The Current Understanding of Pre-Pregnancy Weight, Gestational Weight Gain, and the Impacts on Maternal and Child Health Among Women with Obesity

June 13, 2018 (12-1 PM EST)
Agenda

12:00 PM  Welcome and Introduction: What We Know
Anna Maria Siega-Riz, University of Virginia

12:10 PM  New Evidence: Weight Gain for Women with BMI ≥ 35 kg/m²
Lisa Bodnar, University of Pittsburgh

12:30 PM  Interventions: Research and Practice
Naomi Stotland, University of California, San Francisco

12:50 PM  Next Steps + Wrap-Up
Jamie Stang, University of Minnesota

1:00 PM   Adjourn

Planning Committee: Anne Dattilo, Nestlé Nutrition; Anna Maria Siega-Riz, University of Virginia; Jamie Stang, University of Minnesota School of Public Health; and Mary Story, Duke University.
Welcome and Introduction: What We Know

Anna Maria Siega-Riz, University of Virginia
Weight Gain During Pregnancy: Reexamining the Guidelines

Committee to Reexamine IOM Pregnancy Weight Guidelines
Released May 27, 2009
Balancing the risk and benefits of gestational weight gain
# 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>
## 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>1.0 (1.0-1.3), 0.51 (0.44-0.58)</td>
</tr>
<tr>
<td>Normal-weight (18.5-24.9 kg/m²)</td>
<td>25-35, 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, 7-11.5</td>
<td>0.6 (0.5-0.7), 0.28 (0.23-0.33)</td>
</tr>
<tr>
<td>Obese (≥ 30.0 kg/m²)</td>
<td>11-20, 5-9</td>
<td>0.5 (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)*
Comparison of Current GWG* and New Guidelines by Prepregnancy BMI Category

*PRAMS 2002-03
Conditions Associated with Obesity in Adult Women

- Hypertension
- Type 2 diabetes
- Gallbladder disease
- Gout
- Eating disorders
- Reduced fecundity and fertility
- Stroke
- Heart disease
- Hyperlipidemia
- Some cancers
- Osteoarthritis
- Mood disorders

Source: Adapted from Bray GA, 2003
Conditions Associated with Obesity During Pregnancy

- Birth Defects
- Early neonatal death
- Gestational diabetes
- Preeclampsia
- Gallbladder disease
- Thromboembolic Diseases

- Gestational hypertension
- Late fetal death
- Cesarean Delivery
- Fetal macrosomia

Source: Adapted from Bray GA, 2003
New Evidence: Weight Gain for Women with BMI $\geq 35$ kg/m$^2$

Lisa Bodnar, University of Pittsburgh
Severe obesity is rising in U.S. women

Fryar et al. 2016
Nearly 1 in 10 women has severe obesity at conception

- Normal weight: 51%
- Overweight: 24%
- Grade 1 obese: 12%
- Grade 2 obese: 5%
- Grade 3 obese: 4%
- Underweight: 4%

Deputy et al. Ob Gyn 2015
Nearly 1 in 10 women has severe obesity at conception

- Normal weight: 51%
- Overweight: 24%
- Grade 1 obese: 12%
- Grade 2 obese: 5%
- Grade 3 obese: 4%
- Underweight: 4%
- BMI ≥ 40: 4%
- BMI 35–39: 5%
- BMI 30–34: 12%

Deputy et al. Ob Gyn 2015
Gestational weight gain declines as BMI increases

- Normal weight: 15.1–15.6 kg
- Grade 1 obesity: 12.3–12.7 kg
- Grade 2 obesity: 10.0–10.8 kg
- Grade 3 obesity: 7.5–9.5 kg

Source: Johnson Bodnar 2010, Durie Hinkle Park Kominiarek Bodnar 2016
Gestational weight gain declines as BMI increases.

Mean gestational weight gain (kg) across different BMI grades:

- Normal weight: 15.1–15.6 kg
- Grade 1 obesity: 12.3–12.7 kg
- Grade 2 obesity: 10.0–10.8 kg
- Grade 3 obesity: 7.5–9.5 kg

IOM-recommended range:

- Johnson
- Bodnar 2010
- Durie
- Hinkle
- Park
- Kominiarek
- Bodnar 2016
Fewer than 1 in 4 pregnant women with obesity gains within the IOM-recommended range

Deputy et al. Ob Gyn 2015
Pattern of gestational weight gain

Hutcheon et al. 
AJCN 2013

Obesity 2015

Hutcheon et al.

Normal Weight

Gestational weight gain (kg) vs. Gestational age (weeks)

Obese Class I

Gestational weight gain (kg) vs. Gestational age (weeks)

Obese class II

Gestational weight gain (kg) vs. Gestational age (weeks)

Obese class III

Gestational weight gain (kg) vs. Gestational age (weeks)
Percent with weight loss during pregnancy

2% - 5%
4% - 9%
9% - 16%

Grade 1 obese
Grade 2 obese
Grade 3 obese

Bodnar 2010
Blomberg
Bogaerts
Bogaerts
Beyerlein
Hinkle
Durie
Bodnar 2016
Health outcomes related to gestational weight gain

- Preeclampsia
- Gestational diabetes
- Small-for-gestational-age birth
- Large-for-gestational-age birth
- Stillbirth
- Mode of delivery
  - Preterm birth
  - Infant death
- Maternal obesity
- Chronic conditions
- Child obesity
- Cognitive function and behavior
- Chronic conditions
Health outcomes related to gestational weight gain

- Preeclampsia
- Gestational diabetes
- Small-for-gestational-age birth
- Large-for-gestational-age birth
- Stillbirth

- Mode of delivery
  - Preterm birth
  - Infant death

- Maternal obesity
- Chronic conditions

- Child obesity
- Cognitive function and behavior
- Chronic conditions
Gestational diabetes (GDM)

MacDonald et al. *Epidemiology* 2017

Adjusted odds ratio (95% CI)

<table>
<thead>
<tr>
<th>Grade 1 obese</th>
<th>1st trimester weight gain trajectory</th>
<th>2nd trimester weight gain trajectory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 2 obese</td>
<td>1st trimester weight gain trajectory</td>
<td>2nd trimester weight gain trajectory</td>
</tr>
<tr>
<td>Grade 3 obese</td>
<td>1st trimester weight gain trajectory</td>
<td>2nd trimester weight gain trajectory</td>
</tr>
</tbody>
</table>

n = 179 cases
n = 129 cases
n = 96 cases
Large-for-gestational-age birth

Faucher & Barger Women and Birth 2015
Small-for-gestational age birth

Faucher & Barger Women and Birth 2015
Cesarean delivery
Preterm birth at <37 weeks

Bodnar et al. *Epidemiology* 2016

![Graph showing adjusted risk of preterm birth vs. gestational weight gain Z-score for different grades of obesity](image)

- Grade 3 obese
  * (n=4701 cases)
- Grade 2 obese
  * (n=4701 cases)
- Grade 1 obese
  * (n=12,881 cases)
Preterm birth at <37 weeks

Adjusted Risk

Gestational Weight Gain Z-Score

~21 kg at 40 weeks

Grade 1 obese
(n=12,881 cases)

Grade 2 obese
(n=4701 cases)

Grade 3 obese
(n=4701 cases)

Bodnar et al. *Epidemiology* 2016
Preterm birth at <37 weeks

Bodnar et al. Epidemiology 2016

Adjusted Risk

Grade 1 obese
(n=12,881 cases)

Grade 2 obese
(n=4701 cases)

Grade 3 obese
(n=4701 cases)

~21 kg at 40 weeks

35 kg

Gestational Weight Gain Z-Score
Infant death

Bodnar et al. Obesity 2016

Grade 1 obese (n=781 cases)
Grade 2 obese (n=466 cases)
Grade 3 obese (n=333 cases)

Adjusted Risk

Gestational Weight Gain Z-Score

2–5.5 kg

35–42 kg
Grade 2 obesity: Multiple, competing outcomes of varying severity

Bodnar et al. Epidemiology 2016
Bodnar et al. Obesity 2016
Grade 2 obesity: Multiple, competing outcomes of varying severity

- Cesarean delivery
- LGA birth
- Preterm
- SGA birth

Equivalent total weight gain at 40 weeks, kg

IOM-recommended range

Adjusted Risk

Infant death

Bodnar et al. *Epidemiology* 2016

Bodnar et al. *Obesity* 2016
Grade 2 obesity: Multiple, competing outcomes of varying severity

Adjusted Risk

IOM-recommended range

Cesarean delivery

LGA birth

Preterm

SGA birth

Equivalent total weight gain at 40 weeks, kg

0.60-

0.50-

0.40-

0.30-

0.20-

0.10-

0.00-

-8.2

-4.0

1.8

9.9

21

37

Adjusted Risk

0.020-

0.015-

0.010-

0.005-

0.000-

-4.0

1.8

9.9

21

37

IOM-recommended range

Infant death

Equivalent total weight gain at 40 weeks, kg

Bodnar et al. *Epidemiology* 2016

Bodnar et al. *Obesity* 2016
Translating research into guidelines: challenges

- Multiple, competing outcomes
- Evaluate outcomes in one population
- Outcomes vary in severity
Summary

● Gestational weight gain declines with severity of obesity.
● Few women with obesity gain within the recommended ranges.
● Risks of low pregnancy weight gain
  ○ SGA birth
  ○ Infant death (but not among grade 3 obese)
● Risks of high pregnancy weight gain
  ○ Cesarean delivery
  ○ LGA birth
  ○ Preterm birth (very high weight gain)
  ○ Infant death (but not among grade 3 obese)
● Innovative methods needed to objectively determine optimal weight gain
Interventions:
Research and Practice

*Listening to Patients and Communities*

Naomi Stotland, University of California, San Francisco
“When I first Googled obesity and pregnancy, I was just one month pregnant with my first child and only partly prepared for the bad news. The rhetoric was alarming — words like “dangerous complications” and “life-threatening” filled my search results, along with rundowns on risk factors for everything from gestational diabetes to infant mortality. And, at the end of most articles, there was a statement that went something like this: Doctors recommend that obese women thinking about getting pregnant should attempt to lose weight before conceiving.”

I remember thinking, Well, too late for that.”

“In my experience, doctors tend to fall into one of two camps: They either ignore my weight, even when it seems relevant and I press the issue, or they make it the center focus of all of my health issues.”

What Interventions Have Been Studied?

• Traditional diet, exercise, and diet + exercise
• Digital Health
• Meal replacement
• Group prenatal care
Traditional Diet and Exercise Interventions

• Overall, diet, exercise, and diet + exercise interventions in pregnancy show a modest but significant effect on reducing GWG

• However, many studies (esp in U.S.) show that these interventions are LESS effective among women with obesity

• The interventions studied are often not well-described and are heterogeneous from study to study, so difficult to interpret as a whole

• Not surprisingly, more intensive (and expensive) interventions with more frequent human interaction seem to be more effective

• Type of diet (eg low glycemic, low fat) seems to be less important than overall caloric restriction, similar to non-pregnant studies, but little is known about long-term impact on offspring
• Need data on frequency of app use (e.g. fitness trackers) during pregnancy among pregnant women overall

• Need data on how often providers are recommending apps

• One study of low-income pregnant women showed high rate of smartphone use but low rate of app use

• Review found that digital health interventions for weight gain in pregnancy were effective, but more effective if used in conjunction with human element (phone calls, in-person visits, group visits.)

• Overall, diet and exercise tracking are effective weight management tools so should probably be more encouraged during pregnancy

• Need better research and better apps specifically designed for pregnancy diet/activity/weight tracking
Randomized controlled clinical trial of behavioral lifestyle intervention with partial meal replacement to reduce excessive gestational weight gain.

Phelan S1, Wing RR2, Brenan A1, McHugh A3, Hackobian TA1, Schaffer A4, Jellalian E1, Hart CN2, Scholl TO5, Munoz-Christian K6, Yin E7, Phipps MG8, Keadle S8, Abrams B8.

Abstract

BACKGROUND: Behavioral lifestyle interventions during pregnancy can prevent excessive gestational weight gain (GWG) in women with normal weight, however, effective interventions to reduce GWG in ethnically diverse women with obesity are lacking.

OBJECTIVE: A randomized controlled trial was conducted to test whether a behavioral lifestyle intervention with partial meal replacement reduces GWG rate in Hispanic and non-Hispanic women with overweight or obesity relative to enhanced usual care.

DESIGN: Participants (n = 257) were recruited in San Luis Obispo, California, and Providence, Rhode Island, between November 2012 and May 2016. Participants were pregnant (mean ± SD: 13.6 ± 1.8 wk of gestation) with overweight or obesity and had a mean age of 30.3 y. 41.6% of participants were Hispanic. Women were randomly assigned within site and by ethnicity to enhanced usual care (n = 128) or to a behavioral lifestyle intervention with partial meal replacement (n = 129). The primary outcome was GWG per week of observation. Secondary outcomes were proportions exceeding Institute of Medicine (IOM) guidelines for total GWG, changes in weight-control behaviors and cardiovascular disease risk factors, and incidence of pregnancy complications. Study retention was 99.6% (256 of 257).

RESULTS: The intervention compared with usual care resulted in less mean ± SD weekly GWG (0.33 ± 0.25 compared with 0.39 ± 0.23 kg/wk; P = 0.02) and total GWG (9.4 ± 6.9 compared with 11.2 ± 7.0 kg; P = 0.03) and reduced the proportion of women who exceeded IOM guidelines for total GWG (41.1% compared with 53.3%; P = 0.03). No significant group × time × demographic subgroup (ethnicity, BMI, age, parity, and income) interactions were observed. Among intervention participants, greater meal replacement intake was related to reduced GWG rate (β = -0.07; 95% CI: -0.12, -0.03; P = 0.002). The intervention compared with usual care increased weight-control strategies (P < 0.0001) and cognitive restraint (P < 0.0001) and reduced triglycerides (P = 0.03).

CONCLUSION: Prenatal behavioral intervention with partial meal replacement significantly reduced GWG in Hispanic and non-Hispanic women with overweight or obesity. This trial was registered at www.clinicaltrials.gov as NCT01545934.
The clinical impact was small but statistically significant, and especially impressive given that this intervention (Centering) was not specifically designed to prevent excessive weight gain.

The effect was seen among all BMI groups including women with obesity.

The effect persisted at 12 months postpartum.
Abstract

OBJECTIVE

The objective of the study was to investigate whether group prenatal care (Centering Pregnancy Plus (CP+)) has an impact on pregnancy weight gain and postpartum weight loss trajectories and to determine whether prenatal depression and distress might moderate these trajectories.

STUDY DESIGN

This was a secondary analysis of a cluster-randomized trial of CP+ in 14 Community Health Centers and hospitals in New York City. Participants were pregnant women aged 14–21 years (n = 984). Medical record review and structured interviews were conducted in the second and third trimesters and 6 and 12 months postpartum. Longitudinal mixed modeling was utilized to evaluate the weight change trajectories in the control and intervention groups. Prenatal distress and depression were also assessed to examine their impact on weight change.

RESULTS

There were no significant differences between the intervention and control groups in baseline demographics. Thirty-five percent of the participants were overweight or obese, and more than 50% had excessive weight gain by Institute of Medicine standards. CP+ was associated with improved weight trajectories compared with controls ($P < .0001$): women at clinical sites randomized to group prenatal care gained less weight during pregnancy and lost more weight postpartum. This effect was sustained among women who were categorized as obese based on prepregnancy body mass index ($P < .01$). Prenatal depression and distress were significantly associated with higher antepartum weight gain and postpartum weight retention. Women with the highest levels of depression and prenatal distress exhibited the greatest positive impact of group prenatal care on weight trajectories during pregnancy and through 12 months postpartum.

CONCLUSION

Group prenatal care has a significant impact on weight gain trajectories in pregnancy and postpartum. The intervention also appeared to mitigate the effects of depression and prenatal distress on antepartum weight gain and postpartum weight retention. Targeted efforts are needed during and after pregnancy to improve weight gain trajectories and overall health.
A. Weight change over time as predicted by intervention condition. B. Weight change over time as predicted by intervention condition \times obese group status.

FIGURE 1.
Weight change over time by intervention condition and obese group status.
Behavioral Health and Patient-Centered Care for Women of Color

• Need to be cautious to avoid “mommy-blaming”, especially among women of color who have been inappropriately blamed for high rates of perinatal morbidity and mortality

• Latest research on racial inequity in perinatal outcomes indicates that structural racism, not “lifestyle”, is primary factor in racial health disparities

• Therefore counseling needs to be VERY focused on patient’s stated goals and providers need to ask, listen to, and respect patient’s concerns

• It is essential to involve and engage with the communities of our patients when developing interventions
What blame-the-mother stories get wrong about birth outcomes among black moms

By Monica McLemore

March 14, 2018

Amid the recent media attention to the increases in maternal morbidity and mortality in the United States, many think pieces and editorials have inadvertently contributed to the phenomenon known as “mother blame.”

Mother blame is the notion that individual characteristics or behaviors such as smoking, late entry to prenatal care, being older during pregnancy, or other chronic health conditions during pregnancy are exclusively responsible for poor birth outcomes. More specifically, for black women, who as a group have the highest rates of maternal morbidity and mortality, people incorrectly assume that they become pregnant while being sicker, older and fatter, and so conclude they’re responsible as individuals for their adverse outcomes.

Such assumptions are incorrect and dangerous for three important reasons. First, addressing individual risk factors will never be enough to reverse the trends. Second, this argument has long been used to blame communities and thus stigmatize black women. Third, and most importantly, focusing on individual responsibility is a distraction from the real source of the crisis: systemic racism.
“So what is successful in lowering risk and improving pregnancy outcomes? Years of data that show that successful public health interventions such as Black Infant Health, Nurse Family Partnership and Centering Pregnancy improve birth outcomes. …These programs are built on several principles, including culturally relevant care, peer-to-peer learning, and establishing cohorts among the women. “

“But it’s important to remember that the health delivery system — and more specifically the people who provide that care — are part of the problem. Several studies and recent reporting from ProPublica and NPR have shown that black and brown pregnant women experience high levels of stress, disrespect, and racism during pregnancy, and these in turn are associated with poor outcomes such as premature birth, maternal morbidity and mortality, and increased risk of death for infants in the first 1,000 days of life.”


Monica Mclemore, PhD, MPH, RN
Assistant Professor
School of Nursing, UCSF
Behavioral Health – the 5 “As”

• **Ask/Assess** *Ask permission* before discussing weight with a patient, and be non-judgmental. Screen for weight status, obesity-associated comorbid conditions and conditions that may interfere with weight loss, and patient interest in weight management.

• **Advise** – on risks associated with obesity (avoid “gloom and doom”) and benefits associated with lower weight gain/improved diet (e.g. GDM risk).

• **Agree** – In discussion with provider, *patient chooses* and sets goals for behavior change – eg cutting out sugar-sweetened drinks.

• **Assist** – suggest resources (apps, online tools), provide support.

• **Arrange** – Follow-up visits. A consistent predictor of weight loss progress is having regular, ongoing interaction with provider or group.

Influence of the 5A's Counseling Strategy on Weight Gain During Pregnancy: An Observational Study

Washington Cole Katie O., Gudzune Kimberly A., Bleich Sara N., Bennett Wendy L., Cheskin Lawrence J., Henderson Janice L., Caulfield Laura E., Guan Yue, and Roter Debra L.

Published Online: 1 Oct 2017 | https://doi.org/10.1089/jwh.2016.6115

Abstract

Background: Healthy weight gain during pregnancy may improve health outcomes for women and infants. The objective of this study was to examine providers' use of the 5A's (Assess, Advise, Agree, Assist, and Arrange) in discussions of weight, nutrition, and physical activity during prenatal visits and evaluate the effect of this approach on gestational weight gain.
Behavioral Health – Evidence-Based Techniques for Long-Term Weight Maintenance

- Self-monitoring and self-weighing
- Reduced calorie intake - most dietary patterns intended to reduce caloric intake lead to near-equivalent weight loss magnitude (low fat vs low glycemic/low carb)
- Smaller and more frequent meals/snacks throughout the day
- Increased physical activity, which has some contribution to initial weight loss but has been shown to be one of the most consistent predictors of long-term weight loss maintenance
- Eating breakfast
- More frequent at-home meals compared with restaurant and fast-food meals
- Reducing screen time
- Use of portion-controlled meals or meal substitutes
- Reducing sweetened beverage intake

Conclusions and Thoughts for the Future

• Digital health and meal replacement interventions show promise for modest reduction in GWG for women with obesity, more research needed

• Best diet to reduce GWG is probably any reasonably healthful diet that reduces calories and is acceptable to your patient

• No great evidence about benefit for other outcomes (e.g. cesarean)

• Important to listen to women and communities about priorities for health and interaction with the healthcare system

• Interventions will be most effective when they are wanted and valued by patients and when their development is informed by communities
Next Steps + Wrap-Up

Jamie Stang, University of Minnesota
Research Limitations and Gaps

Lack of diversity in study populations, which may limit application in clinical settings

• Racial/ethnic diversity
  • Need for culturally tailored interventions that incorporate cultural values/beliefs

• Socio-economic status
  • Food security
  • Access to health care and/or prenatal care

• Geographic classification
  • Rural populations may face unique barriers
Study designs often not rigorous enough

- Small sample sizes
  - Underpowered to examine intended outcome measures
  - Large, diverse samples that allow study of low weight gain or weight loss

- Rigorous methods of gestational weight gain that account for correlation with gestational age
  - Total weight gain vs weight gain patterns across pregnancy

- Innovative methods that address unique needs of varying levels of severity

- Examination of relationships between gestational weight gain and maternal-child outcomes
  - Child weight status, health status, behavior, cognition
  - Maternal weight gain, pre-eclampsia, depression
Uncertainty over ideal gestational weight gain for women with higher grades of obesity

- Is weight loss safe during pregnancy?

Interconception research and intervention is lacking

- Postpartum weight retention and interpregnancy weight gain not well understood
- > 15% of women change weight classifications within 12-18 months postpartum
- Cumulative effect of gestational weight gain and postpartum retention on subsequent pregnancies not well documented

More research needed on effective intervention strategies

- Changing behaviors is difficult for most women
- Intensive interventions with frequent contacts that address all levels of influence (personal, family, community, society) are needed
- “e-health” interventions that may transcend geographic barriers
- Engaging interventions that reduce drop-out rates
  - Rate of 12% to 50% or more reported in literature
- Research funding to develop interventions that are economically feasible for implementation in routine care settings
Next Steps?

A comprehensive, strategic research agenda

- Large, diverse populations of women
- Rigorous study designs
- Intensive interventions that address multiple behavioral influences
- Development and evaluation of technology-based interventions
- More training opportunities for family practice, obstetric and women’s health care professionals