Published in final edited form as:

Matern Child Health J. 2021 August ; 25(8): 1242–1253. doi:10.1007/s10995-021-03149-9.

Bias in Self-reported Prepregnancy Weight Across Maternal and Clinical Characteristics

Andrea J. Sharma[1,3], **Joanna E. Bulkley**[2], **Ashley B. Stoneburner**[2], **Padmavati Dandamudi**[2], **Michael Leo**[2], **Williams M. Callaghan**[1], **Kimberly K. Vesco**[2,4]

[1]Division of Reproductive Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, Atlanta, GA, USA

[2]Kaiser Permanente Center for Health Research, Portland, OR, USA

[3]U.S. Public Health Service Commissioned Corps, Atlanta, GA, USA

[4]Department of Obstetrics & Gynecology, Kaiser Permanente Northwest, Portland, OR, USA

Abstract

Objectives—Prepregnancy body mass index (BMI) and gestational weight gain (GWG) are known determinants of maternal and child health; calculating both requires an accurate measure of prepregnancy weight. We compared self-reported prepregnancy weight to measured weights to assess reporting bias by maternal and clinical characteristics.

Methods—We conducted a retrospective cohort study among pregnant women using electronic health records (EHR) data from Kaiser Permanente Northwest, a non-profit integrated health care system in Oregon and southwest Washington State. We identified women age ≥ 18 years who were pregnant between 2000 and 2010 with self-reported prepregnancy weight, ≥ 2 measured weights between ≤ 365-days-prior-to and ≤ 42-days-after conception, and measured height in their EHR. We compared absolute and relative difference between self-reported weight and two "gold-standards": (1) weight measured closest to conception, and (2) usual weight (mean of weights measured 6-months-prior-to and ≤ 42-days-after conception). Generalized-estimating equations were used to assess predictors of misreport controlling for covariates, which were obtained from the EHR or linkage to birth certificate.

✉Andrea J. Sharma, AJSharma@cdc.gov.

Author Contributions All authors contributed to the intellectual content of this paper and have met the following 3 requirements: (a) significant contributions to the conception and design, acquisition of data, or analysis and interpretation of data; (b) drafting or revising the article for intellectual content; and (c) final approval of the published article.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10995-021-03149-9.

Code Availability The statistical analysis programming code is available upon request.

Conflict of interest All authors declare that they have no conflict of interest.

Publisher's Disclaimer: 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 or Kaiser Permanente.

Ethical Approval All procedures performed in this study were in accordance with the ethical standards of the 1964 Helsinki declaration and its later amendments. The Kaiser Permanente Northwest Institutional Review Board (IRB) approved this study and granted a waiver of informed consent. The IRB at the Centers for Disease Control and Prevention also approved the study.

Results—Among the 16,227 included pregnancies, close agreement (± 1 kg or ≤ 2%) between self-reported and closest-measured weight was 44% and 59%, respectively. Overall, self-reported weight averaged 1.3 kg (SD 3.8) less than measured weight. Underreporting was higher among women with elevated BMI category, late prenatal care entry, and pregnancy outcome other than live/stillbirth ($p < .05$). Using self-reported weight, BMI was correctly classified for 91% of pregnancies, but ranged from 70 to 98% among those with underweight or obesity, respectively. Results were similar using usual weight as gold standard.

Conclusions for Practice—Accurate measure of prepregnancy weight is essential for clinical guidance and surveillance efforts that monitor maternal health and evaluate public-health programs. Identification of characteristics associated with misreport of self-reported weight can inform understanding of bias when assessing the influence of prepregnancy BMI or GWG on health outcomes.

Keywords

Pregnancy; Body weights and measures; Body mass index; Gestational weight gain; Validation studies

---

Prepregnancy body mass index (BMI) and gestational weight gain (GWG) are known determinants of medical and obstetrical complications during pregnancy and fetal growth (Goldstein et al., 2017; Satpathy et al., 2008). Further, clinical guidance for the recommended range of GWG is determined by prepregnancy BMI category (Rasmussen, Yaktine, & Institute of Medicine (US) and National Research Council (US) Committee to Reexamine IOM Pregnancy Weight Guidelines, 2009). Computation of both BMI and GWG requires a measure of prepregnancy weight, thus accurate reporting of prepregnancy weight is essential for appropriate clinical guidance and monitoring of GWG during pregnancy. In addition to clinical needs, accurate reporting of prepregnancy weight is important for public health surveillance efforts that monitor maternal health and for research studies examining associations between prepregnancy BMI, GWG and health outcomes.

Prepregnancy weight is usually self-reported by a woman at the first prenatal care visit because few women will have weight clinically measured close to conception and weight measured at prenatal care entry may already reflect loss or gain related to pregnancy. Errors in self-reported prepregnancy weight can lead to misclassification, resulting in incorrect estimates of measures such as the proportion of women entering pregnancy at a healthy weight or achieving recommended GWG, and biased associations and flawed conclusions (Headen et al., 2017; Kesmodel, 2018). Understanding the degree to which women misreport their recalled prepregnancy weight, and characteristics associated with misreport, is needed to improve interpretation of data and to correct for any bias and differential misclassification (Lash, Abrams, et al., 2014; Lash, Fox, et al., 2014).

A recent systematic review summarized the literature on the accuracy of self-reported pregnancy-related weight (Headen et al., 2017). Overall, correlation between self-reported weight and weight measured within 6–12 months prior to conception was high, ranging from 0.90 to 0.99, and self-reported weight averaged 0.34–1.60 kg lower than measured weight. Only three studies examined variation in reporting error by maternal characteristics, primarily age, race/ethnicity and parity, with conflicting results (Bannon et al., 2017; Han et al., 2016; Oken et al., 2007). Only two studies examined misclassification of BMI category (Bannon et al., 2017; Han et al., 2016). All eight studies only included women with a live birth or stillbirth after 28 weeks of gestation, and the majority examined fewer than 300 women.

Given these knowledge gaps, the objective of this study was to compare prepregnancy weight self-reported at prenatal care entry to clinic weights measured near conception in a large cohort of pregnancies, regardless of pregnancy outcome. The true gold standard weight at conception is not available, and daily weight fluctuations are common (Orsama et al., 2014). Therefore, we assessed two "gold standards" using clinically measured weights between 6-months-prior-to and ≤ 42 days after conception: (1) the weight measured closest to conception, and (2) the average of all measured weights within this time period, referred to as usual weight. We evaluated accuracy of self-reported prepregnancy weight overall, and degree of reporting bias by several maternal and clinical characteristics.

Methods

Study Population

We conducted a retrospective cohort study among pregnant women using electronic health records (EHR) data from Kaiser Permanente Northwest (KPNW). KPNW is a non-profit integrated delivery system that cares for a half million medical plan members in western Oregon and southwest Washington. KPNW's members represent about 24% of the area's population and are demographically representative of the coverage area. Data were extracted from the KPNW EHR system and Oregon and Washington birth certificates. Validated algorithms to identify pregnancies and to link medical records to birth certificates have been described elsewhere (Dietz et al., 2012; Hornbrook et al., 2007). The Kaiser Permanente Northwest Institutional Review Board (IRB) approved this study and granted a waiver of informed consent. The Centers for Disease Control and Prevention IRB also approved the study.

Prepregnancy weight was self-reported on the new patient obstetric questionnaire from 2000 through 2010, removed in August of 2011, and then added back in 2014. Therefore, we analyzed data for two cohorts (Fig. 1). For the primary analysis, we selected all pregnancies that started between January 1, 2000 and December 31, 2010 and started prenatal care prior to December 31, 2010. Pregnancies were linked to birth certificate records, which allowed for assessment of reporting bias by four additional maternal characteristics (i.e., education, marital status, smoking status, parity); this was considered a sub-analysis as not all pregnancies link to a birth certificate. To confirm main findings in a more contemporary cohort, we completed a parallel secondary analysis among pregnancies that began between January 1, 2015 and December 31, 2016 and started prenatal care prior to December 31, 2016. Among this cohort, birth certificate data was not yet available for births occurring in 2017 therefore no linkage to the birth certificate was conducted.

All eligible pregnancies were screened for study inclusion. To be included in the analysis, pregnancies were required to have: a self-reported weight; at least two measured weights within 12-months-prior-to and ≤ 42-days-after conception (for data cleaning purposes), one measured weight was required to be within 6-months-prior-to and ≤ 42-days-after conception; measured height at ≥ 18 years of age; and Kaiser enrollment at any time during pregnancy.

Data Cleaning and Variable Creation

To clean data, we omitted self-reported weights < 50 lbs (22.7 kg) as these values were deemed to be data entry errors. We manually reviewed records where self-reported weight was between 50 and 75 lbs (22.7–34.1 kg) (n = 1) or > 350 lbs (159.1 kg) (n = 16); all were deemed plausible and retained. For measured weights, we obtained all weights in the EHR taken between 12-months-prior-to and ≤ 42-days-after conception. We omitted weights measured during a previous pregnancy, within 12 weeks of a previous pregnancy outcome that was live born or stillborn, or within 4 weeks of a pregnancy outcome other than live born or stillborn. From remaining weights, we computed within-person coefficient of variance and flagged pregnancies where COV > 10. Among these, we further assessed plausibility of weight measures using the protocol described in eFigure 1. Implausible measured weights were omitted. Any pregnancy record that no longer met inclusion criteria after data cleaning was excluded (56 pregnancies from 2000 to2010; 2 pregnancies from 2015 to 2016). Using cleaned weights, we considered the conventional “gold standard” prepregnancy weight to be the measured weight closest to date of conception between 6-months-prior-to and ≤ 42-days-after conception. Because body weight is known to fluctuate (Orsama et al., 2014), we estimated an alternative “gold standard” referred to as “usual weight” and calculated this as the average of all measured weights between 6-months-prior to and ≤ 42-days-after conception.

Height was computed as the median of heights measured ≥ 18 years of age. Heights < 48 or > 78 inches were deemed implausible and omitted. Body mass index [BMI = weight (kg)/height^2 (m)] was calculated using closest measured weight to conception and median height then categorized as underweight (BMI < 18.5), normal weight (BMI 18.5–24.9), overweight (BMI 25.0–29.9), or obesity (BMI ≥ 30.0). We further categorized women with obesity as class I (BMI 30.0–34.9), class II (BMI 35.0–39.9) and class III (BMI ≥ 40.0). We manually reviewed 2 records with BMI > 65 to confirm plausibility; these observations were retained in the analysis. We calculated BMI using self-reported weight and median height to assess concordance with BMI calculated using closest measured weight.

From the EHR, we obtained woman’s age at start of pregnancy, Medicaid enrollment, trimester of prenatal care entry, and pregnancy outcome (live or stillborn vs. all other pregnancy losses). Live and stillborn were grouped together as these outcomes occur later in gestation and the woman would not know her pregnancy outcome at the time of reporting her prepregnancy weight, which may not be the case for other pregnancy outcomes. We estimated total number of weight measures the woman had in the year prior to pregnancy, regardless of whether the value was omitted during data cleaning, as a proxy measure of healthcare utilization. Women who are weighed more frequently may have better knowledge of their weight and thus self-report more accurately. For pregnancies linked to a birth certificate, we obtained race/Hispanic origin, parity, marital status, tobacco use, and educational attainment. If race/Hispanic origin was not available or unknown from the birth certificate, race/Hispanic origin were obtained from the EHR when available.

Statistical Analysis

To assess selection bias, we compared characteristics of pregnancies included in the analysis with those we excluded and those that did and did not link to a birth certificate. To assess accuracy of self-reported weight, we calculated mean difference between self-reported weight and the “gold standard” closest weight or usual weight, overall and by each maternal or clinical characteristic. We examined agreement with three indices: (1) intraclass correlation (ICC) and 95% confidence intervals (CI) for absolute agreement based on a two-way random effects model for a single measure; (2) concordance correlation coefficient (CCC) and 95% CI, a correlation that also takes into account departure from perfect agreement; and (3) limits of agreement based on Bland–Altman plots. We described differences in direction of misclassification by reporting the proportion of women self-reporting weight within > − 3, − 1 to − 3, ± 1, 1–3, > 3 kg of measured weight [(self-reported weight − measured weight)]. Because the importance in the absolute difference in weight likely depends on body weight, we described the proportion of women self-reporting weight within > − 5%, > − 2% to − 5%, ± 2%, > 2% to 5%, > 5% of their measured weight [(self-reported weight − measured weight)/measured weight]. Using multivariable linear regression, we identified maternal and clinical characteristics associated with misclassification of self-reported prepregnancy weight. Finally, we examined concordance in prepregnancy BMI category between BMI calculated using self-reported prepregnancy weight or measured weight and assess agreement using a simple κ statistic; we calculated sensitivity, specificity, positive predictive value, and negative predictive value. For all analyses, we used generalized estimating equations (GEE) to account for correlations introduced by including more than one pregnancy to the same woman. Statistical significance was set at a p-value < 0.05. Statistical analyses were run in Statistical Analysis Software (SAS) version 9.4 (SAS Institute, Cary, NC) and STATA 14 software (StataCorp LP).

Results

Of the 56,122 eligible pregnancies in 2000–2010, 16,227 (29%) had data required for the primary analysis. Of these, 12,492 (77%) linked to a birth certificate (Fig. 1). Among those excluded, 82% were missing self-reported weight or a measured weight between 6-months-prior-to and ≤ 42-days-after conception. Among pregnancies included, over half of women were overweight or had obesity, 61.0% were 25–34 years of age, the majority were non-Hispanic white (71.2%) and 95.8% entered prenatal care during their first trimester. Compared to those included, pregnancies excluded from analysis had a higher proportion of women who were younger than 25 years, had a race/Hispanic origin other than non-Hispanic white, were enrolled in Medicaid or Washington Basic Plan, or entered prenatal care after the first trimester (eTable 1). BMI category did not differ between pregnancies included or excluded from analysis.

Primary Analysis: 2000–2010 Pregnancies

Among pregnancies included in the primary analysis, 90.3% had least one measured weight in the 6 months prior to pregnancy, 43.2% had measured weight within the first 42 days-after conception, and 65.0% had a measured weight within 7–12 months prior to pregnancy; 17.9% had at least one measured weight in all 3 time periods. On average, self-reported weight was collected at 8.8 (SD 3.1) weeks of gestation, while closest measured weight was collected at 4.6 (SD 8.0) weeks prior to conception. The ICC and CCC between self-reported weight and closest measured weight were 0.985 (95%CI 0.980, 0.989) and 0.985 (95%CI 0.985, 0.986), respectively. The 95% limits of agreement were − 7.1 to 5.0 kg. For usual weight, 77% of pregnancies had 2–3 measured weights between 6-months-prior to ≤ 42-days-after conception, 20% had 4–6 measured weights, and 3% had 7 or more. The ICC and CCC between self-reported weight and usual weight were 0.985 (95%CI 0.981, 0.988) and 0.985 (95%CI 0.985, 0.986), respectively. The 95% limits of agreement were − 7.2 to 5.2 kg.

Self-reported weight averaged 1.3 kg less than closest measured weight (Table 1). Degree of misreport in self-reported weight differed by prepregnancy BMI category, trimester of prenatal care entry and pregnancy outcome. Underweight women over-reported their weight by 0.07 kg. Women in all other BMI categories underreported their weight: normal weight by 0.68 kg, overweight and class I obesity underreported by 1.3 kg, and class II/III obesity by 1.7 kg. Women entering prenatal care in the first trimester underreported by 1.0 kg, while those entering in third trimester underreported by 3.3 kg. Women with pregnancies that ended in a live or stillbirth underreported by 0.99 kg while those with other pregnancy outcomes underreported by 1.4 kg. Apart from women who were underweight, results were similar using usual weight as the gold standard.

Primary Sub-Analysis: 2000–2010 Pregnancies Linked to Birth Certificate

Compared to pregnancies included in the primary analysis, pregnancies that linked to a birth certificate had a lower proportion of women who were ≥ 35 years or had an education > 12th grade, and a higher proportion of women who were non-Hispanic white or entered prenatal care after the first trimester (eTable 2). Self-reported weight was 0.98 kg less than closest measured weight (Table 2). The predictors of misreport were consistent to findings in the primary analysis. None of the four maternal characteristics provided on the birth certificate were associated with bias in misreport.

Secondary Analysis: 2015–2016 Pregnancies

Of the 8748 eligible pregnancies in 2015–2016, fewer than half (45%) had data required (Fig. 1). Among those excluded from analysis, 74% were missing either self-reported weight or a measured weight between 6-months-prior-to and ≤ 42-days-after conception. Characteristics of the 2015–2016 cohort can be found in eTable 3.

Most pregnancies (87.7%) had at least one measured weight in the 6 months prior to pregnancy, 56.9% had measured weight within the first 42 days-after conception, and 64.9% had a measured weight within 7–12 months prior to pregnancy; 25.6% had at least one measured weight in all 3 time periods. Self-reported weight was collected on average at 7.5 (SD 3.1) weeks of gestation and closest measured weight at 2.6 (SD 7.7) weeks prior to conception, on average. The ICC and CCC between self-reported weight and closest measured weight were 0.990 (95%CI 0.988, 0.992) and 0.990 (95%CI 0.989, 0.991), respectively. The 95% limits of agreement were − 5.9 to 4.5 kg. The ICC, CCC and limits of agreement between self-reported weight and usual weight were nearly identical (data not shown).

Self-reported weight averaged 0.72 kg less than closest measured weight (eTable 4). Like 2000–2010, misreport in self-reported prepregnancy weight differed by prepregnancy BMI category and trimester of prenatal care entry; however, the degree of misreport was smaller among pregnancies in 2015–2016.

Distribution of Reporting Error by BMI Category: Absolute vs Relative Difference

The proportion of women with close agreement (± 1 kg) in terms of *absolute difference* between self-reported weight and measured weight decreased as BMI category increased. However, the proportion with close agreement (± 2%) in terms of the *difference as a proportion of body weight* was consistent by BMI category (Fig. 2).

Concordance Between Prepregnancy BMI Category Based on Self-reported or Closest Measured Weight

Among the 2000–2010 pregnancies, concordance in prepregnancy BMI category calculated with self-reported weight and BMI calculated using closest measured weight was 90.6% (κ = 0.84) (Table 3). Concordance was highest among women whose self-reported weight resulted in BMI categorized as obesity (97.6%) and lowest among women whose self-reported weight resulted in BMI categorized as underweight (69.6%). Concordance was similar (92.6%, κ = 0.86) among 2015–2016 pregnancies.

Discussion

An accurate assessment of prepregnancy weight is needed for clinical guidance related to gestational weight gain and for interpreting surveillance and research estimates related to maternal weight and gestational weight gain. We found that pregnant women tend to underreport prepregnancy weight by about 1.0–1.3 kg at prenatal care entry. The degree of misreport in our study is consistent with previous studies that found pregnant women underreport their prepregnancy weight by 0.34–1.6 kg compared to clinically measured weights prior to conception (Bannon et al., 2017; Headen et al., 2017). We found three characteristics associated with misreport of weight: prepregnancy BMI category, trimester of prenatal care entry, and pregnancy outcome.

Similar to other studies of pregnant women, (Bannon et al., 2017; Han et al., 2016; Stevens-Simon et al., 1992) we found that underreporting of prepregnancy weight increases with BMI category ranging from about 0.7 kg among normal weight women to 1.5 among women with obesity. About half of normal weight women had a self-reported weight within close agreement (± 1 kg) to measured weight whereas about one-third with obesity had close agreement. Compared to other BMI categories, women with obesity had a higher proportion that both under- or over-reported weight by more than 1 kg. Patterns were similar between the 2000–2010 and 2015–2016 cohorts, but the proportion of women under- or over-reporting by ≥ 3 kg declined over time across all BMI categories. When misreport was examined as a proportion of body weight, patterns of misreport were strikingly similar across BMI categories. Although women with obesity have a higher proportion and degree of misreport overall, the amount of misreport was proportional to body weight, illustrating that small amounts of misreport may be more clinically meaningful for leaner women.

The strongest predictor of misreport was late entry into prenatal care. Women entering prenatal care in the third trimester underreported prepregnancy weight by about 3 kg compared to 1 kg among women entering care in the first trimester, which suggests that accuracy of self-reported prepregnancy weight declines as time passes. To our knowledge, we are the first to examine misreport by trimester of prenatal care entry. Fewer than 1% of women in our study entered care in the third trimester; our findings should be confirmed.

We are also the first study to include all pregnancies regardless of outcome. We observed that women with a live or stillborn outcome underreported weight by about 1 kg compared to 1.4 kg among women with other pregnancy losses. Why misreport in prepregnancy weight differs by pregnancy outcome is unclear. Regardless of reason, accounting for this bias may be important when examining associations between maternal weight and pregnancy outcomes. Unlike other studies (Bannon et al., 2017; Han et al., 2016), we did not observe a significant difference in misreport of weight by maternal racial or ethnic group or parity.

Misreport of prepregnancy weight has implications when advising women about recommended gestational weight gain. Underreporting of prepregnancy weight could result in misclassification of BMI to a lower weight category leading a clinical provider to advise a woman to gain more weight than needed (Rasmussen et al., 2009). Overall, self-reported prepregnancy weight accurately classified 91% of women into the correct BMI category. However, notable differences existed by BMI category. Misclassification of BMI category was highest among underweight women (30.4%) and lowest among women with obesity (2.4%). In the context of providing guidance on gestational weight gain (Rasmussen et al., 2009), about 7% and 2% of pregnancies in 2000–2010 may have been advised to gain too much or too little weight.

Misreported prepregnancy weight can introduce measurement error in the estimation of total gestational weight gain and may bias estimates on adherence to gestational weight gain recommendations or for etiologic associations. We did not ascertain delivery weight to estimate total gestational weight gain, thus could not determine the proportion of women who would have their GWG adherence misclassified. Our findings on the magnitude and direction of error in self-reported prepregnancy weight can be used as internal or external validation for the application of methods that account for bias due to measurement error, such as probabilistic bias analysis or Bayesian adjustment (Lash et al., 2010; Lash, Abrams, et al., 2014; Lash, Abrams, et al., 2014; Lash, Fox, et al., 2014; Lash, Fox, et al., 2014; MacLehose & Gustafson, 2012).

Strengths of our study include large sample size and rigorous data cleaning to ensure that implausible measured weights were not included. We made two novel comparisons. First, we used a novel gold standard of "usual weight." Weight fluctuates daily (Orsama et al., 2014) and recall of past weight may approximate be the average. Self-reported weight performed slightly better against the usual weight gold standard, but agreements were not meaningfully different from the closest measured weight. Second, we examined the degree of misreport as a proportion of measured weight. The observation that one-third of women misreport their weight by more than 2% of measured weight is concerning.

Our study has limitations. First, only 29% of pregnancies from 2000 to 2010 were eligible and included. About one in four pregnancies were missing self-reported weight (23%), but the vast majority were excluded due to missing the required clinical weight measures. In 2015–2016, more pregnancies were eligible (45%) as fewer women were missing self-reported weight (8%). The lack of measured weight near conception is similar to previous studies (14% to 48% reported missing measured weight within 6 months prior to pregnancy) (Ferrara et al., 2007; He et al., 2014; Oken et al., 2007; Sharma et al., 2015; Stevens-Simon et al., 1992) and reinforces the reason self-reported prepregnancy weight is commonly used. In a relatively young and healthy population, frequent interaction with the health care system is low (Oza-Frank et al., 2014). Second, gestational age at the first prenatal visit was used to approximate the time of recall for self-reported weight but may not be exact as questionnaires could have been completed 2–4 weeks before their first visit. Despite this uncertainty, our findings show that earlier entry into prenatal care, and presumably less recall time, is associated with better accuracy in reporting prepregnancy weight. Third, we grouped live births and stillbirths together to distinguish from early pregnancy losses. Due to small sample sizes, we were unable to examine whether misreport differed between pregnancies ending with a live birth or stillbirth. Fourth, misclassification of BMI in our study is only based upon misreport of prepregnancy weight. We used the median of all adult height measures recorded to minimize variations that may be introduced by protocol (e.g., removal of shoes) or calibration differences. Finally, different settings may use different equipment for measuring weight and clinical data (e.g., taking off shoes or heavy clothes, frequency of calibrating equipment), or serve different populations; thus, our results may not be generalizable.

Conclusion

Women commonly misreport prepregnancy weight at prenatal care entry. On average, they underestimate weight by 1–1.3 kg, but the range is large (− 7 to 5 kg). We identified three characteristics associated with misreport that may introduce bias in research studies that rely on self-reported prepregnancy weight. Although self-reported weight performs reasonably well to classify BMI category for clinical recommendations on gestational weight gain, women who begin pregnancy with overweight or obesity or enter prenatal care after the first trimester may be more likely to underreport prepregnancy weight. For women close to BMI category boundaries (e.g., normal weight close to overweight, overweight close to obese classification), clinicians might consider this potential for BMI misclassification and the woman's current clinical context when counseling on gestational weight gain goals. Regardless of accuracy of prepregnancy weight, it is important for clinicians and women to focus on rate of weight gain and for women to maintain a steady trajectory as recommended (Rasmussen et al., 2009).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Funding

Research reported in this publication was funded by Contract # CDC 200-2016-M-91914, "Assessment of Self-Reported Weight," from the Centers for Disease Control and Prevention (awarded to Dr. Bulkley).

Data Availability

The study protocol is available upon request.

References

Bannon AL, Waring ME, Leung K, Masiero JV, Stone JM, Scannell EC, & Moore Simas TA (2017). Comparison of self-reported and measured pre-pregnancy weight: Implications for gestational weight gain counseling. Maternal and Child Health Journal, 21(7), 1469–1478. 10.1007/s10995-017-2266-3 [PubMed: 28155023]

Dietz PM, Rizzo JH, England LJ, Callaghan WM, Vesco KK, Bruce FC, Bulkley JE, Sharma AJ, & Hornbrook MC (2012). Early term delivery and health care utilization in the first year of life. The Journal of Pediatrics, 161(2), 234–239. 10.1016/j.jpeds.2012.02.005 [PubMed: 22421263]

Ferrara A, Weiss NS, Hedderson MM, Quesenberry CP Jr., Selby JV, Ergas IJ, Peng T, Escobar GJ, Pettitt DJ, & Sacks DA (2007). Pregnancy plasma glucose levels exceeding the American Diabetes Association thresholds, but below the National Diabetes Data Group thresholds for gestational diabetes mellitus, are related to the risk of neonatal macrosomia, hypogly-caemia and hyperbilirubinaemia. Diabetologia, 50(2), 298–306. 10.1007/s00125-006-0517-8 [PubMed: 17103140]

Goldstein RF, Abell SK, Ranasinha S, Misso M, Boyle JA, Black MH, Li N, Hu G, Corrado F, Rode L, Kim YJ, Haugen M, Song WO, Kim MH, Bogaerts A, Devlieger R, Chung JH, & Teede HJ (2017). Association of gestational weight gain with maternal and infant outcomes: A systematic review and meta-analysis. JAMA, 317(21), 2207–2225. 10.1001/jama.2017.3635 [PubMed: 28586887]

Han E, Abrams B, Sridhar S, Xu F, & Hedderson M (2016). Validity of self-reported pre-pregnancy weight and body mass index classification in an integrated health care delivery system. Paediatric and Perinatal Epidemiology, 30(4), 314–319. 10.1111/ppe.12286 [PubMed: 26961120]

He X, Hu C, Chen L, Wang Q, & Qin F (2014). The association between gestational weight gain and substantial weight retention 1-year postpartum. Archives of Gynecology and Obstetrics, 290(3), 493–499. 10.1007/s00404-014-3235-3 [PubMed: 24728106]

Headen I, Cohen AK, Mujahid M, & Abrams B (2017). The accuracy of self-reported pregnancy-related weight: A systematic review. Obesity Reviews, 18(3), 350–369. 10.1111/obr.12486 [PubMed: 28170169]

Hornbrook MC, Whitlock EP, Berg CJ, Callaghan WM, Bachman DJ, Gold R, Bruce FC, Dietz PM, & Williams SB (2007). Development of an algorithm to identify pregnancy episodes in an integrated health care delivery system. Health Services Research, 42(2), 908–927. 10.1111/j.1475-6773.2006.00635.x [PubMed: 17362224]

Kesmodel US (2018). Information bias in epidemiological studies with a special focus on obstetrics and gynecology. Acta Obstetricia et Gynecologica Scandinavica, 97(4), 417–423. 10.1111/aogs.13330 [PubMed: 29453880]

Lash TL, Abrams B, & Bodnar LM (2014). Comparison of bias analysis strategies applied to a large data set. Epidemiology, 25(4), 576–582. 10.1097/EDE.0000000000000102 [PubMed: 24815306]

Lash TL, Fox MP, MacLehose RF, Maldonado G, McCand-less LC, & Greenland S (2014). Good practices for quantitative bias analysis. International Journal of Epidemiology, 43(6), 1969–1985. 10.1093/ije/dyu149 [PubMed: 25080530]

Lash TL, Schmidt M, Jensen AO, & Engebjerg MC (2010). Methods to apply probabilistic bias analysis to summary estimates of association. Pharmacoepidemiology and Drug Safety, 19(6), 638–644. 10.1002/pds.1938 [PubMed: 20535760]

MacLehose RF, & Gustafson P (2012). Is probabilistic bias analysis approximately Bayesian? Epidemiology, 23(1), 151–158. 10.1097/EDE.0b013e31823b539c [PubMed: 22157311]

Oken E, Taveras EM, Kleinman KP, Rich-Edwards JW, & Gillman MW (2007). Gestational weight gain and child adiposity at age 3 years. American Journal of Obstetrics and Gynecology, 196(4), 322–328. 10.1016/j.ajog.2006.11.027 [PubMed: 17403405]

Orsama AL, Mattila E, Ermes M, van Gils M, Wansink B, & Korhonen I (2014). Weight rhythms: Weight increases during weekends and decreases during weekdays. Obesity Facts, 7(1), 36–47. 10.1159/000356147 [PubMed: 24504358]

Oza-Frank R, Gilson E, Keim SA, Lynch CD, & Klebanoff MA (2014). Trends and factors associated with self-reported receipt of preconception care: PRAMS, 2004–2010. Birth, 41(4), 367–373. 10.1111/birt.12122 [PubMed: 24995805]

Rasmussen KM, Yaktine AL, & Institute of Medicine (US) and National Research Council (US) Committee to Reexamine IOM Pregnancy Weight Guidelines (Eds.). (2009). Weight gain during pregnancy: Reexamining the guidelines. National Academies Press.

Satpathy HK, Fleming A, Frey D, Barsoom M, Satpathy C, & Khandalavala J (2008). Maternal obesity and pregnancy. Post-graduate Medicine, 120(3), E01–09. 10.3810/pgm.2008.09.1920

Sharma AJ, Vesco KK, Bulkley J, Callaghan WM, Bruce FC, Staab J, Hornbrook MC, & Berg CJ (2015). Associations of gestational weight gain with preterm birth among underweight and normal weight women. Maternal and Child Health Journal, 19(9), 2066–2073. 10.1007/s10995-015-1719-9 [PubMed: 25652068]

Stevens-Simon C, Roghmann KJ, & McAnarney ER (1992). Relationship of self-reported prepregnant weight and weight gain during pregnancy to maternal body habitus and age. Journal of the American Dietetic Association, 92(1), 85–87 [PubMed: 1728630]

Author Manuscript
Author Manuscript
Author Manuscript

Significance

What's already known:

Self-reported prepregnancy weight is commonly underestimated. Women with elevated body mass index (BMI) tend to underestimate their weight more than leaner women.

What this study adds:

In addition to increasing BMI category, underestimation of prepregnancy weight is higher among women who begin prenatal care after the first trimester or have a pregnancy outcome other than live or stillbirth. Misreported prepregnancy weight can introduce bias in the estimation of BMI category, total gestational weight gain, and adherence to gestational weight gain recommendations.

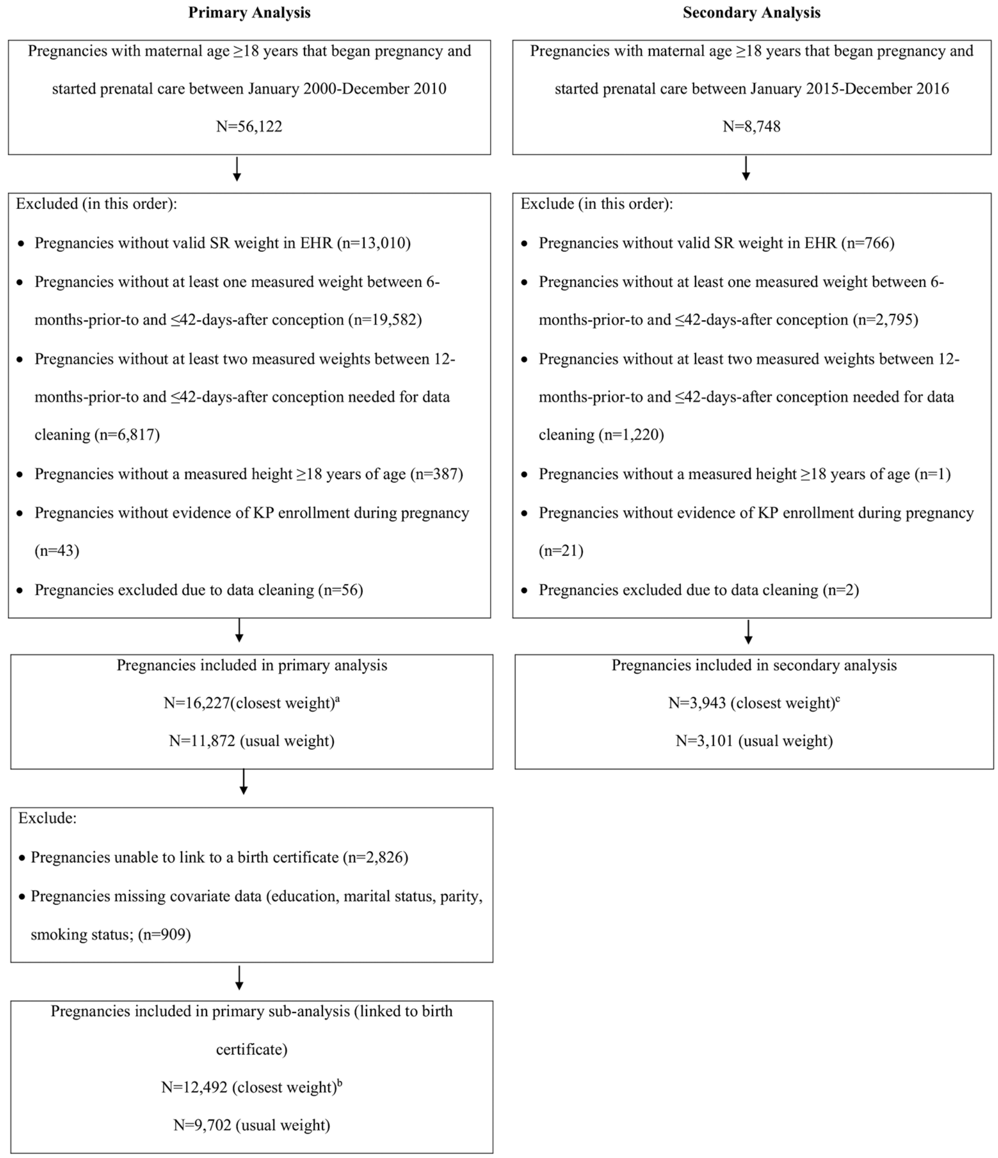

Fig. 1.

Consort diagrams for primary analysis (2000–2010) and secondary analysis (2015–2016)

a Comparison of pregnancies included in primary analysis to pregnancies excluded can be found in eTable 1.

b Comparison of pregnancies included in primary sub-analysis to pregnancies excluded can be found in eTable 2.

c Comparison of pregnancies included in secondary analysis to pregnancies excluded can be found in eTable 3.

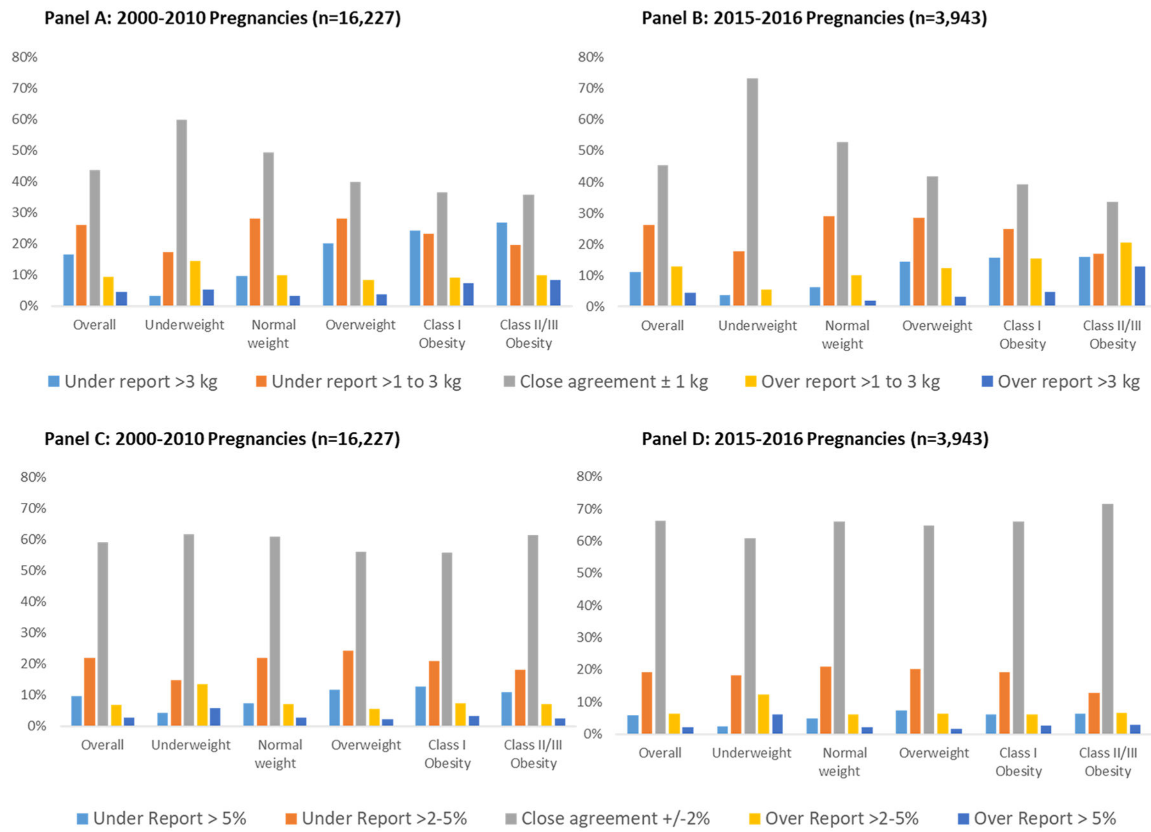

Fig. 2.

By body mass index category, distribution of reporting error in self-reported prepregnancy weight compared to weight measured CLOSEST[a] to conception in terms of absolute difference (Panels **A** and **B**) and as a proportion of measured weight (Panels **C** and **D**)

[a] Measured weight closest to date of conception between 6-months-prior-to (≤182 days) and ≤42-days-after conception.

Table 1

Mean difference and predictors of bias between self-reported prepregnancy weight and clinically measured weight by maternal or clinical characteristics, 2000–2010 pregnancies

Characteristic	Self-reported vs weight measured CLOSEST to conception[a] N = 16,227			Self-reported vs measured USUAL weight[b] N = 11,872		
	N	Mean difference: Self-reported minus CLOSEST weight (kg)	Adjusted[c]	N	Mean difference: Self-reported minus USUAL weight (kg)	Adjusted[c]
		Mean (SD)	Beta [95% CI]		Mean (SD)	Beta [95% CI]
Overall		− 1.3 (3.8)	–		− 1.2 (3.9)	–
Body Mass Index						
Underweight	347	0.07 (1.8)	0.80 [0.59, 1.0]	246	− 0.34 (1.5)	0.41 [0.21, 0.62]
Normal weight	7357	− 0.68 (2.1)	Reference[d]	5257	− 0.73 (2.1)	Reference[d]
Overweight	4276	− 1.3 (2.9)	− 0.59 [− 0.69, − 0.49]	3171	− 1.2 (2.8)	− 0.45 [− 0.57, − 0.34]
Class I Obesity	2234	− 1.3 (3.7)	− 0.66 [− 0.82, − 0.50]	1661	− 1.3 (3.8)	− 0.57 [− 0.77, − 0.38]
Class II/III Obesity	2013	− 1.7 (5.2)	− 1.0 [− 1.2, − 0.77]	1537	− 1.4 (5.4)	− 0.64 [− 0.92, − 0.37]
Age (years)						
18–24	3812	− 1.2 (3.5)	− 0.17 [− 0.31, − 0.03]	2926	− 1.1 (3.6)	− 0.21 [− 0.37, − 0.05]
25–29	5254	− 0.98 (3.0)	Reference	3810	− 0.88 (3.0)	Reference
30–34	4638	− 0.95 (2.9)	0.04 [− 0.08, 0.15]	3307	− 1.0 (3.1)	− 0.15 [− 0.29, − 0.01]
35–39	2053	− 1.1 (2.9)	− 0.05 [− 0.20, 0.10]	1473	− 1.0 (2.8)	− 0.10 [− 0.28 0.07]
40 +	470	− 1.1 (2.6)	0.00 [− 0.26, 0.25]	356	− 1.2 (2.6)	− 0.20 [− 0.49, 0.10]
Race/ethnicity						
Hispanic (any race)	1652	− 1.2 (3.1)	− 0.03 [− 0.19, 0.14]	1229	− 0.98 (3.1)	0.22 [0.02, 0.41]
White (non-Hispanic)	12,154	− 1.0 (3.1)	Reference	8888	− 1.0 (3.2)	Reference
Black (non-Hispanic)	541	− 1.2 (3.4)	− 0.01 [− 0.31, 0.28]	404	− 0.96 (3.7)	0.20 [− 0.15, 0.55]
Asian/Pacific Islander (non-Hispanic)	1232	− 0.88 (2.1)	− 0.13 [− 0.26, − 0.01]	867	− 0.79 (2.0)	0.07 [− 0.09, 0.22]
American Indian/Alaska Native (non-Hispanic)	130	− 1.4 (3.3)	− 0.26 [− 0.82, 0.29]	101	− 1.7 (3.2)	− 0.74 [− 1.8, 0.33]
Multiple/Other/Unknown	518	− 1.3 (4.1)	− 0.12 [− 0.48, 0.24]	383	− 1.2 (4.1)	− 0.09 [− 0.30, 0.13]
Enrolled in Medicaid or Washington basic health plan						
Yes	870	− 1.4 (4.1)	− 0.23 [− 0.50, 0.05]	695	− 1.6 (4.3)	− 0.44 [− 0.77, − 0.12]
No	15,357	− 1.0 (3.0)	Reference	11,177	− 0.97 (3.1)	Reference[d]

Characteristic	Self-reported vs weight measured CLOSEST to conception[a] N = 16,227			Self-reported vs measured USUAL weight[b] N = 11,872		
	N	Mean difference: Self-reported minus CLOSEST weight (kg)	Adjusted[c]	N	Mean difference: Self-reported minus USUAL weight (kg)	Adjusted[c]
		Mean (SD)	Beta [95% CI]		Mean (SD)	Beta [95% CI]
Number times weight measured in year prior to pregnancy (proxy of weight knowledge)						
2	5040	− 0.99 (3.1)	0.00 [− 0.10, 0.10]	2554	− 0.99 (3.1)	− 0.01 [− 0.15, 0.12]
3 +	11,187	− 1.1 (3.1)	Reference	9318	− 1.0 (3.2)	Reference
Prenatal care entry						
First trimester	15,550	− 1.0 (3.0)	Reference[d]	11,404	− 1.0 (3.0)	Reference[d]
Second trimester	614	− 1.6 (4.4)	− 0.59 [− 0.93, − 0.24]	425	− 1.8 (4.9)	− 0.81 [− 1.3, − 0.35]
Third trimester	63	− 3.3 (8.3)	− 2.3 [− 4.3, − 0.26]	43	− 3.3 (9.3)	− 2.3 [− 5.0, 0.43]
Pregnancy Outcome						
Live or stillborn	14,560	− 0.99 (3.1)	Reference[d]	10,615	− 0.98 (3.2)	Reference[d]
Other	1667	− 1.4 (3.1)	− 0.39 [− 0.56, − 0.23]	1257	− 1.3 (3.1)	− 0.30 [− 0.48, − 0.11]

[a] Measured weight closest to date of conception between 6-months-prior-to (≤ 182 days) and ≤ 42-days-after conception

[b] Average of all available measured weights between 6-months-prior-to (≤ 182 days) and ≤ 42-days-after conception

[c] Based on linear regression and adjusted for all other covariates in table

[d] Main effect $p < .05$

Table 2

Mean difference and predictors of bias between self-reported prepregnancy weight and clinically measured weight by maternal or clinical characteristics, 2000–2010 pregnancies linked to certificate of live birth

Characteristic	Self-reported vs weight measured CLOSEST to conception[a] N = 12,492		Self-reported vs measured USUAL weight[b] N = 9072	
	Mean difference: Self-reported minus CLOSEST weight (kg)	Adjusted[c]	Mean difference: Self-reported minus USUAL weight (kg)	Adjusted[c]
	Mean (SD)	Beta [95% CI]	Mean (SD)	Beta [95% CI]
Overall	− 0.98 (3.1)	–	− 0.98 (3.1)	–
Body Mass Index				
Underweight	0.05 (1.7)	0.76 [0.55, 0.98]	− 0.36 (1.4)	0.40 [0.19, 0.61]
Normal weight	− 0.64 (2.1)	Reference[d]	− 0.70 (2.2)	Reference[d]
Overweight	− 1.2 (2.8)	− 0.55 [− 0.66, − 0.43]	− 1.1 (2.8)	− 0.43 [− 0.56, − 0.30]
Class I Obesity	− 1.3 (3.7)	− 0.66 [− 0.84, − 0.47]	− 1.3 (3.8)	− 0.61 [− 0.83, − 0.39]
Class II/III Obesity	− 1.6 (5.1)	− 0.96 [− 1.2, − 0.70]	− 1.3 (5.2)	− 0.59 [− 0.90, − 0.29]
Age (years)				
18–24	− 1.1 (3.4)	− 0.10 [− 0.26, 0.05]	− 1.1 (3.5)	− 0.16 [− 0.35, 0.02]
25–29	− 0.95 (3.1)	Reference	− 0.87 (3.1)	Reference
30–34	− 0.87 (2.8)	0.06 [− 0.07, 0.19]	− 0.96 (3.0)	0.12 [− 0.28, 0.04]
35–39	− 1.0 (3.0)	− 0.08 [− 0.26, 0.10]	− 1.0 (2.8)	− 0.15 [− 0.35, 0.04]
40 +	− 1.0 (2.5)	0.02 [− 0.29, 0.33]	− 0.96 (2.6)	− 0.07 [− 0.44, 0.30]
Race/ethnicity				
Hispanic (any race)	− 1.2 (3.3)	− 0.08 [− 0.28, 0.12]	− 1.1 (3.3)	0.09 [− 0.15, 0.33]
White (non-Hispanic)	− 0.95 (3.1)	Reference	− 0.98 (3.2)	Reference
Black (non-Hispanic)	− 1.2 (3.5)	− 0.07 [− 0.43, 0.28]	− 0.94 (3.8)	0.20 [− 0.25, 0.65]
Asian/Pacific Islander (non-Hispanic)	− 0.86 (2.1)	− 0.14 [− 0.28, − 0.01]	− 0.74 (2.0)	0.06 [− 1.1, 0.23]
American Indian/Alaska Native (non-Hispanic)	− 1.3 (3.3)	− 0.18 [− 0.80, 0.45]	− 1.6 (3.2)	− 0.46 [− 1.1, 0.23]
Multiple/Other/Unknown	− 1.3 (3.6)	− 0.32 [− 0.85, 0.21]	− 1.2 (3.5)	− 0.21 [− 0.81, 0.38]
Enrolled in Medicaid or Washington basic health plan				
Yes	− 1.6 (4.6)	− 0.25 [− 0.58, 0.09]	− 1.5 (4.4)	− 0.45 [− 0.84, − 0.06]
No	− 0.94 (3.0)	Reference	− 0.96 (3.0)	Reference[d]

Characteristic	Self-reported vs weight measured CLOSEST to conception[a] N = 12,492		Self-reported vs measured USUAL weight[b] N = 9072	
	Mean difference: Self-reported minus CLOSEST weight (kg)	Adjusted[c]	Mean difference: Self-reported minus USUAL weight (kg)	Adjusted[c]
	Mean (SD)	Beta [95% CI]	Mean (SD)	Beta [95% CI]
Education				
< 12	− 1.4 (3.6)	− 0.16 [− 0.45, 0.12]	− 1.3 (3.5)	− 0.12 [− 0.45. 0.22]
12	− 1.1 (3.5)	Reference	− 1.1 (3.7)	Reference
> 12	− 0.90 (2.8)	0.10 [− 0.04, 0.25]	− 0.89 (2.8)	0.13 [− 0.04, 0.31]
Marital Status				
Not married	− 1.1 (3.7)	Reference	− 1.1 (3.8)	Reference
Married	− 0.95 (2.9)	− 0.02 [− 0.19, 0.16]	− 0.94 (2.9)	− 0.01 [− 0.22, 0.19]
Smoking Status				
Nonsmoker	− 0.96 (3.0)	0.13 [− 0.13, 0.38]	− 0.95 (3.0)	0.25 [− 0.07, 0.56]
Smoker	− 1.2 (3.8)	Reference	− 1.4 (4.1)	Reference
Number times weight measured in year prior to pregnancy (proxy of weight knowledge)				
2	− 0.96 (3.1)	− 0.10 [− 0.14, 0.10]	− 1.0 (3.2)	− 0.06 [− 0.22, 0.09]
3 +	− 0.99 (3.0)	Reference	− 0.97 (3.1)	Reference
Prenatal care entry				
First trimester	− 0.95 (3.0)	Reference[d]	− 0.94 (3.0)	Reference[d]
Second trimester	− 1.6 (4.4)	− 1.1 [− 2.4, 0.16]	− 1.8 (5.0)	− 0.73 [− 1.2, − 0.21]
Third trimester	− 2.2 (4.5)	− 0.53 [− 0.92, − 0.15]	− 2.1 (3.5)	− 0.99 [− 2.2, 0.24]
Parity				
Nulliparous	− 1.0 (2.9)	Reference	− 0.91 (2.9)	Reference
Multiparous	− 0.98 (3.2)	0.09 [− 0.02, 0.21]	− 1.0 (3.3)	0.03 [− 0.10, 0.16]

[a] Measured weight closest to date of conception between 6-months-prior-to (≤ 182 days) and ≤ 42-days-after conception

[b] Average of all available measured weights between 6-months-prior-to (≤ 182 days) and ≤ 42-days-after conception

[c] Based on linear regression and adjusted for all other covariates in table

[d] Main effect $p < .05$

Table 3

Concordance between prepregnancy BMI category estimated using self-reported prepregnancy weight versus weight measured CLOSEST to conception

2000–2010 Pregnancies (n = 16,227)											
BMI Category based on self-reported weight (row %)	**BMI Category based on weight measured closest to conception**[a]										
	Underweight	**Normal Weight**	**Overweight**	**Obesity**	**Row Total**	**Crude agreement**	**Kappa Statistic**	**SE %**	**SP%**	**PPV%**	**NPV %**
Underweight	291	126	1	0	418	90.6	0.86	83.9	99.2	69.6	99.6
	69.6%	30.1%	0.2%	0%	2.6%						
Normal Weight	56	7028	660	6	7750			95.5	91.9	90.7	96.1
	0.7%	90.7%	8.5%	0.1%	47.8%						
Overweight	0	202	3519	370	4091			82.3	95.2	86.0	93.8
	0%	4.9%	86.0%	9.0%	25.2%						
Obesity	0	1	96	3871	3968			91.1	99.2	97.6	96.9
	0%	0%	2.4%	97.6%	24.5%						
Column Total	347	7357	4276	4247	16,227						
	2.1%	45.3%	26.4%	26.2%	100%						
2015–2016 Pregnancies (n = 3943)											
BMI Category based on self-reported weight (row %)	**BMI Category based on weight measured closest to conception**[a]										
	Underweight	**Normal Weight**	**Overweight**	**Obesity**	**Row Total**	**Crude agreement**	**Kappa Statistic**	**SE %**	**SP%**	**PPV%**	**NPV %**
Underweight	72	29	0	0	101	92.6	0.89	87.8	99.2	71.3	99.7
	71.3%	28.7%	0%	0%	2.6%						
Normal Weight	10	1605	117	0	1732			96.3	94.4	92.7	97.2
	0.6%	92.7%	6.8%	0%	43.9%						
Overweight	0	33	886	77	996			86.1	96.2	89.0	95.1
	0%	3.3%	89.0%	7.7%	25.3%						
Obesity	0	0	26	1088	1114			93.4	99.1	97.7	97.3
	0%	0%	2.3%	97.7%	28.6%						
Column Total	82	1667	1029	1165	3943						
	2.1%	42.3%	26.1%	29.6%	100%						

SE sensitivity; *SP* specificity; *PPV* positive predictive value; *NPV* negative predictive value

[a]Measured weight closest to date of conception between 6-months-prior-to (≤ 182 days) and ≤ 42-days-after conception