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Neonatal Abstinence Syndrome and Maternal Opioid-Related Diagnoses: Analysis of ICD-10-CM Transition, 2013–2017

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Abstract

BACKGROUND AND OBJECTIVES: Hospital discharge records remain a common data source for tracking the opioid crisis among pregnant women and infants. *The International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM)* transition from the *International Classification of Diseases, Ninth Revision, Clinical Modification* may have affected surveillance. Our aim was to evaluate this transition on rates of neonatal abstinence syndrome (NAS), maternal opioid use disorder (OUD), and opioid-related diagnoses (OUD with ICD-10-CM codes for long-term use of opioid analgesics and unspecified opioid use).

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METHODS: Data from the 2013–2017 Healthcare Cost and Utilization Project’s National Inpatient Sample were used to conduct, interrupted time series analysis and log-binomial segmented regression to assess whether quarterly rates differed across the transition.

RESULTS: From 2013 to 2017, an estimated 18.8 million birth and delivery hospitalizations were represented. The ICD-10-CM transition was not associated with NAS rates (rate ratio [RR]: 0.99; 95% confidence interval [CI]: 0.90–1.08; $P = .79$) but was associated with 11% lower OUD rates (RR: 0.89; 95% CI: 0.80–0.98; $P = .02$) and a decrease in the quarterly trend (RR: 0.98; 95% CI: 0.96–1.00; $P = .04$). The transition was not associated with maternal OUD plus long-term use rates (RR: 0.98; 95% CI: 0.89–1.09; $P = .76$) but was associated with a 20% overall increase in opioid-related diagnosis rates including long-term and unspecified use (RR: 1.20; 95% CI: 1.09–1.32; $P < .001$).

CONCLUSIONS: The ICD-10-CM transition did not appear to affect NAS. However, coding of maternal OUD alone may not capture the same population across the transition, which confounds the interpretation of trend data spanning this time period.

Cases of neonatal abstinence syndrome (NAS),^{1,2} often seen by pediatric hospitalists, and maternal opioid use disorder (OUD)³ dramatically increased from 2000 to 2014. Hospital discharge and administrative data remain the most common data sources for surveillance of these conditions across US jurisdictions^{4,5} and have been validated for NAS.^{6,7} On October 1, 2015, the transition to *International Classification of Diseases, 10th Revision, Clinical Modification* (ICD-10-CM) expanded coding specificity (Table 1), including the introduction of codes to identify long-term (current) use of opioid analgesics and unspecified opioid use. In previous work, researchers documented that the ICD-10-CM transition was associated with increased opioid-related diagnoses in hospital discharges.⁸ We evaluated the rate of NAS among birth hospitalizations, as well as maternal OUD and maternal opioid-related diagnoses (OUD, long-term use, and unspecified opioid use), among delivery hospitalizations, from hospital discharge data from 2013 to 2017 by quarter, to understand whether the ICD-10-CM transition disrupted trends for NAS and maternal OUD.

METHODS

Data Source

In this analysis, we used data from the National Inpatient Sample (NIS)⁹ of the Agency for Healthcare Research and Quality’s Healthcare Cost and Utilization Project (HCUP). The NIS includes a 20% stratified sample of all-payer discharge data from community non-rehabilitation hospitals in participating states, covering >97% of the US population. The NIS is weighted to be nationally representative of all hospitalizations within community non-rehabilitation hospitals. As a secondary analysis of anonymized data, this project was not required to undergo institutional review board approval.

Outcomes

NAS was identified among birth hospitalizations by the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) diagnosis code 779.5 (drug withdrawal syndrome in newborn) excluding possible iatrogenic withdrawal and ICD-10-

CM diagnosis code P96.1 (neonatal withdrawal symptoms from maternal use of drugs of addiction) (Table 1). Possible iatrogenic exclusions in the ICD-9-CM are no longer necessary in the ICD-10-CM with the introduction of P96.2 (withdrawal symptoms from therapeutic use of drugs in newborn).

Among delivery hospitalizations, maternal opioid-related cases were identified and categorized according to coding guidance (Table 1).^{10–12} OUD was identified from diagnoses of opioid dependence and nondependent abuse, aligning with *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* criteria.¹⁰ Long-term (current) use of opioid analgesics and unspecified opioid use were identified only in the ICD-10-CM coding scheme because these diagnosis codes did not exist in the ICD-9-CM. Coding guidance indicates that unspecified opioid use should not be simultaneously coded with OUD; if both codes are present, only the codes for OUD should be assigned.^{10–12} Additionally, guidance indicates that long-term use of opioid analgesics should not be used to indicate OUD but rather continued use for long-term treatment of a condition.^{10–12} However, authors of a previous study have found that long-term use of opioid analgesics has been documented as OUD in claims.¹³ Thus, 2 composite ICD-10-CM measures were also examined: (1) OUD plus long-term use of opioid analgesics given the overlap and potential for coding shifts between dependence and long-term use of opioid analgesics and (2) all maternal opioid-related diagnoses (OUD plus long-term and unspecified use). Opioid-related codes for poisoning and adverse effects were not examined because they were relatively rare and less pertinent to the focus of delivery hospitalizations and NAS. Hospitalizations for birth (ICD-9-CM and ICD-10-CM diagnosis codes pertaining to the birth of a single or multiple live born infant) and delivery (ICD-9-CM and ICD-10-CM diagnosis codes for the outcome and type of delivery, Medicare Severity Diagnosis Related Group delivery codes, selected ICD delivery-related procedure codes) were identified (Table 1). Births that indicated a transfer from another hospital were excluded to avoid duplication.

Analysis

An interrupted time series analysis was conducted that included both visual inspection of rates and regression analysis.^{14,15} Rates of NAS (cases per 1000 birth hospitalizations) and maternal OUD (cases per 1000 delivery hospitalizations) were calculated and plotted by quarter for 2013–2017. These data years were selected to center on the ICD-10-CM transition with 2 full years before and after. Quarterly rates were also calculated and plotted for maternal outcomes only available in the ICD-10-CM (for 2015 quarter 4 [Q4] to 2017 Q4): maternal long-term use of opioid analgesics, unspecified opioid use diagnoses, OUD plus long-term use of opioid analgesics, and all maternal opioid-related diagnoses (maternal OUD, long-term [current] use of opioid analgesics, and unspecified opioid use) per 1000 deliveries. Following other analyses of the ICD-10-CM transition,^{16,17} we employed a segmented regression approach common to both interrupted time series¹⁴ and sharp regression discontinuity designs¹⁸ using log-binomial models. The segmented regression model includes an immediate intercept change or “jump” with the ICD transition as well as a time trend or slope that is allowed to vary before and after the transition. The immediate change is captured through a dummy variable indicating the ICD-10-CM transition (0 from 2013 quarter 1 [Q1] to 2015 quarter 3; 1 from 2015 Q4 to 2017 Q4);

the trend is captured in a quarterly time variable (1 in 2013 Q1 to 20 in 2017), and the change in trend after the transition is captured by a quarterly time variable that starts in the ICD-10-CM (0 from 2013 Q1 to 2015 quarter 3; 1 in 2015 Q4 to 9 in 2017 Q4). The primary focus is on the immediate change in outcomes associated with the ICD transition controlling for underlying time trends. Potential seasonality was controlled with dummy variables for quarter, and standard errors accounted for the complex sampling by using the SVY command in Stata (Stata Corp, College Station, TX). A 2-sided P value of $<.05$ was considered statistically significant.

RESULTS

From 2013 to 2017, 3.8 million sampled birth and delivery hospitalizations were weighted to represent an estimated 18.8 million birth and delivery hospitalizations. The ICD-10-CM transition was not associated with a change in NAS rates (rate ratio [RR]: 0.99; 95% confidence interval [CI]: 0.90–1.08; $P = .79$; Fig 1). However, the ICD-10-CM transition was associated with an 11% decrease in maternal OUD rates (RR: 0.89; 95% CI: 0.80–0.98; $P = .02$; Fig 2) and a 2.3% decrease in the quarterly trend (RR: 0.98; 95% CI: 0.96–1.00; $P = .04$).

When adding long-term use to OUD, the ICD-10-CM transition was not associated with changes in rates (RR: 0.98; 95% CI: 0.89–1.09; $P = .76$). However, when adding unspecified use to OUD and long-term opioid use, a 20% rise in maternal opioid-related codes was observed (RR: 1.20; 95% CI: 1.09–1.32; $P < .001$).

DISCUSSION

In this analysis of nationally representative hospital discharge data, the ICD-10-CM transition was not associated with changes in NAS rates as represented by ICD coding but was associated with lower rates of maternal OUD and a disruption in observed OUD trends. The introduction of long-term (current) use of opioid analgesics appeared to have contributed to shifts in patients identified with diagnosis codes used for OUD documented at delivery hospitalization, similar to an analysis of general members of commercial health insurance.¹³ Although coding guidance does not suggest medications for OUD be coded as long-term (current) use of opioid analgesics, these codes may be useful in broadly understanding exposures that contribute to a diagnosis of NAS. Furthermore, the unspecified opioid use codes captured an additional 20% of patients with opioid-related exposures that may be of interest. Conversely, although the ICD-10-CM introduced the ability to differentiate iatrogenic withdrawal, this coding change was not associated with NAS rates.

NAS is an indicator used by multiple federal agencies (including the Agency for Healthcare Research and Quality, the Centers for Disease Control and Prevention, and the Health Resources and Services Administration) as well as state public health agencies to understand the burden of the opioid crisis on maternal and child health. To aid in standardization, the Council for State and Territorial Epidemiologists, an organization of member states and territories representing public health epidemiologists, proposed standard NAS surveillance

definitions.¹⁹ Our ICD-10-CM definitions align with this new guidance for administrative billing or claims data.

This analysis has a few limitations. First, we cannot confirm whether the same exact cases would be identified in both the ICD-9-CM and ICD-10-CM because cases were identified by using different coding schemes. Additionally, uptake and use of the ICD-10-CM codes may vary by hospital and state. There have been many initiatives at the hospital, local, state, and federal level to better provide quality coordinated care for pregnant and postpartum women with OUD and their infants. We are unable to ascertain whether improved recognition or true prevalence changes of these conditions influenced the observed trend over the ICD-10-CM transition.

The ICD-10-CM provides additional codes to monitor opioid-related diagnoses for pregnant women and infants. Trend analyses covering the ICD-10-CM transition should acknowledge that both OUD and NAS algorithms had important changes in relevant codes. The ICD-10-CM transition did not appear to affect NAS. However, coding of maternal OUD alone may not capture the same population across the ICD transition, which confounds interpretation of trend data spanning this time period.

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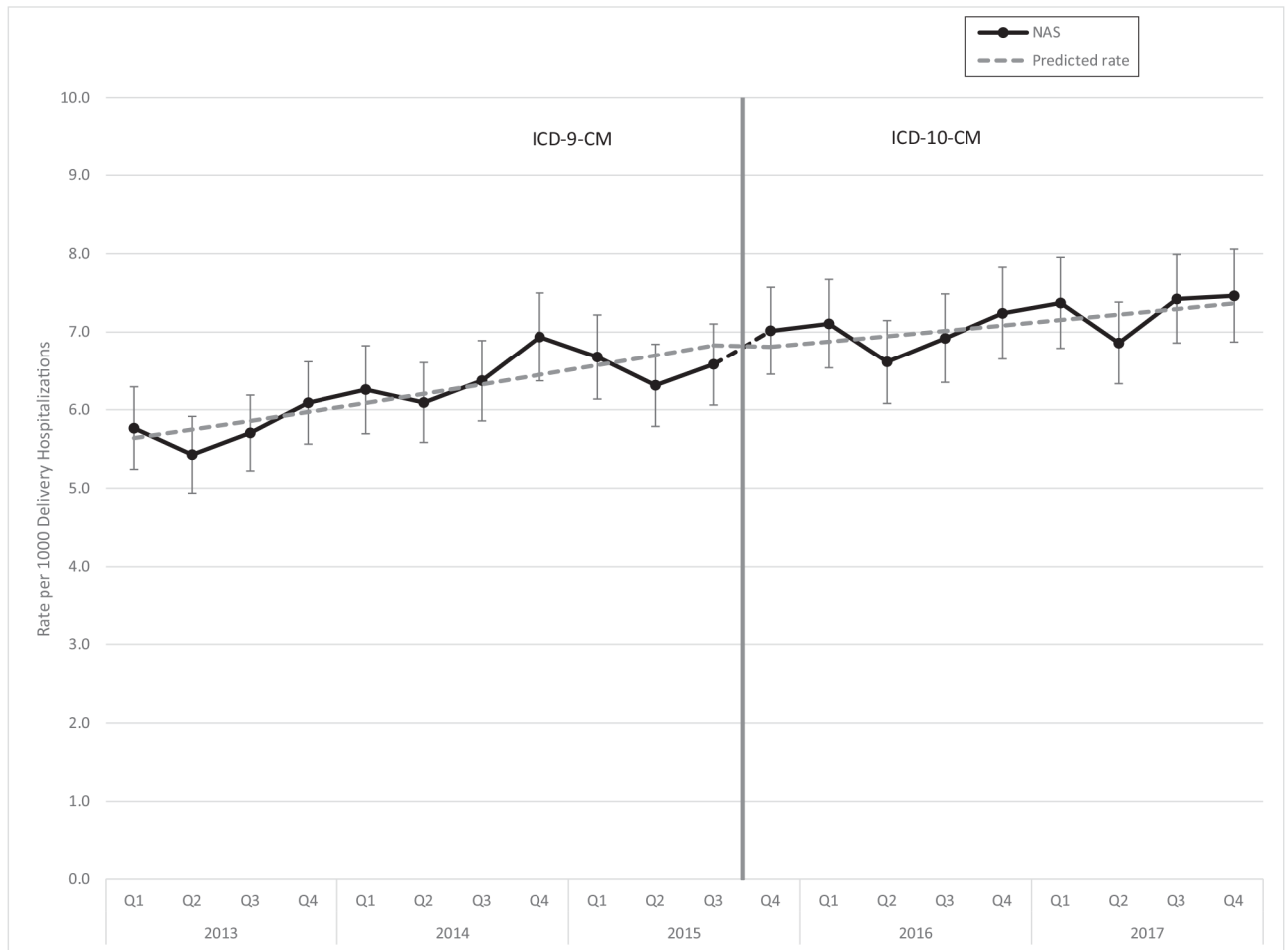


FIGURE 1.

Quarterly rates with 95% CIs and predicted rates from segmented regression models for NAS from 2013 to 2017, allowing discontinuities in intercepts and slopes with the ICD-10-CM transition in 2015 Q4. Q, quarter.

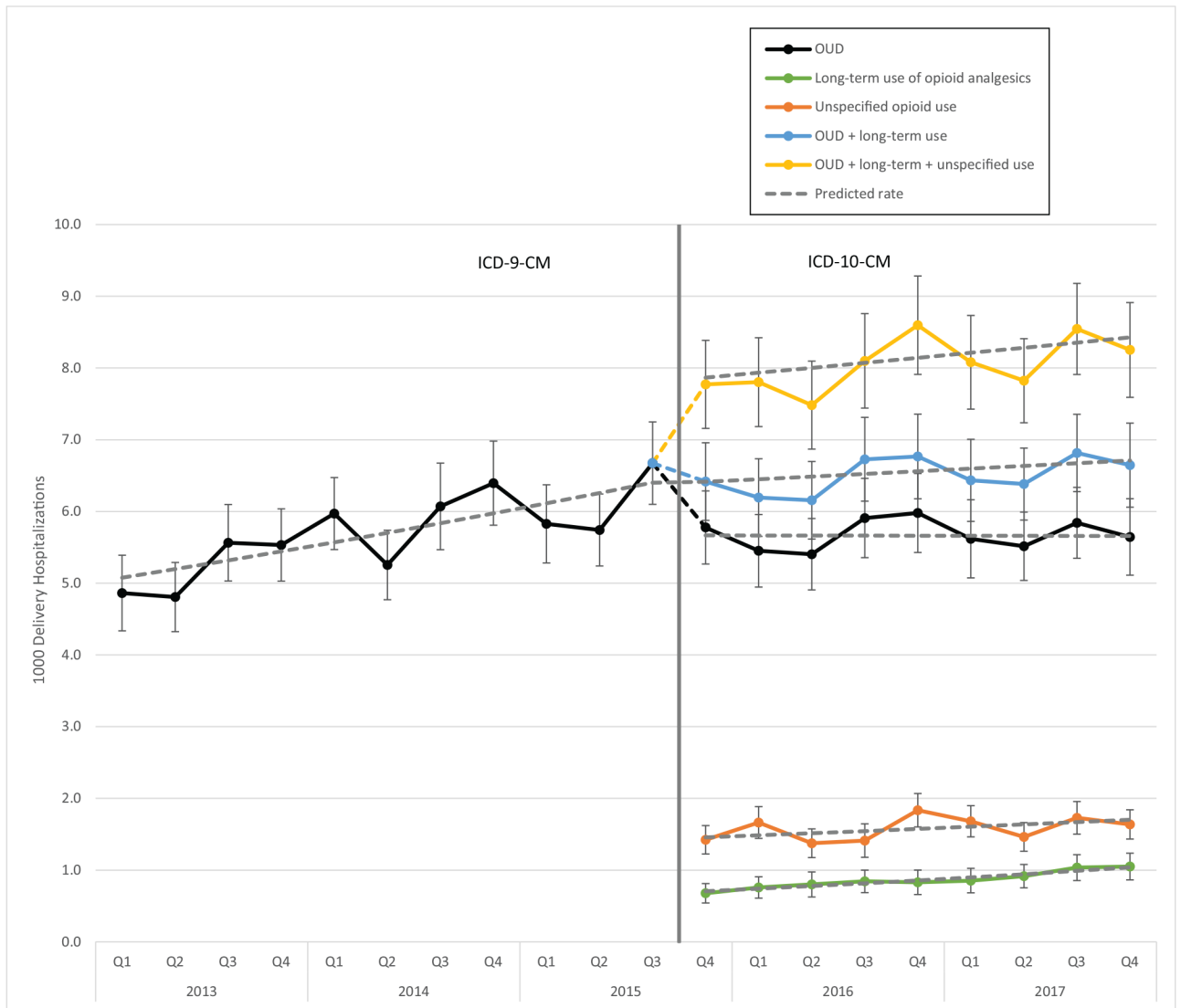


FIGURE 2. Quarterly rates with 95% CIs and predicted rates from segmented regression models for maternal opioid-related diagnoses from 2013 to 2017, allowing discontinuities in intercepts and slopes with the ICD-10-CM transition in 2015 Q4. Q, quarter.

TABLE 1

NAS, Maternal Opioid-Related, Birth, and Delivery Hospitalization Codes

	ICD-9-CM Codes	ICD-10-CM/PCS Codes
NAS		
Diagnosis codes	779.5 (iatrogenic exclusion codes: 765.00–765.05, 770.7, 772.1x, 777.5x, 777.6, 779.7)	P96.1 (iatrogenic exclusions no longer necessary with P96.2)
OID		
Diagnosis codes (opioid dependence)	304.00–304.02, 304.70–304.72	F11.20, F11.22–11.29
Diagnosis codes (nondependent opioid abuse)	305.50–305.52	F11.10, F11.12–11.19
Long-term (current) use of opioid analgesics		
Diagnosis codes	—	Z79.891
Unspecified opioid use	—	F11.90–F11.99
Diagnosis codes		
Birth hospitalizations		
Diagnosis codes	V30.XX–V39.XX ending in 00 or 01, or 1 ^a	Z38.00, Z38.01, Z38.1, Z38.2, Z38.30, Z38.31, Z38.4, Z38.5, Z38.61–Z38.66, Z38.68, Z38.69, Z38.7, Z38.8
Delivery hospitalizations		
Diagnosis codes	V27, 650, 669.70, 669.71	Z37, O80, O82, O75.82
Diagnosis related group codes	765–768, 774–775	765–768, 774–775
Procedure codes	720, 721, 7221, 7229, 7231, 7239, 724, 7251, 7252, 7253, 7254, 726, 7271, 7279, 728, 729, 7322, 7359, 736, 740, 741, 742, 744, 7499	10D00Z0–10D00Z2, 10D07Z3–10D07Z8, 10E0XZZ
Exclusion diagnosis codes	630–639	O00, O01, O02, O03, O04, O07, O08
Exclusion procedure codes	6901, 6951, 7491, 750	10A00ZZ, 10A03ZZ, 10A04ZZ, 10A07Z6, 10A07ZW, 10A07ZX, 10A07ZZ, 10A08ZZ

PCS, procedure coding system; —, not applicable.

^aBirth hospitalizations with an indication of transfer from another hospital were excluded to reduce duplication (<1%).