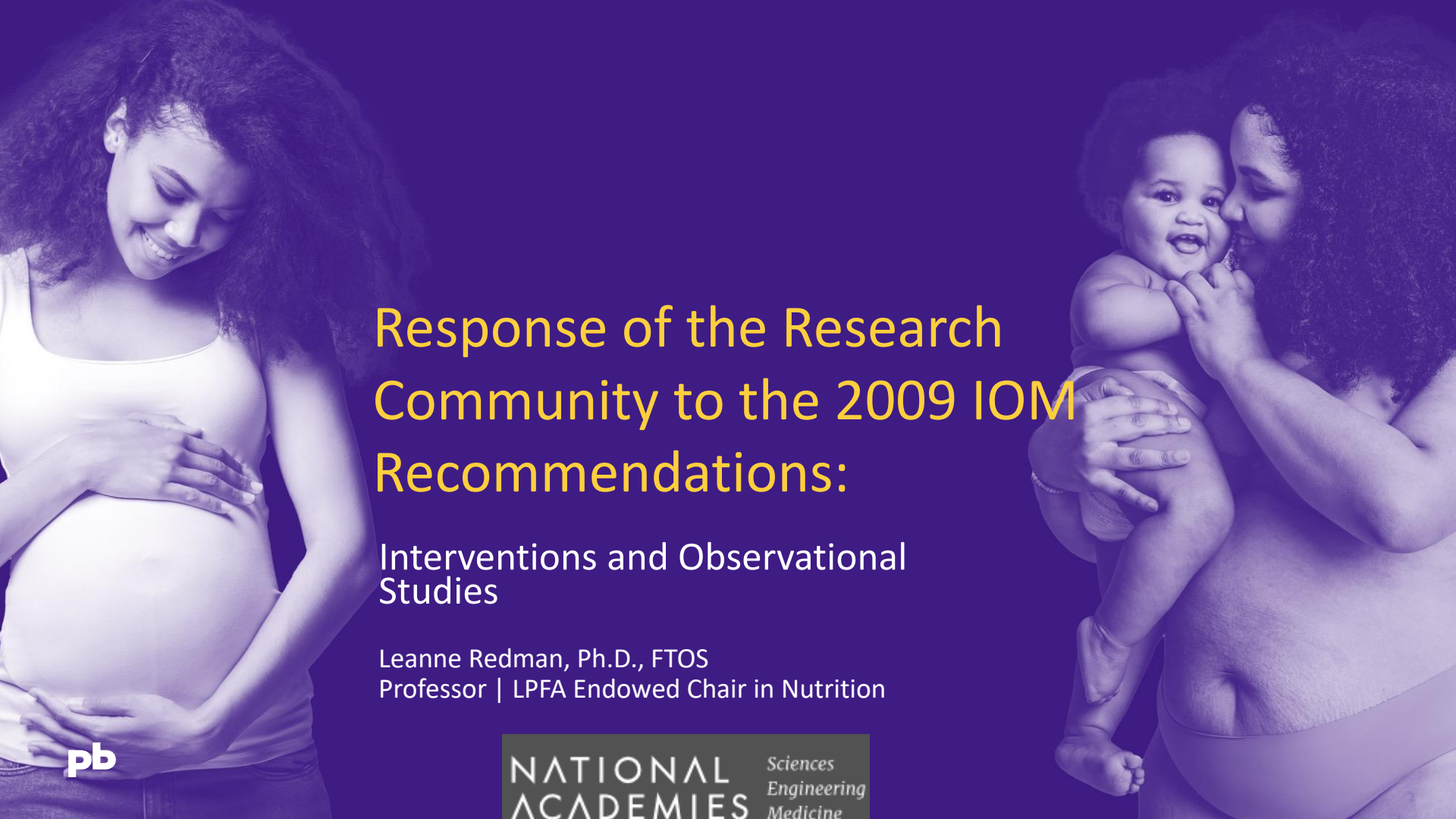


Conflicts of Interest

No Conflicts of Interest related to this workshop or presentation



Response of the Research Community to the 2009 IOM Recommendations:

Interventions and Observational
Studies

Leanne Redman, Ph.D., FTOS
Professor | LPFA Endowed Chair in Nutrition



NATIONAL
ACADEMIES

Sciences
Engineering
Medicine

Walk through

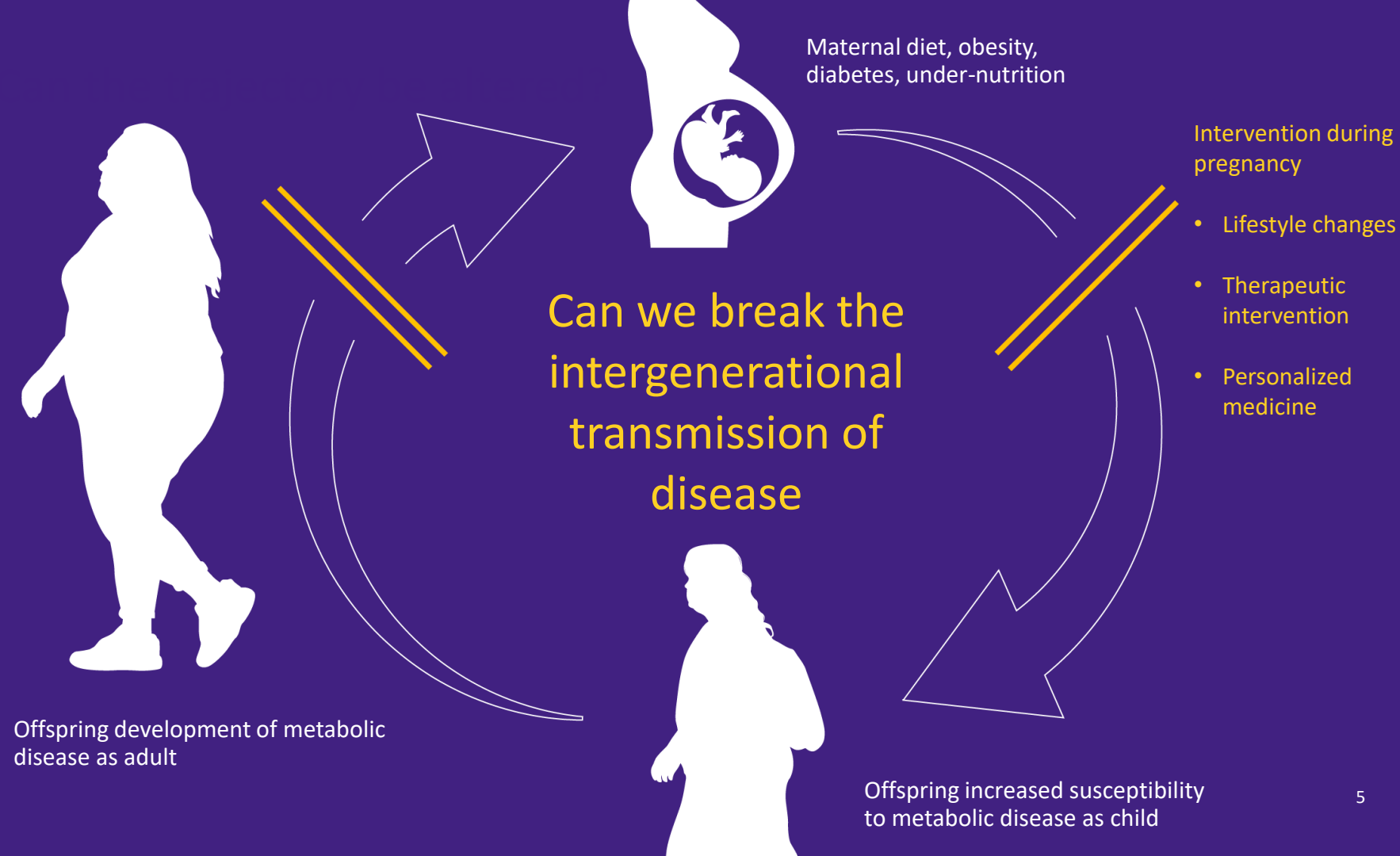
Review the current evidence:

1. LIFE-Moms consortium
2. Advances with observation studies
3. Personalized medicine



1.

Lifestyle Interventions in Expectant Moms
LIFE-Moms



Lifestyle interventions in expectant moms “LIFE-Moms” Consortium

DPP-like x 2
DASH
Meal replacements
US dietary guidelines –
parents as teachers
Personalized ILI

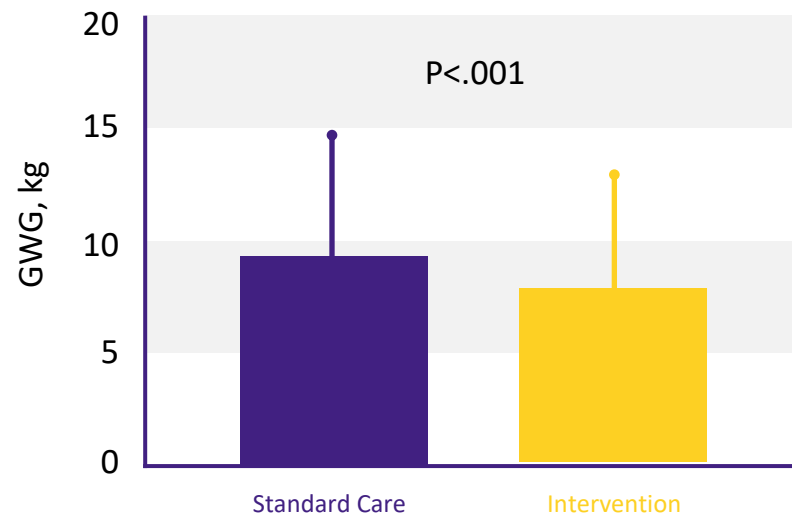
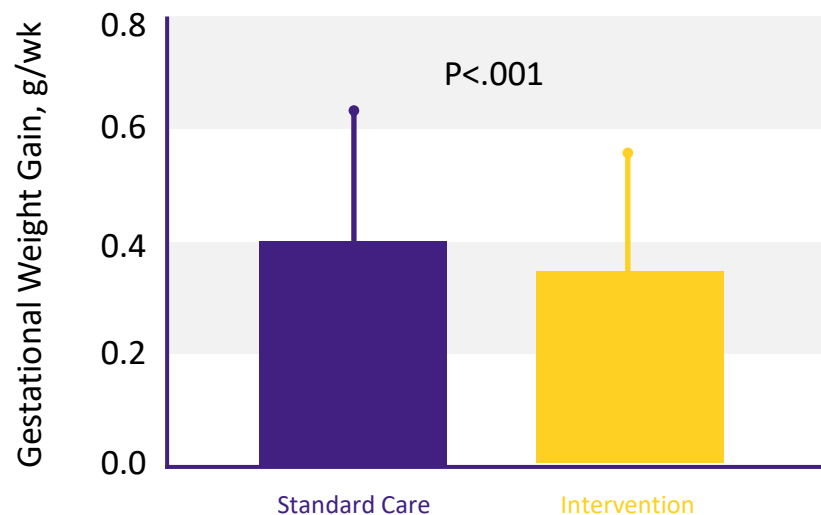
N=1150 overweight and
obese pregnant women



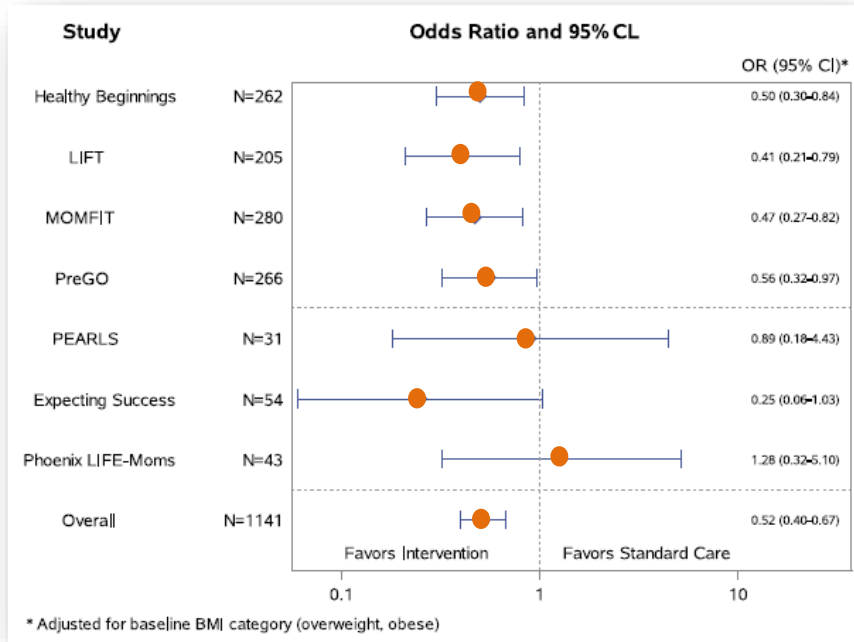
Lifestyle Interventions in Reduce GWG

7

**Adjusted for baseline BMI category (overweight, obese)



Lifestyle Interventions Limit Gestational Weight Gain in Women with Overweight or Obesity: LIFE-Moms Prospective Meta-Analysis



Excess GWG

Intervention



357/578 (61.8%)

Standard Care



422/563 (75%)

OR 0.52 (0.4 – 0.67), $p < .001$

Interventions had a null effect on maternal and infant outcomes

	Intervention (N=574)	Standard of care (N=565)	Intervention Effect Odds Ratio (95% CI)	P-value
Gestational HTN/preeclampsia	52/573 (15.4%)	77/564 (13.7%)	1.15 [0.83, 1.61]	0.40
Gestational Diabetes	57/513 (11.1%)	59/494 (11.9%)	0.92 [0.61, 2.31]	0.09
Cesarean Delivery	209/573 (36.5%)	179/565 (31.7%)	1.24 [0.97, 1.58]	0.33
Preterm Delivery	55/574 (9.6%)	64/565 (11.3%)	0.83 [0.56, 1.21]	0.11
Fetal/neonatal death	13/574 (2.3%)	22/565 (3.9%)	0.57 [0.28, 1.15]	0.15
Birth weight (g) **, #	3306 ± 588	3268 ± 571		0.71
SGA < 10 th percentile #	40/563 (7.1%)	51/543 (9.4%)	0.74 [0.48, 1.13]	0.16
LGA ≥ 90 th percentile	60/563 (10.7%)	48/543 (8.8%)	1.23 [0.83, 1.84]	0.31
Macrosomia (birth wt ≥ 4000 g)	48/563 (8.5%)	43/543 (7.9%)	1.15 [0.75, 1.79]	0.52
Birth weight for length z-score #,†	-0.18 ± 1.29	-0.27 ± 1.29		0.24
NICU/intermediate nursery stay **, #	71/564 (12.6%)	68/543 (12.5%)	1.05 [0.73, 1.51]	0.80

Caveats



All interventions commenced < 16 weeks
No evidence for early vs late



The trials were not pragmatic
High BMI = Healthy



Counseling and Behavioral Interventions for Healthy Weight
and Weight Gain in Pregnancy
Evidence Report and Systematic Review
for the US Preventive Services Task Force

Amy G. Cantor, MD, MPH; Rebecca M. Jungbauer, DrPH, MPH, MA; Marian McDonagh, PharmD; Ian Blazina, MPH;
Nicole E. Marshall, MD, MCR; Chandler Weeks, MPH; Rongwei Fu, PhD; Erin S. LeBlanc, MD, MPH; Roger Chou, MD



Less excess GWG: -7.6% ADR [absolute risk difference] or 1.02kg!
Reduced postpartum weight retention



Gestational diabetes: -1.6% ARD [absolute risk difference]
Emergency cesarean: -2.4% ARD
Macrosomia: -1.9% ARD
Large for gestational age: -1.3% ARD



B.

Offer effective behavioral counseling interventions aimed at promoting healthy weight gain and preventing excess gestational weight gain in pregnancy

Figure. Clinician Summary: Behavioral Counseling Interventions for Healthy Weight and Weight Gain in Pregnancy

What does the USPSTF recommend?	For pregnant adolescents and adults: Offer effective behavioral counseling interventions aimed at promoting healthy weight gain and preventing excess gestational weight gain in pregnancy. <u>Grade B</u>
To whom does this recommendation apply?	Pregnant adolescents and adults
What's new?	This is a new recommendation
How to implement this recommendation?	1. Identify patients (adolescents and adults) who are pregnant. 2. Offer effective behavioral counseling or refer patients to behavioral counseling in other settings. Effective behavioral counseling interventions varied in the following: • <i>Content:</i> ◦ Individual focus on nutrition, physical activity, or lifestyle and behavioral change ◦ Multiple components, most commonly including active/supervised exercise or counseling about diet and physical activity • <i>When to start/stop:</i> Generally started at the end of the first trimester or the beginning of the second trimester and ended prior to delivery • <i>Duration and intensity:</i> Varied from 15 to 120 minutes and consisted of <2 contacts to ≥12 contacts • <i>Who delivered the intervention:</i> Highly diverse and included clinicians, registered dietitians, qualified fitness specialists, physiotherapists, and health coaches across different settings (eg, local community fitness center) • <i>How the intervention was delivered:</i> Delivery methods included individual or group counseling that was delivered in person, by computer/Internet, or by telephone calls

2.

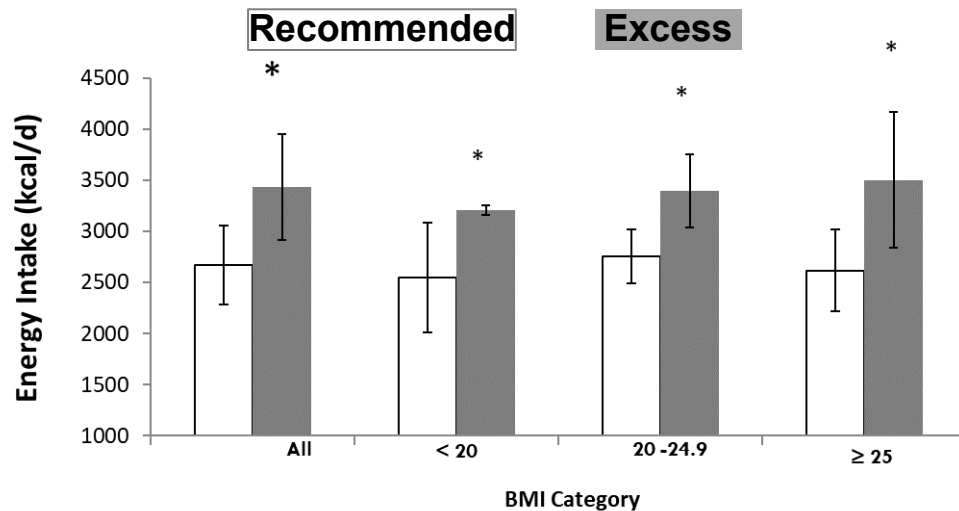
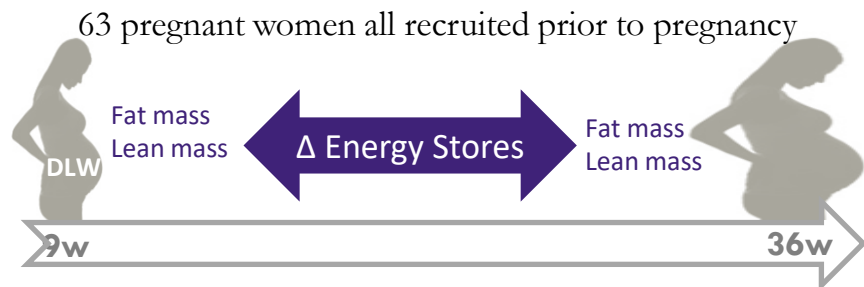
Observational studies





Energy requirements during pregnancy based on total energy expenditure and energy deposition¹⁻⁴

Nancy F Butte, William W Wong, Margarita S Treuth, Kenneth J Ellis, and E O'Brian Smith



The current dietary advice for pregnant women is not specific to obesity

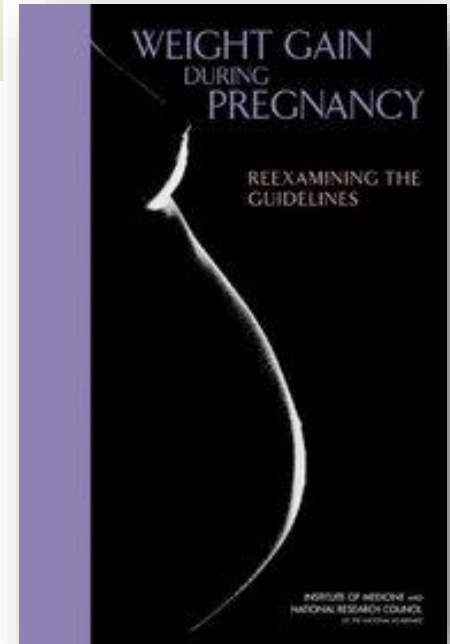
DRI 2005

First trimester, when weight gain is minimal, **no extra calories usually are needed.**

Second trimester, you need an **extra 340 calories a day**, and

Third trimester, **about 450 extra calories a day.**

“Keep in mind that these amounts are for women who were a normal weight before pregnancy. If you are overweight or obese, you may need fewer extra calories.”



First energy balance study in pregnant people with obesity

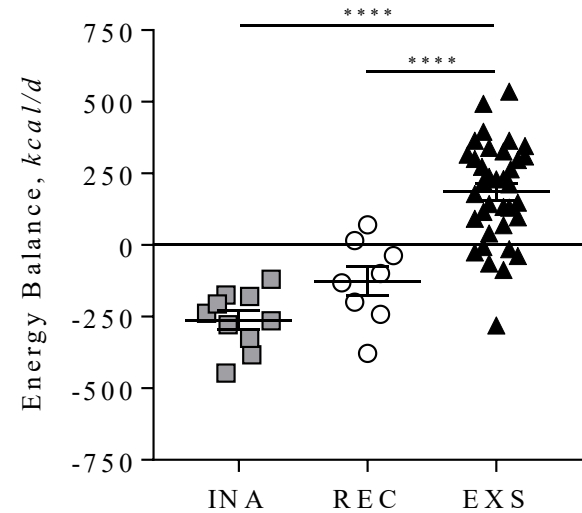
2005 DRI

Second trimester, +340 kcal/d

Third trimester, +450 kcal/d

"...If you are overweight or obese, you may need fewer extra calories."

$$EI = \Delta \text{ Energy Expenditure} + \Delta \text{ Energy Stores}$$

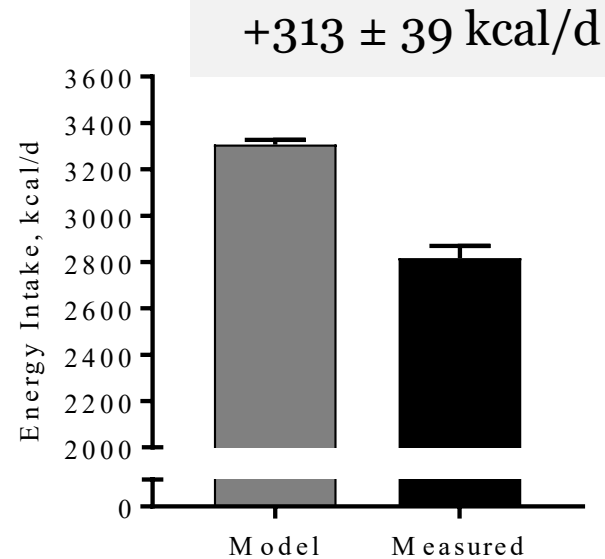
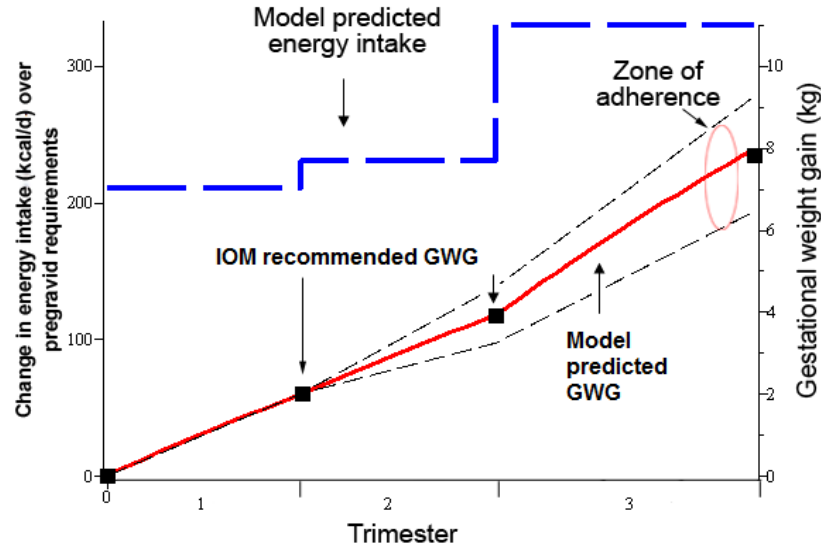


INADEQUATE: -262 ± 32 kcal/d (~9%)

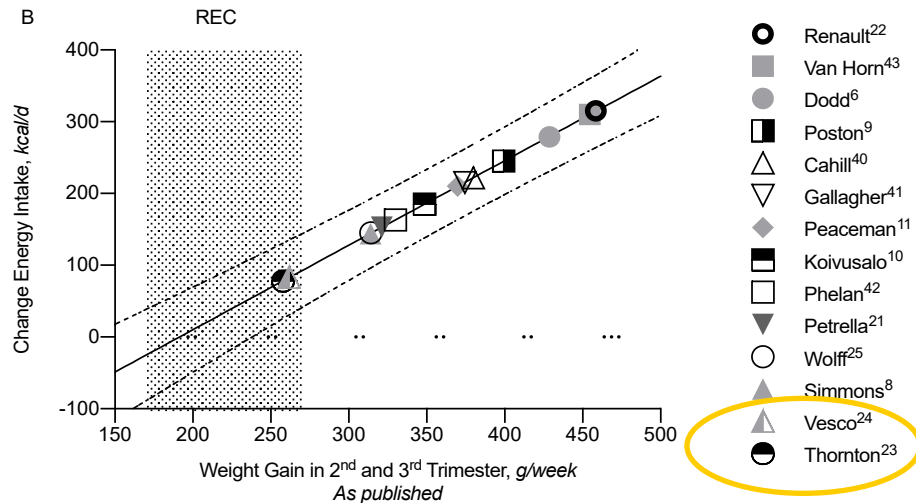
RECOMMENDED: -125 ± 52 kcal/d (~4%)

EXCESS: +186 ± 29 kcal/d

2005 DRI (and our model) over-estimated EI needed to support recommended weight gain



In other trials, women were eating more than prior to their pregnancy



Intervention



No Intervention



$$\text{Change EI [kcal/d]} = 1.178 \pm 0.108 * \text{GWG [g/week]} - 225 \pm 46,$$

Efficacy of a Group-Based Dietary Intervention for Limiting Gestational Weight Gain among Obese Women: A Randomized Trial

Obesity (2014) **22**, 1989–1996.

Kimberly K. Vesco^{1,2}, Njeri Karanja¹, Janet C. King³, Matthew W. Gillman⁴, Michael C. Leo¹, Nancy Perrin¹,
Cindy T. McEvoy⁵, Cara L. Eckhardt⁶, K. Sabina Smith¹ and Victor J. Stevens¹

Healthy Moms Trial, Kaiser Permanente NW

○ N=118 singleton pregnancies

- Usual care
- Lifestyle intervention (maintain weight)
- DASH diet, 30% calorie reduction

	Control
	Mean ± SD or N (%)
2 weeks postpartum—randomization (kg)	1.2 ± 5.6
34 weeks gestation—randomization (kg)	8.4 ± 4.7
Rate of weight gain (kg/week)	0.4 ± 0.2
Rate of weight gain according to 2009 IOM guidelines for obese women	
Below (<0.18 kg/week)	7 (12%)
Within (0.18 to 0.27 kg/week)	3 (5%)
Above (>0.27 kg/week)	47 (82%)

	N (%)		Odds ratio	95% CI for Odds ratio	Effect size ^a
Maternal	Control N= 58	Intervention N= 56			
Gestational hypertension, preeclampsia	6 (10%)	5 (9%)	0.85	[0.24-2.96]	0.02
Gestational diabetes	7 (12%)	6 (11%)	0.87	[0.28-2.78]	0.02
Cesarean delivery	26 (45%)	21 (38%)	0.74	[0.35-1.56]	0.07
Primary cesarean delivery	12 (21%)	15 (27%)	1.40	[0.59-3.34]	0.07
Neonatal					
LGA	15 (26%)	5 (9%)	0.28 ^b	[0.09-0.84]	0.22
Macrosomia (>4000 g)	13 (22%)	6 (11%)	0.42	[0.15-1.18]	0.16
SGA	4 (7%)	3 (5%)	0.76	[0.11-4.76]	0.03
Preterm birth (<37 weeks)	1 (2%)	4 (7%)	4.38	[0.41-219.64]	0.13
Preterm birth (<34 weeks)	1 (2%)	0 (0%)	N/A ^c	N/A ^c	0.09
NICU admission ^d	6 (11%)	2 (4%)	0.33	[0.03-2.00]	0.13
Hyperbilirubinemia ^d	7 (12%)	6 (11%)	0.91	[0.29-2.91]	0.02
Birth trauma ^d	2 (4%)	2 (4%)	1.08	[0.08-15.38]	0.01
Hypoglycemia ^d	1 (2%)	1 (2%)	1.08	[0.01-86.03]	<0.01
Respiratory morbidity ^d	7 (12%)	3 (6%)	0.43	[0.07-2.03]	0.11

10 (18%)

24 (44%)

3.

Is there a need for precision?



Yes – dietary intake prescriptions can be personalized

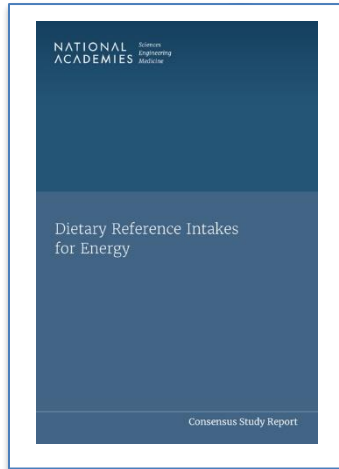


Figure 1. 2023 Dietary Reference Intake Equations for Estimating Energy Requirements for Persons around Pregnancy

Physical Activity Category	Pregnancy Stage	EER Equation (kcal/day)
Inactive	Preconception and Trimester 1	$EER = 584.90 - (7.01 \times \text{age}) + (5.72 \times \text{height}) + (11.71 \times \text{weight})$
	Trimester 2 and 3	$EER = 1,131.20 - (2.04 \times \text{age}) + (0.34 \times \text{height}) + (12.15 \times \text{weight}) + (9.16 \times \text{gestation}) + \text{energy deposition}$
Low active	Preconception and Trimester 1	$EER = 575.77 - (7.01 \times \text{age}) + (6.60 \times \text{height}) + (12.14 \times \text{weight})$
	Trimester 2 and 3	$EER = 693.35 - (2.04 \times \text{age}) + (5.73 \times \text{height}) + (10.20 \times \text{weight}) + (9.16 \times \text{gestation}) + \text{energy deposition}$
Active	Preconception and Trimester 1	$EER = 710.25 - (7.01 \times \text{age}) + (6.54 \times \text{height}) + (12.34 \times \text{weight})$
	Trimester 2 and 3	$EER = -223.84 - (2.04 \times \text{age}) + (13.23 \times \text{height}) + (8.15 \times \text{weight}) + (9.16 \times \text{gestation}) + \text{energy deposition}$
Very active	Preconception and Trimester 1	$EER = 511.83 - (7.01 \times \text{age}) + (9.07 \times \text{height}) + (12.56 \times \text{weight})$
	Trimester 2 and 3	$EER = -779.72 - (2.04 \times \text{age}) + (18.45 \times \text{height}) + (8.73 \times \text{weight}) + (9.16 \times \text{gestation}) + \text{energy deposition}$

EERs in kilocalories per day are estimated by age in years, height in centimeters, weight in kilograms, gestation in weeks and energy deposition or mobilization in kilocalories per day. Energy deposition/mobilization (kcal/d) for underweight + 300 kcal/d, normal weight + 200 kcal/d, overweight + 150 kcal/d, and obese –50 kcal/d.

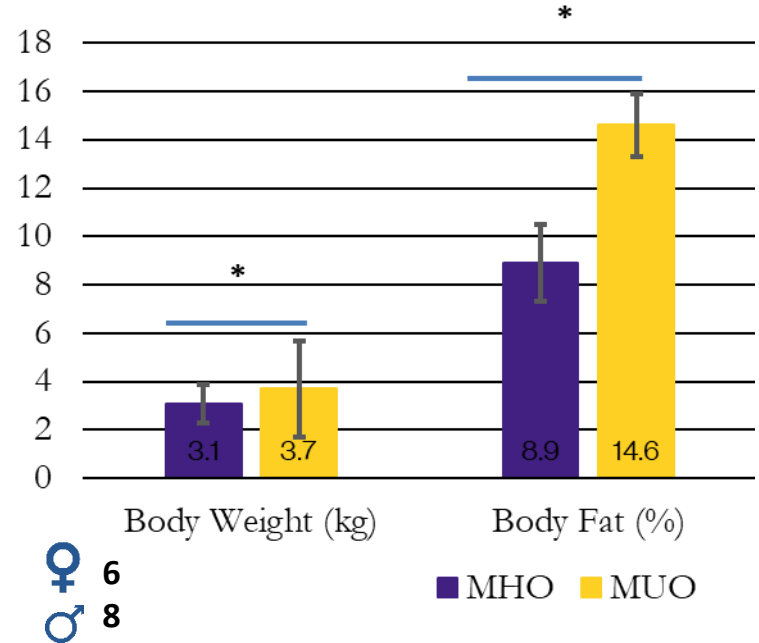
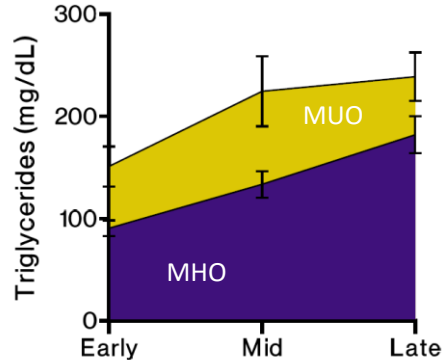
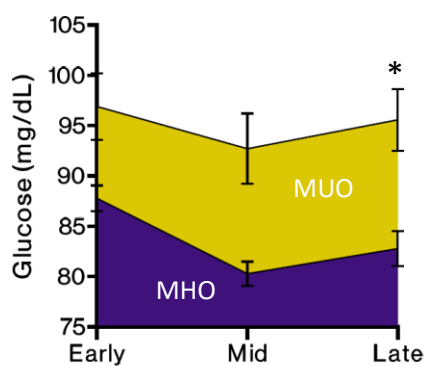
Or maybe it has nothing to do with maternal weight or weight gain?

Metabolically healthy obesity
“MHO”

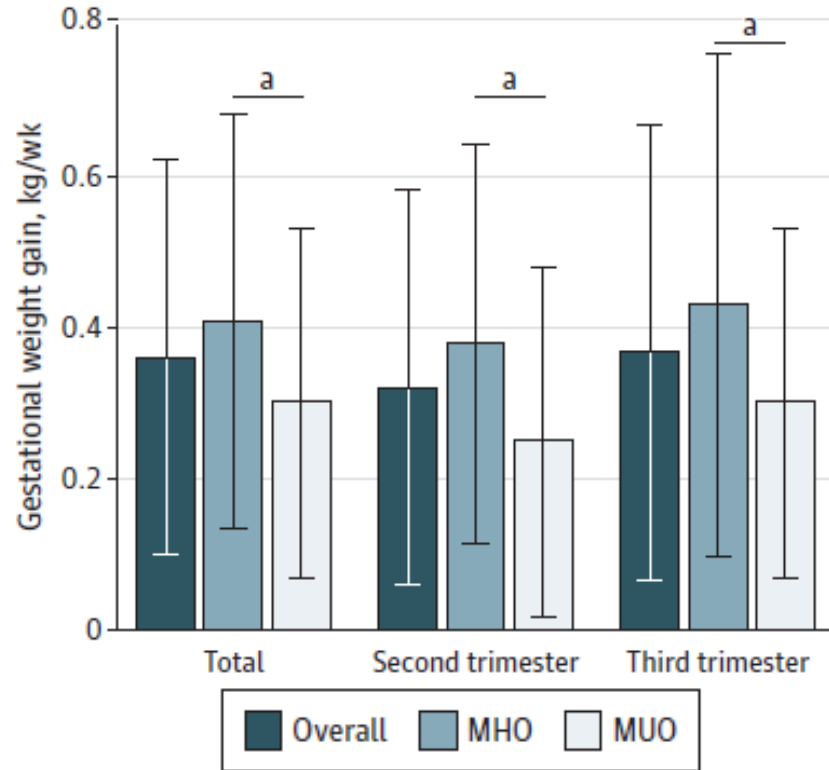
Obesity with no
other risk factors
for metabolic
syndrome

Metabolically unhealthy obesity
“MUO”

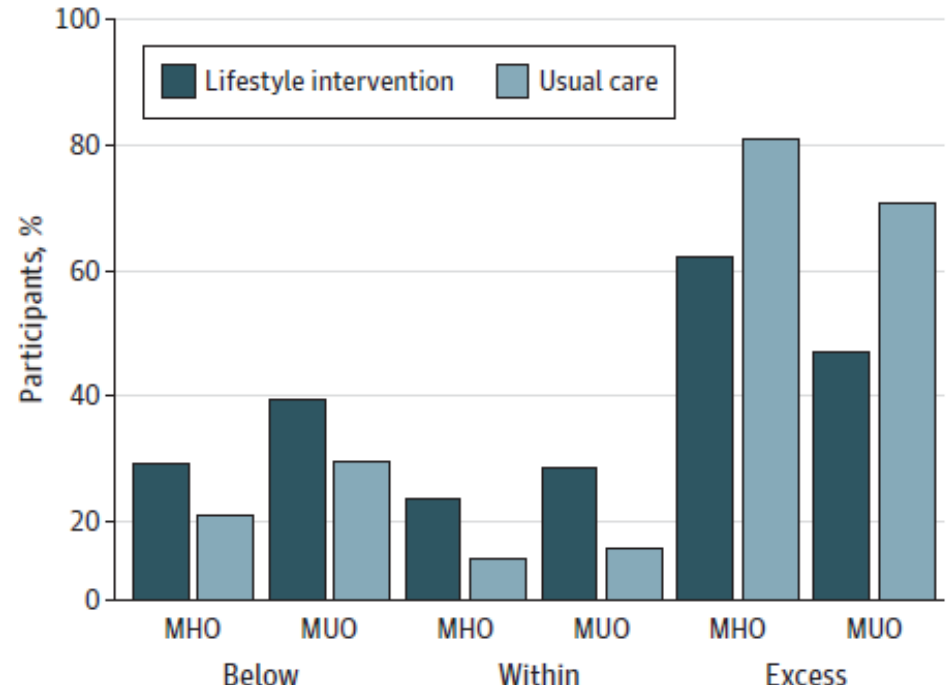
Obesity ≥ 2
risk factors



Gestational Weight Gain



2009 Guideline Attainment



Gaps and Future Directions

- Dissemination and implementation trials
 - WIC
 - Nurse Family Partnership / Home Visitation Programs
 - Routine OB care
- Quantifying the ‘voltage’ drop – is the effect size large enough for downstream effects?
- Personalized and precision interventions

Summary

- LIFE-Moms consortium showed intensive lifestyle interventions can reduce excess GWG among women living with overweight/obesity
- These approaches produced a 1.5kg effect size in weight gain, but no differences in maternal/infant outcomes from standard care
- A meta-analysis of the USPSTF informed a Grade B recommendation – all women who are pregnant should be offered weight management support in pregnancy
- Women with obesity do not need to increase calorie intake to achieve appropriate weight gain
- More precise approaches that consider individuals and not groups, need to be tested



Pennington Biomedical
Research Center

labs.pbrc.edu/womenshealth



National Institutes of Health

LIFE-Moms Consortium Colleagues

Participants, partners, families

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