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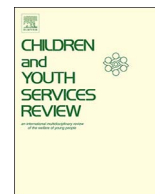
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Trends in infants reported to child welfare with neonatal abstinence syndrome (NAS)



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A B S T R A C T

Background: Substance abuse among caregivers is a known risk factor for child maltreatment, and some of these children subsequently come to the attention of the child welfare system. The recent opioid epidemic has led to rising numbers of women who use opioids during pregnancy and infants born with neonatal abstinence syndrome (NAS), raising the question of whether there has been a consequent rise in the numbers of these infants reported to the child welfare system. The purpose of this study is to examine the trend in the number and percentage of infants reported to the child welfare system with neonatal abstinence syndrome (NAS) from 2004 to 2014, and determine whether the trend is distinct from the trend in the percentage of infants reported with fetal alcohol spectrum disorder (FASD).

Methods: We analyzed National Child Abuse & Neglect Data System (NCANDS) data on reports of infants (aged < 1 year) with NAS between 2004 and 2014. Due to state differences in data collection and data quality across the study period, the sample included reports from 10 states. We utilized a Generalized Estimating Equations (GEE) model approach to examine the trend over time in the percentage of NAS and FASD cases reported to child welfare in our 10 state sample. Year was used as an identifying variable and Substance Type was repeated over time and clustered by State.

Results: The number of reports of infants with NAS for the 10 states was the lowest at 3073 in 2009 and highest at 4806 in 2014. The average percentage of cases of NAS reported rose from 4.72% in 2004 to 9.19% in 2014. The results of the GEE revealed a significant main effect of Substance Type ($p = 0.015$) and Year ($p = 0.009$), indicating that overall, averaged across time, the percentage of NAS reports was greater than the percentage of FASD reports and averaged across substance type, the percentage of substance-related reports increased over time.

Discussion: NAS reports increased significantly over time, most pronounced between 2010 and 2014, while the trend for FASD reports did not show significant change over the study period. Moreover, the child welfare reports data obtained from the 10 state sample aligned with national NAS incidence data. Although recent efforts to curb prescribing and other means of supply have been implemented, it remains to be seen whether the large rise seen will continue or be ameliorated by these public health initiatives. However, overall these findings suggest that immediate efforts are needed to prepare the child welfare system for this trend, as well as to treat opioid addiction among women of child bearing age.

1. Introduction

Recent media coverage highlights the epidemic of opioid analgesic prescription pain reliever misuse¹ and its devastating effect on infants, from stories of a young child trapped in a car with parents who had overdosed, to infants struggling to withdraw from the opioids in their

system at birth (c.f. Allen, 2016; Bernstein, 2015; Boyette, 2016; Fisher, 2015; McDaniel, 2017; Saint Louis, 2016; Seelye, 2016; Stein & Bever, 2017; Wang, 2017). The literature has yet to address exactly how many infants become involved in the child welfare system due to parental opioid use and how these numbers have changed over time. During fiscal year 2014, 11 states experienced as much as a 50% increase

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¹ We use the term opioid throughout this paper. The National Data Archive on Child Abuse and Neglect uses the term narcotics, which refers to opioid pain relievers (Medline Plus, 2015). Opioid is a broader term, which is more commonly used in public health literature.

among infant victims of maltreatment due to their primary caretaker's substance use disorders compared to the previous year (Administration for Children, 2016). This study will begin to fill this gap in the literature.

1.1. Opioids defined

Opioids are a class of drugs including heroin and prescription pain relievers (e.g., oxycodone, hydrocodone, codeine, morphine, and fentanyl), that activate opioid receptor proteins in the body and the brain to diminish pain signals' intensity (NIDA, 2016a, 2016b). Opioids can be natural (i.e., alkaloids derived from the resin of plants, such as the opium poppy), semi-synthetic (i.e., created in a laboratory from natural opiates), or synthetic (i.e., generated in a laboratory from artificial compounds; Koob, Arends, & Le Moal, 2014).

1.2. Factors contributing to the opioid crisis

Recent trends in opioid use suggest that we may expect a concomitant rise in the number of opioid-related child welfare reports. Today opioid pain relievers are one of the most prescribed drugs in the United States. In 2012 (the most recent data available), "health care providers wrote 259 million prescriptions for opioid pain medication, enough for every adult in the United States to have a bottle of pills" (Dowell, Haegerich, & Chou, 2016, p. 1). The United States consumes over 80% of the world's opioid pain relievers, even though our total population makes up < 5% of the world's population (Krans & Patrick, 2016). Moreover, the percentage of non-medical use of opioids among pregnant women is 5% (Kozhimannil, Graves, Levy, & Patrick, 2017).

However, some actions taken by states and physicians to intervene in the crisis suggest that we may expect to see the rate of opioid-related child welfare reports level off or decline in the future. Some states' development of prescription drug monitoring programs (PDMPs) appears to be having an effect on reducing opioid misuse, which may in turn lead to declines in the number of women who use opioids during pregnancy (Ali, Dowd, Classen, Mutter, & Novak, 2017). PDMPs capture healthcare providers' prescribing of opioids to patients as a means of reducing prescription substance misuse. States have also adopted a variety of policies intended to address concerns of prenatal substance use, such as mandatory testing and referral by health care providers, priority access to substance use treatment for pregnant women, and laws prohibiting discrimination in treatment settings (Guttmacher Institute, 2016). The available research, however, shows mixed results from the impact of these policies on maternal and child health outcomes (Coyer, 2017).

1.3. Neonatal abstinence syndrome

Between 2000 and 2012, opioid use (including illicit or nonmedical use of opioids, prescription opioid pain medications, and medication assisted treatment) among pregnant women has nearly quintupled (Krans & Patrick, 2016; Patrick et al., 2012; Patrick, Davis, Lehmann, & Cooper, 2015). Infants prenatally exposed to opioids are at risk for a condition known as neonatal abstinence syndrome (NAS; or specifically, neonatal opioid withdrawal syndrome (NOWS)) (Ko et al., 2016; Patrick et al., 2012; SAMHSA, 2016a). NAS includes central nervous system irritability (e.g., tremors, rigid muscles, and seizures), digestive tract dysfunction (e.g., feeding difficulties), and inability to maintain core body temperature (Ko et al., 2016; Patrick et al., 2012; SAMHSA, 2016b). Infants with NAS are also more likely to have low birth weight (Creanga et al., 2012; Patrick et al., 2015), which increases the likelihood of short-term complications (e.g., infection, anemia, and jaundice), long-term complications (e.g., cerebral palsy, developmental delays, learning and behavioral problems), and infant death (Maternal and Child Health Bureau, 2015). Every 25 minutes an infant is born with NAS, which equates to approximately \$1.5 billion in hospital

expenditures, most of which (81%) state Medicaid programs pay (Patrick, 2015; Patrick et al., 2015).

Several factors influence the symptom severity of NAS, including which opioid the mother consumed, the mother's drug history (including substance use preceding delivery and the use of other drugs simultaneously or concurrently), the mother's metabolism, the amount of opioids transferred across the placenta, and placental metabolism (Hudak et al., 2012, p. e544). For example, pregnant women who simultaneously consume opioids with cocaine, benzodiazepines, or heavy tobacco use are more likely to have infants with more severe NAS symptoms (Hand, Short, & Abatemarco, 2017). In addition, how infants with NAS are treated in the hospital can improve or worsen NAS symptoms (SAMHSA, 2016a; Wachman, Hayes, Brown, et al., 2013).

1.4. Characteristics of infants with NAS

Most NAS studies provide information about the mothers' characteristics, but not the infants. Patrick, Kaplan, Passarella, Davis, and Lorch' (2014) study provides the exception. The sample consisted of 1424 infants with NAS across 14 U.S. children's hospitals between 2004 and 2011; 53.9% were male, 77.5% were White, and 56.8% had Medicaid insurance.

1.5. Characteristics of mothers of infants with NAS

More is known about mothers of infants with NAS, who tend to be less educated and White. Between 2004 and 2013 the racial composition of mothers of children with NAS shifted to be more White (64% to 76%), and less Black (10% to 5%) and Hispanic (18% to 10%). The maternal age stayed generally constant from 28.2 to 27.7 years (Tolia et al., 2015).

Additionally, although women who use opioids during pregnancy may be economically diverse, they share numerous stressors (SAMHSA, 2016b). These women are more likely to experience anxiety, depression, and chronic health conditions (e.g., hypertension, diabetes, and renal disease) and less likely to have adequate prenatal care compared to those who do not use opioids. They are also more likely to use tobacco, alcohol, and illicit drugs (Whiteman et al., 2014). In addition, studies have found that women opioid users are more likely to have experienced physical abuse or sexual abuse as children (Bartholomew, Courtney, Rowan-Szal, & Simpson, 2005; Conroy, Degenhardt, Mattick, & Nelson, 2009), to have been in a relationship with intimate partner violence (SAMHSA, 2016b), and to have severe post-traumatic stress disorder (Mills, Lynskey, Teesson, Ross, & Darke, 2005).

1.6. Geographic concentration of NAS

While Desai, Hernandez-Diaz, Bateman, and Huybrechts (2014) found a concentration of Medicaid-receiving mothers in the South and Midwest who had infants with NAS, cases of NAS generally are most concentrated in the East South Central Census Bureau geographic division (Kentucky, Tennessee, Mississippi, and Alabama), where the rate is 16.2 per 1000 hospital births (95% CI [12.4 to 18.9]), and in New England (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut), where the rate is 13.7 per 1000 hospital births (95% CI [12.5 to 14.5]). NAS seems to be concentrated in states where opioid prescriptions are also highest. Maine and New Hampshire are two of five states that prescribe the most long-acting prescription opioids, and Alabama, Tennessee and Kentucky are three of five states that prescribe the most short-acting prescription opioids. The fewest cases of NAS are located in the West South Central Division (Oklahoma, Texas, Arkansas and Louisiana) where the rate is 2.6 per 1000 hospital births (95% CI 2.3 to 2.9; Patrick et al., 2015).

1.7. State studies of substance use in child welfare

We found only two studies that examined how changes in opioid use over time affected child welfare programs. [França, Mustafa, and McManus \(2015\)](#) used data from the Acute Hospital Case Mix available from the Massachusetts Center for Health Information and Analysis to explore how babies with NAS affected the child welfare system. This study found that between 2004 and 2013 the number of infants born with NAS increased > 6-fold. França and colleagues estimated that half of these infants were placed in out of home care, with 75% going into kinship placements and 25% going into foster placements. [Mowbray et al. \(2017\)](#) used data from administrative records of the Illinois Title IV-E Alcohol and Other Drug Abuse Demonstration Waiver to explore longitudinal trends in substance use among caregivers who were involved in the child welfare system between 2000 and 2015. Most of the sample was female (56.7%) and Black/African American (73.7%). Black/African Americans and individuals in the other racial/ethnic group reduced their opioid use by 20% and 15%, respectively. Conversely, Whites increased their use by 15% between 2000 and 2015.

1.8. Study purpose

The purpose of this study is to examine the trend in the number and percentage of infants reported to the child welfare system with neonatal abstinence syndrome (NAS) from 2004 to 2014, and whether the trend is distinct from the trend in the percentage of infants reported with fetal alcohol spectrum disorder (FASD). We hypothesized that the percentage of infants reported with NAS would increase over time and would be significantly steeper than any rise in alcohol-related reports.

2. Methods

National Child Abuse & Neglect Data System (NCANDS) data between 2004 and 2014 were analyzed. States collect and maintain their own data regarding child maltreatment cases each year and subsequently map their data collection variables to the NCANDS variables for the national system reporting. There are differences between states in the way they document, collect, and report data for the demographic variables (beyond age and sex) and risk factors that are part of NCANDS ([Administration for Children, 2016](#)). Since the reliability of these activities varies across states, we limited the analysis of demographic factors to infants' age and sex. We reviewed all states' variable mapping files for each year and determined that states vary in their approach to collecting and reporting substance-related variables. For example, within several states changes were made over time in the way data were reported to NCANDS; these changes prohibit the ability to track trends over time because the reporting criteria were not consistent over the study period. Additionally, between states there were differences in the collection of substance use-related variables (e.g., several states collected a combined substance exposure variable without distinguishing drug from alcohol exposure) that prohibit the ability to examine NAS and FASD separately. Furthermore, some states consider prenatal substance use in their definition of child abuse or other child maltreatment criteria (see Supplemental material 1, item 5 ([Guttmacher Institute, 2016](#))) which would necessarily substantiate a report, whereas other states have different definitions. Given these differences within and between states, the final study sample resulted in the inclusion of 10 states with the most reliable data, including California, Colorado, Hawaii, Maine, Missouri, Nebraska, New Hampshire, South Carolina, West Virginia, and Wyoming. The full selection procedures for this study are described in Supplemental material 1.

Analysis was confined to reports of infants aged less than one year at the time of the report in order to capture cases most likely to represent prenatal exposure resulting in NAS or FASD rather than exposure or ingestion after birth. Since the criteria for inclusion was infants less than one year old during any given year, siblings, families, and

duplicates (in subsequent years) were excluded. To define cases for the study, we selected the outcome variable of interest "CDDrug" that NCANDS defines as "the compulsive use of or need for narcotics by the child. This element should include infants addicted at birth." This selection was made with the guidance of National Data Archive on Child Abuse & Neglect (NDACAN, the repository for NCANDS data) who consider this a suitable proxy for infants born with Neonatal Abstinence Syndrome (NAS) ([National Data Archive on Child Abuse & Neglect, 2016](#)). Based on NDACAN's guidance, we interpreted this variable to be representative of infants with NAS who are reported to the child welfare system. We included cases of substantiated and unsubstantiated reports of child abuse because Drake's harm evidence model suggests that there is little difference between substantiated and unsubstantiated rates ([Drake, 1996](#); [Drake, Jonson-Reid, Way, & Chung, 2003](#); [Kohl, Jonson-Reid, & Drake, 2009](#); [Snyder & Smith, 2015](#)). This approach was consistent with this study's goal of assessing the trends of infants with NAS who are reported to the child welfare system. In order to compare reports of infants with NAS to reports of infants with FASD, we selected a secondary outcome variable, "CDAlc" that NCANDS defines as "A compulsive use of or need for alcohol by the child. This element should include infants addicted at birth, or who are victims of Fetal Alcohol Syndrome, or who may suffer other disabilities due to the use of alcohol during pregnancy."

2.1. Analyses

The authors ran descriptive statistics on the characteristics of infants by sex. In addition, child welfare reports of infants with NAS or FASD were analyzed over the 10 year period to determine if there were statistical differences in the admission rates between the years. This time period coincides with trend data on the rise of the opioid epidemic ([Desai et al., 2014](#); [Patrick et al., 2015](#)). We report the number of reports and calculated a percentage for the reports of infants with NAS and FASD, separately, who were reported to child welfare agencies by dividing the number of reports for each type (i.e., NAS, FASD) by the total number of infant maltreatment reports in that year. We analyzed these percentages as our primary outcome rather than raw count or number due to the wide range of population sizes in the included states and the wide range of overall cases reported to child welfare.

In order to examine the trend over time in the percentage of NAS and FASD cases reported to child welfare in our 10 state sample, we utilized a Generalized Estimating Equations (GEE) model approach. This approach is appropriate for modeling multiple outcomes repeated over time which are also clustered by subject identification (in this case, State). State was provided as the identifying variable with Year (2004–2014) and Substance Type (NAS vs. FASD) as the repeated terms in the model. Based on the descriptive statistics, we included a term for the linear trend over time as well as a quadratic term. In addition, to test our hypothesis that the trend of NAS reports would increase over time and to a greater extent than the trend of FASD reports, we included interaction terms with Substance Type.

3. Results

The number of child maltreatment reports of infants (less than one year old) with NAS and FASD, between the years 2004–2014 is reported in [Table 1](#). The number of reports of infants with NAS ranged from a minimum of 3073 in 2009 to a maximum of 4806 in 2014. The number of reports of infants with FASD ranged from a minimum of 1235 in 2010 to a maximum of 1957 in 2005. The number of reports by infant sex is provided in [Table 2](#). Between 2004 and 2014, the number of cases of substantiated and unsubstantiated reports of child maltreatment related to infants (< 1 year old) with NAS and FASD was evenly split by sex. Males generally exceeded females with a range of a minimum percent of 50.55 in 2013 to a maximum of 53.28 in 2006, as well as a gender ratio of 1.09 in the first and last study years. The percentage of

Table 1
Reports of infants (< 1 year old) with neo-natal abstinence syndrome (NAS) and fetal alcohol spectrum disorder (FASD) in 10 study states, 2004–2014.

Cause	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number											
Neo-natal abstinence syndrome	3908	4606	4274	3994	3350	3073	3099	3394	3756	4297	4806
Fetal alcohol spectrum disorder	1766	1957	1805	1756	1476	1363	1235	1269	1316	1483	1564
All causes	47,003	50,031	49,399	51,280	54,343	53,110	52,205	53,872	53,587	54,844	55,919

Note: Raw counts of both substantiated and unsubstantiated child welfare reports are included in this table, treating each case equally without consideration of state.

reports of females ranged between a minimum of 47.18 in 2009 to a maximum of 48.76 in 2013.

The observed average percentages of NAS reports and FASD reports are plotted across time in Fig. 1. In 2004, the average percentage of NAS child welfare reports was 4.61% compared with the average percentage of FASD child welfare reports, which was 0.74%. The NAS percentage increased to 6.38% in 2006 compared with 1.46% for FASD. The percentages then declined somewhat to a low of 4.49% and 0.69% in 2010, respectively. After 2010, the percentage of NAS reports grew steadily to 9.19% in 2014, whereas the percentage of FASD reports remained low to 1.15% in 2014 (Fig. 1).

The results of the GEE revealed a significant main effect of Substance Type ($p = 0.015$) and Year ($p = 0.009$), indicating that overall, averaged across time, the percentage of NAS reports was greater than the percentage of FASD reports and averaged across substance type, the percentage of substance-related reports increased over time (Table 3). The linear increase over time was qualified by a significant Year \times Year interaction ($p = 0.013$), indicating a quadratic increase in the percentage of reports. Finally, a significant Substance Type \times Year interaction ($p = 0.011$) qualified by a significant Substance Type \times Year \times Year interaction ($p = 0.006$), indicated that the trend in NAS reports is significantly different from the trend in FASD reports and is characterized by a quadratic slope over time. Fig. 1 demonstrates the observed percentages and the model derived interaction for the trends over time in NAS reports and FASD reports to child welfare. Consistent with our hypothesis, NAS reports increased significantly over time, most pronounced between 2010 and 2014, whereas the trend in FASD reports did not show significant change over the study period (Fig. 1).

4. Discussion

The aim of this study was to investigate the trend in reporting of infants with neonatal abstinence syndrome to the child welfare system in multiple states. We examined the trend in reporting percentages for 10 states over the course of 10 years (2004–2014) and compared the trend to that of reporting infants with fetal alcohol spectrum disorder. Prior studies have focused either on the incidence of NAS in hospital settings (Ko et al., 2016; Ko et al., 2017; Krans & Patrick, 2016; Patrick et al., 2012) or examined individual states (França et al., 2015; Mowbray et al., 2017). We show that although the percentage of infants

reported to child welfare with FASD has remained low and stable over the study period, the percentage of infants reported with NAS has increased exponentially. National statistics show that the number of NAS births has increased from 1.2 per 1000 hospital births in 2000 to 3.39 in 2009, aligned with an increase in prenatal opioid use among pregnant women from 1.9 per 1000 hospital births to 5.60 hospital births over the same period (Patrick et al., 2012).

Although observations for almost two decades have inferred that parental substance abuse plays a role in involvement with child protective services, information has been incomplete. The increase in the percentage of infants with NAS reported to child welfare in this study is aligned with national NAS incidence data obtained from hospital birth records in that the rate of NAS was higher in 2014 than 2004 (Ko et al., 2016; Ko et al., 2017; Krans & Patrick, 2016; Patrick et al., 2012). The observed increase in reporting is consistent with what França et al. (2015) found in the Massachusetts child welfare system. The declines we saw from 2007 to 2009 coincide with decreases in opioid use found among Black mothers and fluctuations in opioid use among White mothers (Mowbray et al., 2017). It is also possible that there have been fluctuations in health care providers' reporting of these cases to the child welfare system.

Two recently published papers address the association between in utero exposure and involvement with Child Protective Services (CPS), although they are both restricted to single state data, and in some cases earlier data, small sample sizes, and self-reported dependent variables (Bushman, Victor, Ryan, & Perron, 2017; Prindle, Hammond, & Putnam-Hornstein, 2018). Using 2006 data from California that linked mother/infant hospital records, Prindle et al. (2018) reported an association between prenatal substance exposure and the likelihood of reports to CPS. In this point-in-time study, 1.45% of live births had a documented prenatal exposure with 61% of such cases associated with CPS reports. Maternal exposure to opioids was reported in 69% of the cases. Exposed infants were reported to CPS at 5 times the rate of unexposed children, with odds ratios of 1.6 (alcohol), 1.7 (opioids), and 1.36 (neonatal withdrawal). Also Bushman et al. (2017) examined data from 1998 through 2013 from mothers involved in the welfare system and screened by the juvenile court assessment program in Chicago and suburban Cook county. Prenatal exposure to opioids was established through maternal self-report. Based on this, 18.2% of 852 births were classified as substance exposed, with 18.3% reported as prescription opioid exposed and 16.1% heroin exposed.

Table 2
Reports of infants (< 1 year old) with neo-natal abstinence syndrome (NAS) in 10 study states, 2004–2014, by gender.

Gender	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number											
Male	2032	2370	2277	2090	1734	1618	1605	1731	1913	2172	2504
Female	1861	2202	1987	1895	1609	1450	1482	1641	1811	2095	2281
Unknown	15	34	10	9	7	5	11	22	32	30	21
Percent											
Male	52.0	51.46	53.28	52.33	51.76	52.65	51.81	51.00	50.93	50.55	52.10
Female	47.62	47.81	46.49	47.45	48.03	47.19	47.84	48.35	48.22	48.76	47.46
Unknown	0.38	0.74	0.23	0.23	0.21	0.16	0.36	0.65	0.85	0.70	0.44

Note: Both substantiated and unsubstantiated child welfare reports are included in this table.

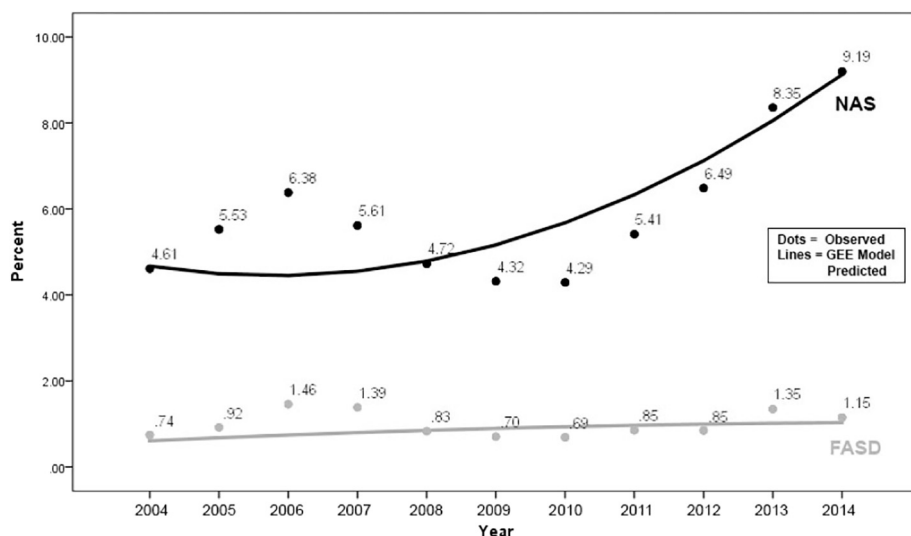


Fig. 1. Trends in the percent of infant maltreatment reports with neonatal abstinence syndrome (NAS) and fetal alcohol spectrum disorder (FASD) averaged over 10-state sample, 2004–2014. Note: The percentages reported in this figure are model derived average percentages that account for the State-level factor.

The GEE model reported in this study shows a relatively stable period of reports of infant maltreatment with NAS from 2004 to 2008; starting in approximately 2009, the percentage of cases of NAS reported rose continuously up to the last data point in 2014 without reaching a plateau. This trend represents an increase of cases from 4.72% in 2004 to 9.19% in 2014, or almost doubling. This rise is not seen in reporting of FASD cases resulting from alcohol-exposed pregnancies although alcohol remains one of the most frequent substances abused by pregnant women. The doubling of the percentage of cases translates into substantial costs for the child welfare system considering that the mean hospital charges in 2012 for an infant with NAS were \$66,700 (Patrick et al., 2015). These costs are 2.6 times the national average administrative and maintenance costs per child per year (\$25,782) for foster children (Zill, 2011).

We also observed the somewhat higher ratio of males to females in the reported cases (approximately 1.09 in the first and last study years; also see Table 2) which is higher than the US birth gender ratio of 1.05 (Matthews & Hamilton, 2005). Our result is consistent with Patrick et al.'s (2014) study and so we believe this result indicates a real difference rather than the result of sampling error. We found no other comparable study which details the gender of infants with NAS. While it is likely that the majority of the infants with NAS are White, unfortunately the race/ethnicity data was unreliable for analysis (Desai et al., 2014; Tolia et al., 2015). It has been reported that there is consistently a greater percentage of boys that are in the child protective system (gender ratio 1.09), although this may result from placement of older children rather than infants (Annie E. Casey Foundation, 2017). Our male to female ratio (1.09) corresponds to the 1.09 ratio found in foster care in overall.

A limitation of this study is that the results may not generalize beyond the 10 state sample, and the outcome variable definition may in

certain cases include substances other than opioids. While the 10 state sample included two states from the New England Census Division with high opioid prescription rates, the inability to include states from the East South Central Census Division introduces the possibility of underestimation. Additionally, it would have been helpful to have additional data regarding risk factors that may have exacerbated NAS, such as poly-substance use, or a lack of prenatal care; and protective factors, such as participating in MAT or other supportive services. However, overall these findings suggest that immediate efforts are needed to prevent infants from being born dependent on narcotics and prepare the child welfare system for this trend, as well as to treat opioid addiction among women of child bearing age.

This study has two important strengths. First, this study begins to fill an important gap in the literature regarding how the opioid epidemic has affected child welfare reports and how this trend might be expected to continue under similar circumstances or with changing rates in adults' opioid use. Second, we analyzed reports from multiple states and employed a rigorous data quality approach.

This study has important implications for practice and future research. First, caregivers should be given special training to address the unique needs of infants with NAS. Second, practitioners working in health care facilities and with child welfare agencies need to be trained to appropriately assess the needs of infants with NAS and their families. Efforts should be made to ensure that staff in child welfare agencies and officers of the courts where child welfare cases are heard understand the benefits of allowing women to use medication to treat opioid addiction. Future research should explore whether women's participation in MAT reduces the likelihood of referral to child welfare and document the outcomes of the infants reported for opioid dependence.

Although a clearer picture has been emerging about NAS in recent years, future studies should examine strategies for prevention and

Table 3
GEE model of trends in the percent of infant maltreatment reports with neonatal abstinence syndrome (NAS) and fetal alcohol spectrum disorder (FASD) averaged over 10-state sample, 2004–2014 (N = 220).

	β	Standard error	95% Wald confidence interval		Wald chi-square	Degrees of freedom	p
			Lower	Upper			
(Intercept)	9.457	3.648	2.307	16.608	6.719	1	0.010
Substance type	-4.418	1.823	-7.991	-0.844	5.871	1	0.015
Year	-0.845	0.325	-1.482	-0.208	6.767	1	0.009
Year * year	0.140	0.057	0.029	0.252	6.104	1	0.013
Substance type * year	0.462	0.181	0.107	0.816	6.511	1	0.011
Substance type * year * year	-0.072	0.026	-0.123	-0.020	7.474	1	0.006
(Scale)	25.323						

treatment for women at risk of an opioid-affected pregnancy, as well as treatment for infants experiencing withdrawal. Approaches to making the range of interventions, including MAT, more accessible and tailored to each family's unique needs are crucial.

5. Conclusion

While this study found that the percentage of cases of infants with NAS who are reported to child welfare rose through 2014, a question remains whether this trend will continue. Although recent efforts to curb prescribing and other means of supply have been implemented, it remains to be seen whether the large rise seen will continue or be ameliorated by these public health initiatives such as PDMPs. In addition to these system-wide measures, person-level screening, treatment and efforts to reach women at the highest risk for opioid affected pregnancies, in settings such as public clinics, jails and prisons, community and social avenues are also indicated.

Disclaimer

The views expressed here are those of the authors and do not necessarily reflect the views of the Substance Abuse and Mental Health Services Administration (SAMHSA) or the U.S. Department of Health and Human Services (DHHS).

Conflict of interest statement

The authors have no conflicts of interest to report.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.chilyouth.2018.01.035>.

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