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The Feasibility and Efficacy of a Behavioral Intervention to Promote Appropriate Gestational Weight Gain

Meghan Baruth[1] · Rebecca A. Schlaff[1] · Samantha Deere[1] · Jessica L. Walker[2] · Brenna L. Dressler[3] · Sarah F. Wagner[4] · Ashley Boggs[5] · Holly A. Simon[6]

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Abstract

Introduction Nearly half of all women gain above gestational weight gain (GWG) recommendations. This study assessed the feasibility and efficacy of a pilot behavioral intervention on GWG and physical activity behaviors.

Methods Women (n = 45) 14–20 weeks gestation enrolled in a behavioral intervention. Physicians 'prescribed' the intervention to low risk patients. The intervention included self-monitoring, support, and optional walking groups. Process evaluation measures regarding usage and acceptability of study components were obtained. Physical activity was objectively measured at baseline and 35 weeks. The percentage of participants with appropriate GWG was calculated. Control data was obtained from the same clinic where participants were recruited.

Results Overall, the intervention was acceptable to participants; attrition was low (6.7%), weekly contact was high (87%), and self-monitoring was high (Fitbit worn on 82% of intervention weeks; weekly weighing on 81%). Facebook (40% of weeks) and study website use (19%) was low, as was walking group attendance (7% attended a single group). Participants reported a lack of discussions about the study with their physician. Results showed no significant difference between intervention and control participants in the percentage who gained excess weight ($p = 0.37$). There was a significant decrease in moderate-to-vigorous physical activity in intervention participants ($p < 0.0001$).

Discussion Continued efforts for promoting physical activity and appropriate GWG are needed. Although acceptable, the intervention was not efficacious. Trainings for, or input from prenatal healthcare providers on how to best encourage and support patients' engagement in healthy behaviors, such as PA, are warranted.

Keywords Behavioral intervention · Public health · Pregnancy · Physical activity · Physicians · Exercise is Medicine · Feasibility

Significance

There is no consensus on what types of interventions or what behavioral strategies are most effective for attenuating gestational weight gain. Continued efforts including novel approaches for promoting healthy behaviors and appropriate GWG are needed until the right 'recipe' (i.e. components, behavioral strategies) is found. This study presents the findings from a pilot behavioral intervention aimed at reducing GWG. Although the efficacy on outcomes was not as anticipated the feasibly and acceptability of the intervention were established.

Introduction

Weight gain recommendations during pregnancy are based on a woman's pre-pregnancy body mass index (BMI); it is recommended that women with a higher pre-pregnancy BMI gain less weight (IOM 2009). Women gaining outside of the recommendations are at an increased risk for many negative

✉ Meghan Baruth
mbaruth@svsu.edu

1 Saginaw Valley State University, 7400 Bay Road, University Center, MI 48710, USA

2 Michigan State University, East Lansing, MI, USA

3 University of Michigan, Flint, Flint, MI, USA

4 Bowling Green State University, Bowling Green, OH, USA

5 Wake Forest University, Winston-Salem, NC, USA

6 Life University, Marietta, GA, USA

maternal outcomes (IOM 2009). Despite this, approximately one-third of women in the US gain within the recommended amount; nearly half gain above (Dudenhausen et al. 2015).

The effectiveness of interventions in reducing gestational weight gain (GWG) is mixed (Krukowski et al. 2017; Nobles et al. 2018; Redman et al. 2017; Yeo et al. 2017); much work remains in understanding how to promote appropriate GWG during pregnancy. Engaging in healthy behaviors during pregnancy such as regular physical activity can promote appropriate GWG (Muktabhant et al. 2015; Streuling et al. 2011). Physical activity during pregnancy has been shown to have minimal risks and to be beneficial to most (American College of Obstetricians and Gynecologists 2015; US Department of Health and Human Services 2008). Despite this, a majority of pregnant women do not meet physical activity guidelines (Hesketh and Evenson 2016). Furthermore, physical activity levels tend to decrease across trimesters (Borodulin et al. 2008; Evenson and Wen 2010). Behavioral physical activity interventions have been conducted in pregnant populations, and overall it appears these types of interventions can increase or attenuate declines in physical activity during pregnancy (Currie et al. 2013). However, published intervention studies are limited by self-reported measures of physical activity and high attrition rates (Currie et al. 2013).

Given the excessive GWG and decline in physical activity that often occur during pregnancy, it is important to develop and implement theoretically-based interventions that are appropriate for pregnant women and the barriers they commonly face. Therefore, the purpose of this study was to assess the feasibility of a pilot behavioral lifestyle intervention in pregnant women. Secondary aims were to examine the efficacy of the intervention on GWG and physical activity behaviors.

Methods

Participant Recruitment

Participants were pregnant women recruited from a local OB/GYN clinic in Saginaw, Michigan. Eligible participants were ≥ 18 years of age, 14–20 weeks gestation, not on bed rest, not told to limit their physical activity or eat a prescribed diet, owned a smart phone, and spoke English. Using the Exercise is Medicine™ (American College of Sports Medicine 2018) approach, physicians 'prescribed' the intervention to patients he/she deemed low risk.

Procedure

Interested participants given a 'prescription' by their healthcare provider met with a member of the research team to assess eligibility. Eligible participants were scheduled for a baseline measurement session. Prior to the session, informed consent was obtained, and participants were given an Actigraph (GT3x, Actigraph, LLC, Fort Walton Beach, FL) to wear. At the session, objectively measured height and weight were obtained, participants completed an online survey, were given a Fitbit and scale, were shown the study website and Facebook page, went over study expectations and goals, were assigned a healthy lifestyle coach, and set their first physical activity and nutrition goals. At 35-weeks, participants wore the Actigraph accelerometer and were e-mailed a survey link to complete.

Intervention

All participants were enrolled in the SELF intervention (Supporting hEaLthy Futures: Creating a Healthy Family by Investing in YourSELF). The active intervention lasted from enrollment until the participant gave birth. The intervention was informed by the Social Cognitive Theory (Bandura 1986), existing literature, and a focus group conducted with a group of pregnant women. The intervention included four key components: Exercise is Medicine™, self-monitoring, opportunities for support, and walking groups (optional).

Exercise is Medicine™

In order to enroll, a healthcare provider had to 'prescribe' exercise (i.e. the intervention) to the participant he/she deemed low risk. The prescription recommended 150 min of moderate to vigorous physical activity a week and encouraged the participants to enroll in the intervention in order to learn strategies that would help her incorporate physical activity into her daily schedule that she would enjoy. It also included information about the health benefits of physical activity participation during pregnancy. A paper prescription had to be turned into study staff upon enrollment.

Self-Monitoring

Participants were given a FitBit Charge to monitor their physical activity (daily) and an Eat Smart Precision digital scale (model ESBS-01) to monitor their weight. Participants were instructed to weigh themselves once a week using the scale provided, and enter their weight into their FitBit account.

Opportunities for Support

Each participant was assigned a 'healthy lifestyle coach,' who was a trained undergraduate research assistant. The coach provided support, set goals, and interacted with the participant weekly. Participants joined a private Facebook

page (monitored by study staff) that provided support and interaction among participants. There was also a private study website with educational materials pertaining to physical activity and nutrition, developed by study staff.

Walking Groups (Optional)

Participants had the option of joining a walking group, where they could get physical activity and support from coaches and other participants. Walking groups were set up and coordinated by coaches when participants expressed interest.

Control Group

Since all SELF participants received the intervention, data from the OB/GYN clinic's electronic medical record were obtained and served as the control group. Women on bedrest, or who had gestational diabetes, pregnancy hypertension or preeclampsia were excluded. Control participants were pregnant during the SELF study period and were matched on pre-pregnancy weight group, race, and age (within ~ 2 years). The earliest and last objectively-measured weight recorded during pregnancy in the electronic medical record were used to calculate GWG.

Measures: SELF Participants

Demographic Variables

Participants reported their age, education, race, marital status, gestational age, and parity.

Body Mass Index

Self-reported pre-pregnancy weight and objectively measured height were used to calculate pre-pregnancy BMI (kg/m^2).

Gestational Weight Gain

GWG was calculated by subtracting pre-pregnancy weight (self-reported) from last reported weight (from weekly weigh-ins or 35 week survey). Participants were categorized as gaining below, within, or above recommendations, based on pre-pregnancy BMI (IOM 2009). The percentage of recommended weight gained was calculated as the percent of the upper weight range value, based on IOM recommendations; therefore a value > 100% indicates GWG above the upper weight range value.

Physical Activity

The Actigraph accelerometer (GT3x, Actigraph, LLC, Fort Walton Beach, FL) measured physical activity. Participants wore the monitor on their right hip, during all waking hours for 7 days. A 60-s epoch was used. To be included in analyses, participants had to wear the monitor for ≥ 10 h per day, on 3 days (Trost et al. 2005). Data recording 60 min or more of consecutive zeros were removed from analyses (Masse et al. 2005; Matthews et al. 2008). The cut points from Freedson et al. (1998) were used to convert raw data counts into minutes of specific intensities of physical activity: ≤ 100 sedentary, > 101 to < 1952 light, and ≥ 1952 moderate to vigorous. Percent of day spent in sedentary, light, and moderate to vigorous physical activity were calculated.

Feasibility Data

The healthy lifestyle coaches collected weekly data from participants, including whether they accessed the Facebook page (Y/N) and study website (Y/N), set a physical activity goal (Y/N) and a nutrition goal (Y/N), met the previous week's physical activity goal (Y/N) and nutrition goal (Y/N), and attended a walking group (Y/N). Coaches also recorded the number of email, text, and phone (separately) communications they had with each participant that week, and logged into their Fitbit account to record whether they wore their FitBit [defined as at least one day per week (Y/N)] and record the participant's body weight (lbs.).

Upon completion of the intervention, interviews were conducted with a subsample of participants to better understand what they liked/did not like about various intervention components. More specifically, participants were asked for their thoughts regarding: weekly weighing, wearing the Fitbit, goal setting, the Facebook page and study website, and interactions with their health coach.

Statistical Analyses

Descriptive statistics were used to examine the demographic characteristics of the sample and study feasibility data. T-tests were used to examine difference in total GWG and the percentage of recommended GWG among SELF participants and matched controls. Differences in the percentage of participants meeting IOM recommendation for GWG between SELF study participants and matched controls were examined using Chi squares. Differences in the percentage of SELF participants meeting IOM recommendations for GWG according to pre-pregnancy BMI were examined using Chi squares. Repeated measures analysis of covariance examined change over time in physical activity behaviors (sedentary, light, moderate to vigorous physical activity), using all available data. The associations between percentage of

recommended weight gained and physical activity behaviors were examined using Pearson correlations. All analyses were completed using SAS 9.4 (SAS Institute, Cary, NC).

Results

Primary Outcome: Feasibility

A total of 57 women were screened, and 45 met eligibility criteria and enrolled in the study; 3 dropped out of the study (6.7%). Demographic characteristics of the sample are shown in Table 1.

On average, participants received the intervention for 19.1 ± 3.2 weeks (note: the 3 drop outs were not included in these analyses). On average, participants visited the Facebook page and website on 40% and 19% of enrolled weeks, set physical activity and dietary goals on 83% and 85% of weeks, and had contact with their coach on 87% of intervention weeks. The most common form of communication was text messaging (88%), followed by email (42%), and phone (6%) (note: multiple forms were used with some participants). Among those who reported each type of communication with her health coach, emails occurred on 37% of intervention weeks, text messaging on 82%, and phone calls on 6%. On average, participants reported their weight on 81% of intervention weeks, and wore their Fitbit on 93% of intervention weeks. A total of 3 participants (7%) attended a (single) walking group session (Table 2).

Overall results from the interviews with a subsample of participants (n = 9), revealed satisfaction with most components of the intervention. Most women found the weekly weighing useful. However, a few stated it had a negative impact on them emotionally (e.g. made her feel bad, became

Table 2 Study feasibility (n = 42[a])

	% of participants	% of weeks among those reporting yes
Visited study Facebook site	100% (n = 42)	39.9
Visited study website	100% (n = 42)	18.9
Set physical activity goals	100% (n = 42)	83.0
Set dietary goals	100% (n = 42)	84.9
Email contact (%ppt)[b]	42.2% (n = 19)	37.0
Text contact (%ppt)[b]	88.1% (n = 37)	81.2
Phone contact (%ppt)[b]	6.0% (n = 3)	5.6
Any contact with coach	100% (n = 42)	86.5
Recorded weight	100% (n = 42)	81.0
Wore Fitbit	100% (n = 42)	92.8
Attended walking group	7.1% (n = 3 attended 1 walking group)	

[a]n = 3 participants dropped out and were not included in these analyses

[b]Contact = a message/phone call was sent AND received

Table 1 Demographic Characteristics of the sample

	Intervention		Controls[a]	
	N	Mean (SD) or %	N	Mean (SD) or %
Age (years)	45	28.4 (4.5)	40	28.9 (3.6)
Parity	45	1.1 (1.0)	40	1.2 (0.8)
Pre-pregnancy BMI (kg/m^2)	45	26.9 (7.2)		N/A
Pre-pregnancy weight category				
Underweight	1	2.2	1	2.5
Normal weight	21	46.7	19	47.5
Overweight	14	31.1	12	30.0
Obese	9	20.0	8	20.0
Gestational age at baseline (weeks)	45	18.0 (2.4)		N/A
Marital status[b]				
Married	38	84.4	22	57.9
Not married	7	15.6	16	42.1
Race				
White	36	81.8	32	80.0
Non-White	8	18.2	8	20.0
Education				
High school graduate	7	15.6		N/A
Some college	12	26.7		
College graduate	26	57.8		

[a]Matched controls were obtained from the OB/GYN clinic's electronic medical record

[b]Significant between group difference

Table 3 Gestational weight gain among participants (n = 40)

	Intervention		Controls		*p* value
	N	Mean (SD) or %	N	Mean (SD) or %	
Mean final weight gestation (weeks)	40	38.0 (2.3)	40	38.8 (1.1)	0.06
Gestational weight gain (lbs)	40	32.6 (13.9)	40	32.0 (16.3)	0.87
Percentage of recommended weight gain (%)	40	113.4 (46.7)	40	111.4 (57.6)	0.87
IOM recommendations					0.66[a]
Below	6	15.0	8	20.0	
Within	12	30.0	14	35.0	
Above	22	55.0	18	45.0	

[a]p-value for excess weight gain = 0.37

Table 4 Gestational weight gain (IOM categories) by pre-pregnancy weight category (n = 40)

Pre-pregnancy weight group	Below		Within		Above	
	N	%	N	%	N	%
Underweight (< 18.5 kg/m^2)	–	–	1	100	–	–
Normal (18.5–24.9 kg/m^2)	3	15.8	7	36.8	9	47.4
Overweight (25.0–29.9 kg/m^2)	3	25.0	3	25.0	6	50.0
Obese (≥ 30.0 kg/m^2)	–	–	1	12.5	7	87.5

There was no significant difference in GWG (IOM categories) according to pre-pregnancy weight category

more obsessed with weight gain). All of the women liked wearing the Fitbit and thought it was useful, with one woman saying it was the most impactful part of the study. For many, it made them aware of physical activity levels. The feedback on goal setting was also positive; most women agreed the weekly frequency was adequate. Most women stated that they didn't access the Facebook page and website very frequently (particularly the website). Although a couple women found the information useful, the overall consensus was that neither Facebook or the website were intentionally used very often nor were they overly valuable to participants. The feedback about the healthy lifestyle coaches was overwhelmingly positive, with participants stating they had a good experience interacting with their coaches; they reported getting the support they needed.

Secondary Outcomes: Gestational Weight Gain and Physical Activity Behaviors

Weight gain data (i.e. final weight recorded ≥ 35 weeks gestation) was available for 40 participants (88.9%); 40 matched controls were obtained from medical records. As shown in Table 3, on average, the 'final' weight was provided during week 38.0 ± 2.3 (intervention) and 38.8 ± 1.1 (controls). Results showed no significant difference in GWG among intervention (32.6 ± 13.9 lb) and control participants (32.0 ± 16.3 lb) (p = 0.87), and no significant difference in the percentage of recommended weight gained among intervention (113.4 ± 46.7%) and control participants (111.4 ± 57.6%) (p = 0.87). A majority of intervention participants gained above the IOM's recommendations (55.0%), while 15.0% gained below, and 30.0% gained within. Percentages were similar for control participants at 45% (above), 20.0% (below), and 35.0% (within). Results showed no significant difference in the percentage of women who gained within each of the IOMs categories (p = 0.66) or who gained excess weight (p = 0.37).

Table 5 Changes in physical activity behaviors

	Baseline (n = 37) (%)	35-weeks (n = 29) (%)	p-value
Sedentary, % day	59.6	64.0	0.02
Light physical activity, % day	39.1	35.5	0.06
Moderate to vigorous physical activity, % day	1.3	0.6	< 0.0001

Table 4 shows the percentage of intervention participants who gained within the IOM's recommendations according to pre-pregnancy weight group. There was no significant difference in the percentage of women who gained within each of the IOM's categories (p = 0.29) or who gained excess weight (p = 0.16) according to pre-pregnancy weight group.

Physical activity behaviors at baseline and 35-weeks are shown in Table 5. At baseline, 37 participants (82.2%) had valid Actigraph data compared to 29 (64.4%) at 35-weeks. There was a significant decrease in percent of day spent in moderate to vigorous physical activit from baseline to 35-weeks (p < 0.0001), and a significant increase in percent of day in sedentary behaviors (p = 0.02). There was

no change in percent of day spent in light physical activity (p = 0.06).

Table 6 shows the associations between the percentage of recommended GWG and physical activity behaviors. There was a significant, positive relationship between percent of day in sedentary behaviors at baseline and percentage of recommended GWG (r = 0.35, p = 0.047) and a significant negative relationship between percent of day spent in moderate to vigorous physical activity at 35 weeks and percent of recommended weight gained (r = −0.44, p = 0.02). There were no other significant relationships.

Discussion

Despite the known risks of excessive GWG, challenges remain in effectively promoting appropriate weight gain in pregnant populations. Continued research is needed to better understand how to most effectively tackle this public health problem. The primary aim of this pilot study was to test the feasibility of a behavioral physical activity and dietary intervention aimed at promoting healthy GWG in pregnant women. Results from this study, like other studies testing the feasibility and/or acceptability of interventions in pregnant women (Hayman et al. 2017; Liu et al. 2015; Willcox et al. 2017), provide valuable insight that can inform future studies.

Overall, this intervention appeared acceptable to participants, as indicated by the very low dropout rate (6.7%) and the high weekly coach-participant contact (87% of intervention weeks). Data from participant interviews found that weekly weighing, wearing the Fitbit, and weekly goals were useful. The acceptability of these components was corroborated by the high percentage of weeks that each of these tasks was completed (e.g. participants wore the Fitbit for 93% of intervention weeks). Although email was initially the mode of communication promoted, it was quickly apparent that it was not the most convenient or effective method; therefore, participants chose their 'preferred' method of communication, which was text messaging. A weekly walking group was an optional intervention component that was utilized by very few participants. This intervention component was made optional, as group-based interventions with pregnant women are challenging, and attendance is often problematic (Liu et al. 2015). Alternative methods for 'group-based' activities are needed; perhaps future studies can incorporate virtual walking/exercise groups, which have been used in other populations (Baez et al. 2017; Tomita et al. 2016). Finally, data from participant interviews indicated that the study website and Facebook pages were not utilized as much as intended. Interview data suggested that participants did not find these intervention components very useful; however, there may have been no 'incentive' to use them as they were not required like other intervention components. Future studies may want to consider developing a phone app, which may be a more convenient way of communicating educational information (i.e. access information via a phone instead of computer).

A secondary aim of this study was to examine the effects of the intervention on GWG. Results showed no significant difference in GWG or the percent gaining within the IOM's recommendations between participants enrolled in the intervention and matched controls. Excessive GWG was reported in over half (55%) of participants, which overall, is consistent with reports from other intervention trials (Krukowski et al. 2017; Liu et al. 2015; Nobles et al. 2018; Redman et al. 2017). Although a majority of participants gained above the IOM recommendations, interestingly, on average, participants only gained about 13% above the upper value of the range of weight gain, which is only ~ 2.6 to 4.6 lb of excess weight, depending on pre-pregnancy BMI. Although interventions have been somewhat, although modestly, successful for reducing overall GWG (Hill et al. 2013; Yeo et al. 2017), they have not been effective in preventing excessive weight gain (Tanentsapf et al. 2011; Thangaratinam et al. 2012). This study may have enrolled participants 'too late', as women were recruited at 14–20 weeks gestation

Table 6 Associations between physical activity behaviors and percentage of recommended weight gain

	% of recommended weight gain Pearson correlation coefficient r, p-value
% day sedentary baseline	0.35, 0.047
% day sedentary 35 weeks	0.09, 0.67
% day light physical activity baseline	−0.31, 0.08
% day light physical activity 35 weeks	−0.06, 0.76
% day moderate to vigorous physical activity baseline	−0.31, 0.07
% day moderate to vigorous physical activity 35 weeks[a]	−0.44, 0.02

[a]Variable transformed [square root], as data were skewed

(average was 18 weeks). Upon enrollment, participants had already gained 10.8 ± 8.5 lb, or about one-third of their total GWG. Using the IOM's recommendations of rate of weight gain, participants should have only gained a *maximum* of 3.4–8.8 lb, depending on pre-pregnancy BMI, upon enrollment into the study. Interestingly, a follow-up linear regression model controlling for age, education, pre-pregnancy BMI and parity indicated that weight gain prior to enrollment predicted GWG ($p = 0.0002$). Women should be enrolled in behavioral interventions earlier to attenuate excessive GWG; for example, women could be enrolled at their first prenatal healthcare visit (i.e. ~ 8 weeks gestation), which may help reduce first trimester weight gain.

Another secondary aim of the study was to examine the effects of the intervention on physical activity levels. Despite being enrolled in a physical activity intervention there was a significant decrease in moderate to vigorous physical activity among participants whose physical activity level upon enrollment was already quite low (mean = 11.5 min, or 1.3% of day). Unfortunately, the intervention wasn't successful in thwarting the decline in physical activity that often accompanies progression through pregnancy (Duncan et al. 2017; Watson et al. 2017). Because there were no control data related to physical activity in this study, it is unclear if this intervention resulted in a lesser decline than what may have occurred with no intervention. Pregnant women may face a number of unique barriers, such as fatigue, nausea, swelling, and discomforts, making physical activity difficult (Harrison et al. 2018); addressing these pregnancy specific barriers, which this study may not have adequately done, may help to increase, or at least maintain, levels of physical activity throughout pregnancy.

Although the intervention was not successful in changing physical activity behaviors, evidence pointed to a positive impact of physical activity behaviors on GWG. Baseline behaviors appeared to be particularly important as percent of day spent sedentary was positively associated with the percentage of recommended GWG, while there was a near significant negative relationship for light and moderate to vigorous physical activity. Furthermore, percent of day in moderate to vigorous physical activity at 35 weeks was negatively associated with the percentage of recommended GWG. Although challenging, efforts aimed at promoting physical activity behaviors in pregnant women are needed. Future interventions might consider focusing on increasing light intensity physical activity or reducing sedentary time, which may be more feasible and realistic than increasing moderate to vigorous physical activity. Furthermore, given the relationships between physical activity behaviors early in pregnancy (i.e. second trimester) and GWG, interventions should focus on promoting these behaviors as early as possible. Efforts aimed at improving physical activity behaviors in early pregnancy may also be more acceptable to participants, as many pregnancy-related barriers to physical activity are less prominent in early gestation.

Interventions aimed at reducing GWG have been found to be more efficacious when delivered by prenatal healthcare providers (Hill et al. 2013; Yeo et al. 2017). A novel component of this study was using the Exercise is Medicine™ approach, where physicians 'prescribed' exercise (i.e. the intervention) to patients. The purpose of including this was to show the value physicians placed on physical activity. Research has showed that pregnant women desire and value advice from their providers (Stengel et al. 2012). Data from this study showed that 69% of participants 'highly valued' their prenatal healthcare provider's opinion (mean score 4.6 ± 0.6 on a 5-point scale). Women whose obstetric providers discussed exercise with them have been shown to be more likely to exercise during pregnancy (May et al. 2013). Unfortunately, only 60% of women in this study reported that their healthcare provider asked about their current physical activity habits while 56% reported their healthcare provider recommended they engage in physical activity during their pregnancy. Although a requirement for enrollment into the study, post-intervention interviews with a subgroup of intervention participants revealed that only 44% stated that they spoke to their physician about the study before enrolling, indicating the healthcare provider prescribed, but did not discuss the intervention with participants. Therefore, physician support may have been perceived as lacking.

Our study joins the challenges many other studies face in promoting physical activity and appropriate GWG during pregnancy. The findings suggest that our intervention may not have been intense enough to impact GWG and physical activity levels. More intense physical activity and dietary counseling efforts from trained professionals who understand the physical and mental changes associated with pregnancy (e.g. registered dietitians, exercise physiologists, physicians) may be necessary to elicit behavioral changes. Although the healthy lifestyle coaches appeared to be a valuable piece of support to participants, they were not trained to deliver such counseling. The need for more intensive interventions delivered by health professionals may be challenging from a public health perspective, as wide-spread dissemination may be difficult due to costs and other logistics.

This study has a number of limitations that should be considered. First, our sample size was small and our study was underpowered. A post hoc power analysis indicated that a sample size of 199 is needed to detect a small difference ($d = 0.20$), based on $\alpha = 0.05$ and 80% power. Second, due to constraints in funding and the pilot-nature of this study, there was no true control group; however, data from the same clinic from which participants were recruited were used as controls in the GWG analyses. Third, although matched controls were obtained, methods for obtaining pre-pregnancy BMI differed (self-reported vs. objectively measured in

clinic). Issues with under/over reporting could have occurred (intervention participants) and/or early weight gain could have been missed (controls). Finally, although the attrition rate was low, there were missing data due to not completing the 35-week survey and/or meeting Actigraph wear time requirements.

This study tested the feasibility of a low-cost, pilot, behavioral intervention on physical activity and GWG and found, overall, the study was feasible/acceptable. Although the efficacy of the study on outcomes was not as anticipated, a larger trial with a control group, incorporating changes based on study findings, is recommended. It is important that interventions consider the feasibility/acceptability through a public health lens, and engage in and report process evaluation efforts. Although efficacy in improving health outcomes is a priority, programs should be cognizant of cost, designed with the needs and barriers of the subpopulation in mind, and not overly burdensome for physicians/clinics. Taking the aforementioned into account is imperative for widespread dissemination of behavioral interventions, which have the potential for meaningful public health impact.

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Compliance with Ethical Standards

Conflict of interest The authors declare they have no conflict of interest.

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