OBSTETRICS

Validation of obstetric estimate of gestational age on US birth certificates

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OBJECTIVE: The birth certificate variable obstetric estimate of gestational age (GA) has not been previously validated against GA based on estimated date of delivery from medical records.

STUDY DESIGN: We estimated sensitivity, specificity, positive predictive value, negative predictive value and the corresponding 95% confidence intervals (CIs) for preterm delivery (<37 weeks' gestation) based on obstetric estimate using estimated date of delivery-based GA as the gold standard. Trained abstractors obtained the estimated date of delivery from the prenatal record (64.8% in New York City, and 94.6% in Vermont), or, when not available, from the hospital delivery record for 2 population-based samples: 586 live births delivered in New York City and 649 live births delivered in Vermont during 2009. Weights were applied to account for nonresponse and sampling design.

RESULTS: In New York City, the preterm delivery rate based on estimated date of delivery was 9.7% (95% CI, 7.6—12.4) and 8.2% (95% CI, 6.3—10.6) based on obstetric estimate; in Vermont, it was 6.8% (95% CI, 5.4—8.4) based on estimated date of delivery and 6.3% (95% CI, 5.1—7.8) based on obstetric estimate. In New York City, sensitivity of obstetric estimate-based preterm delivery was 82.5% (95% CI, 69.4—90.8), specificity 98.1% (95% CI, 96.4—99.1), positive predictive value 98.0% (95% CI, 95.2—99.2), and negative predictive value 98.8% (95% CI, 99.6—99.9). In Vermont, sensitivity of obstetric estimate-based preterm delivery was 93.8% (95% CI, 81.8—98.1), specificity 99.6% (95% CI, 98.5—99.9), positive predictive value 100%, and negative predictive value 100%.

CONCLUSION: Obstetric estimate-based preterm delivery had excellent specificity, positive predictive value and negative predictive value. Sensitivity was moderate in New York City and excellent in Vermont. These results suggest obstetric estimate-based preterm delivery from the birth certificate is useful for the surveillance of preterm delivery.

Key words: birth certificates, gestational age, preterm, validation

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Gestational age (GA) recorded in the birth certificate is the cornerstone of several important maternal and child health indicators including percent of US infants born preterm (<37 weeks' gestation), small for GA and large for GA. In 2003, the National Centers for Health Statistics (NCHS) released a revised US Standard Certificate of Live Birth that included a new measure for GA, obstetric estimate (OE). OE replaced clinical estimate (CE) of GA from the 1989 version of the birth certificate. The most significant differences between these 2 measures is that the instructions for birth clerks or clinicians recording the OE were more detailed and explicitly state that the estimate should be determined by all perinatal factors and assessments but not the neonatal examination.[1] In addition, the instructions note that OE should not be completed solely on the infant date of birth and the mother's last menstrual period (LMP). Whereas instructions for the previously used CE simply noted to enter the length of gestation estimated by the attendant, and to not compute the item based on the infant date of birth and mother's LMP.

Two previous validations of the OE on the birth certificate have used different gold standards and study populations, and found varying results. The first study compared the distributions of birthweight for GA using the OE and a gold standard. The sample was 2005 US births and the gold standard was LMP-based

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GA if it agreed within 1 week to the OE. It found that the median, 10th, and 90th percentile birthweight distributions were virtually identical for the gold standard and the OE but that they differed for LMP-based GA.[2] Another study used early ultrasound (<20 weeks) as its gold standard and the population was a subsample of California births. It found OE-based preterm delivery (<37 weeks' gestation) had moderate sensitivity (74.9%) and positive predictive value (PPV) (85.1%).[3] Neither of these studies used what clinicians would consider to be their gold standard, the best obstetric date of delivery (BO-EDD).

During prenatal care, clinicians estimate a BO-EDD based on all available information, including ultrasound, LMP, and physical examination. In the first trimester, the American College of Obstetrics and Gynecology (ACOG) recommends that the BO-EDD be based on the following hierarchy: (1) LMP if confirmed by ultrasound and dates are within 7 days, or (2) by ultrasound if the LMP is unknown or differs >7 days from the ultrasound estimate, or (3) by the date of conception if resulting from assisted reproductive technology.[4] For women entering prenatal care in the second trimester, the same criteria are recommended, with the exception of basing EDD on ultrasound if it differs with the LMP >10 days. In the third trimester, ultrasound is not recommended for dating purposes. Once the BO-EDD is determined during the initial prenatal care visits, clinicians use it to estimate GA during the pregnancy and at delivery. Thus, for clinicians, BO-EDD is the gold standard for determining an infant's GA at delivery. We sought to validate the OE reported on the birth certificate using the BO-EDD as the gold standard. A secondary purpose of this analysis was to assess the frequency with which EDD is based on LMP or ultrasound-based dates.

Materials and Methods

This study is part of a special validation project funded by the Centers for Disease Control and Prevention. Two Pregnancy Risk Assessment Monitory System (PRAMS) sites, NYC and Vermont, were funded to validate self-reported information from mothers in the PRAMS[5] and from the 2003 birth certificate. PRAMS is a population-based surveillance system that uses state vital records as its sampling frame, and which links birth certificate data to mother's responses on a questionnaire filled out 4 months on average after delivery. The sample from NYC included all PRAMS respondents who delivered in any of the city's 41 birthing hospitals from Jan. 1 to June 4, 2009 (n = 603); Vermont's sample included all PRAMS respondents who delivered in any of the state's 12 hospitals or in 1 New Hampshire Hospital close to Vermont's border from Jan. 1 through Aug. 31, 2009 (n = 664). The PRAMS response rates were 67.3% for NYC and 82.8% for Vermont during the study period. Our inclusion criteria for this analysis required complete OE information on the birth certificate, complete EDD information on the prenatal or hospital record, and GA estimates between 20 and 44 weeks. For Vermont, 15 of 664 did not meet inclusion criteria resulting in a final sample size of 649. For NYC, 17 of 603 did not meet inclusion criteria resulting in a final sample size of 586.

Medical record abstraction was done manually with physical records, except in the few hospitals where the records were electronic. In those circumstances, the information was abstracted manually from the computerized record. The data abstractors were trained by 2 authors (P.D. and J.B.) and 4 additional staff members to abstract information in a standardized manner. To evaluate reliability of record abstraction, approximately 25 medical records in both NYC and Vermont were re-abstracted by authors PD, JB, and 4 additional project staff and compared. Errors in abstractions (estimated to be <3% for all variables) were noted and then reviewed with the abstractors. The final EDD, which we refer to as the BO-EDD in this paper, recorded in the prenatal or hospital record was abstracted from paper or electronic records at each birthing hospital. The prenatal record was the first place abstractors looked for the BO-EDD, and if the prenatal record was missing, it was abstracted from the hospital delivery record. In NYC, 64.8% of the BO-EDD was abstracted from the prenatal record and 33.2% from the hospital record; in Vermont 94.6% of the BO-EDD was abstracted from the prenatal record and 5.4% from the hospital delivery record. Prenatal medical forms have several fields for recording the initial EDD, the LMP-based EDD, the ultrasound-based EDD and the final-EDD. Some hospital records also noted ultrasound-based EDD. All of these EDDs were abstracted if available. We considered the final EDD recorded in the prenatal record to be the BO-EDD. The EDD recorded in the delivery record was used as the BO-EDD in the absence of a prenatal record. Date of birth was also abstracted from the hospital delivery record. EDD-based GA was calculated using this formula: [280 days − (EDD-DOB)]/7, then rounded down to nearest whole number for completed weeks of gestation. The OE was taken from the birth certificate and was based on completed weeks of gestation.

To describe the characteristics of the NYC and Vermont samples, we examined age, race/ethnicity, marital status, education, and trimester entering prenatal care using data from the birth certificate, and mothers' participation in the Special Supplemental Nutrition Program for Women, Infants and Children Program (WIC) using self-reported data on the PRAMS questionnaire. To explore the validity of the OE, we estimated sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) with 95% confidence intervals (CIs) for early/moderate (20-33 weeks), late (34-36 weeks), and all (<37 weeks) preterm groups. The BO-EDD was the gold standard. Estimates were considered excellent if >90% and moderate if 70-90%.[6] The source of the BO-EDD was determined by comparing it with the EDD based on LMP and the EDD based on ultrasound abstracted from prenatal records. If the BO-EDD matched the EDD based on LMP then we concluded that LMP was the source of BO-EDD. If the BO-EDD matched the EDD based on ultrasound then we concluded that ultrasound was