

# Identification of quality measures for opioid-exposed newborns and other variables for the opioid-exposed dyad from the electronic health record

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**PheKB URL:** <https://phekb.org/phenotype/opioid-exposed-infant-clinical-indicators>

**GitHub URL:** [https://github.com/The-Wei-Lab/clinical\\_indicators\\_for\\_opioid\\_exposed\\_infants](https://github.com/The-Wei-Lab/clinical_indicators_for_opioid_exposed_infants)

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# 1 Study Description

## Objective

We leveraged existing data from a single electronic health care system in the southeastern United States to demonstrate the feasibility of measuring quality indicators for the hospital-based care of opioid-exposed newborns using existing data infrastructure. Additionally, we identified other key variables related to the care of opioid-exposed maternal-infant dyads.

## Patients and Methods

Using a predefined population of opioid-exposed infants from an Epic electronic health record, we developed criteria for the identification of quality indicators and other variables from the clinical data recorded during the birth hospitalization and the perinatal period. Informed by existing literature and the study team's clinical expertise, we used a combination of structured and unstructured data elements.

## Results

Out of 36 hospital quality indicators identified as important and feasible by an expert panel using a Delphi approach, we were able to extract the necessary elements to assess 8 indicators: Infant assessment for signs of withdrawal begins before 12 hours of life, the infant was provided breastmilk at any point during the birth hospitalization unless contraindicated by infectious disease or relapse in the past 30 days, a certified lactation consultant was consulted during the birth hospitalization, the primary medication used to treat infant opioid withdrawal was an opioid, the infant was observed for at least 24 hours after weaning off medications prior to discharge, percent of opioid-exposed infants who were treated with pharmacotherapy, duration of pharmacotherapy in days (i.e., length of treatment), and the duration of the birth hospitalization in days (i.e., length of stay).

## Conclusions

Health care systems can utilize the published algorithms to assist in leveraging existing EHR data to assess quality of care for opioid-exposed newborns.

## 2 Population Overview

This protocol is used in conjunction with published algorithms for identifying the phenotype of opioid-exposed mother-infant dyads.

<https://phekb.org/phenotype/opioid-exposed-infants>

The opioid-exposed phenotype algorithm establishes parameters for identifying maternal-infant linkage, birth hospitalization encounters, and gestational age which are prerequisite steps for identifying the quality indicators and other variables described below.

## 3 Quality Indicators

### 3.1 NOWS scoring

**Infant assessment for signs of withdrawal begins before 12 hours of life.**

Denominator – all opioid-exposed newborns

Numerator – first documented summary NOWS score was documented between birth date/time and birth date/time +12 hours.

### 3.2 Feeding

**A certified lactation consultant was consulted during the birth hospitalization.**

Denominator – opioid-exposed newborns without evidence of maternal HIV diagnosis or present/positive/non-zero maternal HIV toxicology OR present/positive/non-zero maternal illicit substance toxicology.

Numerator – lactation note was present in the infant's record

**The infant was provided breastmilk at any point during the birth hospitalization, unless contraindicated by infectious disease or relapse in the past 30 days.**

Denominator – opioid-exposed newborns without evidence of maternal HIV diagnosis or present/positive/non-zero maternal HIV toxicology OR present/positive/non-zero maternal illicit substance toxicology.

Numerator – breastfeeding search term(s) present in discharge summary, lactation note, or progress note from the birth hospitalization.

### 3.3 Infant pharmacotherapy

**The percent of opioid-exposed infants who were treated with pharmacotherapy.**

Denominator – all opioid-exposed newborns

Numerator – newborns who received any pharmacotherapy during the birth hospitalization

**The duration of pharmacotherapy in days (i.e., length of treatment)**

Denominator – opioid-exposed newborns who received any pharmacotherapy during the birth hospitalization

Numerator – Total number of days the newborn received any pharmacotherapy during the birth hospitalization.

**The primary medication used to treat infant opioid withdrawal was an opioid (e.g., morphine, methadone).**

Denominator – opioid-exposed newborns with a NOWS diagnostic code who received any pharmacotherapy during the birth hospitalization

Numerator – newborns who received any opioid as part of the pharmacotherapy during the birth hospitalization

**The infant was observed for at least 24 hours after weaning off medications prior to discharge.**

Denominator – opioid-exposed newborns who received any pharmacotherapy during the birth hospitalization

Numerator – newborn discharge date greater than the date of last infant pharmacotherapy dosage

### **3.4 Length of stay**

**The duration of the birth hospitalization in days (i.e., length of stay)**

Denominator – all opioid-exposed newborns

Numerator – birth hospitalization, or the number of days between the birth visit start end dates

## **4 Other Variables**

### **4.1 Infant death**

Infants with date of death within the birth hospitalization.

### **4.2 Maternal insurance type**

Maternal primary insurance documented during the birth hospitalization.

### **4.3 Maternal smoking status**

Maternal smoking status during pregnancy from estimated time of conception through the infant's date of birth documented using SNOMED codes/concept ID/recode descriptions.

### **4.4 Maternal mental health diagnoses**

Maternal mental health diagnoses during pregnancy and post-partum period. Pregnancy is defined as the estimated time of conception through delivery. Post-partum is defined as the date of delivery (baby date of birth) to 1-year postpartum. Mental health diagnosis categories are flagged based on 1 inpatient or 2 outpatient codes for each diagnosis type – anxiety disorders, depressive disorders, bipolar disorder, personality disorders, other psychotic disorders, schizophrenia, and other.

### **4.5 Maternal opioid and non-opioid prescriptions**

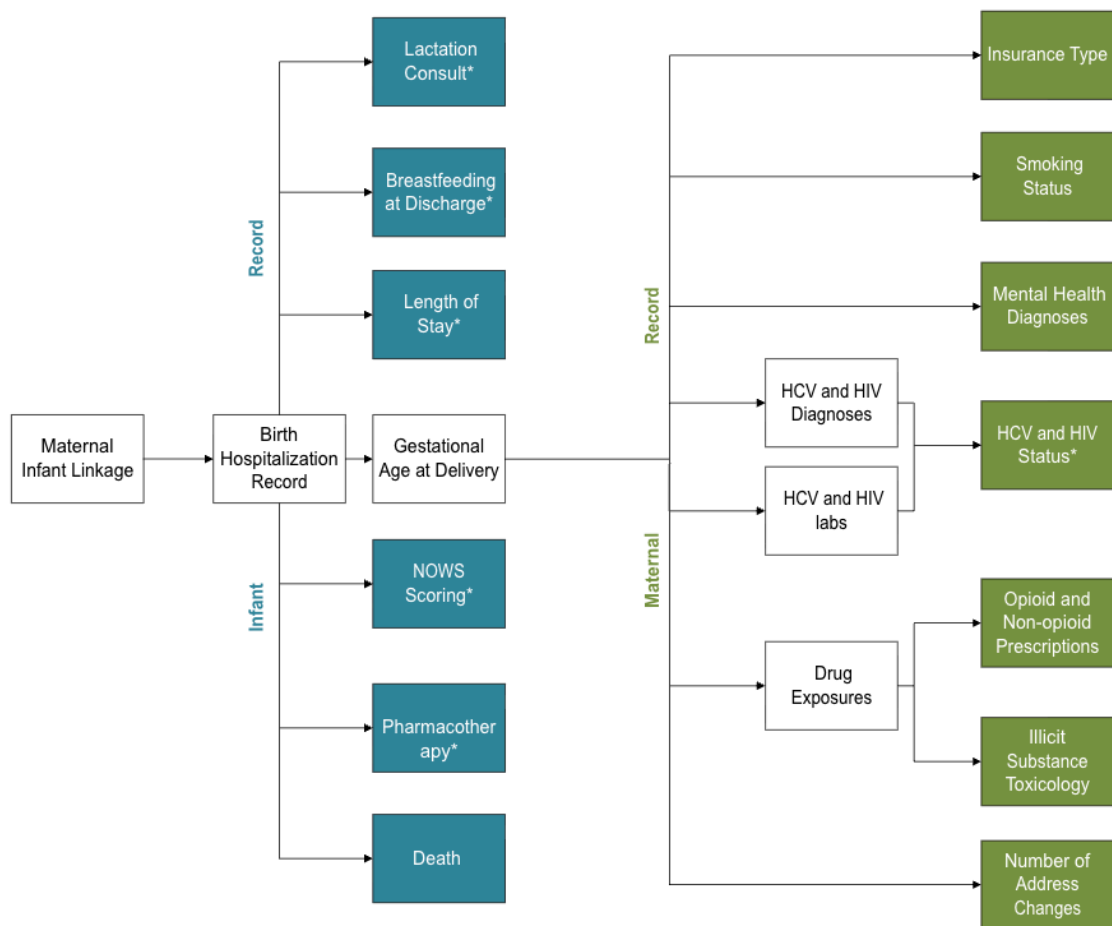
Maternal opioid and non-opioid drug inpatient drug exposures 90 days to 2 days prior to birth using opioid and non-opioid drug name search.

### **4.6 Maternal illicit substance toxicology**

Maternal illicit substance toxicology lab results using short and long lab names between 30 days prior to delivery (baby date of birth) and end of the birth hospitalization stay with qualitative indicators of “present,” “positive,” or “reactive” or a non-zero quantitative value.

### **4.7 Maternal number of address changes**

The number of changes in location defined as any change to documented mailing address from estimated time of conception to 1-year postpartum.



\*Used for quality measures for opioid-exposed newborns

## 5 Code Description

### 5.1 Data Description

The EHR data used was organized according to Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM) (<https://www.ohdsi.org/>).

### 5.2 Code Availability

All code is available on GitHub at: <https://github.com/Precision-Phenotyping-Core>

Code was written in Python, Spark SQL, and SQL.

Code files are available in two formats: Python-based Jupyter Notebook (\*.ipynb), which can be opened in most integrated development environment (IDE) software (e.g. Visual Studio Code), and HTML (\*.html), which can be opened in most web browsers (e.g. Chrome).

All the notebooks/files have been edited for public dissemination and are not executable as is.

## 5.3 Nomenclature

Filenames follow the descriptions described in the published manuscript (see Figure 1).

Within each file, there may be alternative descriptions used. Major examples are listed below:

- 1) 'Birthing parent' may be represented as 'mom' or 'maternal'
- 2) 'Child' may be represented as 'infant' or 'baby'
- 3) 'Dyad' may be represented as 'pair', e.g. 'birthing parent-child dyad' may be represented as 'mom-baby pair'
- 4) 'Fetal abnormalities' may be represented as 'congenital malformations'

## 5.4 File Descriptions

There are 14 overall notebooks that were used for the implementation of quality indicator identification.

Additional details and documentation may be found in each notebook/file.

All ICD/CPT codes used can be found in the file AlgorithmValidation\_supplementintotables.xlsx, which is available on both [GitHub](#) and [PheKB](#). This file contains the supplementary tables from the published manuscript (URL to be updated upon publication). Refer to [Chapter 2.1](#) for details on which table should be used for which criteria.

ICD/CPT codes listed in AlgorithmValidation\_supplementintotables.xlsx/Supplementary Tables should supersede any discrepancies in the codes listed in the notebooks/files.

The following is a list and description of notebooks/files in the order of intended execution.

- I. Project\_modules.ipynb
  - Called by other notebooks to import necessary libraries, define table names, and define common functions

### 1) Maternal Infant Linkage



- First step in the pipeline to gather information on babies that fit inclusion criteria. This step matches the maternal record to the baby's record in the EHR and establishes a date of birth
- 2) **Birth Hospitalization Record**
  - This step comes after the birth step in the pipeline, and connects an initial hospital visit to the baby's birth date to gather data from the inpatient stay. Here, basic information about the hospital visit is gathered and a visit id is collected. This visit ID then matches some of the following covariates to the initial birth inpatient visit such as lactation
- 3) **Infant Pharmacotherapy**
  - This step comes after birth visit in the workspace pipeline. It creates a set of codes matching drug related codes in the infants' electronic health record with the birth hospital visit.
- 4) **Infant Exposed Opioid NICU Stay**
  - This step comes after birth visit in the workspace pipeline. The notebook finds evidence of opioid exposure for infants during or after the initial birth inpatient visit
- 5) **Infant NOWS Scoring**
  - This step comes after birth visit in the workspace pipeline. It pulls every NAST or NOWS composite score recorded during the birth hospitalization from nursing flow sheets.
- 6) **Maternal Drug Exposures**
  - This step comes after birth visit in the workspace pipeline. It connects any maternal drug related codes to the initial inpatient birth visit
- 7) **Maternal Opioid Prescription**
  - Using the Drug Related codes from the maternal health record, this notebook filters for the use of opioids in the patient's medical record
- 8) **Maternal Illicit Substance Toxicology**
  - Using the Drug Related codes from the maternal health record, this notebook filters for evidence of present/positive/non-zero laboratory toxicology results indicative of illicit substance use recorded from 30-days prior to delivery up through and including the birth hospitalization.
- 9) **Gestational Age at Delivery**
  - This notebook depends in part on the birth visit notebook in the pipeline. The notebook uses standardized metrics for gestational age to match an estimated date of conception for each pregnancy
- 10) **Maternal hcv and hiv Diagnosis**
  - This notebook depends on the gestational age notebook in the pipeline and pulls all HIV and HCV related ICD codes from a patient's medical records around the pregnancy period
- 11) **Maternal hcv and hiv Labs**

- This notebook depends on the gestational age notebook in the pipeline and pulls all HIV and HCV related LOINC codes from a patient's medical records around the pregnancy period

#### 12) **All Maternal hcv and hiv Records**

- This notebook depends on both the mom\_hcv\_hiv\_lab and the mom\_hcv\_hiv\_icd notebook, and performs an inner join to show which patients have both ICD and Lab values

## 6 Contact Information

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