Public Health Nutrition: 22(12), 2228–2236 doi:10.1017/S1368980019000703

Obese women's perceptions of weight gain during pregnancy: a theory-based analysis

Emily M Nagourney[1], Dina Goodman[1], Yukyan Lam[1], Kristen M Hurley[1], Janice Henderson[2] and Pamela J Surkan[1,*]

[1]Department of International Health, Johns Hopkins Bloomberg School of Public Health, 615 N. Wolfe Street, Baltimore, MD 21205, USA: [2]Department of Gynecology and Obstetrics, Johns Hopkins Medicine, Baltimore, MD, USA

Submitted 7 September 2018: Final revision received 27 December 2018: Accepted 6 February 2019: First published online 28 May 2019

Abstract

Objective: Excess gestational weight gain (GWG) in obese women is linked to adverse maternal outcomes and is particularly pervasive among African Americans, who have the highest obesity rates in the USA. A better understanding of culturally relevant attitudes and perceptions of GWG is needed to develop targeted interventions to prevent excess GWG among this group.

Design: Using the constructs of Social Cognitive Theory, we explored attitudes and perceptions surrounding diet and exercise among low-income obese African-American pregnant women in Baltimore. We conducted twenty-one semi-structured in-depth interviews with pregnant adult women.

Setting: Participants were recruited from a referral clinic for obese pregnant women at a large urban hospital in Baltimore, MD, USA.

Participants: Twenty-one low-income African-American adult females in the first two trimesters of pregnancy with BMI > 30·0 kg/m^2.

Results: Lack of knowledge was not the main obstacle to healthy behaviours during pregnancy. Rather, food cravings and fatigue, an unhealthy physical food environment, limited self-efficacy for controlling excessive GWG, and a lack of adequate emotional and informational support impacted women's agency. While digital technology was discussed as a vehicle to promote maintenance of a healthy weight in pregnancy, further research is needed to test how it can be used to empower women to engage in healthy behaviours during pregnancy.

Conclusion: Interventions to prevent excess GWG among African-American pregnant women should harness support from partners and family and must go beyond sharing of clinical knowledge to also include strategies that improve the food environment, diet quality and self-efficacy.

Keywords
Obesity
Pregnancy
Gestational weight gain
African-American women
Social Cognitive Theory

Women who gain excessive weight during pregnancy are at increased risk for poor maternal outcomes (e.g. pregnancy-associated hypertension and gestational diabetes) and complications during labour and delivery, particularly if they were obese prior to pregnancy[1]. In addition to adverse maternal outcomes, maternal obesity also increases the risk of associated fetal outcomes including macrosomia, preterm birth and neural tube defects[2,3].

Obesity rates in the USA are highest among African Americans[4]. Given their pre-pregnancy BMI, women in this group are more likely to enter pregnancy at a higher BMI and retain weight postpartum, compared with White and Hispanic women[5,6]. These important sequelae motivated the Institute of Medicine to publish revised guidelines in 2009 regarding optimal gestational weight gain (GWG), which shifted the focus to a more conservative weight gain goal of 5·0–9·0 kg for obese women (compared with the previous open-ended recommendation of 6·8 kg)[7].

Eating a healthy diet and engaging in physical activity are among the most proximal risk factors associated with

*Corresponding author: Email psurkan@jhu.edu

maternal weight gain[8]. Previous research has investigated how personal and environmental factors motivate or inhibit mothers from carrying out these behaviours, but rarely is this examined among low-income and obese pregnant women. Therefore a better understanding of perceptions of GWG among this group is needed[9].

Among the theoretical frameworks for understanding behaviour change, Social Cognitive Theory (SCT) is particularly useful for the current context because it highlights the roles of individual characteristics as well as the social context in shaping behaviour and the interplay between them. Developed by Anthony Bandura, this theory posits three core constructs: personal factors, behaviour and environmental factors[10,11]. Through reciprocal determinism, the hallmark principle of SCT, each construct influences and is influenced by the others. SCT is relevant to our study of weight gain among low-income and obese African-American pregnant women in Baltimore because the behaviours of interest are those related to diet and physical activity, such as eating healthy or unhealthy foods, and exercising or not exercising[8]. Environmental factors include the physical and social environments, such as the accessibility/availability of healthy foods and the presence of social support networks[12]. Personal factors include an individual's knowledge, as well as personal agency and self-efficacy. Personal agency can be defined as the intention and forethought that drives behaviour[13] and self-efficacy can be defined as one's confidence in performing a behaviour[12]. Reciprocal determinism stipulates that environmental factors will reinforce or detract from personal agency, self-efficacy and knowledge, thereby impacting behaviour. In theory, behaviour and personal factors can in turn shape the environment. For example, pregnant women may successfully model ideal diet and exercise behaviours for other pregnant women, participate in support groups or routinely demand information from their health-care providers, thus prompting providers to offer more systematic support.

Despite growing evidence that there are misperceptions and insufficient knowledge of weight gain in pregnancy[9], little in-depth, contextual research has addressed GWG in specific minority populations at risk for obesity. Research suggests that African-American women tend to gain above the recommended amount during pregnancy, often reporting the importance of 'eating for two' to prevent poor outcomes associated with low weight gain as opposed to consideration of the outcomes associated with excessive GWG. Previous research also indicates that some women lack knowledge about healthy GWG recommendations, despite worrying about having unhealthy infants or developing chronic diseases due to their weight status[5,14]. Additionally, research analysing patient and provider perceptions of weight gain and counselling during pregnancy found that cultural differences as well as low income and low education levels are perceived barriers to providing effective counselling[15]. Furthermore, while SCT has been used as a framework for research on diet and physical activity[12,16,17], few studies have investigated how lack of personal agency can act as a barrier to healthy behaviours during pregnancy. Therefore, we explored attitudes and perceptions of weight gain in pregnancy among low-income, African-American women to improve our understanding of how personal, behavioural and environmental factors affect diet and physical activity behaviours during this period. These data can be used to inform the development of intervention strategies to prevent excess GWG and to educate women on risks associated with excessive GWG.

Methods

Participants and recruitment

We conducted twenty-one in-depth interviews with pregnant women in Baltimore, MD, USA, from February 2015 to January 2016. We recruited women from a referral clinic for obese pregnant women (self-reported pre-pregnancy BMI above 30·0 kg/m^2) at a large urban hospital. Once referred to the clinic, pregnant women who were obese, but without significant co-morbidities, received prenatal care and nutritional counselling. We enrolled women in the first or second trimester of pregnancy, aged 18 years or older, and who had not yet received nutritional counselling.

Data collection

A team of researchers at Johns Hopkins Bloomberg School of Public Health, with graduate-level training in qualitative research methods, conducted the interviews until saturation was reached. Interviewers used a semi-structured interview guide containing open-ended questions about perceptions of GWG, behaviours related to diet and physical activity before/during pregnancy, personal goals around GWG, and sources of information/support for healthy weight gain and behaviour. Examples of questions asked during interviews include: 'What does having a healthy pregnancy mean to you?', 'What are your goals for this pregnancy?' and 'How has being pregnant changed the way you eat?' Interviews were conducted in examination rooms at the clinic and lasted approximately 30 to 50 min. All interviews were audio-recorded and field notes were expanded after each interview. Interviews were transcribed verbatim by research team members. Written informed consent was obtained prior to each interview. With consent from participants, sociodemographic information was collected from clinic medical records. All participants were compensated with $US 15 gift cards.

Data analysis

After data transcription, members of the research team individually reviewed transcripts and developed topical codes using Grounded Theory, meaning that data were

https://doi.org/10.1017/S1368980019000703 Published online by Cambridge University Press

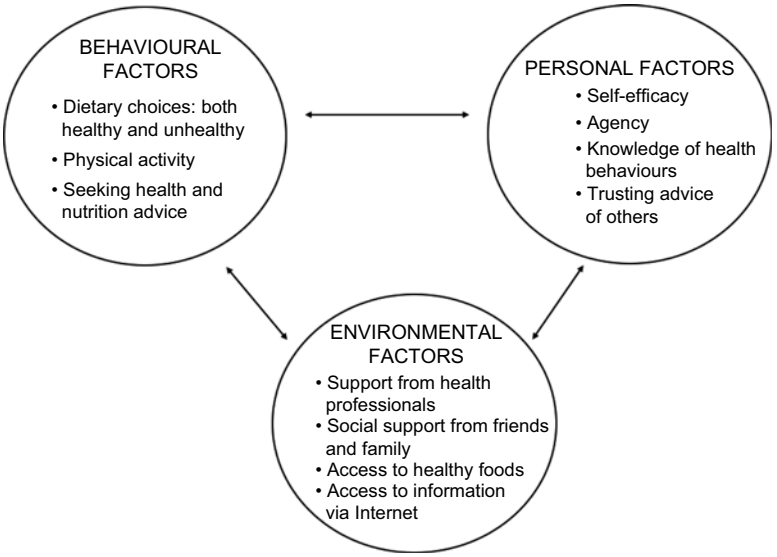

Fig. 1 A Social Cognitive Theory-based model of factors affecting weight gain during pregnancy

interpreted dynamically with few questions developed *a priori*[18]. Through team discussions and reflection, a codebook was developed and entered into Dedoose[19]. Two members of the research team applied the codebook to all interview transcripts in their entirety, iteratively updating the codebook after team consensus. Topical codes included personal agency, lack of personal agency, knowledge, desire for more information, social support, lack of social support, healthy practices, unhealthy practices, health concerns and physical changes.

For the analysis, the research team used the SCT framework, referring specifically to the interaction between the theory's three main constructs: behavioural factors, personal factors and environmental factors (Fig. 1). Themes guiding the analysis were generally classified as either 'barriers' or 'facilitators' to healthy practices, with specific attention to personal factors such as agency, self-efficacy and social support. In the context of our study, agency was defined as a woman's capacity to implement a healthy diet and be physically active while pregnant, and self-efficacy was conceptualized as her confidence to perform these activities.

Results

These results include qualitative data from twenty-one African-American adult females with a pre-pregnancy BMI > 30·0 kg/m^2. Demographic data were collected on all but one participant (n 20). The pregnant women interviewed were aged 18–33 years and had BMI between 30·8 and 46·4 kg/m^2, and 90 % (n 19) were not married. Five participants (25 %) did not complete high school, while nine (45 %) had either a General Educational Development or high-school diploma. Six participants (30 %) had some college but no college degree. None of the twenty participants had a college degree.

In line with the three constructs of SCT, participants described how behavioural, personal and environmental factors were critical in trying to achieve healthy weight gain during pregnancy (see Fig. 1).

Behavioural factors

Dietary choices during pregnancy

Many participants showed awareness of the importance of improving their diets during pregnancy. Women discussed eliminating unhealthy foods, suppressing predisposition for junk foods, staying hydrated and adjusting meal portions as common practices arising during pregnancy:

> 'I'm working on eating less sweets. I'm a real big sweets fan. I've been craving sweets a lot. Just eat more vegetables, eat more fruits stuff like that.' (Single, age 23 years, completed high school)

Another participant discussed healthy eating in terms of portion size and meal frequency:

> 'I'm eating small snacks now. Just in more, smaller portions to even everything out with me being pregnant. Before then, I would just eat the regular three-course, and maybe one snack. But, like I said, by this pregnancy, I learned that I have to eat, small portions and then, you know, have more snacks instead of just, eatin' all a full plate of food and goin' out to eat, you know, just stuffin' myself.' (Single, age 29 years, completed high school)

Despite acknowledging the importance of healthy dietary patterns during pregnancy, participants also described cravings beyond their control, particularly for unhealthy

https://doi.org/10.1017/S1368980019000703 Published online by Cambridge University Press

foods. Pre-existing disposition to eat 'junk' foods was a commonly described behavioural factor causing weight gain in pregnancy. Many participants also described unhealthy eating habits arising during pregnancy, citing new cravings for unhealthy foods and changes in appetite and preference as reasons for their unhealthy dietary choices:

> 'Before I wasn't a candy person but now I gotta have chocolate or something.' (Single, age 29 years, completed high school)

Another participant suddenly began craving soda during pregnancy:

> 'I never was a soda person but now I just want a Pepsi or something … something strong.' (Single, age 29 years, completed high school)

Furthermore, one woman described an increased affinity for greasy foods resulting from nausea and subsequent changes in appetite:

> 'French fries and bacon is like my main staples. They're the things I can eat and won't feel nauseous … I would eat out every now and then, I would say once or twice a month? But now it's like every day, and it could end up being like 3 meals a day …' (Single, age 31 years, some college no degree)

Other women described decreases in appetite for healthy foods, which led to snacking on unhealthy foods or foods with low nutritional content:

> 'Now that I'm pregnant, I really don't eat as much. And if I do, I snack on like cookies, or … something like that.' (Single, age 20 years, did not complete high school)

Another participant recounted how she could only stomach ginger ale and crackers, leading her to eat only two packages of crackers daily.

Engaging in physical activity during pregnancy

Pregnancy was commonly described as a barrier to physical activity. Many participants expressed a lack of control over their energy level, which affected their ability to be active:

> 'The baby [is] making me tired and, you know, I know it ain't me because I don't ever get tired!' (Single, age 23 years, completed high school)

Similarly, another woman explained how this change in energy made her feel not herself and impacted her ability to exercise:

> 'Before I could walk from East Baltimore to West. No problem. Now you can't even get me to get off of the bed, except for appointments. I have gotten so lazy, it is ridiculous. And that's not myself.' (Single, age 33 years, did not complete high school)

However, some participants (*n* 4) cited using the Internet to find resources about safe exercises for pregnant women. YouTube and Google, in particular, provided participants with information about exercising. As one participant stated:

> 'I even did [a search] through the Internet … people would email and send me different things [about] pregnancy in general, exercises or different things that you can go through.' (Single, age 26 years, some college no degree)

Seeking health and nutritional advice during pregnancy

Participants sought advice from health professionals regarding dietary behaviours during pregnancy:

> '[It is important to] keep your line of communication open with your doctor because that is your lifeline. The doctor's going to help you with whatever.' (Single, age 33 years, did not complete high school)

Another participant described receiving help from a dietitian during a recent pregnancy, which helped her control her weight:

> '[Something in] my last pregnancy, which I found helpful and was cool, was that I got a dietitian. Um, I didn't have that in my first pregnancy … she gave me like a whole list of recommendations for what to steer clear from and what's good for you and [the] baby. And I actually had pre-set meals that you could set up yourself.' (Married, age 26 years, some college no degree)

Personal factors

Personal agency and self-efficacy

Participants demonstrated varying levels of agency (intention or forethought) and self-efficacy (confidence) for managing a healthy weight gain in pregnancy, ranging from women who described lack of control over their bodies to those with positive attitudes that helped them maintain their weight goals and positive dietary patterns. One participant expressed little personal agency and low self-efficacy regarding cravings:

> 'You know, when you want something … so you eat it. I've been having these cravings for crabs for like two weeks, and I'm not gonna stop having those cravings until I get them.' (Single, age 23 years, completed high school)

Another participant reiterated the same idea, stating:

> 'You can't really tell a pregnant person what to do about her health as far as eating. When it comes down to that eating, she's gonna eat.' (Single, age 28 years, completed high school)

One woman described the experience of weight gain during pregnancy as beyond her control and 'overwhelming', especially because it was a reversal of progress she had

https://doi.org/10.1017/S1368980019000703 Published online by Cambridge University Press

previously made in losing weight. She indicated feeling as if she lacked the capacity to improve her health and this was a major barrier to weight loss.

Other participants, in contrast, demonstrated agency and self-efficacy surrounding the consumption of a healthy diet, as one woman explained how her positive mindset helped her meet her goals during pregnancy:

> 'If you think negative, it'll be negative, if you think positive, it'll be positive. So my way of thinking is, always think positive. So as far as me changing my diet … I'm really strong-minded in goals. And you know I'm always thinking positive. I can be having a bad day, but it's like, okay, it's alright, it's just a different day from yesterday, from tomorrow.' (Single, age 29 years, completed high school)

Another participant mentioned how effects of her pregnancy (tiredness, sickness, etc.) would not stop her from achieving her goals in terms of being physically active:

> 'If they say that they want me to exercise more, Imma make myself do it … I'm not going to go by my pregnancy forcing me being tired. If I'm gonna do something, I'm gonna do it. Nothing is going to stop me [laughs] I don't care how tired, how sick [I am]. None of that.' (Single, age 23 years, completed high school)

Some women expressed concern regarding parenthood and their sense of responsibility for the baby before and after delivery. They worried about endangering the fetus and desired a healthy baby:

> 'I believe that once you become pregnant you already a mom … I need to be healthy to have a healthy baby.' (Single, age 22 years, did not complete high school)

Another woman emphasized the ramifications of eating habits:

> 'You have a life growing in you. Whatever I eat, the baby gets. You know, even I just ate some Oreos, but it affects the baby so … whatever I put in my body, he is affected by it.' (Single, age 18 years, did not complete high school)

These women felt a strong sense of responsibility that contributed to their sense of agency and self-efficacy, thereby empowering them to eat healthily and exercise.

Knowledge of healthy behaviours

The interviews revealed that most participants had some existing knowledge about nutrition and the health risks of excess weight gain in pregnancy. Motivations to consume a healthy diet during pregnancy were often related to concern for the baby's well-being:

> 'Everything about the diet is important because you're not just eating for yourself anymore. You're eating to kinda nurture a whole other being.' (Single, age 31 years, some college no degree)

Various women cited complications that would result if not maintaining a healthy diet, such as diabetes, high blood pressure, malnutrition in the baby and a more difficult delivery:

> 'If I'm healthier, it probably wouldn't be difficult delivering the baby and stuff. If I'm very unhealthy, then it probably would be … complications and all that.' (Single, age 23 years, did not complete high school)

Although cravings were seen as inevitable, some women indicated knowledge regarding portion size:

> 'Only thing I can say is just eat in moderation … definitely eat what you like but eat in moderation.' (Single, age 33, did not complete high school)

In this regard, another participant pointed out a common 'belief' that pregnant women are:

> '[E]ating for two, and they want to eat double portions.' (Single, age 31 years, some college no degree)

However, discussions with participants revealed a gap in knowledge, where some participants recognized that high-fat foods were unhealthy but were less aware of some foods high in sugar content:

> 'I needed to cut [soda] – um, as soon as I could and replace it with something as far as, you know, juice or anything like that.' (Married, age 26 years, some college no degree)

Likewise, when probed about maintaining a healthy pregnancy, another participant discussed her preferences for foods she thought were healthy:

> 'Vegetables are great. And fruit is just as fine. And that's what I prefer. I do eat vegetables but not as much I'm sure as I should. But I prefer fruit, I like fruit [laughs], fruit juice, things like that.' (Single, age 33 years, did not complete high school)

Environmental factors

Support from health professionals

Participants described mixed experiences and opinions regarding support from health-care providers during pregnancy. One first-time mother appreciated help from multiple sources, including therapists, mothers' groups and other types of programmes. These enabled her to address not only exercise and pregnancy, but also the emotional challenges of parenting in light of the recent death of her own mother:

> 'I did the moms' programme at Harriet Lane clinic … I did phone calls through therapists and

https://doi.org/10.1017/S1368980019000703 Published online by Cambridge University Press

different types of programmes … at the time I was going through depression because of my mom. I was finding different programmes that help with first-time moms, dealing with death in the family and stuff like that. I was just going through everything. And try to figure out how I can get myself together and be better for me and my son. And have better communication with my family. So that really helped for me. Pretty much everything to try and figure it out, and everything came out to be great.' (Single, age 26 years, some college no degree)

However, some participants expressed mistrust and/or dissatisfaction with advice from medical professionals. When asked about her perspective on having a healthy pregnancy, one participant pointed out that lack of knowledge was not the barrier:

'The only thing that you get, like, when you come and see the doctor is "you shouldn't do this, you shouldn't have that" and like, I know that. Don't tell me that.' (Single, age 31 years, some college no degree)

Another woman, on the other hand, felt insufficiently informed about what to eat and desired advice from her doctor:

'If the doctor isn't telling me like … ok … what are you eating … like … how am I right now? If they ain't sayin' nothin' wrong with it, then I'm just gonna continue how I was eating. But … if they did say somethin' was wrong and that it was time to change my diet and stuff like that, like, I haven't got an opinion on my diet yet. So, it's just like, [laughs] I'm just gonna keep eatin' like I've always eatin' [shrugs].' (Single, age 23 years, did not complete high school)

Social support from friends and family

Many participants described emotional support and encouragement from family members and significant others to make healthy choices, such as family members cooking healthier foods, encouraging them to stay away from unhealthy foods and providing advice on healthy lifestyle choices. Partners played a particularly important role, as one participant described:

'My boyfriend is everything to me. Like everything I want to do, he's like, "let's do it … if you could just get the ball rolling, I promise the weight will drop off you." … I don't feel like I have lack of support.' (Single, age 31 years, some college no degree)

Another participant similarly explained how her husband's healthier behaviours served as a model for her to maintain a healthier lifestyle:

'[My husband's] very healthy, very thin … And so because of him, I, you know, began to research. It was never him saying that I needed to … it was me wanting to join in with him … It's not him encouraging me, it's kind of an "us" thing.' (Single, age 29 years, some college no degree)

Conversely, some participants described instances in which family members were not supportive of their healthy choices and did not provide an environment conducive to maintaining a healthy lifestyle during pregnancy. For example, when asked whether she discussed food choices with her partner, one woman responded:

'[W]e don't really talk about it … trying to explain stuff to him he don't really understand, so it frustrates me, so I don't really, I just leave it alone.' (Married, age 22 years, completed high school)

Another participant described how her family, although well intentioned, did not understand that being active was desirable and, in fact, an important part of being pregnant:

'My grandmother be like, "You don't go to store, I'll go to the store." … Because some people will be like, "You know she pregnant. She don't gotta do that. I do it." … But you know you still should move and be active.' (Single, age 22 years, did not complete high school)

Access to healthy food

The physical food environment was an important barrier to healthy eating during pregnancy, especially in terms of high cost of healthy foods. Regarding financial barriers to purchasing healthy foods, one participant explained:

'It's a financial issue for most people. Like my friend bought a 100 dollars' worth of groceries to do her smoothie cleanse. That's expensive … And when you're low income that takes away from other things that you need … I don't have any issue knowing what to do. It is me trying to decide on a fixed income with 400 dollars' worth of food stamps and that may seem a lot but with three people and try to eat four to five weeks … breakfast, lunch, dinner … or healthy snacks. Healthy stuff adds up … why is a double cheeseburger a dollar but a salad, five? Like wait a minute that doesn't make sense to me.' (Single, age 31 years, some college no degree)

Access to information via the Internet

Many participants (*n* 12) discussed receiving information from sources beyond their main health-care provider, such as second opinions from other resources like books and the Internet. One participant explained how she used her 'Google addiction' to join discussion forums on having a baby and find information about counting calories. Another participant used YouTube to access workouts for each trimester, while one used a mobile phone app to learn about safe exercises during pregnancy.

https://doi.org/10.1017/S1368980019000703 Published online by Cambridge University Press

One participant suggested that these sources were less reliable than the advice of a medical professional, but then also expressed doubt in doctors based on a prior negative experience:

> 'Certain sources, aren't ... reliable ... your OB she knows more than the Internet, and she sees you on a monthly or weekly basis, so the Internet, they're just going off their opinion, what they went through, so I would suggest, don't do the Internet. ... You can't trust doctors neither ... to see like how much roughly you should be gaining, like the OB gonna tell you, but sometimes you don't listen to that ... My first experience with my son ... it was a bad experience you know. They cut him on his forehead, he was in the NICU, it was a lot, so, sometimes you can't trust doctors neither.' (Single, age 18 years, did not complete high school)

Discussion

In the present study, we found that while most expectant mothers were knowledgeable about the importance of healthy lifestyle behaviours during pregnancy, participants described multiple factors that negatively impacted their ability to put that knowledge into action and confidently engage in healthy behaviours during pregnancy. These factors highlight the core constructs of SCT, including a lack of personal agency and low self-efficacy, stemming in part from inadequate emotional and informational support (from health professionals, and sometimes family and friends) and the lack of access to healthy foods.

In contrast to prior literature[20,21], our findings suggest that lack of knowledge was not the major personal factor influencing diet and physical activity behaviours of obese African-American pregnant women. For example, previous qualitative research by Setse *et al.* to document weight-loss programme preferences among pregnant African-American women in Baltimore found that women lacked knowledge regarding the nutritional content of certain foods[20]. Similarly, interviews with pregnant women in an urban maternity hospital in Australia suggested that participants had limited knowledge of risk factors for GWG[21]. Our participants, however, revealed some existing knowledge about nutrition and the health risks of excess weight gain in pregnancy, particularly relating to high-fat foods and portion size. Knowledge was more limited on topics such as foods with high sugar content and exercise. Also related to our participants' knowledge of gestational weight gain, our findings align with previous literature that describes individual perceptions of 'eating for two' and the belief that pregnant women should not exercise or participate in everyday activities like walking to the store[5,14].

While most women in our study sought advice from various avenues to increase their knowledge of healthy behaviours during pregnancy, dissatisfaction with advice (or lack thereof) from health professionals was commonly described. This is consistent with qualitative research among overweight/obese postpartum women, which also found that health professional advice, particularly about physical activity, was insufficient and eventually led women to turn to the Internet, magazines and family/friends[22,23].

Despite interest in maintaining a healthy lifestyle during pregnancy, participants often described challenges in changing their behaviours. While most women were knowledgeable about the consequences of excess GWG and the positive impact of healthy diet and physical activity behaviours, for many, this knowledge did not translate into actions leading to those behaviours. This finding is consistent with others that have found that self-efficacy regarding diet and physical activity among low-income minorities is instrumental in determining one's ability to stay healthy[12,24]. In the present study, participants often attributed the lack of self-efficacy to the receipt of insufficient advice and support from health professionals and family/friends, respectively.

Regarding environmental factors, the food environment in Baltimore was an additional barrier in terms of the relatively higher cost of purchasing healthy foods. This finding is consistent with other research in Baltimore suggesting limited availability of healthy food options in addition to customer preferences for lower costs and foods with higher fat content[25,26]. Similarly, studies conducted among pregnant women identified the high cost of nutrient-rich foods as a factor preventing women from making healthy dietary choices[27,28]. Furthermore, a 2018 report on Baltimore City's Food Environment found that 23·5 % of Baltimore residents live in areas with limited food quality and access to transportation[29].

Finally, our findings identified the potential role of digital technology as a vehicle to translate self-efficacy into action. Study participants reported gathering information from mobile applications, YouTube videos and blog posts. These results suggest that use of technology may increase confidence to institute behavioural change and have a positive effect on health behaviours during pregnancy. However, the quality of the resources used by participants in the present study was unknown, and further research is needed to determine the accuracy of these sources and/or the best way to link pregnant women to credible sources. While robust literature exists on the use of digital technology to promote healthy behaviours, further research should explore how digital technology can be used in conjunction with health services to increase access to timely and accurate advice (e.g. 'ask the expert' page) and social support (e.g. chat groups, etc.) for pregnant women[30–33].

In general, we found that although participants implicitly or explicitly expressed a need for improving environmental factors (e.g. increased social and professional

https://doi.org/10.1017/S1368980019000703 Published online by Cambridge University Press

support, availability of digital tools, etc.), they had limited ability to bring about such changes by themselves. In the language of SCT, the interaction among the three constructs of personal, environmental and behavioural factors appears unbalanced, with environment doing more to determine, rather than be determined by, the other constructs. Another asymmetry is noted between personal and behavioural factors, as there were many more examples of personal factors (e.g. lack of agency and self-efficacy) inhibiting optimal behaviours and far fewer examples of how successful behaviours (e.g. establishing an exercise routine) could reinforce personal factors like agency and self-efficacy in a beneficial way.

The present study is not without limitations. Our sample was clinic-based, possibly providing results that are more representative of low-income women with access to specialized health care. As such, it is possible that the high level of knowledge found regarding healthy lifestyle behaviours may not exist in pregnant women receiving less specialized health care. It is also unknown if any participants received any other nutritional counselling outside the clinic. Nevertheless, the results provide an in-depth and contextualized understanding of GWG in a high-risk population and may be relevant to the care of pregnant women attending clinics, through which such programmes could be implemented.

Our findings highlight targeted strategies that may be leveraged to limit excess GWG among low-income obese African-American women. Interviews with expectant mothers revealed that while women are often knowledgeable about the consequences of poor diet and physical inactivity during pregnancy, multiple factors result in an unbalanced interaction among the three constructs of SCT. An inadequate food environment, lack of social support and insufficient information from health professionals have the potential to negatively impact a pregnant woman's confidence (self-efficacy) and capacity (personal agency) to successfully carry out healthy lifestyle changes. In particular, both productive and counterproductive influences from partners, mothers and grandmothers seemed to be important, and may be a promising point of intervention. Additionally, health-care providers could consider replacing the 'eating for two' slogan with a 'caring for two' message, to help clarify the notion of needing to augment or even double the amount of food consumed while pregnant, a belief held by some women. Changing this language might shift the emphasis from nutrition quantity to quality, while leveraging the idea of caring for another human being might increase a woman's self-efficacy and agency. Finally, future efforts to prevent excess GWG among African-American low-income pregnant women may also benefit from going beyond the sharing of clinical knowledge to take advantage of novel strategies (e.g. digital technology platforms) that can improve diet and increase self-efficacy among this population.

Acknowledgements

Acknowledgements: The authors would like to acknowledge the women who participated in this study. They also acknowledge the following students for their assistance in collecting data: Sally Dunst, Jillian Emerson, Yasmin Ogale, Kate Raisler, Kim Espinosa Schroeder and Maria Jose Mejia Ruiz. *Financial support:* This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors. *Conflict of interest:* None. *Authorship:* E.M.N. and D.G. drafted the manuscript. Y.L., K.M.H., J.H. and P.J.S. helped with the writing, edited the manuscript and provided substantive comments. D.G. and P.J.S. helped collect the qualitative data. J.H. facilitated data collection and contributed to editing and the interpretation of the results. P.J.S. and K.M.H. initiated and came up with the concept for the study. P.J.S. supervised the data collection and overall development of the manuscript. *Ethics of human subject participation:* This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board. Written informed consent was obtained from all participants.

Author ORCID. Pamela J Surkan, 0000-0002-0334-5931.

References

1. Abenhaim HA, Kinch RA, Morin L *et al.* (2007) Effect of pre-pregnancy body mass index categories on obstetrical and neonatal outcomes. *Arch Gynecol Obstet* **275**, 39–43.
2. Leddy MA, Power ML & Schulkin J (2008) The impact of maternal obesity on maternal and fetal health. *Rev Obstet Gynecol* **1**, 170–178.
3. McDonald SD, Han Z, Mulla S *et al.* (2010) Overweight and obesity in mothers and risk of preterm birth and low birth weight infants: systematic review and meta-analyses. *BMJ* **341**, c3428.
4. Ogden CL, Carroll MD, Kit BK *et al.* (2014) Prevalence of childhood and adult obesity in the United States, 2011–2012. *JAMA* **311**, 806–814.
5. Goodrich K, Cregger M, Wilcox S *et al.* (2013) A qualitative study of factors affecting pregnancy weight gain in African American women. *Matern Child Health J* **17**, 432–440.
6. Headen I, Mujahid MS, Cohen AK *et al.* (2015) Racial/ethnic disparities in inadequate gestational weight gain differ by pre-pregnancy weight. *Matern Child Health J* **19**, 1672–1686.
7. Institute of Medicine, Committee on Nutritional Status During Pregnancy and Lactation (1990) *Nutrition During Pregnancy: Part I Weight Gain; Part II Nutrient Supplements*. Washington, DC: National Academies Press.
8. Chang M-W, Nitzke S, Guilford E *et al.* (2008) Motivators and barriers to healthful eating and physical activity among low-income overweight and obese mothers. *J Acad Nutr Diet* **108**, 1023–1028.
9. Reyes NR, Klotz AA & Herring SJ (2013) A qualitative study of motivators and barriers to healthy eating in pregnancy for

https://doi.org/10.1017/S1368980019000703 Published online by Cambridge University Press

low-income, overweight, African-American mothers. *J Acad Nutr Diet* **113**, 1175–1181.
10. Bandura A (1978) The self system in reciprocal determinism. *Am Psychol* **33**, 344–358.
11. Bandura A (1986) *Social Foundations of Thought and Action: A Social Cognitive Theory*. Englewood Cliffs, NJ: Prentice-Hall, Inc.
12. Baranowski T, Perry CL & Parcel GS (2002) How individuals, environments, and health behavior interact. In *Health Behavior and Health Education: Theory, Research, and Practice*, pp. 165–184 [K Glanz, B Rimer, and K Viswanath, editors]. San Francisco, CA: Jossey-Bass.
13. Davison J, Share M, Hennessy M *et al.* (2015) Caught in a 'spiral'. Barriers to healthy eating and dietary health promotion needs from the perspective of unemployed young people and their service providers. *Appetite* **85**, 146–154.
14. Ledoux T, Van Den Berg P, Leung P *et al.* (2015) Factors associated with knowledge of personal gestational weight gain recommendations. *BMC Res Notes* **8**, 349.
15. Whitaker KM, Wilcox S, Liu J *et al.* (2016) Patient and provider perceptions of weight gain, physical activity, and nutrition counseling during pregnancy: a qualitative study. *Womens Health Issues* **26**, 116–122.
16. Cramp AG & Bray SR (2009) A prospective examination of exercise and barrier self-efficacy to engage in leisure-time physical activity during pregnancy. *Ann Behav Med* **37**, 325–334.
17. Herring SJ, Cruice JF, Bennett GG *et al.* (2016) Preventing excessive gestational weight gain among African American women: a randomized clinical trial. *Obesity (Silver Spring)* **24**, 30–36.
18. Charmaz K (2006) *Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis*. London: SAGE Publications Ltd.
19. SocioCultural Research Consultants, LLC (2017) *Dedoose*. Los Angeles, CA: SocioCultural Research Consultants, LLC.
20. Setse R, Grogan R, Cooper LA *et al.* (2008) Weight loss programs for urban-based, postpartum African-American women: perceived barriers and preferred components. *Matern Child Health J* **12**, 119–127.
21. Shub A, Huning EYS, Campbell KJ *et al.* (2013) Pregnant women's knowledge of weight, weight gain, complications of obesity and weight management strategies in pregnancy. *BMC Res Notes* **6**, 278.
22. Downs DS, Savage JS & Rauff EL (2014) Falling short of guidelines? Nutrition and weight gain knowledge in pregnancy. *J Womens Health Care* **3**, 1000184.
23. Stengel MR, Kraschnewski JL, Hwang SW *et al.* (2012) 'What my doctor didn't tell me': examining health care provider advice to overweight and obese pregnant women on gestational weight gain and physical activity. *Womens Health Issues* **22**, e535–e540.
24. Chasan-Taber L (2012) Physical activity and dietary behaviors associated with weight gain and impaired glucose tolerance among pregnant Latinas. *Adv Nutr* **3**, 108–118.
25. Franco M, Diez Roux AV, Glass TA *et al.* (2008) Neighborhood characteristics and availability of healthy foods in Baltimore. *Am J Prev Med* **35**, 561–567.
26. Kim M, Budd N, Batorsky B *et al.* (2017) Barriers to and facilitators of stocking healthy food options: viewpoints of Baltimore City small storeowners. *Ecol Food Nutr* **56**, 17–30.
27. George GC, Hanss-Nuss H, Milani TJ *et al.* (2005) Food choices of low-income women during pregnancy and postpartum. *J Acad Nutr Diet* **105**, 899–907.
28. Sui Z, Turnbull D & Dodd J (2013) Enablers of and barriers to making healthy change during pregnancy in overweight and obese women. *Australas Med J* **6**, 565–577.
29. Misiaszek C, Buzogany S & Freishtat H (2018) *Baltimore City's Food Environment Report*. Baltimore, MD: John Hopkins Center for a Livable Future.
30. Davis AM, Wambach KA, Nelson EL *et al.* (2014) Health behavior change in pregnant women: a two-phase study. *Telemed J E Health* **20**, 1165–1169.
31. Jackson RA, Stotland NE, Caughey AB *et al.* (2011) Improving diet and exercise in pregnancy with Video Doctor counseling: a randomized trial. *Patient Educ Couns* **83**, 203–209.
32. Mercado A, Marquez B, Abrams B *et al.* (2017) Where do women get advice about weight, eating, and physical activity during pregnancy? *J Womens Health* **26**, 951–956.
33. Willcox JC, van der Pligt P, Ball K *et al.* (2015) Views of women and health professionals on mHealth lifestyle interventions in pregnancy: a qualitative investigation. *JMIR Mhealth Uhealth* **3**, e99.

https://doi.org/10.1017/S1368980019000703 Published online by Cambridge University Press