OBSTETRICS

Weight gain in pregnancy: does the Institute of Medicine have it right?

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OBJECTIVE: We aimed to examine whether women who adhered to Institute of Medicine (IOM) guidelines for gestational weight gain (GWG) had improved perinatal outcomes.

STUDY DESIGN: This is a population-based retrospective cohort study of nulliparous women with term singleton vertex births in the United States from 2011 through 2012. Women with medical or obstetric complications were excluded. Prepregnancy body mass index was calculated using reported weight and height. Women were categorized into 4 groups based on GWG and prepregnancy body mass index: (1) weight gain less than, (2) weight gain within, (3) weight gain 1-19 lb in excess of, and (4) weight gain ≥20 lb in excess of the IOM guidelines. The χ^2 test and multivariable logistic regression analysis were used for statistical comparisons.

RESULTS: Compared to women who had GWG within the IOM guidelines, women with excessive weight gain, particularly ≥20 lb, were more likely to have adverse maternal outcomes (preeclampsia: adjusted odds ratio [aOR], 2.78; 95% confidence interval [CI], 2.82–2.93; eclampsia: aOR, 2.51; 95% CI, 2.27–2.78; cesarean: aOR, 2.1; 95% CI, 2.14–2.19), blood transfusion (aOR, 1.22; 95% CI, 1.11–1.33), and neonatal outcomes (5-minute Apgar <4: aOR, 1.22; 95% CI, 1.14–1.31; ventilation use >6 hours: aOR, 1.24; 95% CI, 1.15–1.33; seizure: aOR, 1.53; 95% CI, 1.24–1.89). Women who gained less than IOM guidelines had lower risks of hypertensive disorders of pregnancy and obstetric interventions but were more likely to have small-for-gestational-age neonates (aOR, 1.55; 95% CI, 1.52–1.59).

CONCLUSION: Women whose GWG is in excess of IOM guidelines have higher risk of adverse maternal and neonatal outcomes, particularly in women with ≥20 lb excess weight gain above guidelines while women who had weight gain below the IOM guidelines were less likely to have maternal morbidity but had higher odds of small for gestational age.

Key words: gestational weight gain, Institute of Medicine, perinatal outcomes

In 2009, the Institute of Medicine (IOM) put forth new guidelines regarding how much weight women should gain during pregnancy.[1] The impetus for the update was partly due to the increasing availability of data on the effect of gestational weight gain (GWG) on perinatal outcomes as well as the changing obstetric population over time since its last recommendation in 1990.[2]

In particular, the 1990 guidelines did not give an upper limit for weight gain in obese patients whereas the revised 2009 guidelines gave a specific recommended range for obese women. Compared to decades prior, women in the United States today are more likely to delay childbearing, have greater access to assisted reproductive technology, have multifetal gestations, have greater racial/ethnic diversity, and be overweight or obese.[3] All of these factors contribute to the fact that up to 70% of pregnant women gain weight in excess of current IOM guidelines.[4]

Previous studies have shown that increasing GWG is associated with higher risk of gestational hypertension,[4-7] preeclampsia,[4,6,8-12] and cesarean delivery.[4-6,8,9,13] Additionally, some studies have shown that increased GWG is associated with adverse neonatal outcomes such as fetal macrosomia,[4-6,8,9,13-15] low Apgar score,[13] hypoglycemia,[5,13,14] admission to the neonatal intensive care unit (NICU),[13] and prolonged hospital stay.[13] There are additional studies associating higher GWG and increased risks of childhood obesity.[16]

Since the release of the IOM guidelines on GWG in 2009, data remain scarce regarding whether adherence to the guidelines is associated with improved perinatal outcomes. Moreover, obesity and excessive GWG continue to be growing public health problems, yet it

remains unclear whether there are increasing odds of adverse outcomes with increasing GWG above IOM guidelines. Thus, we designed a population-based, retrospective cohort study to examine GWG classified by the IOM guidelines and associated perinatal outcomes. Our hypothesis was that women who had GWG below or above the IOM guidelines were at higher risk of maternal and neonatal morbidity compared to women whose weight gain was in accordance with the IOM guidelines, particularly in the obese women.

MATERIALS AND METHODS

This is a population-based retrospective cohort study of low-risk nulliparous women with term singleton vertex live births in the United States from 2011 through 2012 using the Vital Statistics Natality birth certificate registry provided and maintained by the Centers for Disease Control and Prevention National Center for Health Statistics. This data set included births to US and non-US residents that occurred in the 50 United States, and the District of Columbia. The 2011 through 2012 birth data were compiled using either the 2003 Revision or the 1989 Revision of US Standard Certificate of Live Birth. Thirty-six states and the District of Columbia had implemented the revised birth certificate in 2011: California, Colorado, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Michigan, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Washington, Wisconsin, and Wyoming. These states represent 83% of live births to US citizens in 2011.[17] In 2012, 2 additional states, Massachusetts and Minnesota, also compiled birth data using the 2003 Revision of US Standard Certificate of Live Birth; these 38 states as well as the District of Columbia represent 86.3% of births to US citizens in 2012.[18] Since information on prepregnancy weight and height was collected in the 2003 Revision of US Standard

Certificate of Live Birth but not in the 1989 Revision, women who gave birth in states using the 1989 Revision in 2011 or 2012 were excluded from analysis. Additionally, we excluded women with medical or obstetric conditions (prepregnancy diabetes mellitus, chronic hypertension, prior preterm birth, and history of poor pregnancy outcome) as well as women who had missing information regarding prepregnancy weight, height, or weight gain in pregnancy.

Collection of information on maternal height and prepregnancy weight was by direct self-report via the Mother's Worksheet for the Child's Birth Certificate (available at http://www.cdc.gov/nchs/data/dvs/momswkstf_improv.pdf). More specifically, questions regarding height and prepregnancy weight were: "What is your height?" and "What was your prepregnancy weight, that is, your weight immediately before you become pregnant with this child?" Information on mother's weight at delivery was collected directly from the medical record. The acceptable range of maternal weight values is 50-400 lb; values out of this range were edited to "not stated" in the natality data and treated as missing, thus not included for the analysis. GWG in pregnancy was calculated by subtracting each individual mother's prepregnancy weight from her weight at delivery. Prepregnancy body mass index (BMI) was calculated using the below formula:

Women were categorized into 4 groups based on prepregnancy BMI and GWG relative to the IOM guidelines (Table 1): (1) weight gain below, (2) weight gain within, (3) weight gain 1-19 lb above, and (4) weight gain ≥20 lb above the IOM guidelines.

Perinatal outcomes were compared between the 4 groups of women who had GWG below, within, 1-19 lb above, or ≥20 lb above the IOM guidelines. Maternal outcomes examined included gestational diabetes mellitus (GDM), gestational hypertension/preeclampsia, eclampsia, induction of labor, cesarean delivery, chorioamnionitis, antibiotics use, postpartum hemorrhage requiring blood transfusion, and intensive care unit (ICU) admission. Neonatal outcomes examined were 5-minute Apgar <4, mechanical ventilation use >6 hours, neonatal seizures, NICU admission, birth trauma, antibiotics use, neonatal transfer to higher-level nursery, large for gestational age (LGA) (>97th percentile), and small for gestational age (SGA) (<3rd percentile). The χ^2 test was used to compare dichotomous outcomes and multivariable logistic regression analysis was used to control for potential confounding. Women whose gestational weight fell within the IOM guidelines were designated as the referent. Covariates included in the multivariable logistic regression

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$$([\text{prepregnancy weight \{lb\}}]/[\text{height \{in\}}]^2) \times 703$$