HHS Public Access

Author manuscript

*Matern Child Health J*. Author manuscript; available in PMC 2015 September 04.

Published in final edited form as:

*Matern Child Health J*. 2014 December ; 18(10): 2489–2498. doi:10.1007/s10995-014-1487-y.

# Validation of Self-reported Maternal and Infant Health Indicators in the Pregnancy Risk Assessment Monitoring System

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## Abstract

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*Disclaimer:* The findings and conclusions in this article are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention, the New York City Department of Health and Mental Hygiene, or the Vermont Department of Health.

To assess the validity of self-reported maternal and infant health indicators reported by mothers an average of 4 months after delivery. Three validity measures—sensitivity, specificity and positive predictive value (PPV)—were calculated for pregnancy history, pregnancy complications, health care utilization, and infant health indicators self-reported on the Pregnancy Risk Assessment Monitoring System (PRAMS) questionnaire by a representative sample of mothers delivering live births in New York City (NYC) (n = 603) and Vermont (n = 664) in 2009. Data abstracted from hospital records served as gold standards. All data were weighted to be representative of women delivering live births in NYC or Vermont during the study period. Most PRAMS indicators had >90 % specificity. Indicators with >90 % sensitivity and PPV for both sites included prior live birth, any diabetes, and Medicaid insurance at delivery, and for Vermont only, infant admission to the NICU and breastfeeding in the hospital. Indicators with poor sensitivity and PPV (<70 %) for both sites (i.e., NYC and Vermont) included placenta previa and/or placental abruption, urinary tract infection or kidney infection, and for NYC only, preterm labor, prior low-birth-weight birth, and prior preterm birth. For Vermont only, receipt of an HIV test during pregnancy had poor sensitivity and PPV. Mothers accurately reported information on prior live births and Medicaid insurance at delivery; however, mothers' recall of certain pregnancy complications and pregnancy history was poor. These findings could be used to prioritize data collection of indicators with high validity.

### Keywords

Validation; Pregnancy; Preterm; HIV test

## Introduction

Public health surveillance of key maternal health indicators is critical for monitoring and assessing the effectiveness of policy and programmatic efforts for maternal and infant health. The Pregnancy Risk Assessment Monitoring System (PRAMS) collects state-specific, population-based information on maternal experiences before, during, and shortly after pregnancy and is administered to women 2–6 months after delivery. As of 2014, PRAMS is implemented in 40 states and one city, representing 78 % of all live births in the United States (US) (http://www.cdc.gov/prams/). PRAMS data are widely used by states to identify women and infants at high risk for health problems and to measure progress in improving health.

The PRAMS survey includes, among many indicators, questions that address medical conditions experienced before or during pregnancy, health care utilization and infant health measures. Although several studies in the US have evaluated mothers' recall of medical conditions occurring before or during pregnancy [1–11]; none have done so with PRAMS data and most evaluated a mother's recall many years after the pregnancy. Studies focused on recall of infant birth weight and gestational age have found high agreement for birth weight [2, 3, 5, 7, 8, 11, 12] but low agreement for gestational age and preterm delivery [4, 5, 7, 8, 11]. A systematic review of studies validating gestational hypertension found mostly low sensitivity ranging from 31 to 65 % in 3 US-based samples; however, one case–control study estimated a sensitivity of 90 % among controls [1]. Two studies have examined other

complications during pregnancy [9, 11]. One of the studies conducted in three Minnesota hospitals among 1,200 women 10–15 years after delivery found low levels of positive agreement for rare complications such as gestational diabetes (GDM), placental abruption, preeclampsia, and placenta previa and moderate agreement for preterm labor [11]. The majority of previous studies are limited by samples that are not population-based and that are outdated [2, 3, 5, 7, 8, 11, 12].

The primary purpose of this analysis was to evaluate the validity of selected self-reported indicators on the PRAMS questionnaire in two different PRAMS sites, one urban with a diverse racial/ethnic population, the other rural with a primarily non-Hispanic white population.

## Methods

### Data Source

Pregnancy Risk Assessment Monitoring System (PRAMS) provided the sample for this analysis, specifically, PRAMS respondents from New York City (NYC) and Vermont who delivered during a 5–8 month period in 2009. Each site used 2009 birth certificate records as its sampling frame, and each month a questionnaire was mailed to a stratified, systematic sample of 100–300 women who recently had delivered a live-born infant. Women who did not respond to the first questionnaire were sent up to two additional questionnaires and, if the questionnaires were not completed and returned, attempts were made to contact the women by telephone. The PRAMS weighted response rates were 67.3 % for NYC for women who delivered during January 1 through June 4, 2009 (N = 31,844/47,342) and 82.0 % for Vermont for women who delivered between January 1 through August 31, 2009 (N = 3,091/3,771). The response rate was calculated by dividing the weighted number of women who returned the questionnaire or were interviewed by the total weighted number of women who were sampled during the study period. The samples were weighted for sample design, nonresponse, and non-coverage, and by using these weights in the analysis, the samples represent all live births among NYC and Vermont residents in the respective study periods. All analyses were conducted with weighted data.

Abstractors traveled to hospitals to abstract information from hospital records. In NYC, abstractors traveled to all 41 hospitals that perform deliveries; in Vermont abstractors traveled to all 12 hospitals that perform deliveries and one New Hampshire hospital close to Vermont’s border. The hospital record included the mother’s prenatal record, her hospital delivery record, and the infant hospital record. Abstractors recorded information on a standardized abstraction form that included detailed instructions on where to find the required information in the records. The data abstractors had medical training or were professional abstractors. They were trained by four authors (PD, LE, JB, CMW) and two additional staff members to abstract information in a standardized manner. No personal identifiers were collected. To confirm data quality, early in the data abstraction process, approximately 25 medical records in both NYC and Vermont were re-abstracted by authors PD, LE, JB, CMW and two additional project staff and compared. Errors in abstractions (estimated to be<3 % for all variables) were noted and then reviewed with the abstractors. Institutional Review Boards in NYC and in Vermont reviewed this project and both found it

exempt from review, as each state public health agency has legal authority to review medical records for public health surveillance purposes.

## Variables

Table 6 in "Appendix" provides the list and definitions of maternal and infant health indicators from the PRAMS questionnaire. For the medical record, data abstracted required a clinical diagnosis for GDM, diabetes, hypertension, placenta previa, placental abruption, preterm labor, and preterm premature rupture of the membranes (PPROM), and written notes or check box was required for a prior live birth, preceding birth was low birth weight (LBW), or preceding birth was preterm. Receipt of an HIV test required that either the date and outcome of the test be noted, or a copy of the test results be found in the medical record. Mother's length of stay was calculated from the date of admission and the date of discharge recorded in the hospital delivery record.

Characteristics of the sample included maternal age, race/ethnicity, marital status, and education using data from the birth certificate, and income level, family size, pre-pregnancy insurance status, and WIC participation using data self-reported by the mother on the PRAMS questionnaire. We converted income levels into three categories (<100, 100–200,>200 %) of the 2008 Federal Poverty Level (FPL) using published charts of the FPLs. Since PRAMS income level responses were categorized by income ranges, the midpoint of each income category was used for analysis.

## Analysis

Prevalence by self-report and in the medical record, sensitivity, specificity, and positive predictive value (PPV), with 95 % confidence intervals (95 % CIs), were calculated for each indicator. These prevalence estimates are population-based, and the 95 % CI expresses that there is a 95 % probability that the calculated confidence interval encompasses the true value of the population parameter. Prevalence estimates where the 95 % CIs did not overlap were considered statistically different. Sensitivity is the proportion of mothers (or infants) identified with the condition who are correctly identified by self-report (true positives/true positives plus false negatives); specificity is the proportion of mothers (or infants) identified not having the condition who are correctly identified not having the condition by self-report (true negatives/true negatives plus false positives). PPV is the proportion of mothers (or infants) with the condition that is correctly identified as having the condition by self-report (true positives/true positives plus false positives). Information abstracted from the hospital record was used as the gold standard (e.g. true positives, true negatives). Sensitivity, specificity, and PPV were each categorized as excellent (>90 %), moderate (70–90 %), or poor (<70 %) [13]. We also combined the ratings of the three validation metrics into an overall rating. We defined excellent overall if at least two of the three validity metrics were >90 %; moderate overall if at least two were ≥70 %; and poor overall if at least two metrics were<70 %. All analyses were stratified by site (NYC and Vermont). Records missing information on any indicators of interest in PRAMS or the medical record were excluded from analyses. For NYC, the percentage of missing observations ranged from 0 % for maternal age, race/ethnicity, marital status, and education to 13.1 % for FPL. For Vermont, the percentage of missing observations ranged from 0 % for age, race/ethnicity, and

Medicaid insurance to 12.8 % for receipt of an HIV test (see Table 6 in "Appendix"). Chi square tests were calculated to assess statistical significance ($p < 0.05$) when comparing the demographic characteristics of NYC and Vermont samples. Analyses were run with SAS version 9.3 and SUDAAN version 11.0 (RTI International).

## Results

The women included in the NYC and Vermont samples had similar age distributions, with about 70 % aged 25 and older, but differed on all other demographic characteristics ($p < 0.05$) (Table 1). Women from NYC were more likely than women from Vermont to be non-white or non-Hispanic, to have been enrolled in WIC, to live below 100 % of the FPL, to be uninsured before pregnancy, to be unmarried, and to have less than a high school education.

### Prevalence of Maternal, Pregnancy, and Infant Characteristics

For both sites, there were few prevalence estimates where the 95 % CI did not overlap for those based on mothers' self-report and on the medical record (Table 2). The exceptions for both NYC and Vermont include preterm labor and receipt of an HIV test. The exceptions for Vermont only include urinary tract infection and hospital stay of 0–2 nights and ≥5 nights. When the 95 % CI did overlap, the data source with the higher prevalence varied by item. For example, for both sites, the prevalence of receipt of an HIV test was higher in the medical record than on PRAMS, whereas hospital stays of ≥5 nights had a higher prevalence on PRAMS than on the medical record.

### Excellent Overall (At Least Two of Three Measures >90 %)

Tables 3 and 4 present the sensitivity, specificity, and PPV for all indicators by site. Table 5 presents the rating (excellent >90 %, moderate 70–90 %, and poor <70 %) for sensitivity, specificity, and PPV for all indicators. Black shading represents excellent, dark grey shading represents moderate, and light grey shading represents poor. For both NYC and Vermont, indicators that were excellent overall included any prior live births, any diabetes, and Medicaid insurance at delivery. For Vermont only, excellent overall indicators included preceding birth was LBW, 0–2 nights mother's stay in the hospital, infant admitted to the NICU, and breastfeeding in the hospital.

### Moderate Overall (At Least Two of Three Measures ≥70 %)

For both sites, five indicators met the criteria for moderate overall, defined as at least two of the three validity measures were ≥ 70 % (Tables 3, 4, 5). These indicators included GDM, hypertension during pregnancy, PPROM, and mother's stay in the hospital 3–4 nights and ≥ 5 nights. For NYC only, receipt of an HIV test during pregnancy, mother's stay in the hospital 0–2 nights and breastfed in the hospital had a moderate overall rating. For Vermont only, preceding birth was preterm and preterm labor had an overall moderate rating.

### Poor Overall (At Least Two of Three Measures<70 %)

For both sites, two indicators met the criteria for poor overall, defined as at least two of the three validity measures<70 % (Tables 3, 4, 5). These indicators were placenta previa/placental abruption and urinary tract infection/kidney infection. For NYC only, three

additional indicators had a poor overall rating: preceding birth LBW, preceding birth preterm, and preterm labor. For Vermont only, receipt of an HIV test during pregnancy had an overall poor rating.

## Discussion

This study was conducted one of the first evaluations of mothers' self-report of pregnancy history, complications during pregnancy, health care utilization, and infant indicators on the PRAMS questionnaire. In our rating system, most indicators fell in the moderate range with only two indicators performing poorly overall in both sites. In addition, while many indicators had excellent to moderate specificity, measures of sensitivity and PPV varied with PPV having the largest number of poor ratings. Many of the indicators have a low prevalence, which is more likely to result in having a poor PPV. PPV is lower when there are greater numbers of false positives, which is more likely when the indicator is rare.

Among indicators with overall excellent ratings in one or both sites, prior live birth and breast-feeding have been previously evaluated, and our findings are consistent with the literature [2, 14]. Admissions to the NICU and Medicaid insurance at delivery have not been previously evaluated. Having valid data for Medicaid is especially valuable, given the likely increases in Medicaid coverage in the years ahead.

Our finding that placenta previa and/or placental abruption and urinary tract infection or kidney infection had poor overall ratings in both sites is consistent with the literature [11]. Possible explanations for these results include the wording of the questions and women's medical knowledge. The PRAMS question asks about "problems with your placenta (such as abruptio placentae or placenta previa)." The question may need to be more specific, provide more explanation of the condition, and ask about each condition separately. In addition, women may have difficulty reporting placenta previa or abruption because they may never have been told they have the condition or clinicians may have used other terminology to explain the condition. Urinary tract infections may not have been reported with high validity because women may fail to remember an infection during pregnancy when asked 2–6 months after delivery, especially one that had minor symptoms. Other sources, such as hospital discharge data, may be better for surveillance of these medical conditions.

Indicators with overall moderate ratings require more thought as to whether the validity is high enough for specific research or surveillance purposes. Two complications, GDM and hypertension, had moderate sensitivity but poor PPV, consistent with most [9, 11] but not all [1] of the literature. PPV was low due to women over-reporting these two conditions. A possible reason for women over-reporting GDM is that diagnosis requires a positive result on two different glucose tests. Women who screened positive on the first test and negative on the second may have misreported that they had GDM. A similar situation may have resulted in the over-reporting of gestational hypertension, as diagnosis requires high blood pressure at two separate visits. Preterm labor had poor PPV in both sites and poor sensitivity in NYC but moderate sensitivity in Vermont. It is common for women to report and even be evaluated for contractions prior to term and yet not have true preterm labor, suggesting it is difficult to collect valid responses from mothers on this condition. Another complication,

PPROM, had moderate sensitivity and poor PPV in NYC and excellent sensitivity and moderate PPV in Vermont, suggesting that the validity of mothers' report of this item may vary by population characteristics.

One surprising result is that mothers in NYC did not report valid information on whether their previous infant was born with LBW. Previous studies consistently have found mothers' reporting of infant birth weight to be highly correlated with birth weight reported in the medical record when mothers were asked to recall the infant's birth weight or when asked to recall if the infant was < 2,500 g [2, 3, 5, 7, 8, 11, 12]. In Vermont, this indicator had excellent sensitivity and an overall excellent rating. NYC's poor overall validity on this indicator suggests that demographic differences may have led to these quality differences in the indicators. Other studies of mother's recall of a preterm delivery have documented low-to-moderate sensitivity [4, 5, 7, 8, 11], which is consistent with our findings.

Receipt of an HIV test had an overall moderate rating in NYC but an overall poor rating in Vermont. Differences in HIV testing policies may be one explanation for this. A woman's ability to accurately report receiving an HIV test will be partly dependent upon informed consent procedures. In 2009, Vermont had an "opt-out" HIV testing policy. Women were informed, either in writing or orally, that they would receive an HIV test and that they had an option to decline it. In NYC, doctors were required to give HIV counseling to all pregnant women, and women were required to give written consent to receive an HIV test. In addition, New York has a policy to test all newborns whose mother was not tested during pregnancy, with no maternal consent required, which may affect maternal acceptance of prenatal testing. Thus, this more involved consent process in NYC may have improved women's reporting. Two previous studies assessed the validity of self-reported HIV testing. One study compared postpartum reporting to medical record and laboratory data in three hospitals in Toronto [15], the other compared self-report of HIV testing history to laboratory data among pregnant women at one hospital [16]. Unlike our study, which found women under-reported HIV testing, both of these studies found women over-reported receiving an HIV test compared to laboratory data.

This study has several noteworthy strengths. It is the first US population-based validity study we are aware of focused on self-reported measures of pregnancy complications and infant outcomes. The inclusion of population-based samples from two diverse populations provided insight on the robustness of findings across varied groups of women. One limitation of this validation study is the possibility that some complications, test results, and maternal behaviors may not have been recorded in the medical record, leading to biased estimates. This limitation is especially relevant for "received an HIV test", as well as for breastfeeding in the hospital. Evaluations are needed to assess whether these results can be replicated at other PRAMS sites.

Our findings have implications for PRAMS as well as for researchers collecting self-reported information on pregnancy histories. For PRAMS, the findings have contributed to the decision to remove some questions from the core questionnaire including those on placenta previa/placental abruption, preterm labor, urinary tract infection/kidney infection, and received an HIV test. In addition, PRAMS is considering revising questions such as the

one on gestational diabetes. For researchers who plan to collect self-reported pregnancy histories, the results provide direction regarding topics that are difficult for women to report valid information, such as placenta previa, and others that are easier, such as Medicaid insurance at delivery and infant was admitted into the NICU. Indicators will need to be considered carefully and researchers need to consider the importance of each validity metric, sensitivity, specificity and PPV. Understanding the strengths and limitations of self-reported indicators on the PRAMS questionnaire will help maternal and child health professionals use PRAMS data appropriately and inform the research efforts of those relying on self-reported information.

## Acknowledgments

We thank Kim Burley for his computer programming assistance and Christopher Johnson and Brian Morrow for their statistical support. In addition, we thank New York City PRAMS project, Vermont PRAMS Project, and Sarah Rubinstein, MPH for training abstractors and validating abstracted data; Brennan Martin, MPH and Joan Mongeon, MS for coordinating data collection efforts; and Jahidah Reid, PA, Odessa Fynn, CM, MS, and Kathleen Keleher, RN, MPH, FACNM, for abstracting information from medical records.

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## Appendix

See Table 6.

## Table 1

Demographic characteristics of PRAMS respondents from New York City and Vermont

| | New York City % (unweighted n = 603) | Vermont % (unweighted n = 664) | Chi square *p* value |
|---|---|---|---|
| *Maternal age (years)* | | | |
| < 20 | 6.9 | 6.5 | 0.7014 |
| 20–24 | 22.7 | 23.2 | |
| 25–34 | 52.5 | 54.9 | |
| ≥35 | 17.9 | 15.3 | |
| *Race/ethnicity* | | | |
| Non-Hispanic white | 22.8 | 92.8 | 0.0000 |
| Non-Hispanic black | 21.1 | 0.6 | |
| Hispanic | 40.7 | 1.3 | |
| Other | 15.4 | 5.4 | |
| *Federal poverty level* | | | |
| < 100 % | 40.7 | 29.9 | 0.0000 |
| 101–200 % | 15.7 | 19.5 | |
| > 200 % | 30.5 | 46.3 | |
| Missing | 13.1 | 4.3 | |
| *Pre-pregnancy Insurance* | | | |
| Yes | 77.1 | 85.9 | 0.0007 |
| No | 22.9 | 14.1 | |
| *WIC* | | | |
| Yes | 57.3 | 45.8 | 0.0003 |
| No | 42.7 | 54.2 | |
| *Marital status* | | | |
| Married | 54.3 | 62.5 | 0.0102 |
| Not married | 45.7 | 37.5 | |
| *Mother's education* | | | |
| < High school graduate | 24.8 | 9.3 | 0.0000 |
| High school graduate | 26.0 | 27.5 | |
| Some college | 20.6 | 25.7 | |
| College graduate | 28.5 | 37.5 | |

New York City included births January 1 through June 4, 2009; Vermont included births January 1 through August 31, 2009. % weighted to adjust for survey design, sampling, and non-response. Sample size varies for each characteristic due to missing values; see Table 6 in "Appendix"

*PRAMS* Pregnancy Risk Assessment Monitoring System, *WIC* Special Supplemental Nutrition Program for Women, Infants and Children

**Table 2**

Prevalence of pregnancy, health care utilization, and infant characteristics from self-report on PRAMS and medical record data

| | NYC | | | | Vermont | | | |
|---|---|---|---|---|---|---|---|---|
| | PRAMS | | MR | | PRAMS | | MR | |
| | % | 95 % CI | % | 95 % CI | % | 95 % CI | % | 95 % CI |
| *Pregnancy* | | | | | | | | |
| Any prior live births | 56.4 | (51.4–61.3) | 58.2 | (53.2–63.0) | 48.0 | (44.2–51.9) | 49.1 | (45.2–53.0) |
| Preceding birth LBW[a] | 11.0 | (5.9–19.4) | 6.1 | (2.8–13.0) | 8.1 | (5.0–12.9) | 5.7 | (3.2–10.0) |
| Preceding birth preterm[a] | 16.9 | (10.6–25.8) | 7.2 | (3.5–14.3) | 10.3 | (6.7–15.4) | 9.9 | (6.4–15.1) |
| Gestational diabetes | 9.5 | (6.9–12.9) | 5.3 | (3.5–8.0) | 5.5 | (4.0–7.5) | 3.3 | (2.2–5.0) |
| Any diabetes | 11.9 | (9.0–15.7) | 7.0 | (4.8–10.0) | 7.3 | (5.5–9.6) | 4.2 | (2.9–6.0) |
| Hypertension during pregnancy | 9.4 | (7.0–12.6) | 7.7 | (5.5–10.6) | 12.8 | (10.4–15.7) | 8.3 | (6.4–10.7) |
| Placental previa, and/or placental abruption | 3.9 | (2.5–6.2) | 2.9 | (1.7–4.9) | 6.2 | (4.7–8.3) | 4.4 | (3.1–6.1) |
| Urinary tract infection or kidney infection | 16.4 | (13.1–20.4) | 11.8 | (9.0–15.4) | 12.5 | (10.0–15.3) | 5.0 | (3.5–7.1) |
| Preterm labor | 13.9 | (10.8–17.7) | 7.9 | (5.8–10.7) | 16.3 | (13.7–19.4) | 6.6 | (5.2–8.5) |
| PPROM | 36.0 | (24.5–49.3) | 23.6 | (14.8–35.4) | 55.4 | (44.6–65.7) | 47.8 | (37.2–58.6) |
| *Health care utilization* | | | | | | | | |
| Mother's nights in hospital | | | | | | | | |
| 0–2 Nights | 36.7 | (31.9–41.8) | 45.6 | (40.5–50.7) | 43.8 | (39.9–47.7) | 55.9 | (52.0–59.8) |
| 3–4 Nights | 50.9 | (45.8–56.0) | 47.4 | (42.3–52.5) | 44.4 | (40.6–48.4) | 39.6 | (35.9–43.5) |
| ≥ 5 Nights | 12.4 | (9.5–16.0) | 7.1 | (5.0–9.8) | 11.8 | (9.5–14.4) | 4.5 | (3.2–6.2) |
| Medicaid insurance at delivery | 58.7 | (53.3–63.8) | 58.6 | (53.3–63.7) | 45.5 | (41.3–49.8) | 43.8 | (39.6–48.1) |
| Received an HIV test during pregnancy | 89.6 | (86.0–92.3) | 98.2 | (96.2–99.2) | 63.2 | (59.1–67.1) | 84.8 | (81.6–87.5) |
| *Infant* | | | | | | | | |
| Infant admitted to NICU | | | | | 9.9 | (8.0–12.1) | 7.7 | (6.2–9.6) |
| Breastfeeding in hospital | 78.4 | (73.9–82.4) | 79.0 | (74.5–82.9) | 81.8 | (78.4–84.7) | 83.9 | (80.7–86.7) |

New York City included births January 1 through June 4, 2009: Vermont included births January 1 through August 31, 2009

*PRAMS* Pregnancy Risk Assessment Monitoring System, *MR* medical record, *LBW* low birth weight, *PPROM* preterm premature rupture of membranes, *NICU* neonatal intensive care unit

[a]Restricted to women with one prior birth

**Table 3**

Sensitivity and specificity of pregnancy, health care utilization, and infant characteristics from self-report on PRAMS using medical record data as the gold standard

| | Sensitivity | | | | Specificity | | | |
|---|---|---|---|---|---|---|---|---|
| | New York City | | Vermont | | New York City | | Vermont | |
| | % | 95 % CI | % | 95 % CI | % | 95 % CI | % | 95 % CI |
| *Pregnancy* | | | | | | | | |
| Any prior live births | 95.8 | (92.0–97.8) | 97.1 | (94.4–98.5) | 98.4 | (94.3–99.5) | 99.2 | (97.6–99.8) |
| Preceding birth LBW[a] | 68.7 | (28.7–92.3) | 98.0 | (94.2–99.3) | 92.8 | (84.5–96.8) | 97.3 | (93.7–98.9) |
| Preceding birth preterm[a] | 45.7 | (16.2–78.5) | 81.1 | (57.2–93.2) | 85.4 | (76.3–91.4) | 97.6 | (94.1–99.0) |
| Gestational diabetes | 88.4 | (67.4–96.5) | 82.0 | (59.1–93.5) | 95.0 | (92.1–96.8) | 97.1 | (95.5–98.2) |
| Any diabetes | 90.7 | (73.8–97.1) | 90.8 | (71.9–97.4) | 94.0 | (90.8–96.1) | 96.3 | (94.5–97.6) |
| Hypertension during pregnancy | 76.7 | (58.5–88.5) | 85.1 | (73.1–92.3) | 96.1 | (93.6–97.7) | 93.7 | (91.3–95.5) |
| Placenta previa, and/or placental abruption | 47.6 | (23.2–73.2) | 41.2 | (26.0–58.3) | 97.3 | (95.2–98.5) | 95.4 | (93.4–96.8) |
| Urinary tract infection or kidney infection | 50.9 | (36.9–64.7) | 47.8 | (30.8–65.3) | 88.2 | (84.4–91.2) | 89.4 | (86.6–91.7) |
| Preterm labor | 51.8 | (36.2–67.0) | 78.3 | (67.4–86.3) | 89.3 | (85.5–92.2) | 88.0 | (85.1–90.5) |
| PPROM | 84.7 | (71.5–92.4) | 99.0 | (97.5–99.6) | 79.1 | (62.8–89.4) | 84.6 | (71.5–92.3) |
| *Health care utilization* | | | | | | | | |
| Mother's nights in hospital | | | | | | | | |
| 0–2 Nights | 71.3 | (63.8–77.8) | 75.5 | (70.7–79.8) | 92.3 | (87.6–95.3) | 96.4 | (93.6–98.1) |
| 3–4 Nights | 78.4 | (71.5–83.9) | 80.0 | (74.6–84.5) | 73.8 | (67.0–79.6) | 78.9 | (74.5–82.8) |
| ≥5 Nights | 77.8 | (58.9–89.5) | 88.7 | (70.4–96.3) | 92.6 | (89.2–94.9) | 91.8 | (89.4–93.7) |
| Medicaid insurance at delivery | 95.3 | (91.4–97.5) | 99.5 | (97.1–99.9) | 93.2 | (87.5–96.4) | 96.6 | (93.8–98.1) |
| Received an HIV test during pregnancy | 89.6 | (86.0–92.4) | 67.7 | (63.3–71.8) | 14.7 | (2.0–59.1) | 61.6 | (51.0–71.2) |
| *Infant* | | | | | | | | |
| Infant admitted to NICU | Not available | | 95.2 | (84.5–98.6) | Not available | | 97.3 | (95.6–98.4) |
| Breastfeeding in hospital | 86.3 | (81.7–89.8) | 96.1 | (94.0–97.4) | 51.3 | (40.6–62.3) | 92.9 | (86.1–96.5) |

New York City included births January 1 through June 4, 2009: Vermont included births January 1 through August 31, 2009

% Weighted to adjust for survey design, sampling, and non-response. Sample size varies for each characteristic due to missing values

*PRAMS* Pregnancy Risk Assessment Monitoring System, *LBW* low birth weight, *PPROM* preterm premature rupture of membranes, *NICU* neonatal intensive care unit

[a] Restricted to women with one prior birth

## Table 4

Positive predictive value of pregnancy, health care utilization, and infant characteristics from self-report on PRAMS

| | New York City | | Vermont | |
|---|---|---|---|---|
| | % | 95 % CI | % | 95 % CI |
| *Pregnancy* | | | | |
| Any prior live births | 98.8 | (95.8–99.7) | 99.2 | (97.4–99.8) |
| Preceding birth LBW[a] | 38.2 | (14.7–69.0) | 68.8 | (43.3–86.4) |
| Preceding birth preterm[a] | 19.6 | (6.7–45.3) | 78.6 | (56.6–91.2) |
| Gestational diabetes | 49.5 | (33.6–65.5) | 49.5 | (33.7–65.4) |
| Any diabetes | 53.2 | (38.4–67.4) | 51.8 | (37.8–65.6) |
| Hypertension during pregnancy | 62.3 | (46.4–75.9) | 55.1 | (44.0–65.7) |
| Placenta previa, and/or placental abruption | 34.7 | (17.0–58.0) | 28.9 | (17.8–43.3) |
| Urinary tract infection or kidney infection | 36.6 | (25.7–49.0) | 19.2 | (11.8–29.6) |
| Preterm labor | 29.4 | (19.5–41.7) | 31.7 | (24.1–40.4) |
| PPROM | 55.5 | (33.0–76.0) | 85.5 | (72.7–92.9) |
| *Health care utilization* | | | | |
| Mother's nights in hospital | | | | |
| 0–2 Nights | 88.6 | (81.9–93.0) | 96.4 | (93.5–98.1) |
| 3–4 Nights | 72.9 | (65.9–79.0) | 71.4 | (65.7–76.5) |
| ≥5 Nights | 44.2 | (31.6–57.6) | 33.6 | (24.4–44.2) |
| Medicaid insurance at delivery | 95.2 | (91.0–97.4) | 95.8 | (92.3–97.7) |
| Received an HIV test during pregnancy | 98.3 | (96.1–99.3) | 90.8 | (87.3–93.4) |
| *Infant* | | | | |
| Infant admitted to NICU | Not available | | 74.6 | (62.9–83.6) |
| Breastfeeding in hospital | 87.0 | (82.5–90.5) | 98.6 | (97.2–99.3) |

New York City included births January 1 through June 4, 2009: Vermont included births January 1 through August 31, 2009

% Weighted to adjust for survey design, sampling, and non-response. Sample size varies for each characteristic due to missing values

*PRAMS* Pregnancy Risk Assessment Monitoring System, *LBW* low birth weight, *PPROM* preterm premature rupture of membranes, *LBW* low birth weight

[a] Restricted to women with at least one prior birth

*Matern Child Health J*. Author manuscript; available in PMC 2015 September 04.

**Table 5**

Summary of sensitivity, specificity, and positive predictive value (PPV) of pregnancy, health care utilization, and infant characteristics from self-report on PRAMS using medical record data as the gold standard

| | NewYork City | | | Vermont | | |
|---|---|---|---|---|---|---|
| | **Sensitivity** | **Specificity** | **PPV** | **Sensitivity** | **Specificity** | **PPV** |
| *Pregnancy* | | | | | | |
| Any prior live births | | | | | | |
| Preceding birth LBW[a] | | | | | | |
| Preceding birth preterm[a] | | | | | | |
| Gestational diabetes | | | | | | |
| Any diabetes | | | | | | |
| Hypertension during pregnancy | | | | | | |
| Placenta previa, and/or placental abruption | | | | | | |
| Urinary tract infection or kidney infection | | | | | | |
| Preterm Labor | | | | | | |
| PPROM | | | | | | |
| *Health care utilization* | | | | | | |
| Mother's nights in hospital | | | | | | |
| 0–2 Nights | | | | | | |
| 3–4 Nights | | | | | | |
| ≥ 5 Nights | | | | | | |
| Medicaid insurance at delivery | | | | | | |
| Received an HIV test during pregnancy | | | | | | |
| *Infant* | | | | | | |
| Infant Admitted to NICU | NA | | | | | |
| Breastfeeding in hospital | | | | | | |

New York City included births January 1 through June 4, 2009: Vermont included births January 1 through August 31, 2009

*PRAMS* Pregnancy Risk Assessment Monitoring System, *LBW* low birth weight, *PPROM* preterm premature rupture of membranes, *NICU* neonatal intensive care unit, *NA* not available

*Black* = excellent >90 %, *Grey* = moderate 70–90 %, *Light grey* = poor < 70 %. Sample size varies for each characteristic due to missing values, see Table 6 in "Appendix"

[a] Restricted to women with one prior birth

## Table 6

List of indicators

| PRAMS—mother's self-report | Missing in PRAMS or the medical record unweighted N (unweighted %) | |
|---|---|---|
| | New York City | Vermont |
| *Prior live birth* | | |
| Before you got pregnant with your new baby, did you ever have any other babies who were born alive? | 24/603 (4.0 %) | 7/664 (1.1 %) |
| *Preceding birth low birth weight* | | |
| Did the baby born just before your new one weigh more than 5 pounds, 8 oz (2.5 k) at birth? Restricted to women with one prior birth. | 12/143 (8.4 %) | 7/192 (3.6 %) |
| *Preceding birth preterm* | | |
| Was the baby just before your new one born more than 3 weeks before his or her due date?<br>Restricted to women with one prior birth. | 10/143 (7.0 %) | 6/192 (3.1 %) |
| *Preexisting diabetes* | | |
| Before you got pregnant with your new baby, were you ever told by a doctor, nurse, or other health care worker that you had Type 1 or Type 2 diabetes? This is not the same as gestational diabetes or diabetes that starts during pregnancy. | 21/603 (3.5 %) | 4/664 (0.6 %) |
| *Gestational diabetes* | | |
| During your most recent pregnancy, were you told by a doctor, nurse, or other health care worker that you had gestational diabetes (diabetes that started during this pregnancy)? | 21/603 (3.5 %) | 11/664 (1.7 %) |
| *Any diabetes* | | |
| Combined a yes to preexisting diabetes or a yes to gestational diabetes. | 30/603 (5.0 %) | 9/664 (1.4 %) |
| *Hypertension during pregnancy* | | |
| Did you have any of the following problems during your most recent pregnancy? High blood pressure, hypertension (including pregnancy-induced hypertension [PIH], preeclampsia, or toxemia). | 34/603 (5.6 %) | 17/664 (2.6 %) |
| *Placenta previa and/or placental abruption* | | |
| Did you have any of the following problems during your most recent pregnancy? Problems with the placenta (such as abruptio placentae or placenta previa). | 22/603 (3.6 %) | 12/664 (1.8 %) |
| *Urinary tract infection or kidney infection* | | |
| Did you have any of the following problems during your most recent pregnancy? Kidney or bladder (urinary tract) infection. | 18/603 (3.0 %) | 11/664 (1.7 %) |
| *Preterm labor* | | |
| Did you have any of the following problems during your most recent pregnancy? Labor pains more than 3 weeks before my baby was due (preterm or early labor). | 48/603 (8.0 %) | 13/664 (2.0 %) |
| *Preterm premature rupture of membranes* | | |
| Did you have any of the following problems during your most recent pregnancy? Water broke more than 3 weeks before my baby was due [premature rupture of membranes (PROM)] Denominator limited to women with a preterm delivery. | 9/186 (4.8 %) | 4/125 (3.2 %) |
| *Mother's length of stay* | | |
| This variable was created by calculating length of stay from two dates, when the mother said she went into the hospital and when she said she was discharged.<br>1. When did you go into the hospital to have your baby?<br>2. When were you discharged from the hospital after your baby was born? | 50/603 (8.3 %) | 19/664 (2.9 %) |
| *Medicaid insured at delivery* | | |
| Did any of these health insurance plans help you pay for the delivery or your new baby? | 20/524 (3.8 %) | 0/549 (0 %) |

| PRAMS—mother's self-report | Missing in PRAMS or the medical record unweighted N (unweighted %) | |
|---|---|---|
| | New York City | Vermont |
| Medicaid | | |
| Excluded responses that included more than one type of insurance. | | |
| *Receipt of an HIV test during pregnancy* | | |
| At any time during *your most recent* pregnancy or delivery, did you have a test for HIV (the virus that causes AIDS)? | 66/603 (10.9 %) | 85/664 (12.8 %) |
| *Infant admitted to NICU* | | |
| After your baby was born, was he or she put in an intensive care unit? | NA | 5/664 (0.8 %) |
| *Breastfeeding in Hospital* | | |
| This question asks about things that may have happened at the hospital where your new baby was born.<br>I breastfed my baby in the hospital. This question was not asked of women whose baby died while they were in the hospital or no longer lived with the mother. | 64/590 (10.8 %) | 17/651 (2.6 %) |
| *Demographics* | | |
| Age | 0/603 (0.0 %) | 0/664 (0.0 %) |
| Race/ethnicity | 0/603 (0.0 %) | 0/664 (0.0 %) |
| Federal poverty level | 75/603 (13.1 %) | 29/664 (4.3 %) |
| Pre-pregnancy insurance | 16/603 (2.7 %) | 1/664 (0.2 %) |
| WIC, Special Supplemental Nutrition Program for Women, Infants and Children | 3/603 (0.5 %) | 3/664 (0.5 %) |
| Marital status | 0/603 (0.0 %) | 1/664 (0.2 %) |
| Mother's education | 0/603 (0.0 %) | 3/664 (0.5 %) |