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Neonatal Abstinence Syndrome (NAS) in Southwestern Border States: Examining Trends, Population Correlates, and Implications for Policy

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Abstract

Introduction Neonatal abstinence syndrome (NAS) is withdrawal syndrome in newborns following birth and is primarily caused by maternal drug use during pregnancy. This study examines trends, population correlates, and policy implications of NAS in two Southwest border states. *Materials and Methods* A cross-sectional analysis of Hospital Inpatient Discharge Data (HIDD) was utilized to examine the incidence of NAS in the Southwest border states of Arizona (AZ) and New Mexico (NM). All inpatient hospital births in AZ and NM from January 1, 2008 through December 31, 2013 with ICD9-CM codes for NAS (779.5), cocaine (760.72), or narcotics (760.75) were extracted. *Results* During 2008–2013 there were 1472 NAS cases in AZ and 888 in NM. The overall NAS rate during this period was 2.83 per 1000 births (95% CI 2.68–2.97) in AZ and 5.31 (95% CI 4.96–5.66) in NM. NAS rates increased 157% in AZ and 174% in NM. NAS newborns were more likely to have low birth weight, have respiratory distress, more likely to have feeding difficulties, and more likely to be on state Medicaid insurance. AZ border region (border with Mexico) had NAS rates significantly higher than the state rate (4.06 per 1000 births [95% CI 3.68–4.44] vs. 2.83 [95% CI 2.68–2.97], respectively). In NM, the border region rate (2.09 per 1000 births [95% CI 1.48–2.69]) was significantly lower than the state rate (5.31 [95% CI 4.96–5.66]). *Conclusions* Despite a dramatic increase in the incidence of NAS in the U.S. and, in particular, the Southwest border states of AZ and NM, there is still scant research on the overall incidence of NAS, its assessment in the southwest border, and associated long-term outcomes. The Healthy Border (HB) 2020 binational initiative of the U.S.-Mexico Border Health Commission is an initiative that addresses several public health priorities that not only include chronic and degenerative diseases, infectious diseases, injury prevention, maternal and child health but also mental health and addiction. The growing opioid epidemic and rise in NAS cases in the Southwest border, as partially shown in this study, provides another opportunity to track health illnesses and outcomes in the Southwest border, especially because there are targeted resources through High Intensity Drug Trafficking Areas (HIDTA) funding.

Keywords Neonatal abstinence syndrome (NAS) · LBW · Respiratory difficulties · Southwest border · Border health · Disparity · Population health

Significance

This is the first study we are aware of that provides us with the unique challenges associated with opioid use in general, and NAS in particular, in the border region. On going research, surveillance, and allocation of funds is critical to monitor emerging issues in the Southwest border. Further research using both California and Texas data will enable us to further understand the extent of the problem and enable us to strengthen binational initiatives to mitigate maternal and child health issues.

Disclaimer The views expressed in the submitted article are those of the authors and not an official position of the AZ Department of Health Services and New Mexico Department of Health.

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Background and Introduction

Notwithstanding the usual challenges of high rates of unemployment, poverty, lack of insurance, and high chronic disease described in the most recent report from the United States (U.S).-Mexico Border Health Commission (2014); there has been scant research and/or publication specifically relating to the incidence and/or prevalence of drug use in the Southwest border nor analysis of specific population health concerns since Harrison et al.'s (1996) seminal article on drug use trafficking in the U.S. Southwest border. Further, research specific to substance use and abuse among the most vulnerable population (i.e., women and children in the border region) is, at best, non-existent.

The Drug Enforcement Agency (DEA) has reported increased availability of illicit drugs in recent years, both in Arizona (AZ) and New Mexico (NM) (United States Department of Justice 2011a, 2011b, 2014). While most prevalence studies examine health outcomes specific to youth access and/or abuse, very few have systematically examined maternal and child outcomes. This is concerning, especially since the Centers for Disease Control and Prevention (CDC) has reported increasing rates of prescription opioid pain reliever use and its impact on many segments of the population, including pregnant women (Epstein et al. 2013).

Some studies, including a large national cohort, have revealed substantial increases in neonatal abstinence syndrome (NAS), from 2004 to 2013, resulting in significant resource utilization (Patrick et al. 2012; Tolia et al. 2015). The National Institutes of Health (NIH), Jansson and Velez (2012), and the U.S. National Library of Medicine (2012) define NAS as a group of problems that occur in newborns exposed to addictive illegal or prescription drugs while in their mother's womb (in utero-exposure). This syndrome is primarily associated with use of opioids and/or narcotics (i.e., heroin, methadone, codeine/hydrocodone), amphetamines, barbiturates, benzodiazepines (i.e., diazepam, clonazepam), cocaine, and/or marijuana, during the prenatal (antepartum) period (Patrick et al. 2012). However, to our knowledge, since Harrison et al.'s study (1996), no research has examined the impact of maternal drug use on infants in Southwest states and the Southwest U.S.-Mexico border region. Hence, we sought to explore the incidence of NAS and drug exposure among infants in two of the Southwest border states, AZ and NM, and their respective border regions.

Methods

Data and Sample

The Arizona Department of Health Services (ADHS) and the New Mexico Department of Health (NMDOH) collect hospital inpatient discharge data (HIDD) from all state-licensed hospitals based on their territory as per statutory authority (Arizona Administrative Code 2004a, 2004b; Health Information System (HIS) Act 2015; NM Stat § 24-14A-3 1996). Those datasets do not include data from federal facilities (i.e., Department of Defense facilities) and Indian Health Services (IHS), as they are not mandated to report. The methodology for the study was based on a research brief originally developed in AZ, described in detail elsewhere (Hussaini 2014), and later replicated by the co-authors for NM. All ADHS and NMDOH inpatient hospital births for 2008–2013 were utilized for AZ and NM, separately.

Measures and Statistical Analysis

Border region is defined as U.S. counties bordering Mexico, as per the U.S.-Mexico Border Region Commission (2014). In AZ, this region comprises the counties of Cochise, Pima, Santa Cruz, and Yuma; and in NM, Dona Ana, Hidalgo, and Luna counties (Fig. 1). For purposes of our analyses we relied on maternal county of residence in identifying border and non-border counties for both AZ and NM. The International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis code 779.5 (drug withdrawal syndrome in newborn) was used to define NAS cases. NAS inclusion criteria was similar to Patrick et al.'s (2012), and included all hospital births occurring inside the hospital, with iatrogenic cases (ICD-9-CM codes: 765.01–765.05, 770.7, 772.1X, 779.7, 777.5X, 777.6), excluded from the numerator. In addition to NAS cases, ICD-9-CM codes 760.72 (narcotics affecting fetus or newborn via placenta or breast milk) and 760.75 (cocaine affecting fetus or newborn via placenta or breast milk) were used to define in utero exposure to narcotics or cocaine, respectively. Other ICD-9-CM codes used were: 779.3 (feeding problems in newborn) for feeding difficulties, 779.0 (convulsions in newborn) and 780.3 (convulsions) for seizures, and 769.XX (respiratory distress syndrome in newborn) and 770.8 (other respiratory problems after birth) for respiratory diagnoses.

Denominators comprised all hospital births for the years of the study (2008–2013), for AZ and NM separately. Rates were case incidents expressed as per 1000 births. Case incident rates, Chi-square tests, and 95% confidence

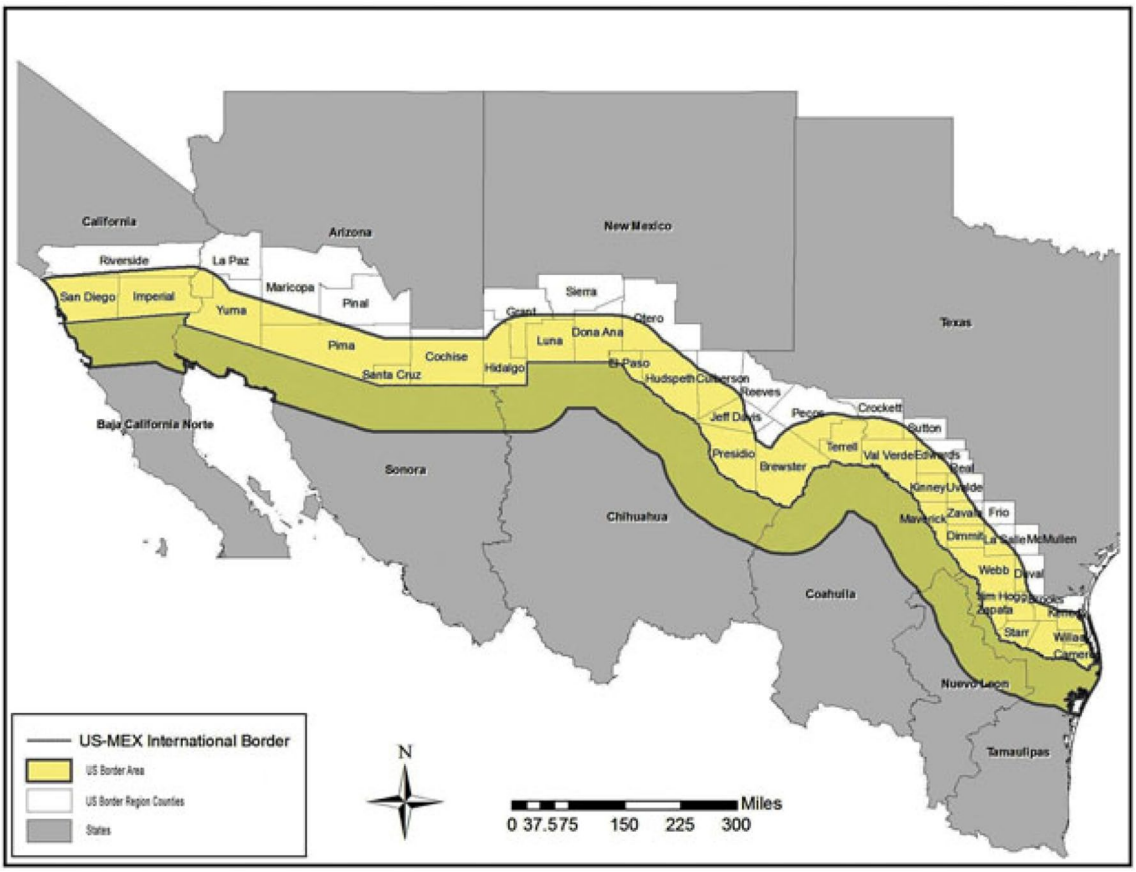

Fig. 1 United States and Mexico Border Region

intervals (CIs) were calculated using SAS v9.3 (SAS Institute, Inc., Cary, NC). For cases less than 30, Poisson-based CIs were estimated and linear trend tests performed, using ordinary least squares (OLS) with the rate as the dependent variable and year as the slope. Autocorrelation was tested using a generalized Durbin-Watson statistic. Our OLS estimates were compared to bootstrap estimates and standard errors. Statistical significance was assessed using Z-test. To compare them to each other, results for AZ and NM are presented separately as annual incident rates during the 2008–2013 time-period. CIs were used as means to gauge differences in rates due to large sample sizes. Non-overlapping 95% CIs were used to determine significant differences between AZ and NM, as opposed to p-values (Gardner and Altman 1986).

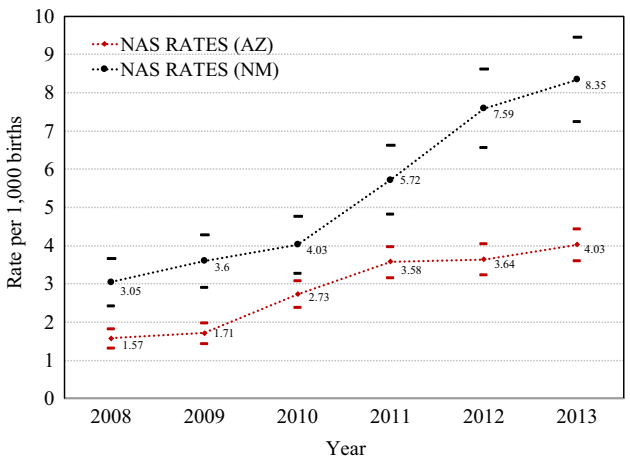

Fig. 2 Neonatal abstinence syndrome (NAS) case incident rates and 95% confidence intervals (CI) for Arizona (AZ) and New Mexico (NM), 2008–2013

Results

During 2008–2013 there were a total of 1472 NAS cases in AZ and 888 in NM. This represents an overall NAS rate of 2.83 per 1000 births (95% CI 2.68–2.97) for AZ and of 5.31 (95% CI 4.96–5.66) for NM. Figure 2 displays increasing trends of NAS rates for the 2008–2013 time-period, for both AZ and NM. The percent change in the rate of NAS cases, between 2008 and 2013, was 157% for AZ and 174% for NM. There was a significant linear trend

Table 1 Characteristics of Arizona and New Mexico newborns with and without a diagnosis of neonatal abstinence syndrome (NAS), 2008–2013

Characteristics	Arizona (N = 520,564)		New Mexico (N = 148,779)	
	Neonatal abstinence syndrome (NAS) (n = 1472)[a]	All other hospital births (n = 519,092)	Neonatal abstinence syndrome (NAS) (n = 888)[a]	All other hospital births in New Mexico (n = 147,891)
Gender (male)	807 (54.82%)	264,831 (51.02%)	480 (54.05%)	75,334 (51.02%)
Clinical conditions				
Low birth weight (< 2500 g)[b]	264 (18.00%)	36,624 (7.06%)	386 (48.49%)	26,685 (21.99%)
Respiratory diagnoses[a]	246 (16.71%)	25,288 (4.88%)	240 (27.03%)	11,463 (7.75%)
Seizures[a]	20 (1.36%)	434 (0.08%)	10 (1.13%)	213 (0.14%)
Feeding difficulties[a]	76 (5.16%)	5,901 (1.14%)	24 (2.70%)	985 (0.67%)
Insurance status				
Medicaid	1144 (77.72%)	274,502 (52.88%)	777 (87.50%)	92,927 (62.83%)
Private payers	198 (13.45%)	189,477 (36.50%)	60 (6.76%)	43,077 (29.13%)
Self-pay	54 (3.67%)	18,308 (3.53%)	24 (2.70%)	6583 (4.45%)
Indian Health Services	20 (1.36%)	3838 (0.74%)	0 (0.0%)	250 (0.17%)
Commercial indemnity	26 (1.77%)	24,117 (4.65%)	NA	NA
Other	30 (2.04%)	7537 (1.70%)	27 (3.04%)	5054 (3.42%)
Race and ethnicity				
American Indian or Alaska Native	71 (4.82%)	19,300 (3.71%)	34 (3.83%)	11,516 (7.79%)
Asian	5 (0.34%)	13,039 (2.51%)	3 (0.34%)	1908 (1.29%)
African American or Black	63(4.28%)	19,906 (4.56%)	10 (1.13%)	2620 (1.77%)
Hispanic or Latino	305 (20.72%)	202,813 (39.07%)	430 (48.42%)	61,708 (41.73%)
Native Hawaiian or Pacific Islander	2 (0.14%)	3,859 (0.74%)	NA	NA
White	1007 (68.41%)	246,029 (47.40%)	236 (26.58%)	52,283 (35.35%)
Two or more races	1 (0.07%)	270 (0.05%)	NA	NA
Unknown/refused	18 (1.22%)	9496 (1.83%)	175 (19.71%)	17,856 (12.07%)
Median cost in dollars (IQR)	$31,070 ($61,295)	$2518 ($1,859)	$24,715 ($40,297)	$1939 ($2,038)
Median length of stay in days (IQR)	13 (21)	2 (2)	14 (18)	2 (1)

Notes All hospital inpatient births for 2008–2013 in Arizona and New Mexico from hospital inpatient discharge data

NA implies not applicable and/or not recorded in a particular state. In New Mexico, Asian and Native Hawaiian or Pacific Islander are combined into one groups due to low numbers of these populations. In this table, both racial/ethnic groups are counted as Asians

IQR inter-quartile range

[a]Conditions identified using the International Classification of Diseases, Ninth Revision, clinical modification (ICD-9-CM) diagnosis codes: 779.5 (drug withdrawal syndrome in newborn) to define NAS, 779.3 (feeding problems in newborn) to define feeding difficulties, 779.0 (convulsions in newborn) and 780.3 (convulsions) to define seizures, and 769.xx (respiratory distress syndrome in newborn) and 770.8 (other respiratory problems after birth) to define respiratory diagnoses

[b]Low birth weight data for New Mexico for 2013 were not available

for both AZ and NM. On average, AZ rates increased by 0.54 per 1000 births (95% CI 0.34–0.74, p = 0.0018) and by 1.15 in NM rates (95% CI 0.79–1.51, p = 0.0009) per year. Table 1 presents characteristics of newborns with NAS compared to all other hospital births, for both states. NAS cases were more likely to have low birth weight (LBW), to have higher rates of respiratory distress and feeding difficulties, and to be on Medicaid; compared to all other newborns. The median cost (total charges documented on HIDD) and length of stay for NAS cases were similar for both states, but higher and longer than their respective non-NAS cases (all other births). In AZ, infants (both NAS cases and non-NAS cases) were more likely to be White (~ 71%), while in NM they were more likely to be Hispanic (~ 42%).

Table 2 presents NAS cases and incidence rates for border and non-border regions for both states. During 2008–2013, there were 437 cases in the AZ border region as compared to 46 cases in NM. NAS rate for the AZ border region was 4.06 per 1000 births (95% CI 3.68–4.44). In NM's border region, the rate of NAS was 2.09 per 1000 births (95% CI 1.48–2.69). In AZ (Table 3), most NAS cases were in Maricopa County (843 cases). Maricopa is a non-border county and the most populous in AZ. Maricopa's case-incident rate was 2.56 per 1000 births (95% CI 2.39–2.73). NAS rates were highest in Pima County (5.08; 95% CI 4.56–5.59), which is

Table 2 Number of neonatal abstinence syndrome (NAS) cases, case incident rates, and 95% confidence intervals (CI) in Arizona and New Mexico border and non-border regions, 2008–2013

Region	Arizona		New Mexico	
	Cases	Rates (95% CI)	Cases	Rates (95% CI)
Border-region[a]	437	4.06 (3.68–4.44)	46	2.09 (1.48–2.69)
Non-border region	1025	2.51 (2.36–2.67)	842	5.80 (5.40–6.19)
Overall state rate[b]	1472	2.83 (2.68–2.97)	888	5.31 (4.96–5.66)

[a]Border region is defined as countries bordering US Mexico southern border as per US–Mexico Border Region commission and comprises of Cochise, Pima, Santa Cruz, and Yuma in Arizona and Dona ana, hidalgo and Luna in New Mexico

[b]Rates are per 1000 hospital birts in Arizona and New Mexico during 2008–2013 with ICD-9-CM code for NAS (779.5)

a border county and accounts for over 25% of AZ's population. In NM, number of NAS cases and rates were highest in Bernalillo, a non-border county and the most populous, with 468 cases and a case-incident rate of 9.00 per 1000 births (95% CI 8.18–9.82). Dona Ana, a border county and NM's second most populous county, had a case-incident rate of 2.23 per 1000 births (95% CI 1.56–2.89). However, in NM, Dona Ana would rank fifth in number of NAS cases and 17th for NAS case-incident rate.

Table 4 presents AZ's and NM's rates of newborns (both NAS and non-NAS) exposed to narcotics and cocaine in utero, for the time-period 2008–2013. The rates of narcotics affecting newborns increased 205% in AZ and 419% in NM. In turn, cocaine rates decreased by 61 and 53% in AZ and NM, respectively. The linear trend for cocaine was significant for AZ but not for NM. On average, AZ rates for cocaine decreased by 0.18 per 1000 births per year, from 2008 to 2013 ($p=0.011$). The linear trend for narcotics was significant for both AZ and NM. On average, AZ rates for narcotics increased by 0.92 per 1000 births ($p=0.0015$) and by 0.86 for NM ($p=0.0012$) per year.

Comparing border and non-border regions, rates of narcotics were higher in AZ's non-border region (3.36 per 1000 births vs. 5.63, respectively) whereas rates of cocaine were higher in AZ's border region (1.74 per 1000 births vs. 0.81, respectively). In NM, rates of both substances were higher in the non-border region compared to the border region (3.36 per 1000 births vs. 1.00 and 1.79 vs. 0.95, for narcotics and cocaine, respectively).

Discussion

NAS rates increased in AZ (157%) and NM (174%) during the time-period covered in the study (2008–2013). The U.S. rate for 2012, the most recent data available, was 5.8 per 1000 births per year (Patrick et al. 2015). Data released by the U.S. Centers of Disease Control and Prevention (CDC), based only on reports from 28 states, indicates that "the overall incidence of NAS in the states … has increased almost 300 percent during 1999–2013, from 1.5 to 6.0 cases per 1000 hospital births (Ko et al. 2016)." Both AZ's (2.83) and NM's NAS rates (2.83 and 5.31, respectively) were lower than this 2013 U.S. rate (52 and 8% lower, respectively).

Differences in AZ and NM rates for NAS as well as for in utero exposure to narcotics or cocaine may be due to the varying environmental contexts of the demographics, accessibility, availability, and use of drugs in these states. Differences between border and non-border regions within these states perhaps requires further exploration. Desai et al. (2015a) examined opioid prescriptions filled in Medicaid-enrolled women and found significant increase in opioid prescription during pregnancy with substantial regional variation. Although no data for AZ were available, the rate of opioid use in NM and Texas was estimated between 20 and 30 percent. California rate was estimated to be between 10 and 20 percent. Desai et al.'s population-based cohort study (Desai et al. 2015b) of Medicaid mothers revealed that the absolute risk of neonatal abstinence syndrome after in utero exposure to prescription opioids was highest in the presence of history of opioid misuse or dependence, followed by alcohol or other drug misuse, exposure to non-opioid psychotropic medications, and smoking (p. 8).

Our study found that a large proportion of NAS and drug-exposed infants in the Southwest border were on Medicaid (i.e., state insurance), as did Patrick's et al. (2012) (Table 1). Similar to Patrick's et al. (2012), AZ and NM NAS infants were more likely to have low birthweight, have respiratory distress, and have feeding difficulties. Again, similar to Patrick et al.'s study (2012), this study found that average length of stay was higher for NAS infants as compared to non-NAS infants. Average billed charges were also higher; however, they are not comparable to the costs calculated in Patrick et al's (2012) study, which were actual costs accrued.

NAS is typically diagnosed post-birth and there is considerable variability and assessment due to lack of standardized approaches (Bagley et al. 2014). Further, data on potential long-term effects of NAS are still scarce. According to Logan et al. (2013) "some studies have indicated Mental Development Index (MDI) was significantly

Table 3 Number of neonatal abstinence syndrome (NAS) cases, case incident rates, and 95% confidence intervals (CI) by counties belonging to the Arizona and New Mexico border and non-border regions, 2008–2013

Region	New Mexico			Arizona		
	County	Cases	Rates (95% CI)	County	Cases	Rates (95% CI)[a]
Border-region	Dona Ana	43	2.23 (1.56–2.89)	Cochise	26	2.58 (1.69–3.78)
	Hidalgo	[b]	[b]	Pima	371	5.08 (4.56–5.59)
	Luna	[b]	[b]	Santa Cruz	[b]	[b]
				Yuma	38	1.89 (1.29–2.49)
Non-border region						
	Bernalillo	468	9.00 (8.18–9.82)	Apache	[b]	[b]
	Catron	0	N/A	Coconino	8	0.93 (0.4–1.83)
	Chaves	16	2.70 (1.55–4.39)	Gila	6	1.92 (0.7–4.18)
	Cibola	[b]	[b]	Graham	13	3.11(1.65–5.31)
	Colfax	[b]	[b]	Greenlee	[b]	[b]
	Curry	[b]	[b]	La Paz	0	N/A
	De Baca	0	N/A	Maricopa	843	2.56 (2.39–2.73)
	Eddy	8	1.68 (0.73–3.31)	Mohave	39	3.65 (2.5–4.79)
	Grant	10	4.87 (2.34–8.96)	Navajo	10	1.35 (0.65–2.49)
	Guadalupe	0	N/A	Pinal	84	2.83 (2.23–3.44)
	Harding	0	N/A	Yavapai	19	1.72 (1.04–2.69)
	Lea	9	1.30 (0.60–2.48)	Unknown	10	N/A
	Lincoln	[b]	[b]			
	Los Alamos	[b]	[b]			
	McKinley	13	1.70 (0.91–2.91)			
	Mora	[b]	[b]			
	Otero	7	1.32 (0.53–2.73)			
	Quay	[b]	[b]			
	Rio Arriba	76	20.52 (15.91–25.13)			
	Roosevelt	0	N/A			
	Sandoval	39	4.24 (2.91–5.57)			
	San Juan	17	1.41 (.82–2.79)			
	San Miguel	10	4.93 (2.36–9.76)			
	Santa Fe	64	7.35 (5.55–9.15)			
	Sierra	[b]	[b]			
	Socorro	15	10.49 (5.87–20.77)			
	Taos	18	9.09 (5.39–18.00)			
	Torrance	[b]	[b]			
	Union	0	N/A			
	Valencia	49	8.80 (6.34–11.27)			

[a]Rates are per 1000 hospital births in Arizona and New Mexico during 2008–2013 with ICD-9-CM code for NAS (779.5) with 95% CI. 95% CI for rates for counts less than 30 are based on Poisson approximation, while counts for 30 or more are based on Normal approximation

[b]Number of cases less than 5 and rates calculated with them have been suppressed

lower in opiate-exposed children at 12 and 18 months… exhibit(ed) increased motor rigidity, dysregulated motor patterns and decreased activity by observation and maternal report on the Bayley Infant Behavior Record. These motor deficits persisted into toddlerhood and were associated with less social responsivity, shorter attention spans, and poorer social engagement" (p. 4). Jansson et al. (2012) also noted that a newborn's display of NAS varies and perhaps is influenced by factors that not only include licit and illicit exposures, but also maternal physiology, epigenetic modifications, and genetic predisposition. Because polysubstance use is common among opioid users, it is not only complicated to attribute NAS to opioids alone (McQueen and Murphy-Oikonen 2016), but also to examine long-term outcomes associated with NAS. McDonald et al. study (2015), comparing the U.S. and Mexico first

Table 4 Rates (per 1000 births) and 95% confidence intervals (CI) for in utero exposure to Narcotics or Cocaine among newborns in Arizona and New Mexico, 2008–2013

Rates (95% CI) of Narcotics and Cocaine in Arizona and New Mexico newborns during 2008–2013				
Year	Arizona		New Mexico	
	Narcotics (N = 2656)	Cocaine (N = 516)	Narcotics (N = 500)	Cocaine (N = 269)
2008	2.56 (2.24–2.88)	1.66 (1.4–1.91)	1.13 (.75–1.51)	2.62 (2.04–3.20)
2009	4.59 (4.15–5.04)	1.11 (0.89–1.33)	1.84 (1.34–2.33)	1.39 (.96–1.81)
2010	4.91 (4.44–5.38)	0.92 (0.71–1.12)	2.70 (2.09–3.31)	1.48 (1.02–1.93)
2011	5.21 (4.71–5.70)	0.81 (0.62–1.00)	3.34 (2.65–4.30)	1.61 (1.14–2.09)
2012	6.55 (6.00–7.10)	0.74 (0.56–0.92)	3.82 (3.08–4.55)	1.67 (1.18–2.15)
2013	7.81 (7.20–8.41)	0.64 (0.47–0.81)	5.87 (4.94–6.80)	1.22 (.80–1.64)
Border region (2008–2013)[a]	3.36 (3.02–3.71)	1.74 (1.49–1.99)	1.00 (.63–1.51)	.95 (.59–1.46)
Non-border region (2008–2013)	5.63 (5.40–5.86)	0.81 (0.91–1.08)	3.36 (3.06–3.66)	1.79 (1.57–2.01)
Overall state rate (2008–2013)[b]	5.19 (4.99–5.39)	1.00 (0.91–1.08)	3.05 (2.78–3.31)	1.68 (1.48–1.88)
% Total change (2012–2013)	19%	− 14%	54%	− 27%
% Total change (2008–2013)	20.5%	− 61%	419%	− 53%

Exposures identified using the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes: 760.72 (narcotics affecting fetus or newborn via placenta or breast milk) and 760.75 (cocaine affecting fetus or newborn via placenta or breast milk)

[a]Border region is defined as countries bordering US Mexico south border as per US Mexico Border Region Commission and comprises of Cochise, pima, Santa Cruz, and Yuma in Arizona and Dona Ana, Hidalgo and Luna in New Mexico

[b]Rates per 1000 hospital births in Arizona and New Mexico during 2000–2013 with ICD-9-CM codes for Narcotics (760.72) and Cocaine (760.75)

trimester prenatal care (FTPNC), suggests that women in the border region were less likely to receive prenatal care. Ideally early detection, reduction in substance use/abuse, and increase access to treatment among women of childbearing during the prenatal period may have substantial impact on the incidence of NAS rates (Patrick et al. 2012). However, data on prenatal care was not available for the present study.

Our study provides the extant of the growing NAS problem in the U.S. Southwest border. It provides a population overview of the impact of illicit and prescription drug use problem through its impact on newborns, specifically in the Southwest U.S. border states of AZ and NM. As opposed to utilizing Health Care Utilization Project (HCUP) data, which are only from participating states and limited in uniquely identifying hospital births, this study utilized administrative data that mirror the vital statistics hospital births for AZ and NM. This study also looked at in utero exposure to drugs such as cocaine and narcotics, which have not been typically captured in previous studies.

Our study has some limitations. It is a descriptive ecological study and as such no inferences can be made at the individual level. It is not exhaustive, as the U.S.-Mexico border covers four states and 48 counties in the U.S. (Arizona, California, New Mexico, and Texas) and six states and 80 municipalities in Mexico. At the time of the study, only data from AZ and NM were available. Even though information on all hospital births for neonates and their NAS status was available, it was not possible to differentiate NAS newborns of mothers undergoing methadone treatment. NAS cases were limited to non-iatrogenic NAS. Finally, and although AZ and NM have strict auditing processes for coding and data errors (i.e., AZ has an error tolerance of 1.5 percent Zingmond et al. 2015) like all administrative data, our data are subject to coding errors.

Conclusion

The Healthy Border (HB) 2020 binational initiative of the U.S.-Mexico Border Health Commission is an initiative that addresses several public health priorities that not only include chronic and degenerative diseases, infectious diseases, injury prevention, maternal and child health but also mental health and addiction (U.S.-Mexico Border Health Commission 2015). The most recent document on prevention and health initiative outlines the aforementioned strategic areas and specific targets to be achieved by 2020 (U.S.-Mexico Border Health Commission 2015). The growing opioid epidemic and rise in NAS cases in the Southwest border, as partially shown in this study, provides another opportunity to track health illnesses and outcomes in the Southwest border especially because there are targeted

resources through High Intensity Drug Trafficking Areas (HIDTA) funding.

Compliance with Ethical Standards

Conflict of interest The authors have nothing to disclose.

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