Objectives

- To describe the prevalence of maternal obesity and excessive gestational weight gain in North America
- To review the 2009 IOM weight gain guidelines and the evidence in support of the guidelines
- To summarize what we have learned to date since the release of the 2009 IOM guidelines
- To inform women and practitioners about the tool kit developed by the IOM committee

Classification* of adult underweight, overweight and obesity by BMI

<table>
<thead>
<tr>
<th>Obesity Class</th>
<th>BMI (kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt;18.5</td>
</tr>
<tr>
<td>Normal</td>
<td>18.5 - 24.9</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.0 - 29.9</td>
</tr>
<tr>
<td>Obesity I</td>
<td>30.0 - 34.9</td>
</tr>
<tr>
<td>Obesity II</td>
<td>35.0 - 39.9</td>
</tr>
<tr>
<td>Obesity III</td>
<td>40+</td>
</tr>
</tbody>
</table>

*National Heart Lung and Blood Institute (NHLBI), 1998
Siega-Riz AM. Maternal Obesity & Gestational Weight Gain. Promoting Healthy Weight 2.0 Colloquium. The University of Tennessee, Knoxville


Source: Canadian Health Measures Survey, Canadian Heart Health Surveys, NHANES; Shields, Carroll, & Ogden, 2011

*Canadian data are for adolescents aged 12–17 years.
†Adolescent data from the 1978-79 Canadian Health Survey.


*Data for 2006 are for all women aged 20 years and older.


Source: NHANES; Ogden et al. JAMA 2010; Ogden et al. JAMA 2012. Obesity defined as BMI ≥95th percentile. NH=non-Hispanic.
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March 25, 2014

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**Conditions Associated with Obesity in Adult Women**

- Sleep disorders
- Hypertension
- Type 2 diabetes
- Gallbladder disease
- Gout
- Eating disorders
- Reduced fecundity and fertility

*Source: Adapted from Bray GA, 2003*

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**Conditions Associated with Obesity During Pregnancy**

- Birth Defects
- Gestational hypertension
- Preeclampsia
- Gestational diabetes
- Late fetal death
- Cesarean Delivery
- Fetal macrosomia
- Gallbladder disease
- Thromboembolic Diseases

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**Conditions Associated with Obesity in Postpartum Women**

- Weight Retention
- Anemia
- Shorter breastfeeding duration
Findings from the Systematic Evidence Based Review

- Strong evidence that overweight/obese women are more likely to have c-sections.
- Strong evidence that overweight/obese women have higher birth weight infants and less LBW or SGA.
- Moderate evidence that obese women less likely to initiate breastfeeding and if they do, they breastfed for a shorter duration.
- Inconclusive evidence that overweight/obese retain more weight postpartum.

Balancing the risk and benefits of gestational weight gain

Possible causal pathways between maternal nutritional status and birth weight or postpartum weight retention

- Maternal nutritional status (available energy and nutrients) (BMI = proxy)
- Duration of gestation
- GWG
- Fetus
- Products of conception
  - Plasma volume
  - Maternal body fat
  - Extracellular fluid, other body composition changes
- Birthweight
- Postpartum weight retention

AHRQ Pub #08-E09

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**Basic Principles**

<table>
<thead>
<tr>
<th>Component</th>
<th>Increase at term (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fetus</td>
<td>3.40 (2.5 – 5.0)</td>
</tr>
<tr>
<td>Placenta</td>
<td>0.65</td>
</tr>
<tr>
<td>Amniotic fluid</td>
<td>0.80</td>
</tr>
<tr>
<td>Maternal tissue (uterus, mammary glands)</td>
<td>1.38</td>
</tr>
<tr>
<td>Blood (plasma and red cell volume)</td>
<td>1.45</td>
</tr>
<tr>
<td>Maternal stores (fat)</td>
<td>3.35 (loss – gain)</td>
</tr>
<tr>
<td>Extracellular extravascular fluid</td>
<td>1.48 (with edema, 4.7)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>12.5</td>
</tr>
</tbody>
</table>

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**IOM Recommendations**

<table>
<thead>
<tr>
<th>Prepregnancy BMI category</th>
<th>Total weight gain (lb, kg)</th>
<th>Rate of weight gain 2nd and 3rd trimester (lb/wk, kg/wk)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight (&lt;18.5 kg/m²)</td>
<td>28-40, 12.5-18</td>
<td>0.12 (1.0-1.3), 0.51 (0.44-0.58)</td>
</tr>
<tr>
<td>Normal-weight (18.5-24.9 kg/m²)</td>
<td>24-36, 11.5-16</td>
<td>1.0 (0.8-1.0), 0.42 (0.35-0.50)</td>
</tr>
<tr>
<td>Overweight (25.0-29.9 kg/m²)</td>
<td>15-25, 7.5-11.5</td>
<td>0.6 (0.5-0.7), 0.28 (0.23-0.31)</td>
</tr>
<tr>
<td>Obese (≥30.0 kg/m²)</td>
<td>11-20, 5-9</td>
<td>0.8 (0.4-0.6), 0.22 (0.17-0.27)</td>
</tr>
</tbody>
</table>

*Calculations assume a first-trimester weight gain of 1.1-4.4 lb (0.5-2.0 kg)
Siega-Riz AM. Maternal Obesity & Gestational Weight Gain. Promoting Healthy Weight 2.0 Colloquium. The University of Tennessee, Knoxville

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Comparison of current GWG* and new guidelines by prepregnancy BMI category

*PRAMS 2002-03

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Intervention Studies During Pregnancy

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Mean difference in GWG (kg) with dietary and lifestyle interventions in pregnancy

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Pregnancy, Infection, & Nutrition (PIN) Study Data - 1998-2005

Women recruited <20 weeks’ gestation (n=~ 5000)

Data collected includes:
- Sociodemographic, Reproductive, Health Behaviors, Psychological factors
- Telephone interviews (17-22 weeks, 27-30 weeks)
- Self-administered questionnaires
- Biospecimens: Blood and Urine (<20 weeks, 26-29 weeks)
- Ultrasounds (<20 weeks, 24-29 weeks)
- Delivery information collected via logs in the hospital and medical records abstracted
- Placenta data on a subset includes weight, photographs, and histology

Predicted Adequacy of Weight Gain Ratio by BMI

From Multivariate Adjusted Linear Regression Models

Mumford et al., JADA 2008
Maternal Attitudes About Gaining Weight


Weight Gain Advice

Professional advice lacks credibility

“I stop listening . . . it’s as though [staff] is doing the same thing with everybody . . . you can’t sit there and come at me with this same formula . . . that you’ve given everybody else.”

(High BMI African–American)


Built Environment

Laraia et al. (2007) conducted a multilevel study of neighborhood factors associated with physical activity and weight gain during pregnancy.

- Social spaces, defined as presence of parks, sidewalks, and porches as well as the presence of people, including nonresidential visitors, was associated with decreased odds for inadequate or excessive GWG.
Next Steps for Intervention Studies

- Studies that combine diet and physical activity—especially targeted to obese women
- Need to take into consideration stages of change, tailored messaging, social cues, and the built environment
- Must address parenting skills and the stressful lives women lead
- Frequent interactions and self monitoring
- Interdisciplinary team that focus on the pre-and inter-conceptional period

Social-Ecological Model

What can we do now to help women enter pregnancy healthy and have optimal outcomes?

- Conceive at a normal prepregnancy BMI
  - Requires preconceptional counseling, contraception, and, for some, weight loss
- Gain within the guidelines
  - Inform women and their health care providers of the guidelines
  - Provide individualized assistance with meeting the guidelines
  - Monitor GWG, guidance on diet and exercise
  - Need to address the fact that women live busy lives and many time constraints

2009 IOM report
Educated women that they are not eating for two!

<table>
<thead>
<tr>
<th>Food</th>
<th>Calories (kiloctories)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 oz lowfat vanilla yogurt + 2 Tb almonds + ½ C berries</td>
<td>340†</td>
</tr>
<tr>
<td>2 oz cheddar cheese + 5 cherry tomatoes + 5 round crackers</td>
<td>340†</td>
</tr>
<tr>
<td>1 medium banana + 1 Tb peanut butter + 8 oz skim milk</td>
<td>340†</td>
</tr>
<tr>
<td>10 medium baby carrots + 1 Tb reduced calorie ranch dressing + 1 medium apple + 2 Tb walnuts</td>
<td>340†</td>
</tr>
<tr>
<td>12 oz fruit smoothie(fruit, juice, lowfat yogurt) + 2 Tb trail mix</td>
<td>450</td>
</tr>
</tbody>
</table>

Widen and Siega-Riz JMWH 2010

Graphic: Guidelines on Weight Gain & Pregnancy

Toolkit: www.iom.edu/whattogaintoolkit

Toolkit: Pregnancy Weight Gain Guidelines

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Questions?

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