

Promoting Physical Activity During Pregnancy & Postpartum: Opportunities & Challenges

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Overview



- Benefits of PA & healthy weight gain in pregnancy & postpartum
- Guidelines for PA & weight gain in pregnancy
- Actual PA & gestational weight gain (GWG)
- Interventions to increase PA and promote healthy weight gain
- My work: HIPP trial



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Key milestones for women that tend to be associated with decreased PA

- Puberty
- Marriage
 - Conflicting evidence
- **Pregnancy**
- Menopause
- Caregiving



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Exercise & pregnancy

- Pregnancy represents “window of opportunity” for health habits
- Pregnancy-specific benefits (ACOG, 2020 Box 2; da Silva et al, 2017 meta-analysis; DiPietro et al, 2019 review)
- Other benefits
 - Maternal mental health (including postpartum; Cai et al, 2022)
 - Possible offspring health benefits (adiposity, neurodevelopment – Alvarez-Bueno et al, 2018)
 - Recent epigenetic reviews (Rasmussen et al, 2021)
- No apparent risk for fetal mortality or other complications (Davenport et al, 2018 & 2019)

Box 2. Benefits of Exercise in Pregnancy

Higher incidence of:

- Vaginal delivery

Lower incidence of:

- Excessive gestational weight gain
- Gestational diabetes mellitus
- Gestational hypertensive disorders*
- Preterm birth
- Cesarean birth
- Lower birth weight

*Defined as gestational hypertension or preeclampsia

Modified from Berghella V, Saccone G. Exercise in pregnancy! Am J Obstet Gynecol 2017;216:335–7.



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🔒 | Research Article |

Exercise during pregnancy mitigates negative effects of parental obesity on metabolic function in adult mouse offspring

Rhianna C. Laker, Ali Altıntaş, Travis S. Lillard, Mei Zhang, Jessica J. Connelly, ... See all authors ▾

11 MAR 2021 // <https://doi.org/10.1152/jappphysiol.00641.2020>

🔗 TOOLS ↩ SHARE

Abstract

Parental health influences embryonic development and susceptibility to disease in the offspring. We investigated whether maternal voluntary running during gestation could protect the offspring from the adverse effects of maternal or paternal high-fat diet (HF) in mice. We performed transcriptomic and whole-genome DNA methylation analyses in female offspring skeletal muscle and targeted DNA methylation analysis of the peroxisome proliferator-activated receptor- γ coactivator-1 α (*Pgc-1 α*) promoter in both male and female adult offspring. Maternal HF resulted in impaired metabolic homeostasis in male offspring at 9 mo of age, whereas both male and female offspring were negatively impacted by paternal HF. Maternal exercise during gestation completely mitigated these metabolic impairments. Female adult offspring from obese male or female parent had skeletal muscle transcriptional profiles enriched in genes regulating inflammation and immune responses, whereas maternal exercise resulted in a transcriptional profile similar to offspring from normal chow (NC)-fed parents. Maternal HF, but not paternal HF, resulted in hypermethylation of the *Pgc-1 α* promoter at CpG-260, which was abolished by maternal exercise. These findings demonstrate the negative consequences of maternal and paternal HF for the offspring's metabolic outcomes later in life possibly through different epigenetic mechanisms, and maternal exercise during gestation mitigates the negative consequences.

Impact on Offspring – 2021 Animal Study

exercise. These findings demonstrate the negative consequences of maternal and paternal HF for the offspring's metabolic outcomes later in life possibly through different epigenetic mechanisms, and maternal exercise during gestation mitigates the negative consequences.



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Adverse outcomes associated with excessive gestational weight gain (GWG)

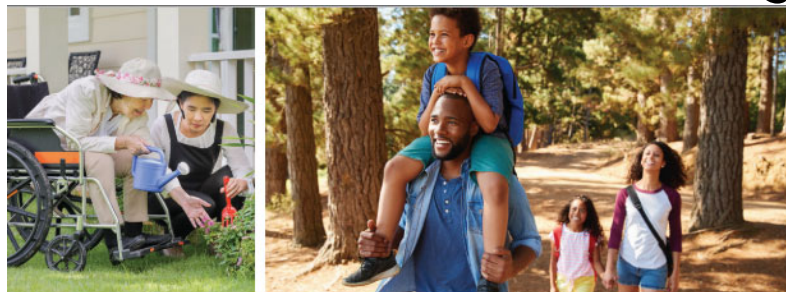
- Pregnancy, labor, and delivery complications:
 - Preeclampsia (elevated BP + protein in urine), cephalopelvic disproportion (baby's head or body too large to fit through pelvis), failed induction, & cesarean delivery
- Neonatal and infant outcomes:
 - Macrosomia (newborn > 8 lbs, 13 oz), low five-minute apgar scores, seizure, hypoglycemia, polycythemia (overproduction of red blood cells), & meconium aspiration (meconium in lungs before delivery)
- Child outcomes:
 - Overweight and obesity (e.g., reviews by Mamun et al, 2014; Lau et al, 2014)
 - Increased risk of earlier pubertal onset (Zhou et al, 2022)
 - Increasing amount of epigenetic research (e.g., review by Opsahl et al, 2021)
- Maternal weight and health outcomes:
 - Postpartum weight retention
 - Strong risk factor for new or persistent obesity

Sources: Goldstein et al, 2017



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Guidelines for PA in pregnancy



Chapter 6. Additional Considerations for Some Adults



Physical Activity in Women During Pregnancy and the Postpartum Period

Physical activity during pregnancy benefits a woman's overall health. Moderate-intensity physical activity by healthy women during pregnancy increases or maintains cardiorespiratory fitness, reduces the risk of excessive weight gain and gestational diabetes, and reduces symptoms of postpartum depression. Reduced risk of excessive weight gain during pregnancy can also reduce the risk of excessive postpartum weight retention, future obesity, and an infant born with high birth weight. Strong scientific evidence shows that the risks of moderate-intensity activity done by healthy women during pregnancy are very low, and do not increase risk of low birth weight, preterm delivery, or early pregnancy loss. Some evidence suggests that physical activity may reduce the risk of pregnancy complications, such as preeclampsia, reduce the length of labor and postpartum recovery, and reduce the risk of having a Cesarean section.

During a normal postpartum period, regular physical activity continues to benefit a woman's overall health. Studies show that moderate-intensity physical activity during the period following the birth of a child increases a woman's cardiorespiratory fitness and improves her mood. Such activity does not appear to have adverse effects on breast milk volume, breast milk composition, or infant growth.

Physical activity also helps women achieve and maintain a healthy weight during the postpartum period and, when combined with caloric restriction, helps promote weight loss.

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Key Guidelines for Women During Pregnancy and the Postpartum Period

- ✓ Women should do at least 150 minutes (2 hours and 30 minutes) of moderate-intensity aerobic activity a week during pregnancy and the postpartum period. Preferably, aerobic activity should be spread throughout the week.
- ✓ Women who habitually engaged in vigorous-intensity aerobic activity or who were physically active before pregnancy can continue these activities during pregnancy and the postpartum period.
- ✓ Women who are pregnant should be under the care of a health care provider who can monitor the progress of the pregnancy. Women who are pregnant can consult their health care provider about whether or how to adjust their physical activity during pregnancy and after the baby is born.

2018 Physical Activity Guidelines for Americans



ACOG COMMITTEE OPINION

Number 804

(Replaces Committee Opinion Number 650, December 2015)

Committee on Obstetric Practice

This Committee Opinion was developed by the Committee on Obstetric Practice with the assistance of committee members Meredith L. Birsner, MD, and Cynthia Gyamfi-Bannerman, MD, MSc.

Physical Activity and Exercise During Pregnancy and the Postpartum Period

ABSTRACT: Exercise, defined as physical activity consisting of planned, structured, and repetitive bodily movements done to improve one or more components of physical fitness, is an essential element of a healthy lifestyle, and obstetrician-gynecologists and other obstetric care providers should encourage their patients to continue or to commence exercise as an important component of optimal health. Women who habitually engaged in vigorous-intensity aerobic activity or who were physically active before pregnancy can continue these activities during pregnancy and the postpartum period. Observational studies of women who exercise during pregnancy have shown benefits such as decreased gestational diabetes mellitus, cesarean birth and operative vaginal delivery, and postpartum recovery time. Physical activity also can be an essential factor in the prevention of depressive disorders of women in the postpartum period. Physical activity and exercise in pregnancy are associated with minimal risks and have been shown to benefit most women, although some modification to exercise routines may be necessary because of normal anatomic and physiologic changes and fetal requirements. In the absence of obstetric or medical complications or contraindications, physical activity in pregnancy is safe and desirable, and pregnant women should be encouraged to continue or to initiate safe physical activities. This document has been revised to incorporate recent evidence regarding the benefits and risks of physical activity and exercise during pregnancy and the postpartum period.

Recommendations

Regular physical activity in all phases of life, including pregnancy, promotes health benefits. Pregnancy is an ideal time for maintaining or adopting a healthy lifestyle and the American College of Obstetricians and Gynecologists makes the following recommendations:

- Physical activity and exercise in pregnancy are associated with minimal risks and have been shown to benefit most women, although some modification to exercise routines may be necessary because of normal anatomic and physiologic changes and fetal requirements.
- A thorough clinical evaluation should be conducted before recommending an exercise program to ensure that a patient does not have a medical reason to avoid exercise.
- Women with uncomplicated pregnancies should be encouraged to engage in aerobic and strength-conditioning exercises before, during, and after pregnancy.
- Obstetrician-gynecologists and other obstetric care providers should evaluate women with medical or obstetric complications carefully before making recommendations on physical activity participation during pregnancy. Activity restriction should not be prescribed routinely as a treatment to reduce preterm birth.
- Additional research is needed to study the effects of exercise on pregnancy-specific conditions and outcomes and to clarify further effective behavioral counseling methods and the optimal type, frequency, and intensity of exercise. Similar research is needed to create an improved evidence base concerning the effects of occupational physical activity on maternal-fetal health.

GUIDELINES FOR PA IN PREGNANCY

- ACOG (2020): Women with uncomplicated pregnancies should be encouraged to engage in aerobic and strength conditioning exercises before, during, and after pregnancy: at least 20-30 minutes per day on most days of the week
 - Women who engaged in high intensity exercise before pregnancy should be able to continue

2019 Canadian guideline for physical activity throughout pregnancy

Michelle F Mottola,¹ Margie H Davenport,² Stephanie-May Ruchat,³ Gregory A Davies,⁴ Veronica J Poitras,¹ Casey E Gray,⁶ Alejandra Jaramillo Garcia,⁵ Nick Barrowman,⁷ Kristi B Adamo,⁸ Mary Duggan,⁹ Ruben Barakat,¹⁰ Phil Chilibeck,¹¹ Karen Fleming,¹² Milena Forte,¹³ Jillian Korolnek,¹⁴ Taniya Nagpal,¹ Linda G Slater,¹⁵ Deanna Stirling,¹⁶ Lori Zehr¹⁷

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This joint SOGC/CSEP Clinical Practice Guideline has been prepared by the Guidelines Consensus Panel, reviewed by the Society of Obstetricians and Gynaecologists of Canada's (SOGC) Maternal Fetal Medicine and Guideline Management and Oversight Committees, and approved by the Board of the SOGC and the Board of Directors of the Canadian Society for Exercise Physiology (CSEP). This article is being copublished in the *Journal of Obstetrics and Gynaecology Canada*: English version 2018;40(11):1549–1559; <https://doi.org/10.1016/j.jogc.2018.07.001>; French version: 2018;40(11):1560–1570. <https://doi.org/10.1016/j.jogc.2018.09.003>.

ABSTRACT

The objective is to provide guidance for pregnant women and obstetric care and exercise professionals on prenatal physical activity. The outcomes evaluated were maternal, fetal or neonatal morbidity, or fetal mortality during and following pregnancy. Literature was retrieved through searches of MEDLINE, EMBASE, PsycINFO, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, Scopus and Web of Science Core Collection, CINAHL Plus with Full Text, Child Development & Adolescent Studies, Education Resources Information Center, SPORTDiscus, ClinicalTrials.gov and the Trip Database from inception up to 6 January 2017. Primary studies of any design were eligible, except case studies. Results were limited to English-language, Spanish-language or French-language materials. Articles related to maternal physical activity during pregnancy reporting on maternal, fetal or neonatal morbidity, or fetal mortality were eligible for inclusion. The quality of evidence was rated using the Grading of Recommendations Assessment, Development and Evaluation methodology. The Guidelines Consensus Panel solicited feedback from end users (obstetric care providers, exercise professionals, researchers, policy organisations, and pregnant and postpartum women). The development of these guidelines followed the Appraisal of Guidelines for Research and Evaluation II instrument. The benefits of prenatal physical activity are moderate and no harms were identified; therefore, the difference between desirable and undesirable consequences (net benefit) is expected to be moderate. The majority of stakeholders and end users indicated that following these recommendations would be feasible, acceptable and equitable. Following these recommendations is likely to require minimal resources from both individual and health systems perspectives.

PREAMBLE

These Guidelines provide evidence-based recommendations regarding physical activity throughout pregnancy in the promotion of maternal, fetal and neonatal health. In the absence of contraindications (see below for a detailed list), following these Guidelines is associated with (1) fewer newborn complications (ie, large for gestational age) and (2) maternal health benefits (ie, decreased risk of pre-eclampsia, gestational hypertension, gestational diabetes, caesarean section, instrumental delivery, urinary incontinence, excessive gestational weight gain and depression; improved blood glucose; decreased total gestational weight gain; and decreased severity of depressive symptoms and lumbopelvic pain). Physical activity is not associated with miscarriage, stillbirth, neonatal death, preterm birth, preterm/prelabour rupture of membranes, neonatal hypoglycaemia, low birth weight, birth defects, induction of labour or birth complications. In general, more physical activity (frequency, duration and/or volume) is associated with greater benefits. However, evidence was not identified regarding the safety or additional benefit of exercising at levels significantly above the recommendations. Prenatal physical activity should be considered a front-line therapy for reducing the risk of pregnancy complications and enhancing maternal physical and mental health. For pregnant women not currently meeting these Guidelines, a progressive adjustment towards them is recommended. Previously active women may continue physical activity throughout pregnancy. Women may need to modify physical activity as pregnancy progresses. There may be periods when following the guidelines is not possible due to fatigue and/or discomforts of pregnancy; women are encouraged to do what they can and to return to following the recommendations when they are able. These Guidelines were informed by an extensive systematic review of the literature,

Guidelines for PA in pregnancy

- Canadian Guideline (2019): All women without contraindications should accumulate at least 150 min of moderate-intensity physical activity each week....
 - Accumulated over a minimum of 3 days per week

 Check for updates

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1339

Weight gain recommendations in pregnancy (National Academy of Medicine, formerly IOM, 2009)

TABLE 1 NEW RECOMMENDATIONS FOR TOTAL AND RATE OF WEIGHT GAIN DURING PREGNANCY, BY PREPREGNANCY BMI

Prepregnancy BMI	BMI ⁺ (kg/m ²) (WHO)	Total Weight Gain Range (lbs)	Rates of Weight Gain* 2nd and 3rd Trimester (Mean Range in lbs/wk)
Underweight	<18.5	28–40	1 (1–1.3)
Normal weight	18.5–24.9	25–35	1 (0.8–1)
Overweight	25.0–29.9	15–25	0.6 (0.5–0.7)
Obese (includes all classes)	≥30.0	11–20	0.5 (0.4–0.6)

+ To calculate BMI go to www.nhlbisupport.com/bmi/

* Calculations assume a 0.5–2 kg (1.1–4.4 lbs) weight gain in the first trimester (based on Siega-Riz et al., 1994; Abrams et al., 1995; Carmichael et al., 1997)



So does this evidence influence pregnant women?

- Physical activity
 - Lower in 1st trimester vs. pre-pregnancy
 - Lower in 3rd vs 1st trimester
 - Low % meeting guidelines
 - (hard to find recent review papers!)
- Weight gain relative to IOM
 - Review of OSs from 29 countries (1.4 million women) (Martinez-Hortelano, 2020)
 - Global population: 39.4% excessive, 27.8% below
 - **North American: 50.6% excessive, 19.1% below**
- Barriers to PA (McKeough et al, 2022; Coll et al, 2017)
 - Pregnancy-related sx's & limitations
 - Lack of knowledge re: safe activity
 - Opinions of women's social circles
 - Safety concerns (maternal/child)
 - Lack of social support
 - Perceive self as active
 - Time constraints
 - Lack of motivation
 - Lack of advice / info
 - Adverse weather
 - Lack of resources



Can we successfully intervene?

Physical Activity Interventions

- James et al, 2020 systematic review
 - Review of 15 RCTs of PA during pregnancy
 - “... interventions seem to have a low impact on the promotion of PA during pregnancy. New intervention strategies need to be assessed, such as the use of mobile health interventions.”
- Flannery et al, 2019 systematic review
 - Review of 19 PA interventions for women with overweight and obesity during pregnancy
 - “Slight increase in PA” in intervention women
 - But....studies had a high risk of bias
- Pearce et al, 2013 systematic review
 - 9 PA interventions during pregnancy
 - 3 of 9 reported statistically significant positive results



Can we successfully intervene?

Interventions to Promote Healthy GWG

- Cantor et al, 2021 – Evidence Report & Systematic Review for USPSTF
 - Interventions focused on diet, exercise and/or behavioral counseling on GWG
 - 68 studies (N=25,789)
 - GWG interventions reduced risk of:
 - Gestational diabetes
 - Emergency cesarean delivery
 - Macrosomia
 - Large for gestational age
 - GWG (-1.02 kg)
 - Excessive GWG
 - Reduced postpartum weight retention at 12 months (-0.63 kg)



CAN WE SUCCESSFULLY INTERVENE?

Interventions to Promote Healthy GWG

- Teede et al., 2022
 - 117 RCTs (N=34,546)
 - **Overall**, lifestyle interventions reduced risk of:
 - GWG (-1.15 kg)
 - Gestational diabetes
 - Total adverse maternal outcomes
 - **Diet** reduced risk of:
 - **GWG (-2.63 kg)**
 - Preterm delivery
 - Large for gestational age
 - NICU
 - **Total adverse maternal outcomes**
 - **Physical activity** reduced risk of:
 - **GWG (-1.04 kg)**
 - Gestational diabetes
 - Hypertensive disorders
 - Cesarean section
 - **Total adverse maternal outcomes**
 - **Diet w/ PA** reduced risk of:
 - **GWG (-1.35 kg)**
 - Gestational diabetes
 - **Total adverse maternal outcomes**



Can we successfully intervene?

Postpartum Weight Loss



- Lim et al, 2020
 - Review of lifestyle interventions on body weight in postpartum
 - 36 studies (N=5,315) – 23 with sufficient data on weight loss
 - All but 1 had high risk of bias
 - Mean of -2.33 kg change in body weight

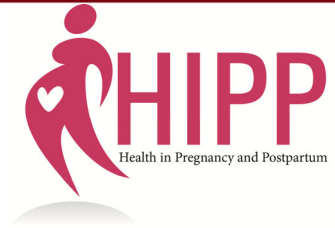


Limitations (especially in GWG field)

- Inclusion of racial/ethnic minorities
- Studies of those who enter pregnancy overweight or obese
- Use of theory-based interventions
- Full inclusion of PA into intervention (emphasis on nutrition education alone)
- Measurement of PA
- Many in countries w/ universal health care
- **Few extend from pregnancy through postpartum**



The HIPP Trial



- Health in Pregnancy and Postpartum (HIPP), NIH R01 (Wilcox & Liu, PIs)
 - Wilcox et al., 2018, *Contemporary Clinical Trials*
 - Builds off our pilot study R21: Liu et al., 2015, *Maternal and Child Health Journal*
- Recruited 219 **African American & white** women w/ overweight and obesity in early pregnancy & following through 12 months postpartum
- Lifestyle behavioral intervention vs. usual care
 - In-person session (pregnancy & postpartum) + telephone counseling + behavioral podcasts + Facebook
 - Social Cognitive Theory
- Primary outcome: GWG
- Secondary outcomes:
 - Postpartum weight retention
 - Maternal PA (SenseWear Armband), Diet, QOL
 - Infant BMI & other measures of adiposity



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HIPP Trial results – excessive GWG

TABLE 2 Interactive effects of behavioral intervention, race/ethnicity, and prepregnancy BMI on GWG and behavioral outcomes

Outcomes	Behavioral intervention	Standard care	Intervention effect
	Least squares mean (95% CI) ^a		
<i>Total GWG at delivery (kg)</i> ^b			
All participants	13.2 (11.7 to 14.6)	12.8 (11.4 to 14.4) ^c	0.3 (–1.6 to 2.3)
With overweight, African American	13.1 (9.7 to 16.5)	17.6 (14.5 to 20.6)	–4.5 (–9.9 to 0.0)
With obesity, African American	12.6 (10.0 to 15.2)	8.5 (5.8 to 11.2)	4.1 (0.3 to 7.9)
With overweight, White	14.6 (12.1 to 17.0)	15.6 (12.7 to 18.6)	–1.0 (–4.6 to 2.5)
With obesity, White	11.6 (8.8 to 14.5)	10.0 (7.3 to 12.7)	1.6 (–2.2 to 5.4)

Significantly lower rates in Intervention vs Standard Care:

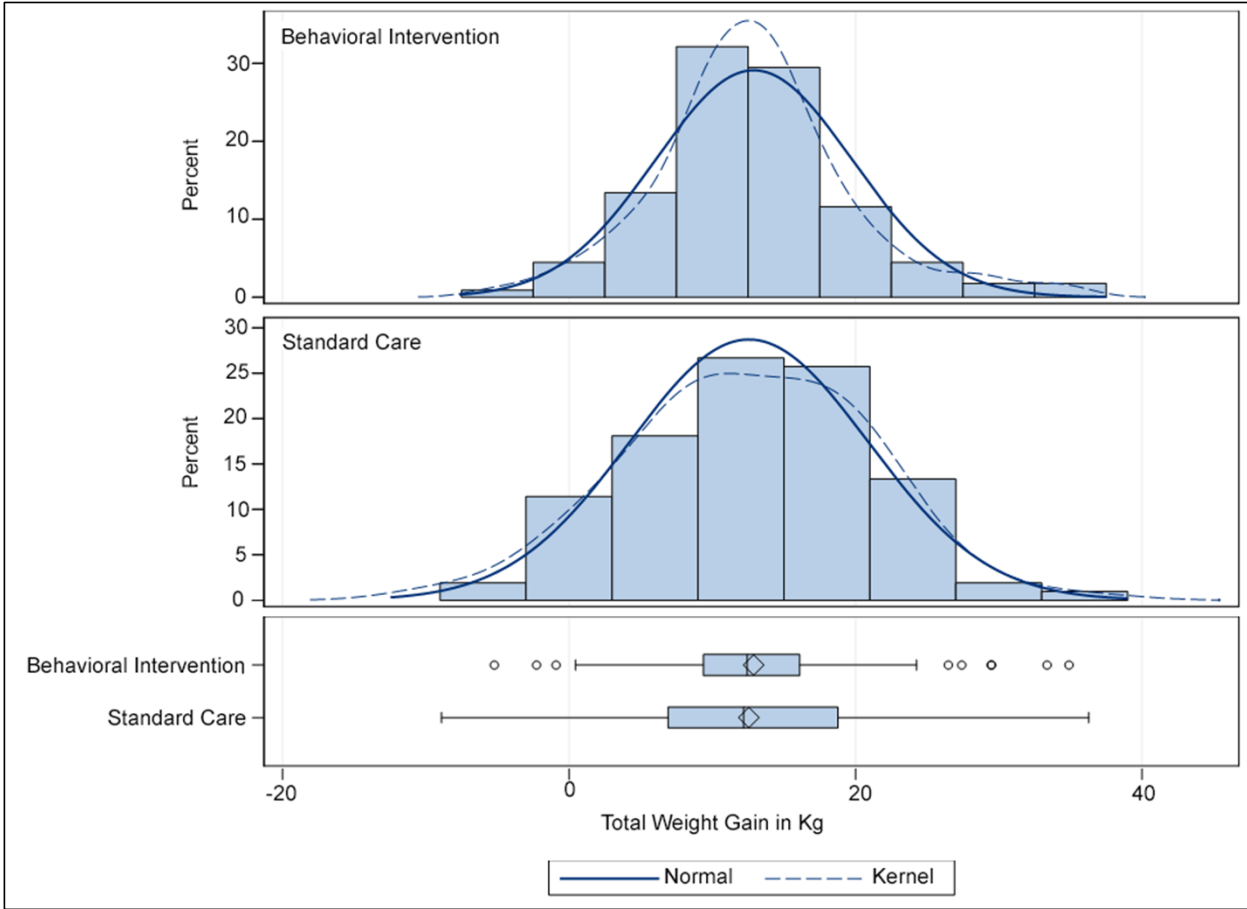
- low birth weight babies
- gestational hypertension
- adverse pregnancy outcomes

Source: Liu, Wilcox et al, 2021, Obesity



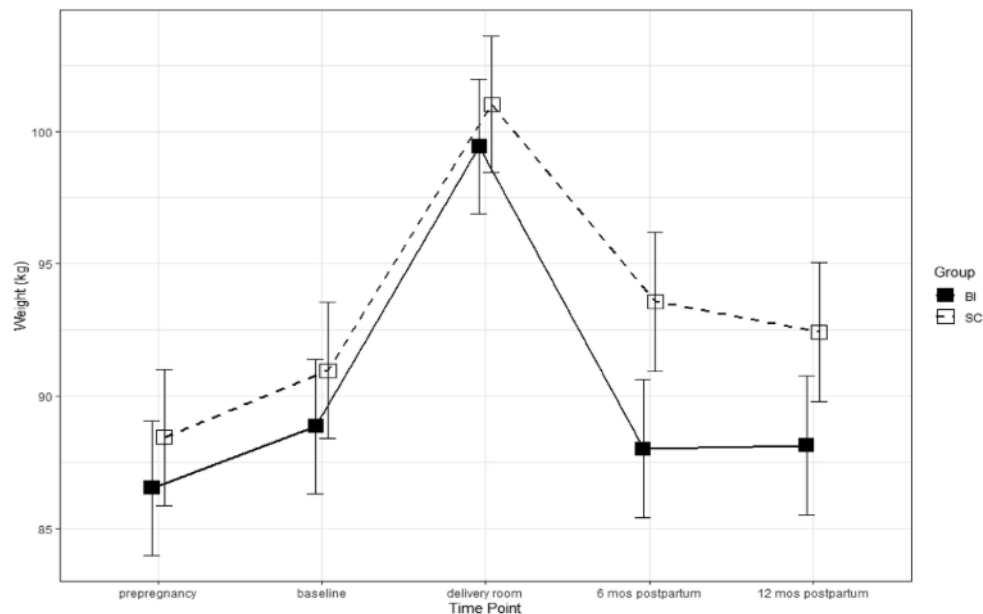
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Figure S1. Total Weight Gain by Intervention Group.



Smaller SD in total GWG among Intervention than Standard Care participants (p=0.04)

HIPP Trial results – postpartum weight retention



Intervention group had greater weight reduction than standard care at 6 & 12 months postpartum when comparing postpartum to:

- prepregnancy
- study baseline (early pregnancy), and
- delivery room

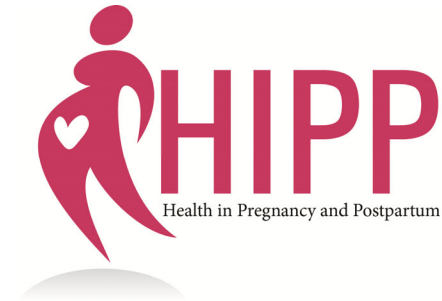
Stay tuned for impact on offspring adiposity!

FIGURE 2 Mean adjusted weights and the 95% CI by time points for participants assigned into behavioral intervention (BI) vs. standard care (SC) groups

Source: Liu, Wilcox et al, 2022, Obesity

HIPP challenges

- Where to start? 😄
- Recruitment! (Liu et al, 2020, Women's Health Reports)
 - Led to change in mode of delivery; did not meet recruitment goal
- Competing priorities – PA/diet/weight often not priority
 - Focus on weight sometimes not appreciated
- Facebook engagement
- Podcast use over time



Summary

- Pregnancy is a major life transition for many women
 - Risks of excessive GWG, weight retention, and reduced PA
- PA is recommended & safe for most
- Interventions should address unique barriers & enablers
- Interventions targeting PA and excessive GWG have yielded favorable but modest results
 - Need more research targeting groups at particular risk for excessive GWG
- Fewer postpartum interventions, but generally favorable results
- More studies spanning pregnancy through postpartum are needed



THANK YOU!



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