnegan et al.,¹ Newnam et al.,³⁴ and D'Apolito,³⁵ and data on outcomes are from Patrick et al.,^{5,6} Jansson and Velez,²³ Lee et al.,²⁴ Uebel et al.,³⁶ Cleary et al.,³⁷ and Wachman et al.³⁸

Video

REVIEW ARTICLE

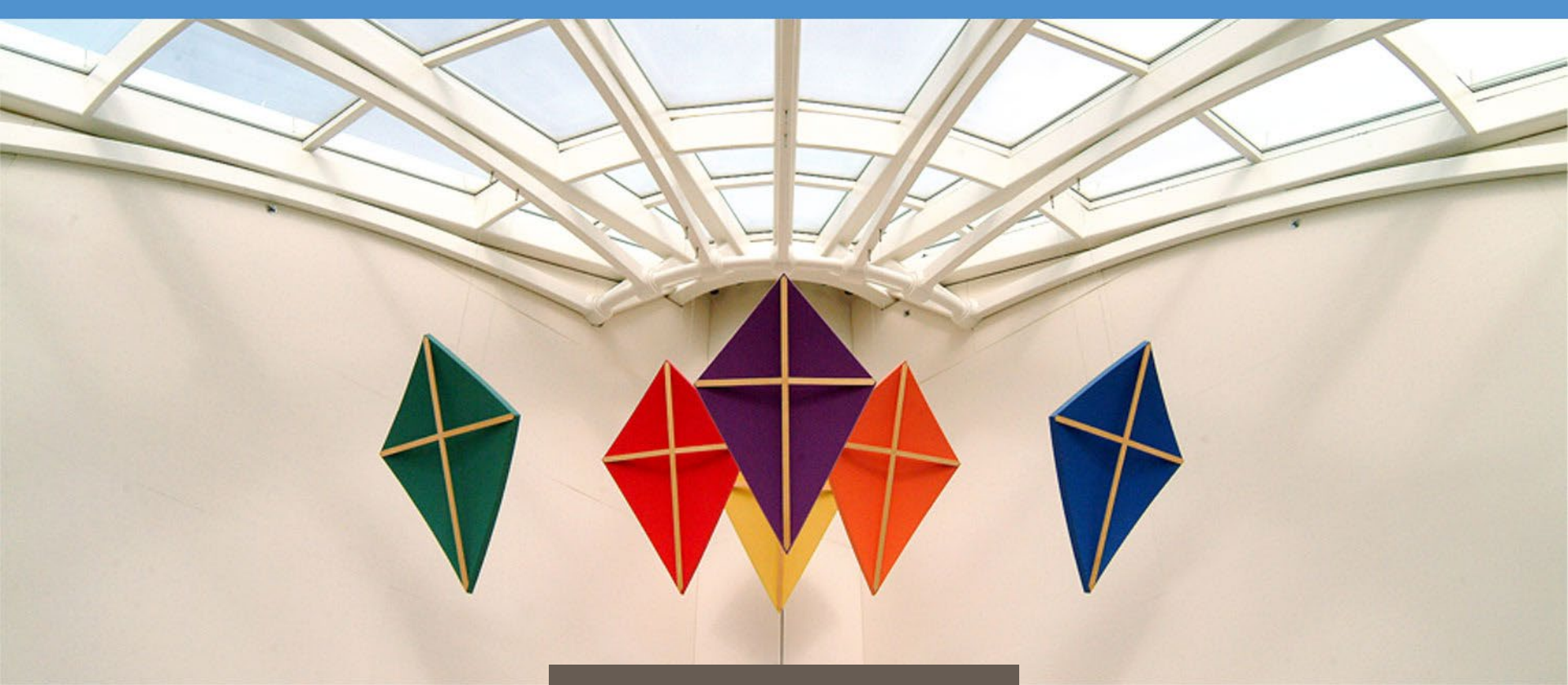
Dan L. Longo, M.D., *Editor*

Neonatal Abstinence Syndrome

Karen McQueen, R.N., Ph.D., and Jodie Murphy-Oikonen, M.S.W., Ph.D.

December 2016 “Effective management strategies have been developed. However, gaps still exist, including lack of clarity and consistency in how the syndrome is defined, measured, and managed.

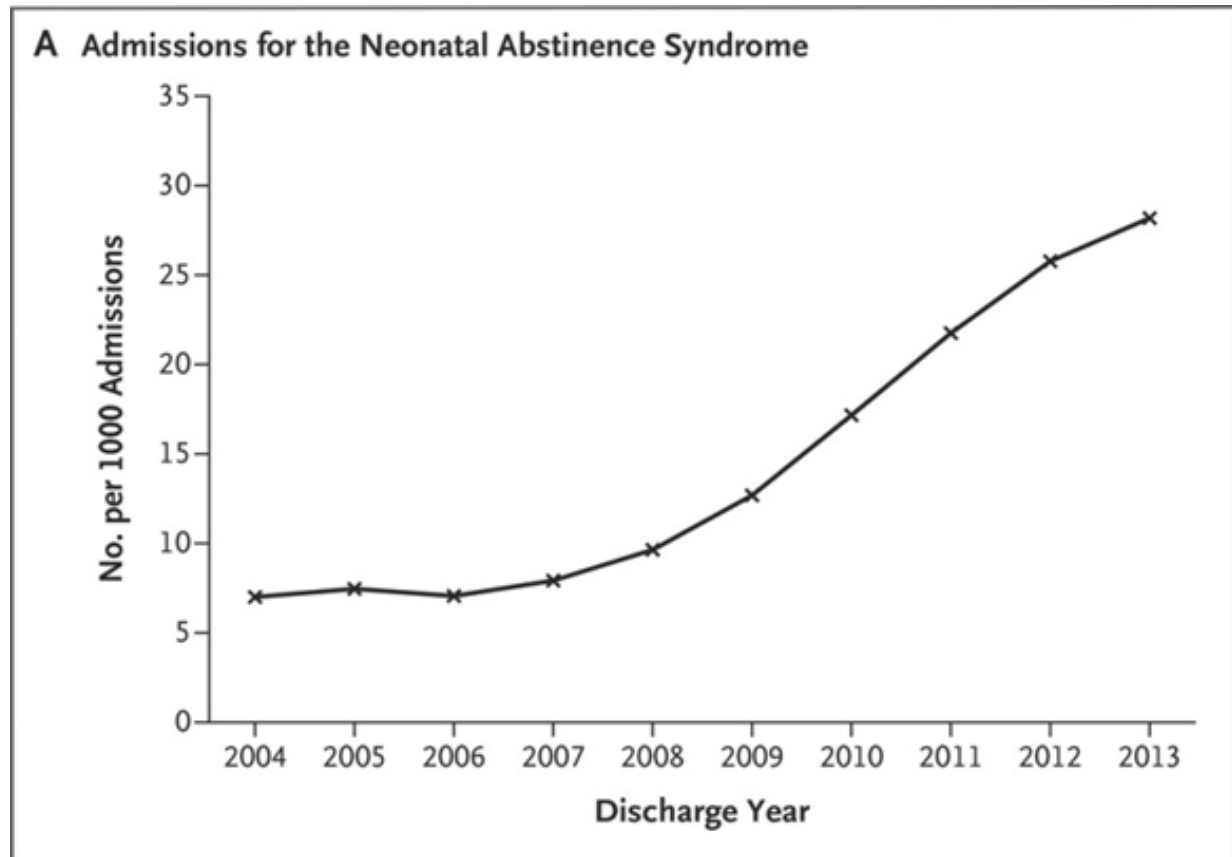
In addition, much of the research has focused on the infant in isolation from the mother.....”



Facts and Stats

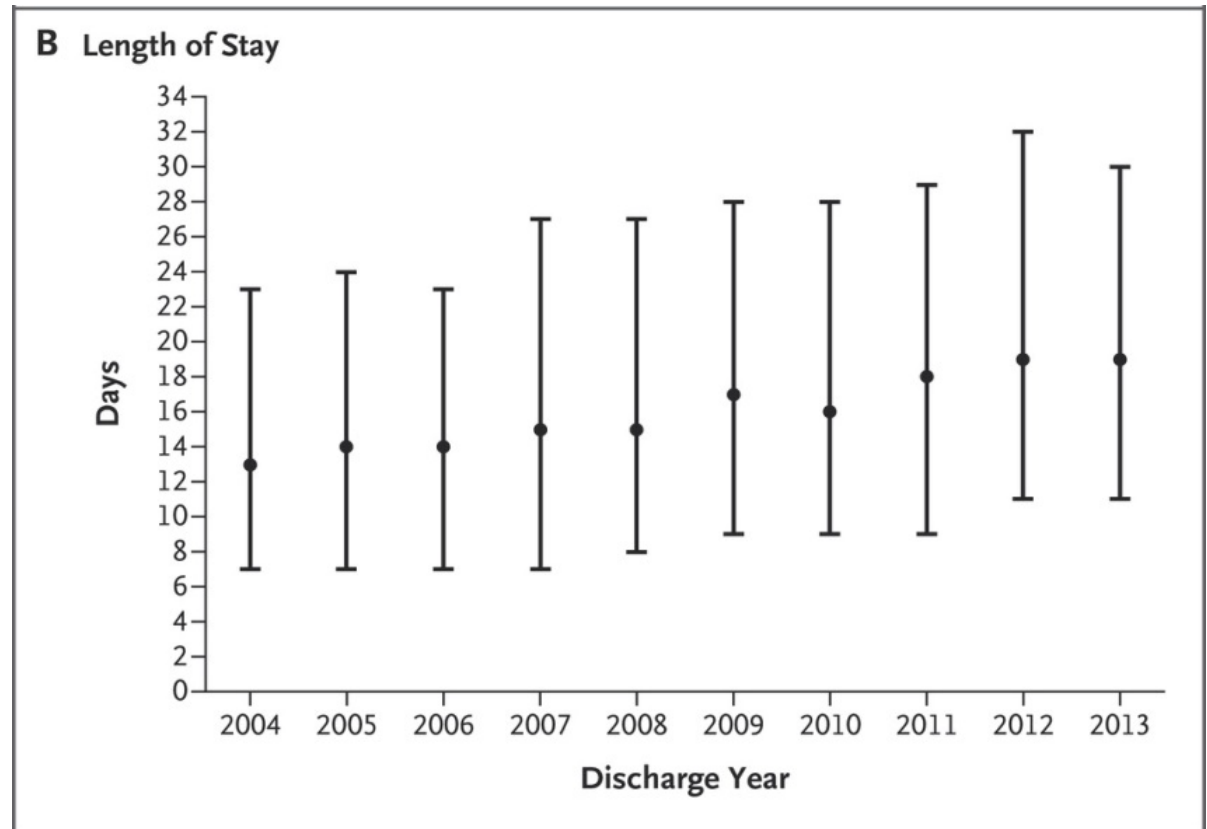
NAS: Number of Admissions

2004-2013- rate
of NAS NICU
admissions when
from 7 to 27
cases per 1000
admission



NAS: Length of Stay

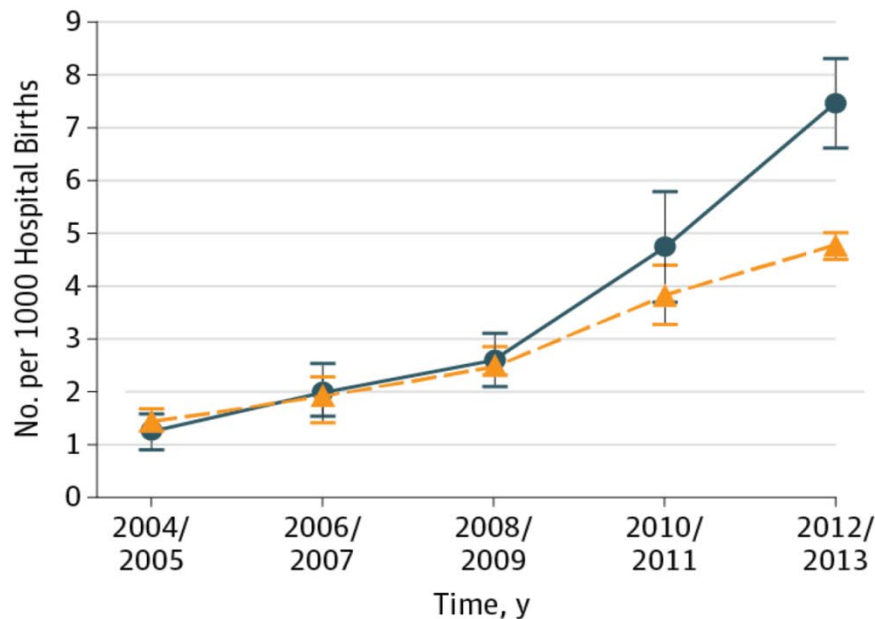
2004-2013
median LOS
increased from 13
to 19 days



From: **Rural and Urban Differences in Neonatal Abstinence Syndrome and Maternal Opioid Use, 2004 to 2013**

JAMA Pediatr. 2017;171(2):194-196. doi:10.1001/jamapediatrics.2016.3750

A Neonatal abstinence syndrome



B Maternal opioid use

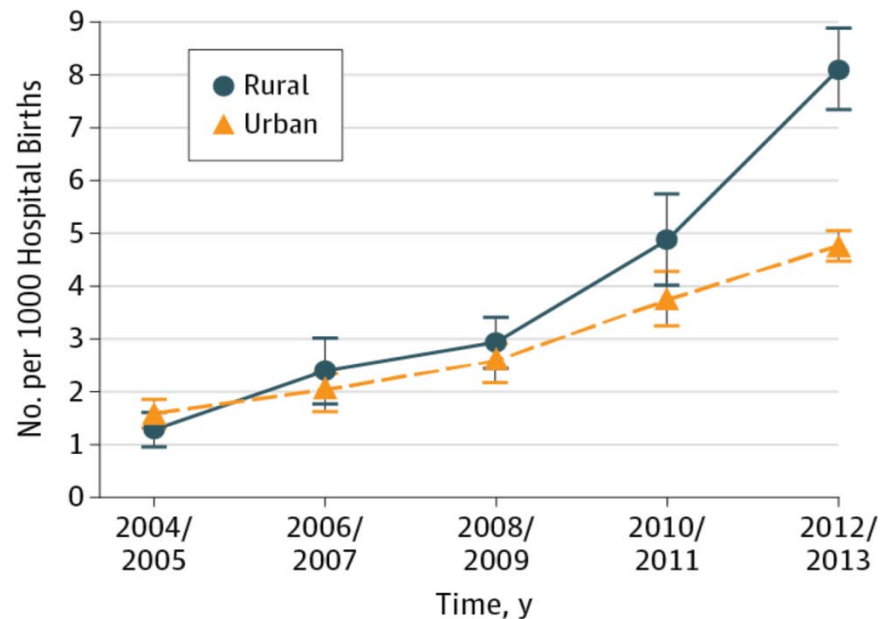


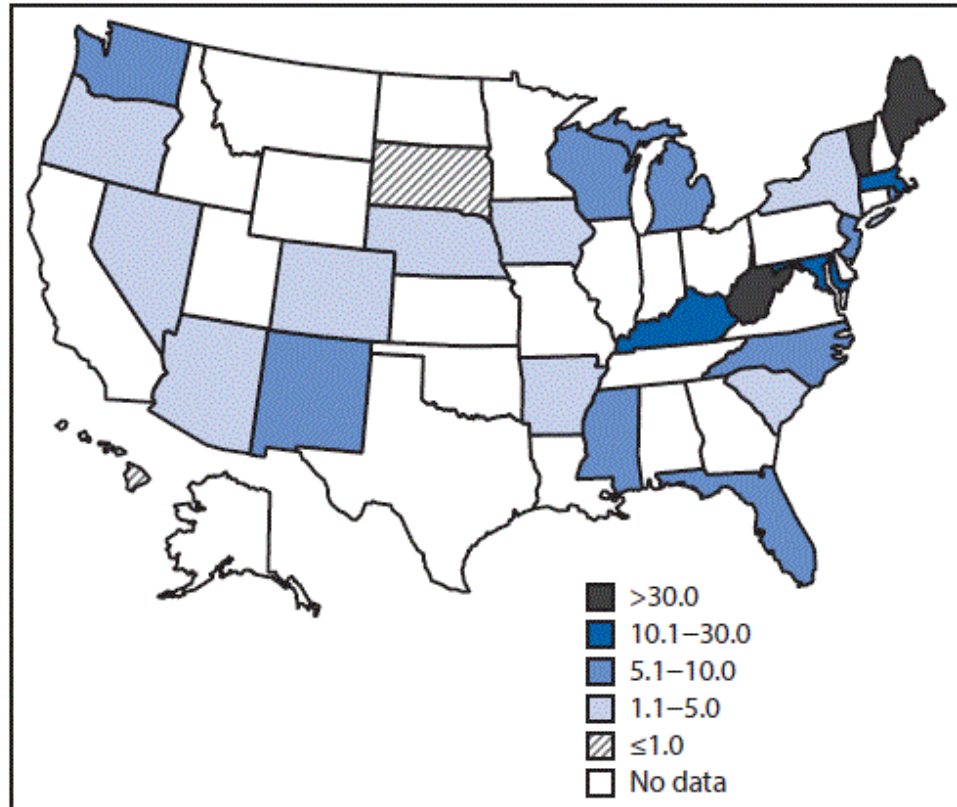
Figure Legend:

Changes in Opioid-Related Diagnoses Among Infants and Mothers by Urban/Rural Status Frequency of neonatal abstinence syndrome (A) and maternal opioid use (B) per 1000 hospital births by rural vs urban status, displayed as 2-year combined estimates.

Date of download: 5/9/2018

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NAS Incidence Rates per 1,000, 25 states from 2012-2013



Ko JY, Patrick SW, Tong VT, Patel R, Lind JN, Barfield WD. Incidence of Neonatal Abstinence Syndrome — 28 States, 1999–2013. *MMWR Morb Mortal Wkly Rep* 2016;65:799–802. DOI

NAS in Maine by County

COUNTY	**2004	**2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
ANDROSCOGGIN	5	14	18	19	37	36	55	82	97	121	104	128	134
AROOSTOOK	1	13	12	19	31	25	35	36	59	67	58	60	76
CUMBERLAND	14	25	32	40	41	56	50	69	63	102	109	103	83
FRANKLIN	0	0	1	1	6	4	10	13	15	16	7	16	10
HANCOCK	1	3	14	8	14	12	21	26	33	30	37	36	38
KENNEBEC	2	10	11	33	36	69	73	84	89	103	102	83	109
KNOX	2	4	4	6	9	9	20	23	37	32	19	27	36
LINCOLN	2	2	3	6	7	3	8	11	17	13	30	23	18
OXFORD	0	5	5	7	14	11	7	19	11	27	34	28	32
PENOBSCOT	12	48	65	73	81	139	162	155	187	182	226	239	213
PISCATAQUIS	0	3	3	7	3	7	8	1	18	15	16	24	21
SAGadahoc	2	2	1	2	6	3	8	6	9	17	8	15	10
SOMERSET	1	4	7	13	16	21	28	42	43	70	56	59	58
WALDO	2	4	2	12	17	16	26	29	23	29	32	33	54
WASHINGTON	1	7	8	9	6	21	18	27	32	47	41	42	41
YORK	7	18	11	18	18	18	38	43	38	55	82	96	91
Unknown/Non-Maine Resident	1	3	4	1	1	1	5	2	1	1	0	1	0
TOTAL	53	165	201	274	343	451	572	668	772	927	961	1013	1024

53

165

201

274

343

451

572

668

772

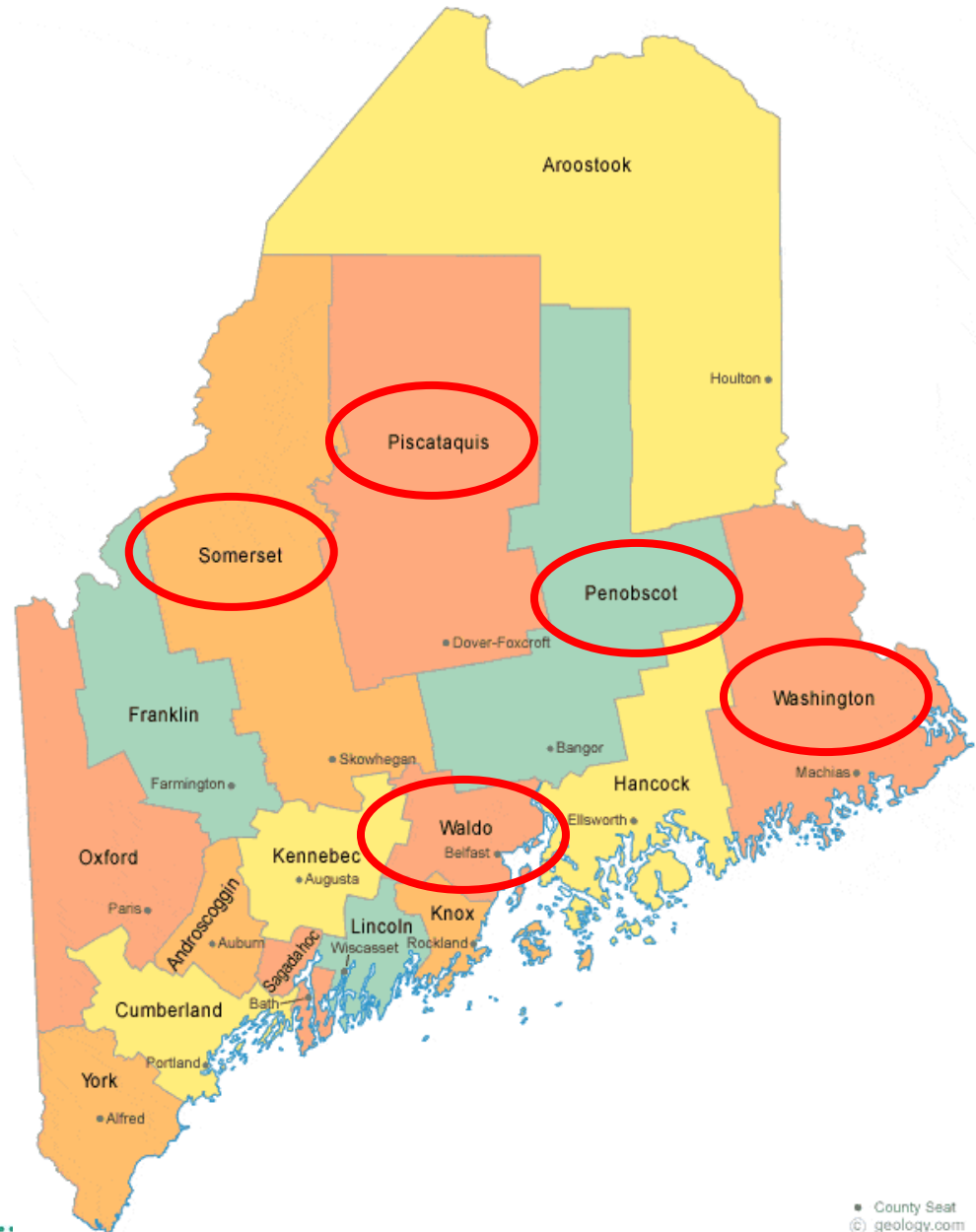
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Our Rural State

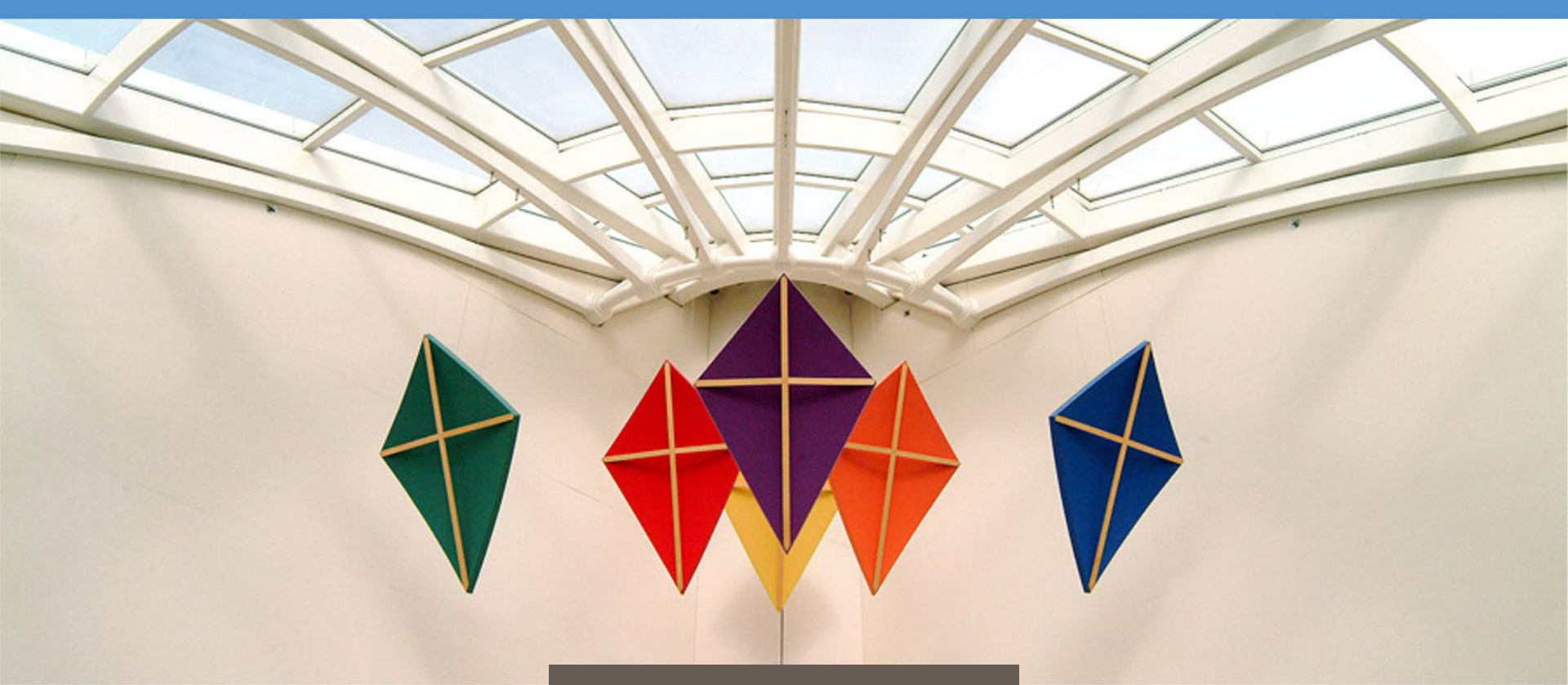


National Statistics on Cost

- 4 Million birth in US/year
 - 24,000 NAS infants born in US (66 per day!)
- Mean length of stay 23 days
 - Each day in the US, there are >1500 hospitalized NAS infants
- Cost \$93,400/infant
 - \$2.2 billion in costs for initial hospitalization
 - >80% are Medicaid

“Costs” at Maine Medical Center

	2013	2014	2015	2016	Total
LOS tx	18	24	24	20	21
LOS not tx	7	7	6	6	6.6
Charges tx	\$71,012	\$104,561	\$102,451	\$86,863	\$88,716
Charges not tx	\$22,889	\$22,037	\$21,711	\$21,501	\$22,252
Payments tx	\$16,216	\$15,904	\$13,897	\$9,077	\$15,120
Payments not tx	\$7,229	\$6,668	\$62,07	\$7,084	\$6,868
Treatment rate	43%	45%	42%	35%	43%



Research and Quality Improvement; Parent and Provider

New handout (pre-natal)

Maine Resources

INFORMATION ON NAS

March of Dimes

- 📍 [www.marchofdimes.org/complications/neonatal-abstinence-syndrome-\(nas\).aspx](http://www.marchofdimes.org/complications/neonatal-abstinence-syndrome-(nas).aspx)

SUBSTANCE ABUSE RESOURCES

MaineHealth Learning Resource Center

- 📞 1 (866) 609-5183
- 📍 www.mainehealthlearningcenter.org/resources/treatment-for-drug-addiction

Maine Alliance for Addiction Recovery (MAAR)

- Free recovery support program and recovery housing help.*
- 📞 (207) 621-8118

Office of Substance Abuse Information & Resource Center

- 📞 1 (800) 499-0027

Substance Abuse & Mental Health Services Administration

- 📍 www.samhsa.gov

The Woman's Project

- 📞 (207) 523-5049

RESOURCES FOR NEW PARENTS

Public Health Nursing in Maine (Statewide Central Referral)

- 📞 1 (877) 763-0438

Text4Baby

Free smartphone app that sends you tips and helpful information.

- 📍 www.text4baby.org

Maine Families

Free visits from child development professionals and parent educators.

- 📞 (207) 624-7900

- 📍 www.maineamilies.org

Lactmed

Free app and website providing information about taking medications or supplements while breastfeeding.

Classes at MMC

- 📍 www.mmc.org/childbirth-parenting-education

MMC New Parent Website

- 📍 www.mmc.org/parent-resources

INFORMATION FOR PREGNANT WOMEN

Neonatal Abstinence Syndrome (NAS)



The Barbara Bush
Children's Hospital
At Maine Medical Center
bbch.org 

New handout (post-natal)

Maine Resources

INFORMATION ON NAS

March of Dimes

- 📍 [www.marchofdimes.org/complications/neonatal-abstinence-syndrome-\(nas\).aspx](http://www.marchofdimes.org/complications/neonatal-abstinence-syndrome-(nas).aspx)

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MMC New Parent Website

- 📍 www.mmc.org/parent-resources

INFORMATION FOR NEW PARENTS

Neonatal Abstinence Syndrome (NAS)



The Barbara Bush
Children's Hospital
At Maine Medical Center
bbch.org

143675 11/16

SYSTEMS	SIGNS AND SYMPTOMS	SCORE	AM						PM						DAILY WT.	
			2	4	6	8	10	12	2	4	6	8	10	12		
CENTRAL NERVOUS SYSTEM DISTURBANCES	High Pitched Cry	2														
	Continuous High Pitched Cry	3														
	Sleeps < 1 Hour After Feeding	3														
	Sleeps < 2 Hours After Feeding	2														
	Hyperactive Moro Reflex	2														
	Markedly Hyperactive Moro Reflex	3														
	Mild Tremors Disturbed	2														
	Moderate Severe Tremors Disturbed	3														
	Mild Tremors Undisturbed	1														
	Moderate Severe Tremors Undisturbed	2														
	Increased Muscle Tone	2														
	Excoriation (specify area): _____	1														
Myoclonic Jerks	3															
Generalized Convulsions	3															
METABOLIC VASOMOTOR/ RESPIRATORY DISTURBANCES	Sweating	1														
	Fever < 101°F (39.3°C)	1														
	Fever > 101°F (39.3°C)	2														
	Frequent Yawning (> 3-4 times/interval)	1														
	Mottling	1														
	Nasal Stuffiness	1														
	Sneezing (> 3-4 times/interval)	1														
	Nasal Flaring	2														
Respiratory Rate > 60/min	1															
Respiration Rate > 60/min with Retractions	2															
GASTROINTESTINAL DISTURBANCES	Excessive Sucking	1														
	Poor Feeding	2														
	Regurgitation	2														
	Projectile Vomiting	3														
	Loose Stools	2														
Watery Stools	3															
SUMMARY	TOTAL SCORE															
	SCORER'S INITIALS															
	STATUS OF THERAPY															

**Finnegan
Scoring
System:
31 items
Score Q4 hrs
Treat for >8 on
2-3 occasions
or >12
on
1-2 occasions**

Non-pharmacological Care

- Skin to skin contact with parents
- Decreased stimulation (light, noise, and tactile)
- Swaddling
- Use of pacifiers
- Breastfeeding



Yale approach to NAS

- Contract with the parents for 24/7 non pharmacologic care
- Evaluate for treatment based on:
 - 1) Can the infant eat?
 - 2) Can the infant be consoled?
 - 3) Can the infant sleep?

Long term outcomes?

- “Potential long-term effects of prenatal methadone exposure on infant and toddler development are not known”

Clin Obstet Gynecol. 2013 March ; 56(1): 186–192.

- Hunt et al assessed opiate-exposed infants at both 18 and 36 months using the Bayley Scales of Infant Development, Second Edition (BSID-II). Mental Development Index (MDI) was significantly lower in opiate-exposed children at 12 and 18 months

Hunt RW, Tzioumi D, Collins E, et al. Adverse neurodevelopmental outcome of infants exposed to opiate in-utero. Early Hum Dev. 2008; 84(1):29–35.

- Comorbidities that make assessment challenging
 - other substance exposure (e.g., alcohol, tobacco, other illicit drugs)
 - environmental risk factors (lead)
 - medical risk factors (poor maternal nutrition, SGA)
 - low socioeconomic status (poor prenatal care)
 - mental health issues

Maine Office of Child and Family Services (OCFS)

On average, MMC reports 131 drug affected babies per year, of which an average of 16% entered DHHS custody.

CALENDAR YEAR	TOTAL DAB REPORTS REPORTED TO DHHS BY MMC	NUMBER ENTERING DHHS CUSTODY	OUTCOMES TO DATE FOR CHILDREN THAT ENTERED CUSTODY
2013	108	24 (22%)	of the 24 removed 6 were reunified; 13 adopted
2014	159	18 (11%)	of the 18 removed 10 were adopted; 6 reunified
2015	144	22 (15%)	of the 22 removed 8 were adopted; 5 reunified
2016	113	15 (13%)	of the 15 removed 2 were adopted; 1 reunified

CALENDAR YEAR	NUMBER OF INFANTS OPIATE EXPOSED FROM MMC DATABASE	NUMBER ENTERING DHHS CUSTODY	OUTCOMES TO DATE FOR CHILDREN THAT ENTERED CUSTODY
2013	146	34 (23%)	11 reunified; 12 adopted
2014	133	20 (15%)	7 reunified; 6 adopted
2015	88	18 (20%)	2 reunified; 2 adopted
2016	53	4 (8%)	1 adopted
Total	420	76 (18%)	

Parental Drug Abuse and Neglect

REMOVAL REASON(S)	2013				2014				2015				2016			
	MMC		All Others		MMC		All Others		MMC		All Others		MMC		All Others	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
PHYSICAL ABUSE	4	17%	9	8%	1	6%	9	13%	5	23%	8	12%	1	7%	10	11%
SEXUAL ABUSE	0	0%	0	0%	0	0%	0	0%	3	14%	3	4%	0	0%	1	1%
NEGLECT	20	83%	103	91%	16	89%	56	80%	22	100%	59	86%	15	100%	81	88%
ALCOHOL ABUSE PARENT	1	4%	15	13%	1	6%	9	13%	6	27%	10	14%	2	13%	13	14%
DRUG ABUSE PARENT	19	79%	83	73%	18	100%	53	76%	21	95%	54	78%	13	87%	64	70%
ALCOHOL ABUSE CHILD	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
DRUG ABUSE CHILD	0	0%	0	0%	0	0%	1	1%	0	0%	0	0%	0	0%	1	1%
CHILD DISABILITY	0	0%	1	1%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
CHILD BEHAVIOR	0	0%	0	0%	0	0%	1	1%	1	5%	0	0%	0	0%	0	0%
DEATH OF PARENT	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
INCARCERATION OF PARENT	3	13%	13	12%	2	11%	5	7%	3	14%	11	16%	3	20%	11	12%
PARENT INCAPACITY	4	17%	8	7%	1	6%	8	11%	5	23%	6	9%	1	7%	8	9%
ABANDONED	0	0%	3	3%	1	6%	2	3%	0	0%	2	3%	0	0%	2	2%
RELINQUISHED	2	8%	0	0%	0	0%	1	1%	0	0%	0	0%	0	0%	3	3%
INADEQUATE HOUSING	8	33%	23	20%	10	56%	13	19%	13	59%	20	29%	10	67%	21	23%

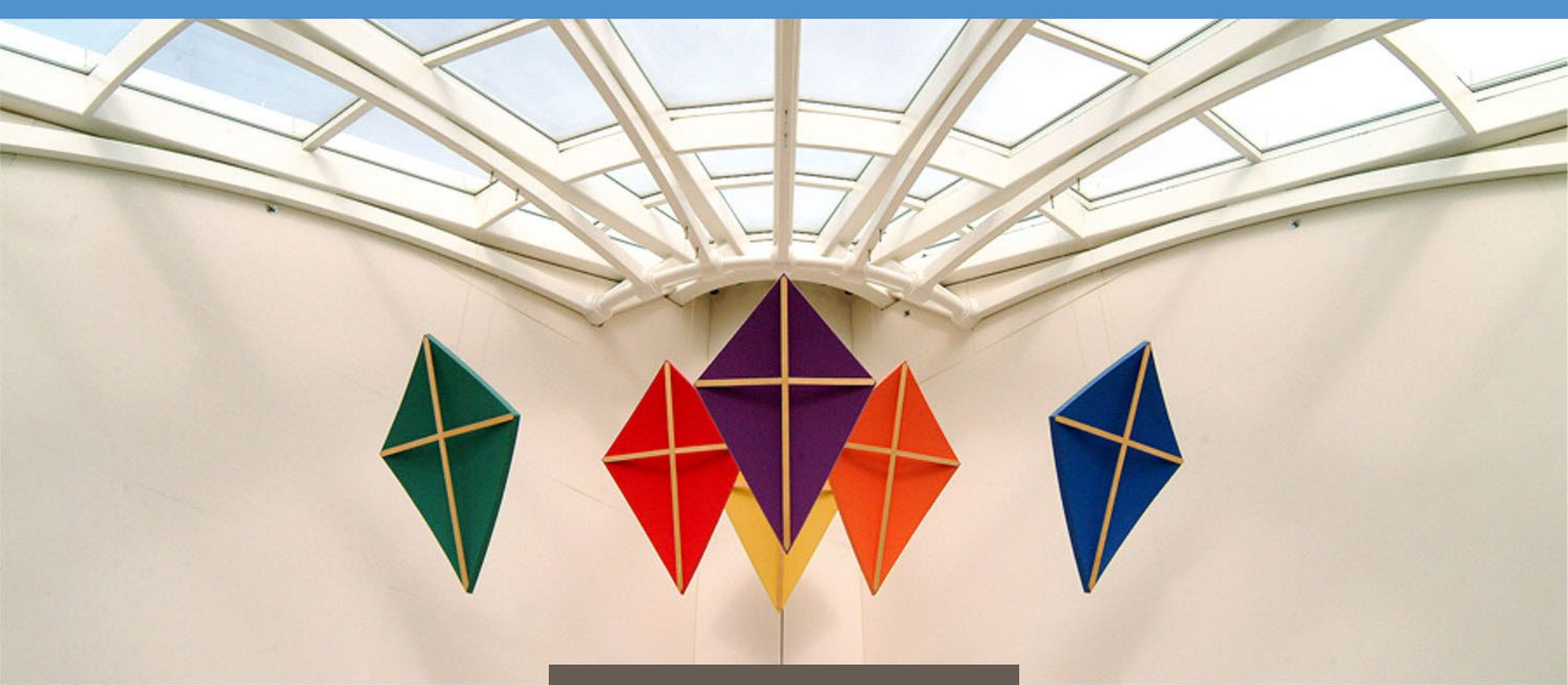
Are we doing all that can be done?

- https://www.ted.com/talks/johann_hari_everything_you_think_you_know_about_addiction_is_wrong/transcript?language=en#t-251438



Rat Park Experiment,
Bruce Alexander,
Canadian
Psychologist,
published 1981





Questions??