Reaching women with obesity to support weight loss before pregnancy: feasibility and qualitative assessment

Denise Simon, Anjali J. Kaimal, Emily Oken and Marie-France Hivert

Abstract
Background: We sought to assess attitudes toward weight and barriers to recruitment of women with obesity for a potential preconception weight-loss/lifestyle modification intervention.
Methods: We performed a qualitative study involving women of reproductive age (18–45) with obesity (body mass index $\geq$30 kg/m$^2$) who were considering a pregnancy in the next 2 years. We evaluated four methods of recruitment. We used previously validated survey questions to evaluate risk perceptions. In a subset, we used semistructured interviews for topics that required more in-depth information: domains included attitudes toward weight-related issues, intentions, and barriers to engagement in a structured weight-loss program. We performed qualitative analyses of interview transcripts using immersion crystallization.
Results: We recruited the majority (80/82, 98%) of women using e-recruitment strategies. Eighty-one women filled out the survey and 39 completed an interview. Three-quarters of the women surveyed (60 of 81) reported attempts to lose weight in the past year and 77% (68/81) of survey respondents cited jobs and work schedules as a barrier to adopting healthy habits. More than 87% (34 of 39) of women interviewed reported willingness to participate in a structured weight-loss program prior to getting pregnant. Of these, 74% (25 of 34) stated they would consider delaying their attempts at a future pregnancy in order to participate in such a program.
Conclusions: E-recruitment is a promising strategy for recruitment for preconception weight-loss and lifestyle modification program. Most women state a willingness to delay pregnancy attempts to participate in a weight-loss program.

Keywords: preconception care, obesity, weight loss, recruitment, feasibility

Introduction
Obesity affects almost a third of women of reproductive age in the United States. Prepregnancy obesity increases risk for adverse health outcomes in mothers and offspring. Experts recommend that women with obesity should lose weight before pregnancy, but there is limited high-quality evidence on the risks and benefits of doing so. A recent review and meta-analysis of interventions to reduce or prevent obesity in this population sighted a severe lack of well-designed high-quality studies on weight management during preconception. Furthermore, the few published studies that have attempted to offer lifestyle or weight-loss interventions to women in a preconception framework have faced major challenges in recruiting women. For example, Gokee-LaRose and colleagues reported that in three National Institutes of Health (NIH)-supported weight-loss studies, young adults aged 18–35 years represented only 7% of the recruited population. Another two studies targeting young women reported difficulties with recruitment and were unable to reach conclusions on the impact...
of the lifestyle/weight-loss interventions they were investigating because of their small sample size.21,22

Given these prior reports, we first aimed to assess the feasibility of recruitment of women with obesity who may be planning a pregnancy in the next 2 years. Secondarily, we invited women to complete a survey and a phone interview to evaluate their attitudes and perceptions toward weight-related issues, intentions, and barriers to taking part in a potential preconception weight-loss intervention to better inform the development of such interventions in the future.

**Methods**

**Population**

We included women between the ages of 18 and 45 years, with a body mass index (BMI) $\geq 30$ k/m$^2$, who reported a plan to become pregnant within the next 2 years and who were English speakers. We excluded women with prior bariatric surgery. This study was approved by the Harvard Pilgrim Health Care Institutional Review Board (IRB reference no: 1105007). We provided participants with a written statement about the research, but due to the nature of data collection, the IRB determined that the study met the regulatory requirements necessary to waive documentation of informed consent.

**Recruitment**

We explored four methods of recruitment between January and July of 2018. We set a recruitment goal to enroll 25 women over the course of 12 months. We evaluated classic recruitment methods of posting flyers in the waiting room, hallways, and restrooms of the Massachusetts General Hospital (MGH) Women’s Health Associates (WHA) and Obstetrics and Gynecology clinics. A member of the study staff was present in the waiting rooms at both clinics to answer any questions and to process enrollment during 10 half-day periods over the course of 2 months. All women attending an appointment for physical exams or annual visits when our staff was on site were handed an informational flyer by the front-desk staff on arrival. Second, we placed an ad in the Metro, a free daily newspaper distributed to users of public transportation in Boston. The ad was included weekly in both the Tuesday Science and Thursday Weekend Edition of the paper for the month of March 2018.

We also used two online or “e-recruitment” strategies. One was an existing service called Research Ally (Rally) that helps researchers at Partners HealthCare (health system that includes MGH) create postings about their studies and facilitate recruitment of participants. Our ad included eligibility criteria and a short study description. Participants indicated their interest by entering contact information and we responded to each participant’s inquiry. Participants were sent a maximum of three reminders to complete study tasks (a survey and a semistructured interview). Finally, we worked with Ovia Health, a Boston-based health solution company that offers a downloadable mobile device App available across the United States, targeted at women trying to conceive. We posted an advertisement to Ovia users whose profile stated “not trying yet” under a question about time trying to conceive. Participants could enter their contact information and calculate their BMI to determine eligibility and follow a link to complete the survey. Again, we responded to each participant’s enrollment inquiry to coordinate a time to speak by phone to complete the semistructured interview.

**Patient and public involvement**

Patients or members of the public were not involved in the design or conduct of the study; however, one of the aims of this study was to collect information about perceived risk, barriers, and facilitators toward weight loss in this specific population to design a patient-centered intervention in the future.

**Measures**

We used a combination of survey and semistructured interviews to examine participants’ attitudes and experiences regarding weight loss and to discover essential components necessary to success of a future weight-loss program. We selected 33 questions from previously validated survey instruments to capture demographic information, domains concerning relationship status, prior obstetrical history, pregnancy intentions, health knowledge, risk perception, and behavior regarding weight loss.4,23 We asked participants to estimate their personal risk of chronic diseases and pregnancy outcomes adapting these
questions from a survey to assess concerns and perceived health risk found using the PhenX Toolkit.23

A research assistant (RA) trained in qualitative research methods led semistructured phone interviews with participants who provided contact information. Our domains included past experiences with weight loss, structured weight-loss program formats, and preferred methods of engagement. Interviews were recorded and transcribed before the recording was destroyed. We provided an electronic $10 Amazon gift card for completion of the online survey and a $20 Amazon gift card for participating in the semistructured interview.

Data analysis
We performed all descriptive analyses using SAS software, version 9.4 (SAS Institute Inc, Cary, NC). We used median and interquartile range (IQR) for continuous data and frequency and percentages for categorical data. Research staff trained in qualitative methods entered interview transcripts into QDA Miner, a qualitative analysis software, and coded using a combination of value and in vivo coding. Codes were revised three times by a single investigator to best align with the study goals to appropriately describe the experiences of participants. We used the immersion-crystallization method to determine the emergent trends and recurrent themes used by most participants.24 Throughout the process, the research team met at each step to establish consensus on the consistency and accuracy of coding and analysis.

Results

Recruitment
Our classic recruitment approaches of posting flyers in relevant clinics and in the science edition of the Metro newspaper did not result in many enrollment inquiries. Our study staff made repeated visits to the clinic but were only approached by one participant interested in enrolling. We did not receive any contacts from women based on the ad we posted in the Metro newspaper.

Most participants in this study were recruited using e-recruitment methods (Figure 1). The Ovia advertisement was active for 70 h in the spring of 2018; there were 257 clicks to a hyperlink where participants could complete a screening survey to determine their eligibility: we received 147 completed screening surveys, of whom 60 women were found eligible to participate (others excluded based on self-reported height and weight leading to calculated BMI < 30).

Out of the 60 eligible women, we received completed surveys from 45 (75%) women, and we were able to complete semistructured interviews with 8 (13%) of the survey respondents. It took many calls and/or emails to set up appropriate times to talk with participants recruited through the app.

The Partners HealthCare web-based ad featured the study for a period of 3 weeks in the spring of 2018. During this time, 136 potential participants entered their contact information to allow screening surveys to be administered. We identified 37 eligible participants, two were not interested in
participating and we received completed surveys from 35 (95%) women. Of these, we reached 29 (78%) participants to complete the semistructured interview. Respondents to the web-based ad were more likely list two valid methods of contact and to respond to our first attempt to reach them.

A total of 81 women filled out the baseline survey and 39 completed the semistructured interview. E-recruitment strategies accounted for 99% of the completed surveys (80/81) and 95% (37 of 39) of the completed semistructured interviews. One subject (recruited at clinical site) participated in the interview portion alone but failed to finish the survey.

**Participant characteristics**
Among the 81 survey respondents, median age was 29 years (IQR: 27–34), median BMI 35 kg/m² (IQR: 32–42) and they reported a wide range of income (Table 1). Women reported a median age at menarche of 12 (IQR: 11–13) years old, and a substantial number (44%, 36 of 81) reported irregular menstruation. Most participants were in a stable relationship and 40% (33 of 81) reported that they were not actively trying to conceive at the time of their enrollment (Table 1).

**Surveys**
All participants described themselves as at least slightly overweight and nearly 50% (40 of 81) described themselves as very overweight. Women identified their weight as contributing to added risk of developing cardiovascular disease and diabetes later in life, and to a somewhat lesser degree to developing pre-eclampsia or gestational diabetes during pregnancy (Figure 2). In contrast, few women perceived their weight as being a risk for a need to undergo a c-section or of giving birth to a large baby (Figure 2).

Almost three-quarters of women (60 of 81) reported having attempted to lose weight in the past 12 months, but very few respondents paid for formal programs or consulted with a dietician during that time. About 90% (73 of 81) of participants reported that they were currently trying to lose weight on the survey, but we did not assess whether these weight-loss attempts

| Table 1. Characteristics of participants at enrollment. |
|-----------------|-----------------|-----------|
|                  | N (%) or median (IQR) |
| N=81             |                  |
| Age, years       | 29 (27–34)       |
| Body mass index (BMI), kg/m² | 35 (32–42) |
| Race             |                  |
| White or Caucasian | 54 (66.7%) |
| Black or African American | 10 (12.3%) |
| Asian            | 5 (6.2%)         |
| Other            | 3 (3.7%)         |
| Mixed            | 9 (11.1%)        |
| Ethnicity: Hispanic | 8 (9.9%)   |
| Household income |                  |
| 20,000 or less   | 5 (6.1%)         |
| 20,001–40,000    | 21 (25.9%)       |
| 40,001–70,000    | 24 (29.6%)       |
| 70,001–100,000   | 13 (16.0%)       |
| More than 100,000 | 15 (18.5%) |
| Don’t know       | 3 (3.7%)         |
| Education        |                  |
| Some high school | 2 (2.5%)         |
| High school graduate | 8 (9.9%) |
| Some college     | 23 (28.4%)       |
| College graduate | 29 (35.8%)       |
| Graduate school  | 19 (23.5%)       |
| Any health insurance | 75 (93.8%) |
| Age of menarche, years | 12 (11–13) |
| Irregular menstrual cycle | 36 (44.4%) |
| Number of prior pregnancies |  |
| No prior pregnancies | 44 (55.6%) |
| 1 pregnancy       | 13 (16.0%)       |

(Continued)
Table 1. (Continued)

| N (%) or median (IQR) | N=81 |
|-----------------------|------|
| 2+ pregnancies        | 23 (28.4%) |
| In a stable relationship | 76 (93.0%) |
| Uses contraception. . . a |      |
| Regularly             | 24 (30.0%) |
| Sometimes or infrequently | 10 (12.5%) |
| Not at all            | 46 (57.5%) |
| Currently, trying to conceive b |      |
| Trying                | 22 (27.2%) |
| Not trying            | 33 (40.7%) |
| Did not answer        | 26 (32.1%) |
| Median months spent trying to conceive b | 6.0 (2.0–12.0) |
| Currently pregnant c  |      |
| No                    | 70 (88.6%) |
| Do not know           | 9 (11.4%) |

aN=80.
bN=22.
cN=79.

were motivated by a desire to conceive or fertility concerns (Table 2). In addition, 77% (68/81) of survey respondents cited jobs and work schedules as a barrier to losing weight and adopt healthy habits (Figure 3).

Qualitative interviews

Nearly all participants interviewed (38 of 39) discussed the need for accountability in successful weight loss (Table 3). Participants described accountability as multifaceted process including the use of: one on one meetings, mobile apps, texting, online tools, and support groups. Participants also discussed their lack of motivation in concert with other challenges to maintaining a weight-loss regimen. They also emphasized a desire to easily incorporate new behaviors into their daily routine, and frequently indicated that prior experiences during structured weight-loss programs were too restrictive. Interviewees identified several helpful features of mobile apps: including facilitating accountability, logging food and exercise, and providing reminders to ensure regular engagement with a weight-loss program.

More than 87% (34 of 39) of women interviewed reported willingness to participate in a structured weight-loss program prior to getting pregnant. Of these, 74% (25 of 34) stated they would consider delaying their attempts at a future pregnancy to allow time to complete a weight-loss program before conception. They reported being willing to delay pregnancy attempts for a range of 3 months to 5 years (median: 12 months) with four out of every five women indicating that they would be willing to delay pregnancy attempts at least 6 months.

Discussion

We found that we can recruit young women with a BMI > 30 kg/m² who are considering a pregnancy and that using e-recruitment had a substantially higher success rate and was more efficient than traditional methods. Based on our experience, the prompt responses on the clinical web-based ad and within the fertility app may point to increasing accessibility or preference of mobile phone platforms. We faced similar challenges in recruitment as have been reported by other studies using “classic” recruitment strategies. Griffin and colleagues discussed their difficulties recruiting overweight and obese young women to a yearlong weight-loss trial, receiving about two recruitments per month over the 24-month recruitment window (they enrolled 50 women, and had aimed for 70). Gokee-LaRose and colleagues reported that in three NIH-supported weight-loss studies, young adults aged 18–35 years represented only 7% of the recruited population. Hutchesson and colleagues identified eight studies of lifestyle interventions targeting young women: only one study aimed at weight loss in women with obesity (others aimed at weight gain prevention) and most studies were of small sample sizes (range: 23–129). Like Griffin and colleagues, we also observed a low response rate to our ad when posted as a flyer in a public space and even with staff were present at clinic locations. Our more novel recruitment strategies utilizing an established web-based ad to reach research participants and placing a targeted ad within an Ovia fertility app seemed to work.
better. We observed a high response rate over a short display time for the Ovia ad yet spend many more hours coordinating times to complete semi-structured interviews.

Other studies have noted challenges recruiting for weight-loss studies among young adults due to weight loss being motivated by body-image and self-esteem rather than prevention of health-related outcomes. Risk perception may be lacking in this younger population as a key step toward intrinsic motivation. Without knowledge of risk factors, belief in personal control and in a benefit of lifestyle modification, it is difficult to achieve the

Figure 2. Participant self-assessed risk of weight-related complications.
Lack of time and motivation are consistently noted as barriers to participation in weight-loss program trials and this was in line with our findings.21,32,33 Regardless, women we spoke with expressed an interest in dedicating time to weight-loss programs as they plan for a pregnancy. This is a key moment to intervene in a women’s life-course to help them enter pregnancy at a healthier weight status, perhaps influencing the health of future generations.

**Strengths and limitations**

Among our strengths, we were able to evaluate multiple recruitment strategies during 6 months of active enrollment, and we recruited a diverse population of women. Most of our survey questions were adapted from previously validated questionnaires. We were also able to gain a clearer understanding of individual survey responses using open-ended questions during the semi-structured interviews.

There are also important limitations to our study. This was a self-selected group of women. Our participants likely have an interest in research or participating in an intervention when compared to those who did not respond to the survey or semi-structured interview. Furthermore, the survey and interviews were only conducted in English, and these women may not be representative of the general population of women of reproductive age with obesity. Our study population was largely non-Hispanic and White, but the prevalence of obesity in women of reproductive age (20–39 years) is higher among non-Hispanic black and Hispanic women in the United States.1 It will be important for future preconception weight-loss trials to target a more racial/ethnically diverse population. We were more successful with e-recruitment, but we cannot infer that women who were willing to respond to a survey and participate in interview would engage in a lifestyle intervention.

**Implications for practice and/or policy**

We found that women had a clear understanding of the risk of excess weight on the development of chronic diseases but were less aware of the obesity-related risk for pregnancy complications. Clinical providers should assess preconception risk related to weight and provide counseling to women of reproductive age to better understand these risks.

### Table 2. Behaviors toward weight loss.

| Behavior                                                | N = 81 | %    |
|---------------------------------------------------------|--------|------|
| Tried to lose weight in the past year                   | 60     | 74.1 |
| Paid for a formal weight-loss program in the past year  | 10     | 12.3 |
| Saw a dietician or nutritionist in the past year        | 12     | 14.8 |
| Followed a diet on your own in the past year            | 46     | 56.8 |
| Currently, trying to . . .                              |        |      |
| Lose weight                                             | 73     | 90.1 |
| Not do anything about weight                            | 7      | 8.7  |
| Stay the same weight                                    | 1      | 1.2  |
| Prior methods of weight lossa (nonexclusive)            |        |      |
| Exercising                                              | 47     | 78.3 |
| Eating fewer calories                                    | 43     | 71.7 |
| Eating less carbs                                        | 33     | 55.0 |
| Maintaining a consistent eating pattern                 | 24     | 40.0 |
| Eating less fat                                          | 22     | 36.7 |
| Weighing yourself frequently                            | 22     | 36.7 |
| Eating breakfast daily                                  | 21     | 35.0 |
| Working to reduce stress                                | 20     | 33.3 |
| Using meal replacements                                 | 15     | 25.0 |
| Using diet pills, laxatives, diuretics, and water pills  | 10     | 16.7 |
| Other                                                   | 4      | 6.7  |

aN = 60.
Figure 3. Barriers to healthy eating.

Table 3. Recurrent themes and representative quotes from semistructured interview.

| Theme                  | N (%) | #Codes | Representative Quote                                                                 |
|------------------------|-------|--------|---------------------------------------------------------------------------------------|
| Accountability\(^a\)   | 38 (97) | 114    | “Personal training was really successful for me. It gave me accountability in terms of making sure that I go to the gym.” “Having someone there to make sure that I stick to it” |
| Motivation\(^b\)       | 19 (49) | 31     | “I’m not as motivated to eat healthy and now it seems like a diet chore. I feel so low energy about going to the gym”. “So now I am struggling on the daily trying not to get discouraged and not stopping going to the gym.” |
| Lack of time\(^c\)     | 19 (49) | 38     | “I had to stop taking the group classes because with my work schedule I couldn’t guarantee that I would be there in time. “I work two jobs ... so I work sixty-four hours a week. I don’t think there is ever a consistent time off I usually never have any days off. So, it is just difficult to motivate myself so that in time where I could be sleeping to roast a bunch of vegetables or grill a bunch of chicken and do all that stuff.” |
| Sustainability\(^d\)   | 20 (51) | 31     | “It’s just short-term tricks that will drop your weight but won’t actually support you for like an ongoing lifestyle change.” “I looked at a 9 week training plan and said, ‘nope I can’t do this’. So, I think it’s important to break a big challenge up into smaller parts.” |
| Apps\(^e\)             | 30 (77) | 58     | “An app-based program that would allow daily tracking of nutritional intake including educational materials that could be customized based on a weekly assessment of where you are in relation to goals” “I would probably say a combination of in person and online. It would be great to check-in with somebody every once and while but then have most of the communication to be one text or an app.” |

\(^a\)“Accountability” defined as discussion of holding the participant accountable for their actions regarding weight loss.
\(^b\)“Motivation” defined as discussion of sources or lack of motivation.
\(^c\)“Lack of time” defined as expressing a limitation in successful weight loss due to time constraints.
\(^d\)“Sustainability” defined as a mention of sustainable weight loss.
\(^e\)“Apps” defined as mentioning mobile applications or technology to facilitate accountability.
We find that young women prefer weight-loss programs that support accountability, incorporate the use of apps, are sustainable, and integrate well into their daily life. Researchers should consider women’s desire for these features when designing weight-loss interventions trials for future implementation into real-life programs in their communities.

Conclusion
Prior studies have found that it is challenging to engage young women of reproductive age into weight-loss programs before they enter pregnancy. E-recruitment may be more successful, particularly among a young adult population. Young women with obesity have a relatively low perception of their weight-related risk regarding obstetric outcomes, which might be one of the key missing steps toward engaging in formal weight-loss programs. It is also notable that most women were willing to delay their pregnancy attempts for the right program. A couple of trials are currently recruiting in this area.34,35 Hopefully these on-going trials will be able to provide some answers on what type of programs can help women of reproductive age to lose weight, and whether these programs can lead to better obstetric outcomes, and healthier metabolic status for women and their offspring.

Author contributions
M.F.H. designed the study and research approach. D.S., A.K., E.O., and M.F.H. all contributed to the design of data collection instruments. D.S. collected data, contributed to data analyses, and wrote the first draft of the manuscript. M.F.H., A.K., and E.O. contributed to discussions, interpreted findings, and edited the manuscript. All authors read and approved the final version of the manuscript for submission.

Funding
The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by the National Institute of Digestive Diseases, Diabetes, and Kidney Disease and the Nutrition Obesity Research Center at Harvard (grant no. P30 DK040561).

Conflict of interest statement
The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Trial registration
This study is registered with www.ClinicalTrials.gov under trial registration number NCT03663621.

ORCID iD
Denise Simon https://orcid.org/0000-0002-4248-1952

References
1. Ogden CL, Carroll MD, Kit BK, et al. Prevalence of childhood and adult obesity in the United States, 2011–2012. JAMA 2014; 311: 806–814.
2. Bider-Canfield Z, Martinez MP, Wang X, et al. Maternal obesity, gestational diabetes, breastfeeding and childhood overweight at age 2 years. Pediatr Obes 2017; 12: 171–178.
3. Adams TD, Hammoud AO, Davidson LE, et al. Maternal and neonatal outcomes for pregnancies before and after gastric bypass surgery. Int J Obes 2015; 39: 686–694.
4. Anderson NH, McCowan LM, Fyfe EM, et al. The impact of maternal body mass index on the phenotype of pre-eclampsia: a prospective cohort study. BJOG 2012; 119: 589–595.
5. Athukorala C, Rumbold AR, Willson KJ, et al. The risk of adverse pregnancy outcomes in women who are overweight or obese. BMC Pregnancy Childbirth 2010; 10: 56.
6. Aune D, Saugstad OD, Henriksen T, et al. Maternal body mass index and the risk of fetal death, stillbirth, and infant death: a systematic review and meta-analysis. JAMA 2014; 311: 1536–1546.
7. Chu SY, Kim SY, Schmid CH, et al. Maternal obesity and risk of cesarean delivery: a meta-analysis. Obes Rev 2007; 8: 385–394.
8. Chu SY, Callaghan WM, Kim SY, et al. Maternal obesity and risk of gestational diabetes mellitus. Diabetes Care 2007; 30: 2070–2076.
9. Gaillard R, Durmus B, Hofman A, et al. Risk factors and outcomes of maternal obesity and excessive weight gain during pregnancy. Obesity 2013; 21: 1046–1055.
10. Goffman D, Madden RC, Harrison EA, et al. Predictors of maternal mortality and near-miss maternal morbidity. J Perinatol 2007; 27: 597–601.
11. O’Brien TE, Ray JG and Chan WS. Maternal body mass index and the risk of preeclampsia:
12. Poobalan AS, Aucott LS, Gurung T, et al. Obesity as an independent risk factor for elective and emergency caesarean delivery in nulliparous women—systematic review and meta-analysis of cohort studies. *Obes Rev* 2009; 10: 28–35.

13. Torloni MR, Betran AP, Horta BL, et al. Prepregnancy BMI and the risk of gestational diabetes: a systematic review of the literature with meta-analysis. *Obes Rev* 2009; 10: 194–203.

14. Bain E, Crane M, Tieu J, et al. Diet and exercise interventions for preventing gestational diabetes mellitus. *Cochrane Database Syst Rev* 2015; 4: CD010443.

15. Muktabhant B, Lawrie TA, Lumbiganon P, et al. Diet or exercise, or both, for preventing excessive weight gain in pregnancy. *Cochrane Database Syst Rev* 2015; 6: CD007145.

16. Poston L, Bell R, Croker H, et al. Effect of a behavioural intervention in obese pregnant women (the UPBEAT study): a multicentre, randomised controlled trial. *Lancet Diabetes Endocrinol* 2015; 3: 767–777.

17. Stang J and Huffman LG. Position of the Academy of Nutrition and Dietetics: obesity, reproduction, and pregnancy outcomes. *J Acad Nutr Diet* 2016; 116: 677–691.

18. Agha M, Agha RA and Sandall J. Interventions to reduce and prevent obesity in pre-conceptual and pregnant women: a systematic review and meta-analysis. *PLoS ONE* 2014; 9: e95132.

19. Griffin HJ, O’Connor HT, Rooney KB, et al. Effectiveness of strategies for recruiting overweight and obese Generation Y women to a clinical weight management trial. *Asia Pac J Clin Nutr* 2013; 22: 235–240.

20. Gokee-LaRose J, Gorin AA, Raynor HA, et al. Are standard behavioral weight loss programs effective for young adults? *Int J Obes* 2009; 33: 1374–1380.

21. Hutchesson MJ, Morgan PJ, Callister R, et al. Be positive be healthy: development and implementation of a targeted e-health weight loss program for young women. *Telemed J E Health* 2016; 22: 519–528.

22. Share BL, Naughton GA, Obert P, et al. Effects of a multi-disciplinary lifestyle intervention on cardiometabolic risk factors in young women with abdominal obesity: a randomised controlled trial. *PLoS ONE* 2015; 10: e0130270.

23. U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute. PhenX Toolkit. 2018; Prostate, Lung, Colorectal and Ovarian (PLCO) cancer screening trial, supplemental questionnaire. Version Date: 1/06, page 09, questions 58 and 59 (source for questions 01 and 02), https://www.phenxtoolkit.org/protocols/view/70701 (accessed 10 December 2018).

24. Seward MW, Simon D, Richardson M, et al. Supporting healthful lifestyles during pregnancy: a health coach intervention pilot study. *BMC Pregnancy Childbirth* 2018; 18: 375.

25. Loria CM, Signore C and Arteaga SS. The need for targeted weight-control approaches in young women and men. *Am J Prev Med* 2010; 38: 233–235.

26. Gokee LaRose J, Leahey TM, Weinberg BM, et al. Young adults’ performance in a low-intensity weight loss campaign. *Obesity* 2012; 20: 2314–2316.

27. Hutchesson MJ, Hulst J and Collins CE. Weight management interventions targeting young women: a systematic review. *J Acad Nutr Diet* 2013; 113: 795–802.

28. Hebden L, Chey T and Allman-Farinelli M. Lifestyle intervention for preventing weight gain in young adults: a systematic review and meta-analysis of RCTs. *Obes Rev* 2012; 13: 692–710.

29. Brewer NT, Weinstein ND, Cuite CL, et al. Risk perceptions and their relation to risk behavior. *Ann Behav Med* 2004; 27: 125–130.

30. Hivert MF, Warner AS, Shrader P, et al. Diabetes risk perception and intention to adopt healthy lifestyles among primary care patients. *Diabetes Care* 2009; 32: 1820–1822.

31. Kim C, McEwen LN, Piette JD, et al. Risk perception for diabetes among women with histories of gestational diabetes mellitus. *Diabetes Care* 2007; 30: 2281–2286.

32. McClure MB. Health behavior change in pregnant women with obesity. *Nurs Womens Health* 2018; 22: 471–480.

33. Nicklas JM, Zera CA, Seely EW, et al. Identifying postpartum intervention approaches to prevent type 2 diabetes in women with a history of gestational diabetes. *BMC Pregnancy Childbirth* 2011; 11: 23.

34. U.S. National Library of Medicine. ClinicalTrials.gov, 2019, https://clinicaltrials.gov/ct2/show/ NCT03146156 (accessed 25 January 2019).

35. LeBlanc ES, Vesco KK, Funk KL, et al. Prepare, a randomized trial to promote and evaluate weight loss among overweight and obese women planning pregnancy: study design and rationale. *Contemp Clin Trials* 2016; 49: 174–180.