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Assessing the Quality of Medical and Health Data From the 2003 Birth Certificate Revision: Results From New York City

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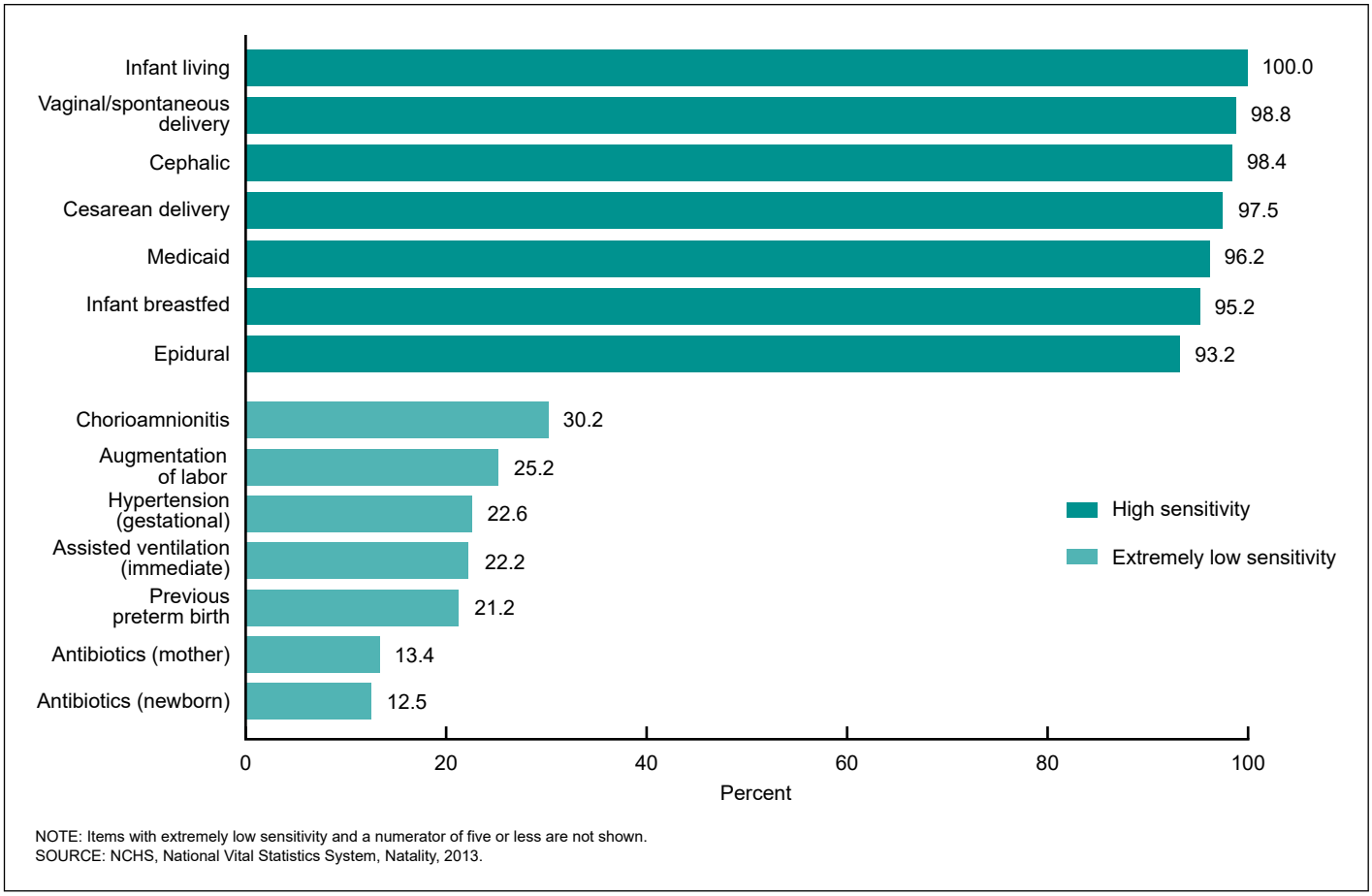
Abstract

Objectives—A primary goal of the 2003 revision of the U.S. Standard Certificate of Live Birth was to improve data quality. This report evaluates the quality of selected 2003 revision-based medical and health data by comparing birth certificate data for New York City with information abstracted from hospital medical records.



NOTE: Items with extremely low sensitivity and a numerator of five or less are not shown.
SOURCE: NCHS, National Vital Statistics System, Natality, 2013.

Figure 1. Checkbox items with high sensitivity and extremely low sensitivity

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NCHS reports can be downloaded from: https://www.cdc.gov/nchs/products/index.htm.

Methods—A random sample of records for 900 births occurring in New York City in 2013 was reviewed. Birth certificate and hospital medical records data were compared for these categories: pregnancy history, prenatal care, gestational age, birthweight, pregnancy risk factors, source of payment, characteristics of labor and delivery, fetal presentation, method of delivery, abnormal conditions of the newborn, infant living, and infant breastfed. Levels of missing data, exact agreement, kappa scores, sensitivity, and false discovery rates are presented where applicable.

Results—Exact agreement or sensitivity between birth certificate and medical record data was high (90.0% or greater) for a number of items (e.g., number of previous cesarean deliveries, cephalic presentation, cesarean delivery, vaginal/spontaneous delivery, obstetric estimate of gestation [within 2 weeks], Medicaid as source of payment for the delivery, birthweight [within 500 grams]), but extremely low (less than 40.0%) for several items (e.g., gestational hypertension, previous preterm birth, augmentation of labor, assisted ventilation, maternal transfusion). Levels of agreement or sensitivity for several items (e.g., obstetric estimate of gestation at delivery [exact number of weeks], previous cesarean delivery, private insurance as the source of payment for delivery, and total number of prenatal care visits [within two visits]), were substantial (between 75.0% and 89.9%) or moderate (between 60.0% and 74.9%). Data quality often varied by hospital.

Keywords: data quality • validity • sensitivity

Introduction

Information from the U.S. birth certificate is used extensively to track trends in demographic characteristics, health care utilization, obstetric procedures, and maternal and infant health. These data have also been widely used in obstetric and perinatal research (1–4). A chief advantage of birth certificate data is that information is collected for essentially every birth occurring in the United States each year, allowing for analysis of subpopulations, and rare conditions and events. The quality of birth certificate health data, however, is of long-standing concern. Studies evaluating 1989 birth certificate revision-based data have consistently shown that the demographic and selected medical and health items (i.e., method of delivery, birthweight, plurality) are collected with a high degree of completeness and accuracy, but that many of the health and medical items are underreported (5–10).

Accordingly, the key objective of the latest revision—The 2003 U.S. Standard Certificate of Live Birth—was to standardize the data collection process and improve data quality. The 2003 revised birth certificate was limited to items that were believed to be collectable with "reasonable completeness and accuracy" (11). A number of steps were taken to enhance the quality of these data: Detailed specifications for state electronic birth registration systems and standardized worksheets were developed to encourage collection of information from the best sources, and a standardized guidebook with detailed definitions and instructions also was developed for use by hospital staff (12,13). Full implementation of the new certificate across the nation was delayed until 2016, however, and studies on the revised data indicate that challenges to data quality persist (14–19).

An earlier validity study, fielded by the National Center for Health Statistics (NCHS) in 2009–2011, assessed the quality of 2003 birth certificate revision–based medical and health data for two states (the states were not identified) (20). It compared birth certificate data with those from hospital medical records and found wide variation in data quality by item, state, and hospital.

This study, building on the earlier validity study, was fielded in 2013, with the aim to assess the recent quality of selected 2003 birth certificate revision–based medical and health data for New York City (NYC) (NYC implemented the 2003 birth certificate revision in 2008). It compares information obtained from the birth certificate with corresponding information for the same mother and newborn abstracted directly from hospital medical records.

Methods

Study sample and data collection

Data for this report were collected in five hospitals in NYC. Birth records were stratified by hospital and month of birth. A simple random sample using the PROC SURVEYSELECT procedure in SAS was used to select a total of 15 cases per strata per month for a total of 180 births per hospital from January through December 2013. Hospital medical records (including prenatal care records) for a total of 900 sampled birth records were abstracted to obtain medical and health information of infants and mothers.

The five hospitals were selected to have varying characteristics based on volume (high or low number of births), setting (suburban or urban), type (public or private), and data quality (the hospital was or was not selected to participate in NYC's "real-time data cleaning" program). Suburban areas were identified by the NYC Vital Records Quality Improvement Unit by examining the area surrounding the hospital. Where the housing and building types of the area surrounding the hospital appeared to be primarily private homes and residences, the hospital was categorized as suburban. The data cleaning program was developed by the NYC Vital Record's Quality Improvement Unit to identify hospitals with a history of poor data quality based predominately on higher-than-average levels of unknowns for selected items compared with other NYC hospitals. NCHS contracted with the NYC Department of Health, Office of Vital Records to develop the data collection instrument; hire and train the abstractors; handle logistics for the state, hospitals, and the abstractors; and develop the medical abstraction data files. Experienced hospital medical data abstractors performed the record reviews. Records from the medical record abstraction data file were linked to the corresponding birth certificate record at NCHS (birth records were previously sent to NCHS by the states under the Vital Statistic Cooperative Program) based on the birth certificate number.

To assess the representativeness of the birth records sampled, selected characteristics of mothers and infants in the

study sample were compared with those of all births occurring in NYC from January through December 2013 (Table 1).

Information abstracted from hospital medical records included selected data items on the U.S. Standard Facility Worksheet (FWS) (available from: https://www.cdc.gov/nchs/data/dvs/facwksBF04.pdf). The FWS is recommended by NCHS and the National Association for Public Health Statistics and Information Systems (NAPHSIS) for states to use to standardize collection of the 2003 birth certificate medical and health information. Items are categorized as continuous (referred to as noncheckbox items) and categorical (referred to as checkbox items). Continuous items have a range of possible values (e.g., values for the obstetric estimate of gestation range from 17 through 47, and 99 [unknown]), whereas the checkbox items have only three possible response categories, "yes" (condition reported), "no" (condition not reported), and "unknown." A value of "yes" for a checkbox item on the birth certificate indicates that the condition should be noted in the medical records.

Quality measurements and analyses

The primary measure used to evaluate birth certificate reporting for the noncheckbox items is the exact agreement (hereafter referred to as agreement). This measure is defined as the percentage of all births for which the values for a given item reported on the birth certificate and in the medical records agree. Categories of agreement are classified as: high (90.0%–100.0%), substantial (75.0%–89.9%), moderate (60.0%–74.9%), low (40.0%–59.9%), or extremely low (less than 40.0%) (Table A). This measure is also shown for the checkbox items.

The primary measure used to assess correspondence for checkbox items is the sensitivity or true positive rate (hereafter referred to as sensitivity), that is, the percentage of births with a condition indicated on the medical record (the "gold standard") that was also indicated on the birth certificate. The classification categories for sensitivity are the same as those for agreement (Table A).

Another, more conservative measure of agreement shown for the categorical checkbox variables is "Cohen's kappa" (kappa). For this study, kappa measures the percentage agreement of the number of births with a condition indicated by the birth certificate and medical record, adjusted for the percentage of agreement expected by chance, that is, the difference by which the observed agreement on the number of births with a condition exceeds chance agreement. Kappa scores are categorized consistent with Altman (21,22): high (0.81–1.00), substantial (0.61–0.80), moderate (0.41–0.60), fair (0.21–0.40), slight (0.01–0.20), chance (0.00), and worse than chance (negative score) (Table A).

The false discovery rate (FDR) is also calculated for checkbox items. The FDR represents the percentage of births with a condition indicated on the birth certificate that is not indicated on the medical record.

Another measure of data quality is the percentage of missing information either on the birth certificate or hospital medical records. This measure is calculated as the number of births with missing information on either the birth certificate, medical record, or both, per the total number of births for a given item.

Table A. Exact agreement, sensitivty or true positive rates, and Cohen's kappa scores

Category	Exact agreement and sensitivity or true positive rate scale
High	90.0–100.0
Substantial	75.0–89.9
Moderate	60.0–74.9
Low	40.0–59.9
Extremely low	Less than 40.0
	Cohen's kappa score scale
High	0.81–1.00
Substantial	0.61–0.80
Moderate	0.41–0.60
Fair	0.21–0.40
Slight	0.01–0.20
Chance	0.00
Worse than chance	Negative score

NOTES: Exact agreement and sensitivity rates are percentages. Kappa scores are categorized for consistency with Altman; see reference 21 in this report.

SOURCE: NCHS, National Vital Statistics System, Natality, 2013.

Records with missing information on either the birth certificate or the medical records were excluded from all measures of agreement used in this study (i.e., exact agreement, sensitivity, kappa, and FDR); see section, "Missing data" and Table 2.

This report includes a number of items that are recodes of one or more items: first trimester prenatal care (prenatal care beginning in the first 3 months of pregnancy, and based on the difference between the date of LMP and date of first prenatal visit); total number of prenatal care visits (within two visits); date LMP began (day) (within 2 days); preterm (LMP-based) (less than 37 completed weeks of gestation, and based on the difference between the date of the LMP and the date of birth); preterm (obstetric estimate-based); obstetric estimate of gestation (within 2 weeks); birthweight within 500 grams; low birthweight (less than 2,500 grams); and very low birthweight (less than 1,500 grams).

Items where the number of cases was fewer than 20 in the denominator were excluded from the analysis and are denoted with an asterisk (*). Items for which the numerator is five or less are denoted by a section mark (§) in both text and tables.

Information on items that have been dropped from national birth certificate reporting as the result of a collaborative review (e.g., meconium staining, fetal intolerance of labor) are not presented in this report (23).

Shortened item titles are used throughout the text and in figures and tables for ease in reading; full titles for all items are shown in the Technical Note Table.

Results

Characteristics of study sample

The distributions of births by maternal age and race and Hispanic origin of the study sample differed from those for all births occurring in NYC during the same time period (Table 1). The women in the study sample were more likely to be

non-Hispanic black, Hispanic, and under age 30. No significant differences were seen for women aged 40 and over or for the infant outcome measures preterm birth and low birthweight, between the sample and all births.

Missing data

Evaluation of concordance between the medical records and birth certificate should take into account proportions of missing data from either the birth certificate or the medical records for the specific item. The following is a discussion of missing data by type of item.

Pregnancy history—Percentages of missing data either on the birth certificate or hospital medical records were highest for the pregnancy history items, month and year of last other pregnancy outcome (42.3% and 28.7%, respectively), and month of last live birth (25.8%) (Table 2). Levels of missing data were low (less than 2%) for the number of previous live births now living and now dead. Information for the pregnancy history items was more often missing from the medical records than from the birth certificate.

Prenatal care and date of LMP—Level of missing data either on the birth certificate or hospital medical records was highest for total number of prenatal care visits (27.6%) (Table 2). Levels of missing data were also about 20% for all components of the date of the first prenatal visit. Data were much more likely to be missing from the medical records than from the birth certificate for all selected items (e.g., month of first prenatal visit was missing from 202 of 900 hospital records compared with 7 birth certificate records). Levels of missing data were approximately 14.0%–15.1% for the components of the date of LMP; all of the missing LMP information was for the medical records, that is, no LMP information was missing from birth certificate records.

For this study, computation of the recoded items, prenatal care beginning in the first trimester and the LMP-based gestational age at delivery, require complete information from other date-based items. The first trimester care requires information on both the complete date of the first prenatal visit and the complete date of the LMP; the LMP-based gestational age requires the complete date of the LMP and the complete date of birth. Accordingly, levels of unknown data for these derived items were higher than those for the individual items; see Table 2.

Number of previous cesareans, the obstetric estimate of gestational age, and birthweight—Levels of data missing on either the birth certificate or the medical record were low for the number of previous cesareans (2.1%), the obstetric estimate of gestational age (0.8%), and birthweight (1.2%).

All checkbox items—Levels of data missing on either the birth certificate or the medical record were low (less than 2%) for all of the checkbox items except gestational diabetes (2.4%) (Table 2).

Table B. Noncheckbox items, by level of agreement

Noncheckbox item
High
Obstetric estimate of gestation (within 2 weeks)†
Number of previous live births now dead
Birthweight within 500 grams†
Number of previous cesarean deliveries
Number of previous live births now living
Date last normal menses began (month)
Substantial
Obstetric estimate of gestation at delivery
Date of last live birth (month)
Date last normal menses began (day) (within 2 days)†
Total number of other pregnancy outcomes
Date last normal menses began (day)
Date of first prenatal care visit (month)
Moderate
Total number of prenatal care visits (within two visits)†
Birthweight (exact grams)
Date of last other pregnancy outcome (month)
Low
Date of first prenatal care visit (day)
Total number of prenatal care visits

†Recoded item.

NOTE: Levels of agreement are defined as follows: high (90.0%-100.0%), substantial (75.0%–89.9%), moderate (60.0%–74.9%), low (40.0%–59.9%), and extremely low (less than 40.0%).

SOURCE: NCHS, National Vital Statistics System, Natality, 2013.

Evaluation of noncheckbox items on the birth certificate

Exact agreement

Patterns of exact agreement for the noncheckbox items were also examined; see Table 3 and Table B. High levels of agreement of 95.0% and above were found for number of previous live births now dead (98.8%), number of previous cesarean deliveries (96.3%), and obstetric estimate of gestation within 2 weeks (99.6%). Agreement was at least 90.0% for number of previous live births now living (91.4%) and month LMP began (90.6%). (Note also levels of missing data for the gestational age items, Table 2.)

Agreement was found to be at least substantial (75.0% or higher) for obstetric estimate of gestation (exact weeks) (88.8%), month of last live birth (86.6%), total number of other pregnancy outcomes (80.6%), day LMP began (77.4%), and month of first prenatal visit (75.5%). Moderate agreement was found for birthweight (exact grams) (69.5%) and month of last other pregnancy outcome (61.4%) (Table 3). (Note also levels of missing data for the pregnancy history, gestational age, and prenatal care items, Table 2.)

Low agreement was found for day of first prenatal visit (58.8%) and total number of prenatal care visits (47.7%). (Note also levels of missing data for the prenatal care items, Table 2.)

Exact agreement for recoded items

Recoding of the continuous variables generally improved agreement between the birth certificate and the medical record; this effect was particularly evident for the number of prenatal visits and birthweight items (Table 3 and Table B). (See also section on "Missing data.") Whereas agreement for the exact number of prenatal visits was 47.7%, recoding visits to within

two visits increased agreement to 72.2%. Similarly, agreement for birthweight in exact grams was 69.5%, but recoding to birthweight within 500 grams and low birthweight (less than 2,500 grams) increased agreement to 98.8% and 92.2%, respectively.

Recoding also improved agreement levels for the detailed obstetric estimate of gestation from 88.8% for exact weeks to 99.6% for gestational age within 2 weeks.

Evaluation of checkbox items on the birth certificate

Agreement and Cohen's kappa scores—Agreement between the birth certificate and medical records (i.e., condition reported and condition not reported) for the majority of the checkbox items (about two-thirds) was 90% or greater (Table 4). Kappa scores were high (0.81 or greater) for previous cesarean delivery, vaginal/spontaneous and vaginal/vacuum delivery, and cesarean delivery. Kappa scores were substantial (0.61–0.80) for gestational diabetes, private insurance, Medicaid, breech presentation, and attempted trial of labor. Kappa scores of 0.01–0.40, suggesting slight to fair agreement were observed for gestational hypertension, previous preterm birth, augmentation of labor, steroids for fetal lung maturation, antibiotics received by the mother, antibiotics received by the newborn, maternal transfusion, assisted ventilation immediately after delivery, assisted ventilation more than 6 hours, self-pay, and infant breastfed at discharge.

Sensitivity rates—Among checkbox items, rates of sensitivity were high (at least 90.0%) for Medicaid, vaginal/spontaneous delivery, cephalic presentation, epidural or spinal anesthesia, cesarean delivery, infant breastfed at discharge, and infant living (Table 4 and Table C, and Figure 1). Sensitivity levels were substantial (75.0%–89.9%) for mother had a previous cesarean delivery, trial of labor attempted, and vaginal/vacuum delivery. Levels were at least moderate (60.0%–74.9%) for private insurance and breech presentation.

Ten of the 27 checkbox items reviewed had extremely low sensitivity levels (below 40.0%). These items were: gestational hypertension, previous preterm birth, augmentation of labor, steroids for fetal lung maturation, antibiotics received by the mother during labor, clinical chorioamnionitis, assisted ventilation immediately after delivery and for more than 6 hours, maternal transfusion, and antibiotics received by the newborn (note that steroids for fetal lung maturation, assisted ventilation for more than 6 hours, and maternal transfusion, sensitivity levels are based on five or fewer events in the numerator).

False discovery rates—Because of the small numbers for some items, reliable information on the FDRs was available for a more limited number of variables compared with the other quality measures (Table 4 and Figure 2). FDR levels, as with the other measures, varied by item. Six items had FDRs of 4% or less: previous cesarean delivery, Medicaid, cephalic presentation, vaginal/spontaneous delivery, cesarean delivery, and infant living (Table 4, Figure 2). The highest FDRs were seen for self-pay (61.5%) and assisted ventilation immediately after delivery (92.1%); both of these checkboxes had low to extremely low levels of sensitivity.

Table C. Checkbox items, by level of sensitivity

Checkbox item
High
Infant living at time of report
Method of delivery—Vaginal/spontaneous
Fetal presentation—Cephalic
Method of delivery—Cesarean
Source of payment—Medicaid
Infant breastfed at discharge
Epidural or spinal anesthesia during labor
Substantial
Mother had a previous cesarean delivery
Trial of labor attempted[1]
Method of delivery—Vaginal/vacuum
Moderate
Source of payment—Private insurance
Fetal presentation—Breech
Low
Diabetes—Gestational
NICU admission
Induction of labor
Hypertension—Prepregnancy
Source of payment—Self-pay
Extremely low
Clinical chorioamnionitis diagnosed during labor
Augmentation of labor
Hypertension—Gestational
Assisted ventilation immediately after delivery
Previous preterm birth
Steroids for fetal lung maturation prior to delivery[§]
Antibiotics received by the mother during labor
Antibiotics received by the newborn
Assisted ventilation more than 6 hours[§]
Maternal transfusion[§]

[§] Figure may not be reliable; numerator less than or equal to 5.

[1]Includes births for which the medical record or the birth certificate indicates a cesarean delivery was performed.

NOTES: Levels of sensitivity are defined as follows: high (90.0%–100.0%), substantial (75.0%–89.9%), moderate (60.0%–74.9%), low (40.0%–59.9%), and extremely low (less than 40.0%). NICU is neonatal intensive care unit.

SOURCE: NCHS, National Vital Statistics System, Natality, 2013.

Exact agreement and sensitivity by hospital

Agreement was high or substantial among each of the five hospitals examined for several of the noncheckbox items: number of previous live births now living and number now dead, month of last live birth, number of previous cesareans, month of LMP, and obstetric estimate of gestation (exact weeks) (Table 5). The level of exact agreement for the day of the first prenatal visit was less favorably and less consistently reported across hospitals—agreement levels ranged from 25.8% to 83.8% (three of the five hospitals showed moderate agreement or better for this item). Agreement levels for the number of prenatal visits ranged widely across hospitals (10.2% to 85.6%) with extremely low levels of agreement observed for three hospitals, but moderate and substantial agreement for two hospitals.

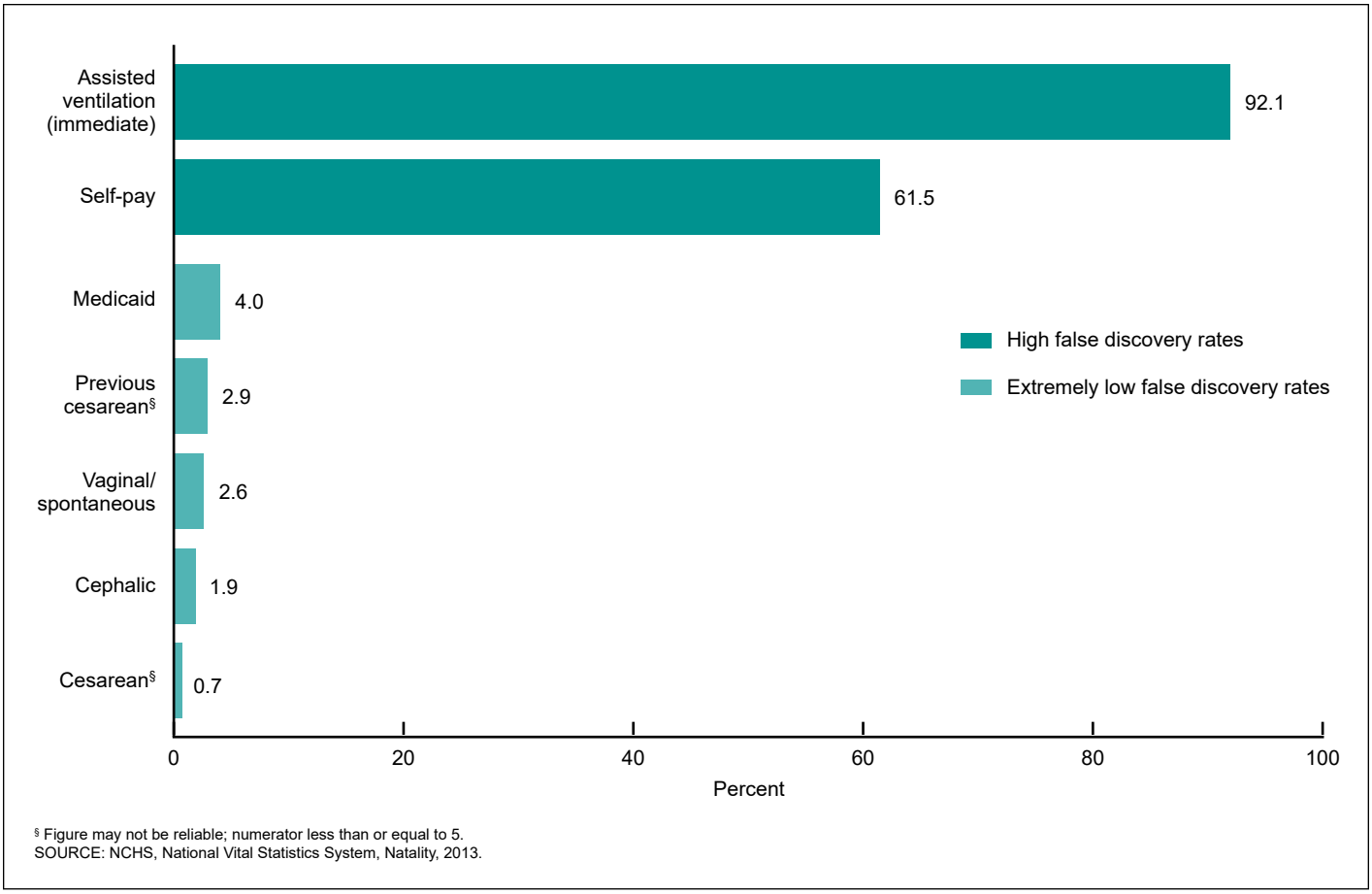


Figure 2. Selected items with lowest and highest false discovery rates

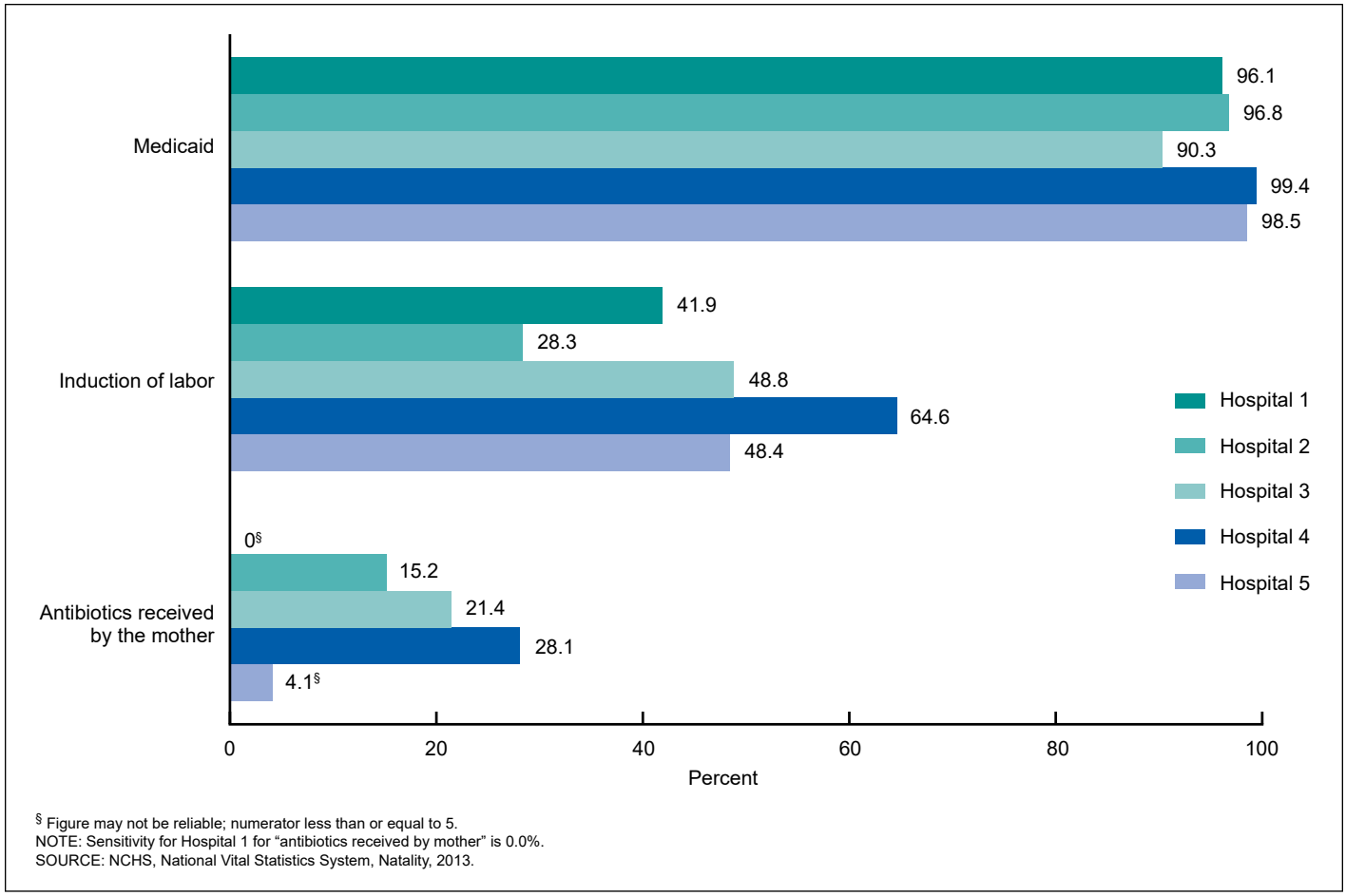
Among the limited number of checkbox items (11) for which numbers were large enough to calculate reliable rates, sensitivity was high or substantial among all five hospitals for Medicaid, epidural or spinal anesthesia, cephalic presentation, vaginal/spontaneous delivery, cesarean delivery, infant living, and infant breastfed (Table 6 and Figure 3). Sensitivity was low or extremely low among all five hospitals for augmentation of labor and antibiotics received by the mother during labor. Greater variability was seen for other items by hospital. For example, the level of sensitivity for induction of labor ranged from 28.3% to 64.6% with sensitivity moderate for one of the five hospitals, low for three hospitals, and extremely low for the remaining hospital.

Discussion

This study of NYC data based on the 2003 birth certificate revision found wide variation in data quality by item and by hospital. Levels of exact agreement or sensitivity between birth certificate and medical records data were high for a number of items (e.g., number of previous cesareans, cesarean delivery, obstetric estimate of gestation [within 2 weeks], and Medicaid), but extremely low for a number of other items (e.g., gestational hypertension, previous preterm birth, and augmentation of labor). Levels of agreement or sensitivity for several items fell within these two extremes (e.g., obstetric estimate of gestation at delivery [exact number of weeks], previous cesarean delivery, private insurance as the source of payment for delivery, and total number of prenatal care visits [within two visits]).

Item data quality also differed by hospital. Whereas several items were consistently well reported across the five hospitals studied (e.g., number of previous cesarean deliveries and obstetric estimate of gestation), other items such as augmentation of labor and antibiotics received by the mother consistently had extremely low agreement or sensitivity across hospitals (Table 5). For several items, data quality varied widely by hospital; for example, levels of agreement for the number of prenatal visits ranged from 10.2% to 85.6%, and sensitivity levels for induction of labor ranged from 28.3% to 64.6%.

Underreporting and misreporting—Underreporting of health conditions is considered a primary limitation of birth certificate data (7,8). Accordingly, the primary statistical measure used in this study to assess underreporting of the categorical variables is sensitivity. Misreporting of information on the birth certificate may also be an issue, however, and FDRs are calculated to assess potential misreporting of the categorical data items. This measure should also be taken into account to assess the quality of a given checkbox item. Higher-than-expected FDRs, even where sensitivity is substantial or better, can be of concern. For example, the relatively high FDRs for epidural or spinal anesthesia (16.3%), trial of labor (17.4%), and breastfeeding (17.0%) indicate that this information was more often reported



§ Figure may not be reliable; numerator less than or equal to 5.
NOTE: Sensitivity for Hospital 1 for "antibiotics received by mother" is 0.0%.
SOURCE: NCHS, National Vital Statistics System, Natality, 2013.

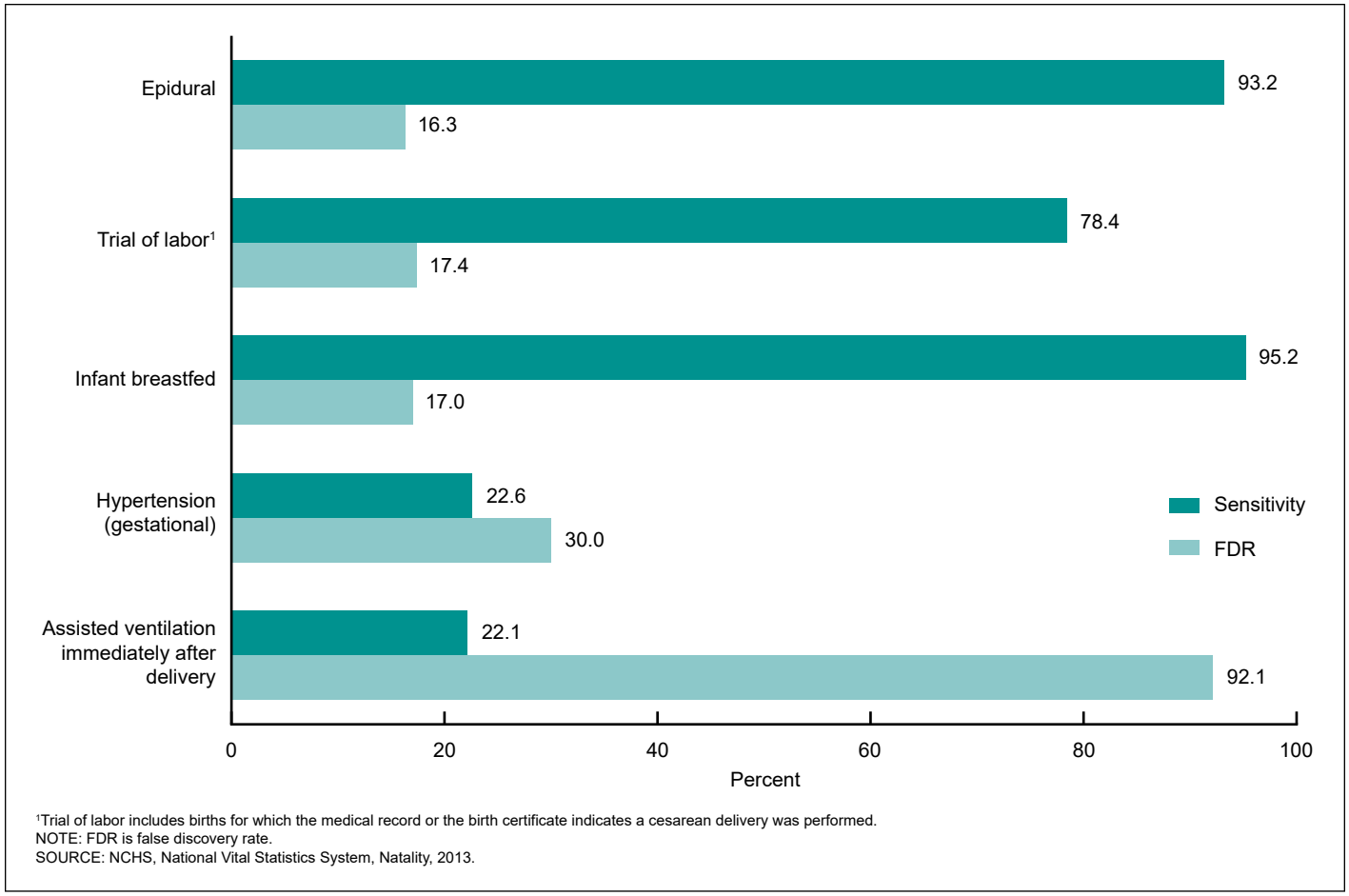
Figure 3. Sensitivity for selected checkbox items, by hospital

for the birth certificate than in the medical records, suggesting that hospital personnel are either misinterpreting the medical records or gathering information from other sources (i.e., the mother, other familial informant, or clinical staff) (Figure 4) (24–28). The FDR findings for these specific items were similar to the earlier validity study (20).

Extremely low sensitivity combined with a high FDR as seen, for example, for gestational hypertension and assisted ventilation immediately after delivery suggests that improved training may be necessary for hospital staff to accurately report this information, or that it may not be feasible to collect high-quality data for certain items for the birth certificate.

Missing data and the use of sources other than the medical record—Levels of missing data differed widely between the medical records and the birth certificate for several pregnancy history and prenatal care items: components of the date of last live birth, components of the date of first prenatal care visit, and the number of prenatal visits (Table 2). The month prenatal care began, for example, was missing in 22.4% of the medical records compared with only 0.8% of birth certificates. Reasons for differences in missing values between the medical records and the birth certificate data include 1) the fact that the mother's prenatal care records were not available for this study's abstractors for nearly one-third of the 900 births for which records were reviewed (e.g., the records may have been available at the time of delivery for completion of the birth certificate information but had been archived by the time this study was fielded and were not made available for review), and 2) information directly from the mother may sometimes have been used to complete the birth certificate instead of the mother's medical records as recommended. An NCHS study based on interviews with hospital staff in 2009–2010 found that whereas most of the medical and health information collected for the birth certificate was gathered by a clinician or by the birth information specialist using the hospital medical records (28), the mother was often the source of the pregnancy history and prenatal care information. (Note the national recommendations are for most of the medical and health and pregnancy history and prenatal information to be gathered by hospital staff using the mother's prenatal care records) (24–28).

Levels of missing data for the checkbox items, in contrast to the pregnancy history items, were low for both the medical records and birth certificate data. Information was somewhat more likely to be missing, however, from the hospital medical records. The reasons for this difference are not clear, but may also result from hospital staff gathering information from the mother when it is not available in the medical records (in contradiction to recommendations). This discrepancy may also result from the clinical hospital staff providing the information for the birth certificate but neglecting to update the medical record (e.g., the birth information specialist might get the information directly



[1]Trial of labor includes births for which the medical record or the birth certificate indicates a cesarean delivery was performed.
NOTE: FDR is false discovery rate.
SOURCE: NCHS, National Vital Statistics System, Natality, 2013.

Figure 4. Sensitivity and false discovery rates for selected checkbox items

from the labor and delivery nurse). In contrast to the impact on the pregnancy history items, the small difference in levels of missing data between sources for checkbox items should have minimal, if any, impact on study results.

Comparison with earlier validity study of birth certificate data—These findings are consistent with those of an earlier validity study fielded in two states during 2009–2011, which similarly assessed the quality of the 2003 revision-based data by comparing birth certificate data with information abstracted from hospital medical records.

Findings among the two states (not identified) and NYC were also often consistent for specific data items (20). That is, a number of items with high agreement or sensitivity in the previous study (e.g., obstetric estimate of gestation [within 2 weeks], number of previous live births now living and now dead, cephalic presentation, vaginal/spontaneous delivery, cesarean delivery) were found to be of high quality in the current study. See Table D and Table E for a summary of findings from the three reporting areas. Similarly, several items were found to have consistently low or extremely low agreement or sensitivity across the three reporting areas (e.g., total number of prenatal visits, gestational diabetes, gestational hypertension, and previous preterm birth).

The quality of a few items, however, was inconsistent across studies. For example, sensitivity for Medicaid as the source of payment for the delivery was high in the NYC results, but only substantial and moderate in the two states in the earlier study (20). Similarly, the quality for information on neonatal intensive care unit admission was low in the current NYC review and for one of the reporting areas for the earlier study, but was high for the other area.

The reasons for the differences in results by reporting area may be explained by the hospitals selected for study (hospitals were purposely chosen to have various levels of birth data quality), the differences in the sampling methods used, and sample sizes (20). Differences in jurisdictional data quality review and outreach, training of hospital staff, and hospital-specific reporting procedures may also play a role.

Limitations—This study has a number of limitations. The use of the hospital medical records as the "gold standard" assumes that these records are available for review and that information in these records is complete. Such may not always be the case. As noted previously, the lack of availability of a substantial percentage of prenatal care records for abstractor review (note that such records may have been available for the hospital staff to complete the birth record at delivery) was a particular concern for this study and compromised estimates of agreement for the pregnancy history and prenatal care items. However, despite the higher levels of missing data, the source of pregnancy history information from the birth certificate is uncertain, and the medical record should be considered the preferred standard for this study.

Table D. Noncheckbox items, by level of agreement and by reporting area

Noncheckbox item	Level of agreement		
	State A[1]	State B[1]	New York City
High agreement			
Birthweight (grams) (within 500 g)†	High	High	High
Obstetric estimate of gestation (within 2 weeks)†	High	High	High
Date last normal menses began (month)	High	High	High
Number of previous live births now dead	High	High	High
Number of previous live births now living	High	High	High
Number of previous cesarean deliveries	High	High	High
Substantial or greater agreement			
Date of last live birth (month)	High	Substantial	Substantial
Date last normal menses began (day) (witin 2 days)†	High	Substantial	Substantial
Total number of other pregnancy outcomes	Substantial	Substantial	Substantial
Date of first prenatal care visit (month)	Substantial	Substantial	Substantial
Other combinations			
Birthweight (exact grams)	High	High	Moderate
Obstetric estimate of gestation at delivery (exact)	High	Moderate	Substantial
Date last normal menses began (day)	Substantial	Moderate	Substantial
Total number of prenatal care visits (within two visits)†	Substantial	Moderate	Moderate
Date of first prenatal care visit (day)	Moderate	Moderate	Low
Date of last other pregnancy outcome (month)	Moderate	Low	Moderate
Low or extremely low agreement			
Total number of prenatal care visits	Low	Extremely low	Low

† Recoded item.
[1]See reference 20 in this report.

NOTE: Levels of agreement within states are defined as follows: high (90.0%–100.0%), substantial (75.0%–89.9%), moderate (60.0%–74.9%), low (40.0%–59.9%), and extremely low (less than 40.0%).

SOURCE: NCHS, National Vital Statistics System, Natality, 2013.

The study sample size, while larger than that of the earlier validity studies in two states, did not allow for hospital-level analysis of many less frequently reported data items—such analysis can inform our understanding of an item's potential for improvement (i.e., if the item can be well reported in at least one hospital, the assumption is that it can be well reported in all). The sample size was also not large enough to allow for collection of many of the more rarely occurring health items on the birth certificate (e.g., use of infertility therapy, infections during pregnancy, and most of the maternal morbidities).

The generalizability of these study results is limited because of its restriction to one vital statistics reporting area and to five hospitals within the reporting area. Hospitals were purposely selected to have varying characteristics (volume of births, setting, type, and data quality), and not to be representative of all hospitals in the jurisdiction. Accordingly, the maternal characteristics of the study sample differed from those of all mothers who gave birth in the city during the time period (infant outcomes were more closely representative of all NYC births) (Table 1). Some differences in item response categories or formatting between the U.S. standard birth certificate and that for NYC may also affect the generalizability of these findings. For example, the NYC birth certificate includes additional response categories for "Infant breastfed before discharge" not included on the U.S. standard (29). Although these additional categories can be collapsed into the U.S. standard categories (yes or no), the differences may positively (or negatively) impact item reporting. Despite these potential limitations for generalizability, the consistency of the findings of this report with those of the earlier validity study in two states (20) suggests that these results may be applicable beyond NYC.

Finally, this study was conducted in 2013 prior to the implementation of several local and national efforts to improve data quality and may not accurately reflect the quality of more current birth certificate data.

Data quality improvement efforts—Since 2013, NCHS has collaborated on a number of projects to improve the quality of birth certificate data. During 2014–2015, the Birth Data Quality Workgroup (BDQWG), a collaboration among NCHS, NAPHSIS, and individual state and jurisdictional vital statistics partners, undertook a comprehensive effort to review nonperforming items on the standard birth certificate. As a result of this effort, 12 nonperforming items were dropped from the national birth data file (23). (The findings of the earlier validity study[20] informed these changes.)

In 2017, NCHS released the first birth e-learning training course, "Applying Best Practices for Reporting Medical and Health Information on Birth Certificates." The course, also developed via the collaborative BDQWG, is designed for both clinical and nonclinical hospital staff. It presents the latest national guidelines for reporting birth information and offers continuing education credits and a certificate of completion (30). A promotional tool kit for the training developed for the vital statistics jurisdictions is also available (31).

In conjunction with the release of the new birth e-learning training, NCHS redesigned and updated, the "Guide to Completing

Table E. Checkbox items, by level of sensitivity, and by reporting area

Checkbox item	Level of sensitivity		
	State A[1]	State B[1]	New York City
High sensitivity			
Infant living at time of report	High	High	High
Method of delivery—Cesarean	High	High	High
Fetal presentation—Cephalic	High	High	High
Method of delivery—Vaginal/spontaneous	High	High	High
Infant breastfed at discharge	High	High	High
Substantial or greater sensitivity			
Epidural or spinal anesthesia during labor	High	Substantial	High
Other combinations			
NICU admission	High	Low	Low
Trial of labor attempted	Substantial	Moderate	Substantial
Induction of labor	Substantial	Low	Low
Source of payment—Private insurance	Substantial	Substantial	Moderate
Mother had a previous cesarean delivery	Substantial	Moderate	Substantial
Source of payment—Medicaid	Substantial	Moderate	High
Antibiotics received by the newborn for suspected neonatal sepsis	Substantial	Extremely low	Extremely low
Augmentation of labor	Moderate	Extremely low	Extremely low
Assisted ventilation immediately after delivery	Moderate	Extremely low	Extremely low
Antibiotics received by the mother during labor	Moderate	Extremely low	Extremely low
Low or extremely low sensitivity			
Diabetes—Gestational	Low	Low	Low
Hypertension—Gestational	Low	Extremely low	Extremely low
Previous preterm birth	Extremely low	Extremely low	Extremely low

[1]See reference 20 in this report.

NOTES: NICU is neonatal intensive care unit. Levels of agreement within states are defined as follows: high (90.0%–100.0%), substantial (75.0%–89.9%), moderate (60.0%–74.9%), low (40.0%–59.9%), and extremely low (less than 40.0%).

SOURCE: NCHS, National Vital Statistics System, Natality, 2013.

the Facility Worksheets for the Certificate of Live Birth and Report of Fetal Death" (13). The Guide includes detailed definitions and reporting instructions for the birth certificate medical and health items. For example, instructions and definitions for reporting information on prenatal care items and on the obstetric estimate of gestation have been expanded. To date, approximately 5,000 hard copies of the new Guide have been distributed to states and hospitals across the country. The Guide is also available from: https://www.cdc.gov/nchs/data/dvs/GuidetoCompleteFacilityWks.pdf.

NCHS and NAPHSIS continue to collaborate on the development of national standards for the automatic transfer of medical and health birth certificate data directly from hospital electronic records to state electronic birth registration systems (32) using HL7 and Integrating the Healthcare Enterprise-based standards; pilot projects have been undertaken. NCHS continues work to update and improve these standards and to evaluate birth and death data transferred from electronic hospital records.

Finally, the BDQWG is currently undertaking an effort to review the 2003 U.S. Standard Certificate of Live Birth and develop recommendations, where appropriate, for modifications to items collected for the national birth data file. It is also collaborating with NAPHSIS to promote use of the new birth e-learning training in hospitals across the country.

Conclusions

This study confirms the findings of an earlier report on the validity of birth data (20) that found wide differences in data quality by item and by state. Many findings on the data quality of specific items were also consistent between studies. Additional studies will also be helpful to carefully vet the quality of data generated from the new systems being developed for the automatic transfer of data from electronic medical records to electronic birth registration systems.

As of January 1, 2016, all vital statistics jurisdictions reported birth data based on the 2003 birth certificate revision. This study further demonstrates that birth certificate data are a reliable source for some health-related data elements, but that underreporting of many items occurred even with the recommended change to standardize worksheets, encouraging collection of data from the best sources, and the availability of detailed item definitions and instructions. The quality of these data should increase as the many current improvement efforts take effect, but further study will be needed to assess the impact of these efforts and to identify those items for which reporting can be adequately improved and those for which it cannot. In the interim, understanding and acknowledging the strengths and weaknesses of these data are essential for responsible use.

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Table 1. Characteristics of study sample and of all births occurring in New York City during the same time period, by selected demographic and health characteristics

Characteristic of mother	Study sample[1]		Total[2]	
	n	Percent	*n*	Percent
Race and Hispanic origin				
All races and origins[3]	900	100.00	120,457	100.00
Non-Hispanic				
White[4]	155	††17.26	36,707	31.50
Black[4]	280	††31.18	23,800	20.43
Hispanic[5]	309	††34.41	35,581	30.42
Age (years)				
Under 20	55	††6.11	5,046	4.19
20–24	212	††23.56	21,083	17.50
25–29	257	††28.56	30,487	25.31
30–34	210	††23.33	35,401	29.39
35–39	123	††13.67	21,819	18.11
40 and over	43	4.78	6,619	5.49
Characteristic of infant				
Preterm[6]	66	7.33	10,798	8.96
Low birthweight[7]	75	8.33	10,208	8.47

†† Difference significant at $p = 0.05$.
[1]Random sample of 15 births per month (birth date) per hospital from January through December 2013 for a total of 180 records per hospital.
[2]All births occurring in New York City from January through December 2013.
[3]Includes other races not shown and origin not stated.
[4]Race and Hispanic origin are reported separately on the birth certificate. Race categories are consistent with the 1997 Office of Management and Budget standards; see reference 28 in this report. Data by race are non-Hispanic and exclude mothers reporting multiple races.
[5]Includes all persons of Hispanic origin of any race.
[6]Born prior to 37 completed weeks of gestation.
[7]Birthweight of less than 2,500 grams (5 lb 8 oz).

SOURCE: NCHS, National Vital Statistics System, Natality, 2013.

Table 2. Records for which specified items are not stated, by source

Item	Total records	Number not stated			Percentage not stated[1]
		Medical record	Birth Certificate	Both	
Noncheckbox items					
Pregnancy history					
Number of previous live births now living	900	11	2	–	1.4
Number of previous live births now dead	900	13	3	–	1.8
Date of last live birth (month)	900	218	28	14	25.8
Date of last live birth (year)	900	98	12	4	11.8
Total number of other pregnancy outcomes	900	56	4	–	6.7
Date of last other pregnancy outcome (month)	900	361	159	139	42.3
Date of last other pregnancy outcome (year)	900	219	110	71	28.7
Prenatal care					
Date of first prenatal care visit (month)	900	202	7	4	22.8
Date of first prenatal care visit (day)	900	237	7	4	26.7
Date of first prenatal care visit (year)	900	203	7	4	22.9
First trimester prenatal care	900	317	7	4	35.6
Total number of prenatal care visits	900	247	7	6	27.6
Number of previous cesarean deliveries	900	15	4	–	2.1
Gestational age					
Date last normal menses began (month)	900	126	–	–	14.0
Date last normal menses began (day)	900	136	–	–	15.1
Date last normal menses began (year)	900	126	–	–	14.0
LMP-based gestation at delivery	900	155	–	–	17.2
Obstetric estimate of gestation at delivery	900	7	–	–	0.8
Birthweight (grams)	900	11	–	–	1.2
Checkbox items					
Pregnancy risk factors					
Diabetes (gestational)	900	19	3	–	2.4
Hypertension (prepregnancy)	900	6	3	–	1.0
Hypertension (gestational)	900	5	3	–	0.9
Previous preterm birth	900	7	3	–	1.1
Mother had a previous cesarean delivery	900	2	3	–	0.6
Source of payment for this delivery	900	10	7	1	1.8
Characteristics of labor and delivery					
Induction of labor	900	11	–	–	1.2
Augmentation of labor	900	5	–	–	0.6
Steroids for fetal lung maturation prior to delivery	900	17	–	–	1.9
Antibiotics received by the mother during labor	900	6	–	–	0.7
Clinical chorioamnionitis diagnosed during labor	900	11	–	–	1.2
Epidural or spinal anesthesia during labor	900	9	–	–	1.0
Fetal presentation at birth	900	8	–	–	0.9
Final route and method of delivery	900	5	–	–	0.6
Maternal morbidity					
Maternal transfusion	900	7	1	–	0.9
Abnormal conditions of the newborn					
Assisted ventilation immediately after delivery	900	4	–	–	0.4
Assisted ventilation more than 6 hours	900	4	–	–	0.4
NICU admission	900	5	–	–	0.6
Antibiotics received by the newborn	900	6	–	–	0.7
Infant living at time of report	900	10	–	–	1.1
Infant being breastfed at discharge	900	4	3	–	0.8

– Quantity zero.

[1]The percentage of records with a not stated or missing value for at least one source (the number of not stated on the medical record plus the number of not stated on the birth certificate minus the number of not stated on both, per the total number of records).

NOTES: LMP is last normal menses. NICU is neonatal intensive care unit.

SOURCE: NCHS, National Vital Statistics System, Natality, 2013.

Table 3. Exact agreement for noncheckbox items

Noncheckbox item	Exact agreement (n = 900)	
	Number[1]	Percent
Pregnancy history		
Number of previous live births now living	811 / 887	91.4
Number of previous live births now dead	873 / 884	98.8
Date of last live birth (month)	316 / 365	[2]86.6
Total number of other pregnancy outcomes	677 / 840	[2]80.6
Date of last other pregnancy outcome (month)	43 / 70	[2]61.4
Prenatal care		
Date of first prenatal care visit (month)	525 / 695	[2]75.5
Date of first prenatal care visit (day)	388 / 660	[2]58.8
First trimester prenatal care†	295 / 385	[2]76.6
Total number of prenatal care visits	311 / 652	[2]47.7
Total number of prenatal care visits (within two visits)†	471 / 652	[2]72.2
Number of previous cesarean deliveries	848 / 881	96.3
Gestational age		
Date last normal menses began (month)	701 / 774	[2]90.6
Date last normal menses began (day)	591 / 764	[2]77.4
Date last normal menses began (day) (within 2 days)†	621 / 764	[2]81.3
Preterm (LMP based)†[3]	63 / 94	[2]67.0
Obstetric estimate of gestation at delivery	793 / 893	88.8
Obstetric estimate of gestation (within 2 weeks)†	889 / 893	99.6
Preterm (obstetric estimate based)†[4]	64 / 72	88.9
Birthweight (exact grams)	618 / 889	69.5
Birthweight within 500 grams†	878 / 889	98.8
Low birthweight†[5]	71 / 77	92.2

† Recoded item.
[1]Number of records for which value on birth certificates and medical records agree, per total records.
[2]Level of missing or unknown values greater than 5%.
[3]Born prior to 37 completed weeks of gestation based on the date the last normal menses began.
[4]Born prior to 37 completed weeks of gestation based on the obstetric estimate.
[5]Less than 2,500 grams (5 lb 8 oz).

NOTE: LMP is last normal menses.

SOURCE: NCHS, National Vital Statistics System, Natality, 2013.

Table 4. Agreement, Cohen's kappa, sensitivity, and false discovery rate for selected checkbox items

Checkbox item	Exact agreement (n = 900)			Sensitivity (n = 900)		FDR (n = 900)	
	Number[1]	Percent	Kappa	Number BC/MR[2]	Percent	Number[3]	Percent
Pregnancy risk factors							
Diabetes—Gestational	845 / 878	96.2	0.63	31 / 52	59.6	12 / 43	27.9
Hypertension—Prepregnancy	873 / 891	98.0	0.58	13 / 29	44.8	*	*
Hypertension—Gestational	838 / 892	93.9	0.31	14 / 62	22.6	6 / 20	30.0
Previous preterm birth	846 / 890	95.1	0.32	11 / 52	21.2	*	*
Mother had a previous cesarean delivery	865 / 895	96.6	0.88	135 / 161	83.9	4 / 139	††2.9
Source of payment for this delivery							
Private insurance	842 / 884	95.2	0.77	83 / 111	74.8	14 / 97	14.4
Medicaid	826 / 884	93.4	0.75	716 / 744	96.2	30 / 746	4.0
Self-pay	853 / 884	96.5	0.38	10 / 25	40.0	16 / 26	61.5
Characteristics of labor and delivery							
Induction of labor	730 / 889	82.1	0.44	97 / 209	46.4	47 / 144	32.6
Augmentation of labor	570 / 895	63.7	0.22	103 / 408	25.2	20 / 123	16.3
Steroids for fetal lung maturation prior to delivery	860 / 883	97.4	§0.26	4 / 25	§16.0	*	*
Antibiotics received by the mother during labor	500 / 894	55.9	0.12	60 / 448	13.4	6 / 66	9.1
Clinical chorioamnionitis diagnosed during labor	852 / 889	95.8	0.44	16 / 53	30.2	*	*
Epidural or spinal anesthesia during labor	737 / 891	82.7	0.56	576 / 618	93.2	112 / 688	16.3
Fetal presentation at birth							
Cephalic	862 / 892	96.6	0.59	839 / 853	98.4	16 / 855	1.9
Breech	870 / 892	97.5	0.64	21 / 34	61.8	9 / 30	30.0
Final route and method of delivery							
Vaginal/spontaneous	873 / 895	97.5	0.95	571 / 578	98.8	15 / 586	2.6
Vaginal/vacuum	881 / 895	98.4	0.81	32 / 41	78.0	5 / 37	††13.5
Cesarean	886 / 895	99.0	0.98	268 / 275	97.5	2 / 270	††0.7
Trial of labor attempted[4]	214 / 251	85.3	0.69	76 / 97	78.4	16 / 92	17.4
Maternal morbidities							
Maternal transfusion	873 / 892	97.9	§0.09	1 / 20	§5.0	*	*
Abnormal conditions of the newborn							
Assisted ventilation immediately after delivery	805 / 896	89.8	0.07	6 / 27	22.2	70 / 76	92.1
Assisted ventilation more than 6 hours	859 / 896	95.9	§0.21	5 / 41	§12.2	*	*
NICU admission	808 / 895	90.3	0.58	74 / 150	49.3	11 / 85	12.9
Antibiotics received by the newborn	801 / 894	89.6	0.19	13 / 104	12.5	*	*
Infant living at time of report	880 / 890	98.9	0.00	880 / 880	100.0	10 / 890	1.1
Infant breastfed at discharge	721 / 893	80.7	0.26	673 / 707	95.2	138 / 811	17.0

* Figure does not meet standards of reliability. Figure may not be precise denominator is less than 20.
§ Figure may not be reliable; numerator is less than or equal to five.
[1]Number of records for which value on birth certificates and medical records agree, per total records.
[2]Number of records where the condition was indicated on both the birth certificate (BC) and medical record (MR), per the total number the condition was indicated on the MRs.
[3]Number of records the condition was indicated on the BC, but not on the MRs per the total number the condition was indicated on the BC.
[4]Includes births for which the MR or the BC indicates a cesarean delivery was performed.

NOTES: FDR is false discovery rate. NICU is neonatal intensive care unit.

SOURCE: NCHS, National Vital Statistics System, Natality, 2013.

Table 5. Exact agreement for noncheckbox items, by hospital

Noncheckbox item	Hospital									
	1 (*n* = 180)		2 (*n* = 180)		3 (*n* = 180)		4 (*n* = 180)		5 (*n* = 180)	
	Number[1]	Percent	Number[1]	Percent	Number[1]	Percent	Number[1]	Percent	Number[1]	Percent
Pregnancy history										
Number of previous live births now living	162 / 178	91.0	171 / 179	95.5	148 / 176	84.1	163 / 178	91.6	167 / 176	94.9
Number of previous live births now dead	176 / 179	98.3	179 / 179	100.0	170 / 172	98.8	174 / 178	97.8	174 / 176	98.9
Date of last live birth (month)	56 / 65	86.2	68 / 75	90.7	62 / 76	81.6	63 / 72	87.5	67 / 77	87.0
Total number of other pregnancy outcomes	132 / 177	74.6	155 / 175	88.6	127 / 159	79.9	122 / 169	72.2	141 / 160	88.1
Prenatal care										
Date of first prenatal care visit (month)	100 / 126	79.4	72 / 126	57.1	152 / 162	93.8	131 / 165	79.4	70 / 116	60.3
Date of first prenatal care visit (day)	80 / 125	64.0	25 / 97	25.8	134 / 160	83.8	109 / 165	66.1	40 / 113	35.4
First trimester prenatal care	53 / 70	75.7	56 / 79	70.9	62 / 68	91.2	68 / 84	81.0	56 / 84	66.7
Total number of prenatal care visits	82 / 123	66.7	9 / 88	10.2	143 / 167	85.6	65 / 167	38.9	12 / 107	11.2
Number of previous cesarean deliveries	170 / 173	98.3	170 / 177	96.0	161 / 175	92.0	172 / 178	96.6	175 / 178	98.3
Gestational age										
Date last normal menses began (month)	134 / 146	91.8	163 / 178	91.6	142 / 157	90.4	158 / 174	90.8	104 / 119	87.4
Date last normal menses began (day)	119 / 143	83.2	138 / 176	78.4	128 / 156	82.1	149 / 174	85.6	57 / 115	49.6
Obstetric estimate of gestation at delivery	164 / 177	92.7	148 / 180	82.2	162 / 178	91.0	151 / 180	83.9	168 / 178	94.4
Birthweight (grams)	164 / 180	91.1	125 / 179	69.8	152 / 176	86.4	142 / 179	79.3	35 / 175	20.0

[1]Number of records for which value on birth certificates and medical records agree, per total records.

SOURCE: NCHS, National Vital Statistics System, Natality, 2013.

Table 6. Sensitivity for selected checkbox items, by hospital

Checkbox item	Hospital									
	1 (*n* = 180)		2 (*n* = 180)		3 (*n* = 180)		4 (*n* = 180)		5 (*n* = 180)	
	Number BC/MR[1]	Percent	Number BC/MR[1]	Percent	Number BC/MR[1]	Percent	Number BC/MR[1]	Percent	Number BC/MR[1]	Percent
Pregnancy risk factors										
Mother had a previous cesarean delivery	21 / 25	84.0	31 / 35	88.6	21 / 33	63.6	31 / 36	86.1	31 / 32	96.9
Source of payment for this delivery										
Medicaid	147 / 153	96.1	120 / 124	96.8	140 / 155	90.3	176 /1 77	99.4	133 / 135	98.5
Characteristics of labor and delivery										
Induction of labor	18 / 43	41.9	13 / 46	28.3	20 / 41	48.8	31 / 48	64.6	15 / 31	48.4
Augmentation of labor	9 / 89	10.1	18 / 109	16.5	23 / 70	32.9	25 / 70	35.7	28 / 70	40.0
Antibiotics received by the mother during labor	0 / 104	§0.0	17 / 112	15.2	15 / 70	21.4	25 / 89	28.1	3 / 73	§4.1
Epidural or spinal anesthesia during labor	98 /108	90.7	151 / 152	99.3	85 / 104	81.7	118 / 123	95.9	124 / 131	94.7
Fetal presentation at birth										
Cephalic	172 / 173	99.4	171 / 173	98.8	163 / 172	94.8	169 / 170	99.4	164 / 165	99.4
Final route and method of delivery										
Vaginal/spontaneous	120 / 120	100.0	101 / 103	98.1	103 / 106	97.2	123 / 125	98.4	124 / 124	100.0
Cesarean	57 / 58	98.3	62 / 64	96.9	53 / 57	93.0	52 / 52	100.0	44 / 44	100.0
Infant living at time of report	180 / 180	100.0	178 / 178	100.0	173 / 173	100.0	176 / 176	100.0	173 / 173	100.0
Infant being breastfed at discharge	123 / 135	91.1	152 / 153	99.3	135 / 143	94.4	162 / 165	98.2	101 / 111	91.0

§ Figure may not be reliable; numerator is less than or equal to five.
[1]Number the condition was indicated on both the birth certificate (BC) and the medical record (MR), per the total number the condition was indicated on the MRs.

SOURCE: NCHS, National Vital Statistics System, Natality, 2013.

Technical Note

Table. Item title key

Full item name	Abbreviated item name
Total number of prenatal care visits for this pregnancy	Number of prenatal care visits
Last normal menses	LMP
Diabetes—Gestational	Gestational diabetes
Hypertension—Gestational	Gestational hypertension
Mother had a previous cesarean delivery	Previous cesarean
Mother had a previous cesarean delivery—If yes, how many?	Number of previous cesarean deliveries
Principal source of payment for this delivery—Private insurance	Private insurance
Principal source of payment for this delivery—Medicaid	Medicaid
Principal source of payment for this delivery—Self-pay	Self-pay
Induction of labor	Labor induction
Steroids (glucocorticoids) for fetal lung maturation received by the mother prior to delivery	Steroids for fetal lung maturation
Clinical chorioamnionitis diagnosed during labor or maternal temperature greater than or equal to 38ºC (100.4ºF)	Clinical chorioamnionitis, Chorioamnionitis
Antibiotics received by the mother during labor	Antibiotics—Mother, Antibiotics received by the mother
Epidural or spinal anesthesia during labor	Epidural or anesthesia, Epidural or spinal anesthesia
Fetal presentation at birth—Cephalic	Cephalic presentation, Cephalic
Fetal presentation at birth—Breech	Breech presentation
Final route and method of delivery—Vaginal or spontaneous	Vaginal or spontaneous
Final route and method of delivery—Vaginal or vacuum	Vaginal or vacuum
Final route and method of delivery—Cesarean	Cesarean delivery, Cesarean
If cesarean, was a trial of labor attempted?	Trial of labor attempted, Trial of labor
Obstetric estimate of gestation	Obstetric estimate
Assisted ventilation required immediately following delivery	Assisted ventilation immediately after delivery, Assisted ventilation (used when referring to both assisted ventilation items), Assisted ventilation—Immediate
Assisted ventilation required for more than 6 hours	Assisted ventilation more than 6 hours
Neonatal intensive care unit	NICU
Antibiotics received by the newborn for suspected neonatal sepsis	Antibiotics received by the newborn, Antibiotics—Newborn
Is infant living at time of report?	Infant living
Is infant being breastfed at discharge?	Infant breastfed, Infant breastfed at discharge

NOTES: LMP is last normal menses. NICU is neonatal intensive care unit.

SOURCE: NCHS, National Vital Statistics System, Natality, 2013.

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