Validation of an ICD-10-based Algorithm to Identify Stillbirth in the Sentinel System

Susan E. Andrade, Sc.D.
Meyers Primary Care Institute/ University of Massachusetts Medical School

November 30, 2018
Disclosures

- The authors have no conflicts of interest to disclose.
- This work was supported by the U.S. Food and Drug Administration (FDA) through the Department of Health and Human Services (HHS) Contract number HHSF223201400030I, Task Order No. HHSF22301002T.
- This presentation reflects the views of the authors and not necessarily those of the U.S. FDA.
Stillbirth Validation Project Workgroup

- **Meyers Primary Care Institute**: Susan Andrade, ScD; Tiffany Moore-Simas, MD, MPH, Med, FACOG; Cassandra Saphirak, MA; Christopher Delude, BA

- **Sentinel Operations Center**: Justin Bohn, ScD; Sandra DeLuccia, MPH; Elnara Fazio-Eynullayeva, MA; Tancy Zhang, MPH; Autumn Gertz

- **U.S. Food and Drug Administration (FDA)**: Danijela Stojanovic, PhD, PharmD; Lockwood Taylor, PhD; Steven Bird, PhD, PharmD

- **Adjudicators**: Julianne Loring, MD (University of Massachusetts Medical School); Erin Longley, MD (Community Health Care)
Background

- This project is one of a series being launched to support FDA’s use of the active postmarket risk identification and analysis system (ARIA) for select medical products, including recent new drug applications.

- Fetal deaths include stillbirths and spontaneous abortions, which are generally differentiated by gestational age and/or birth weight.
  - Stillbirth data in the U.S. are commonly reported as fetal deaths at ≥ 20 weeks gestation.

- Approximately 24,000 stillbirths occur in the U.S. annually, representing about 1% of all pregnancies.

Few studies have developed and validated algorithms to identify stillbirths using administrative or claims data in U.S. populations

- Vaccine Safety Datalink (VSD) developed and validated an International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) based algorithm for identifying pregnancy episodes, outcomes, and mother-infant pairs
  - 12 pregnancies identified with ICD-9-CM codes for stillbirth, 11 were confirmed through medical record review (PPV=92%)
- No published U.S. or Canadian studies have validated algorithms to identify stillbirths based upon ICD-10-CM codes

Objectives

- Develop an ICD-10-CM based algorithm to identify stillbirth

- Assess the positive predictive value (PPV) of the ICD-10-CM based algorithm and Patient Episode Profile Retrieval (PEPR) results through medical chart review
Design of Stillbirth Validation Project

- Determination of the population in whom to identify stillbirth, development of an ICD-10-CM-based algorithm, formulation of the clinical case definition, and formulation of a strategy to evaluate the accuracy of PEPR results to identify patients who had a stillbirth event
- Execution of PEPR and retrieval of patient profiles and medical records for review
- Abstraction and adjudication
- Calculation of PPV
Sentinel Tools for Identification and Retrieval of Cohorts/Data of Interest

- **Cohort Identification and Descriptive Analysis (CIDA) Tool**
  - Main purpose of the CIDA tool is to identify and extract cohorts of interest from the Sentinel Distributed Database (SDD) based on the specification of requester-defined options (e.g., exposures, outcomes, continuous enrollment requirements, incidence criteria, inclusion/exclusion criteria, relevant age groups and demographic criteria such as sex and race)

- **Patient Episode Profile Retrieval (PEPR) Tool**
  - Retrieves patient-level electronic data drawn from Data Partners’ SDDs
  - A “patient episode profile” is a summary of information (e.g., encounters, diagnosis codes, procedure codes, etc.) pertaining to a particular patient during a particular time period
Identification of Stillbirth Events: Algorithm Development

- Algorithm based upon information from published studies and results of trend and code distribution analyses using Truven Health MarketScan® Commercial and Medicare Supplemental Databases
  - Identified ICD-10-CM diagnosis for potential stillbirths by conducting forward-backward mapping of ICD-9-CM codes validated in the VSD study by Naleway et al. using the General Equivalence Mappings (GEMs) tool
    - Additional search of ICD-10-CM diagnosis codes to ensure complete capture of potentially relevant codes
  - Trend analysis: found an almost two-fold increase in the rate of stillbirth in the ICD-10 era compared to ICD-9 era using the initial code list determined by the workgroup
    - More pronounced in outpatient setting vs. inpatient setting
<table>
<thead>
<tr>
<th>ICD-10-CM Diagnosis Codes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>O31.00XX</td>
<td>Papyraceous fetus, unspecified trimester</td>
</tr>
<tr>
<td>O31.02XX</td>
<td>Papyraceous fetus, second trimester</td>
</tr>
<tr>
<td>O31.03XX</td>
<td>Papyraceous fetus, third trimester</td>
</tr>
<tr>
<td>O36.4XXX</td>
<td>Maternal care for intrauterine death</td>
</tr>
<tr>
<td>Z37.1</td>
<td>Single stillbirth</td>
</tr>
<tr>
<td>Z37.3</td>
<td>Twins, one liveborn and one stillborn</td>
</tr>
<tr>
<td>Z37.4</td>
<td>Twins, both stillborn</td>
</tr>
<tr>
<td>Z37.60</td>
<td>Multiple births, unspecified, some liveborn</td>
</tr>
<tr>
<td>Z37.61</td>
<td>Triplets, some liveborn</td>
</tr>
<tr>
<td>Z37.62</td>
<td>Quadruplets, some liveborn</td>
</tr>
<tr>
<td>Z37.63</td>
<td>Quintuplets, some liveborn</td>
</tr>
<tr>
<td>Z37.64</td>
<td>Sextuplets, some liveborn</td>
</tr>
<tr>
<td>Z37.69</td>
<td>Other multiple births, some liveborn</td>
</tr>
<tr>
<td>Z37.7</td>
<td>Other multiple births, all stillborn</td>
</tr>
<tr>
<td>P95</td>
<td>Stillbirth</td>
</tr>
</tbody>
</table>
Algorithm Development (continued)

- Final Algorithm

At least one ICD-10-CM code specifically describing stillbirth/stillborn outcome of delivery (Z37.1, Z37.3, Z37.4, Z37.6X, Z37.7, P95)

OR

At least one ICD-10-CM code for intrauterine death or papyraceous fetus (O36.4XXX and O31.0XXX) **PLUS** an ICD-10-CM code indicating a gestational age greater than or equal to 20 weeks (ICD-10-CM codes Z3A20-Z3A49) was recorded within the period 28 days before the code for intrauterine death or papyraceous fetus
Final ICD-10-CM Based Algorithm for Stillbirth

Study Period: July 1 2016 – end of available data

Index Date
Diagnosis of stillbirth
Aged 12-55 Years

-270
Continuous enrollment: medical and drug coverage

Washout for index event

-183

Index Date
Diagnosis of intrauterine death
Aged 12-55 Years

-270
Continuous enrollment: medical and drug coverage

Washout for index event

-183

Inclusion: diagnosis of ≥ 20 weeks gestation

-28

OR
Clinical Case Definition

- Clinical definition for stillbirth based upon case definition of Brighton Collaboration Stillbirth Working Group
- Death of the fetus could have been diagnosed before the onset of labor or at the time of delivery
- Information documented and procedures performed could differ for events diagnosed at the time of delivery (or post-delivery) and events diagnosed before the onset of labor (pre-delivery)

Clinical Case Definition (continued)

- If the event was diagnosed post-delivery:
  - Determination of the absence of signs of life at time of delivery (no spontaneous movements, no heartbeat, no respirations, and Apgar score of 0 at 1 and 5 min) is made by physical examination after attended delivery by obstetric care provider
    - AND
  - Gestational age $\geq 20$ weeks
    - AND
  - No procedure performed to intentionally stop fetal cardiac activity (e.g. KCL injection for termination)
Clinical Case Definition (continued)

- If the event was diagnosed pre-delivery:
  - Prenatal ultrasound examination documenting lack of fetal cardiac activity or movement before the onset of labor
    OR
  - Auscultation for fetal heart tones (using electronic devices or non-electronic devices) documenting lack of fetal heartbeat
    AND
  - Gestational age ≥ 20 weeks
    AND
  - No procedure performed to intentionally stop fetal cardiac activity (e.g. KCL injection for termination)
Project Status

- ICD-10-CM based algorithm developed and tested on Truven Health MarketScan® data
- Clinical definition determined
- Draft abstraction and adjudication forms developed
Next Steps

- Identification and sampling of potential cases for chart and PEPR results review: will pursue retrieval of 200 and aim to retrieve up to 150 charts
- Retrieval and redaction of medical records
  - Standard Operation Procedures (SOP) document being developed for Data Partners
- Chart abstraction
- Adjudication of potential cases
  - PEPR results
    - to determine whether using PEPR data alone is sufficient to identify stillbirth among patients
  - Medical charts
  - Calculation of PPV
Acknowledgements

- Many thanks are due to Data Partners who will provide data and medical charts to be used in the analysis