Identifying Target Behaviors for Weight-management Interventions in Overweight Women during Pregnancy and the Postpartum Period: A Qualitative Study Informed by the Behaviour Change Wheel

Johanna Saarikko (jpksaa@utu.fi)
University of Turku

Hannakaisa Niela-Vilén
University of Turku

Amir Rahmani
University of California, Irvine

Anna Axelin
University of Turku

Research Article

Keywords: pregnancy, overweight, obesity, weight-management, technology, communication, experience, qualitative research, perinatal care

DOI: https://doi.org/10.21203/rs.3.rs-117248/v1

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Abstract

Background: Maternal overweight is increasing, and it is associated with several risks for both the mother and child. Healthy lifestyle behaviors adopted during pregnancy are likely impact women's health positively after pregnancy. The study's aim was to identify and describe weight management behaviors in terms of the Capability, Opportunity and Motivation Behaviour (COM-B) -model to target weight management interventions from the perspectives of overweight women and maternity care professionals.

Methods: This qualitative, descriptive study was conducted in 2019–2020. Individual interviews of overweight pregnant and postpartum women (n = 11) and focus group interviews of public health nurses (n = 5) were undertaken in two public maternity clinics in Southwest Finland. The data were analyzed using deductive content analysis consistent with the COM-B model.

Results: In the capability category, overweight women and public health nurses thought that there was a need to find consistent ways to broach overweight, which had become a part of women's identities. The use of health technology was considered as a part of antenatal care to broach the subject of weight and weight management. Smart wearables could also support evaluating overweight women's lifestyles. The opportunity category highlighted a lack of resources for support in perinatal care, especially after birth. Support from family was the most important facilitating factor besides motivation. There was a conflict between pregnancy as an excuse to engage in unhealthy habits and pregnancy as a motivational period during which to change one's lifestyle. Furthermore, the women wanted a tough stance on weight management and discreet counseling.

Conclusions: Our findings offer a theoretical basis for tailoring, testing and implementing interventions that address barriers to effective weight management. Such interventions should offer clear advice and non-judgmental support during pregnancy and after delivery by targeting women's capabilities, opportunities, and motivation. Health technology could be a valuable component of intervention, as well as an implementation strategy, as it provides ways to broach this topic and support overweight women during maternity care.

Background

Maternal overweight, defined as a body mass index (BMI) of 25 or higher before pregnancy, increases risks for the mother and her infant [1, 2, 3]. Obesity among women of reproductive age is increasing globally, especially in high-income countries [4]. In Finland, 36% of pregnant women are overweight, and 14% are obese; these numbers have risen over time [5]. Pregnant women visit maternity clinics frequently, so public health nurses working there play a key role in supporting pregnant women with weight management [6]. In addition, women might be more open to adopting health behaviors during pregnancy [7].

Overweight women and maternity clinic nurses are reluctant or find it difficult to discuss weight and weight management in maternity care [8, 9]. Many women lack the knowledge and skills to manage their
weight effectively. However, overweight women want information about the risks of obesity, and they want more information about and support for weight management during pregnancy and the postnatal period [10, 11, 9, 12]. Furthermore, researchers have identified a range of effective interventions for weight management during pregnancy and postpartum period, but these interventions are difficult to implement in clinical practice [13, 14].

There is a lack of effective strategies for supporting weight management in maternity care [15]. Health technology applications that support weight management could be useful alternatives to standard practices [16, 17] and would provide possibilities for example continuous monitoring of pregnant women's physiological parameters. Real-time information between scheduled appointments could support weight management counseling in maternity care [18]. Health technology could also provide solutions for implementation difficulties of effective weight-management interventions.

Although several previous studies examined the experiences of overweight and obese women during pregnancy, there is a need to identify more closely overweight women's health behaviors to focus on problematic areas and choose effective implementation strategies [19, 20]. Target behaviors should be clarified to tailor interventions based on women's identified needs. To address this gap, the following theoretical frameworks were used to gain a rigorous understanding of the needs for effective weight-management support: the Behaviour Change Wheel (BCW), the Capability, Opportunity and Motivation Behaviour (COM-B), and the Theoretical Domains Framework (TDF).

The aim of this study was to identify and describe weight management behaviors in terms of the COM-B model from the perspectives of maternity care professionals and overweight and obese women.

Methods

Design and setting

This study is a part of multiphase research project aimed at tailoring and implementing an evidence-based weight management intervention for overweight pregnant women. A qualitative, descriptive study design was used to investigate perceptions of weight management support among overweight pregnant and postpartum women. In Finland, women receive free care from maternity clinics located in primary health care centers run by registered public health nurses or registered midwives. Semi-structured individual and focus group interviews were undertaken in two public maternity clinics located in four municipalities in the Hospital District of Southwest Finland. The study was reported according to the Consolidated Criteria for Reporting Qualitative Research checklist.

Participants

A purposive sample of overweight women and public health nurses was recruited into the study between April 2019 and January 2020. Women were eligible if they were 1) pregnant or had delivered their baby in
the past six months, 2) ≥ 18 years of age, and 3) overweight (BMI ≥ 25). The public health nurses identified and informed eligible women about the study. After providing oral and written information, the public health nurses asked permission for the researcher to contact potential participants. All public health nurses (n = 8) working at the selected maternity and child health clinics were eligible for the study. The researcher contacted public health nurses via e-mail and scheduled meetings after receiving approval from the health center’s nurse director.

**Theoretical approach**

The BCW was used as a theoretical framework to understand and identify the cognitive, affective, social, and environmental influences of overweight and obesity during pregnancy on behavior [20, 21, 22]. The BCW consists of three core components: 1) a model of behavior that includes physical and psychological capability, physical and social opportunity, and automatic and reflective motivation (i.e., the COM-B-model); 2) intervention functions; and 3) policy categories, which are decisions made by authorities that enable intervention functions to occur. According to the BCW model, behavior is an interactive system involving capability, opportunity, and motivation that can be changed by the intervention functions [20]. The TDF, a meta-framework incorporating 33 psychology theories and over 128 behavioral change constructs, can be used to expand on the COM-B model’s components to identify target behaviors [20]. The TDF has 14 theoretical domains related to an individual’s capability, opportunity, and motivation to support behavior change [22]. Compatibility with the TDF increases the COM-B model’s theoretical thoroughness because the TDF has been widely used and validated in studies identifying the determinants of behavior change [23, 24, 25]. According to the BCW, intervention development processes are categorized into three stages and are subdivided further into eight steps, as depicted in Figure 1. This study focuses on Stage 1, laying the groundwork for understanding the target behavior [21].

**Interview guides**

A semi-structured interview guides, informed by the BCW theory for both overweight women and public health nurses, were developed by the researchers (JS, HN-V and AA). Both guides included themes about weight-management support, barriers and facilitators of delivering the weight-management intervention and utilizing technology in weight-management support.

**Data collection**

Overweight women initially approached by the public health nurses were contacted by telephone and invited to participate in an interview at a time convenient to them. Public health nurses willing to participate were contacted by e-mail or telephone to arrange a scheduled time for focus group interviews. The first author (JS) informed all participants about the purpose of the study and secured written informed consent. The first author (JS) conducted 11 individual interviews with pregnant or postpartum
women, and two researchers (JS and HN-V) conducted two focus group interviews with public health nurses. Focus group interviews lasted between 60 and 90 minutes, and individual interviews lasted between 35 and 75 minutes. All interviews were audio-recorded, and field notes were made. Researcher (JS) collected background information from the participants with a questionnaire.

Analysis

The audio-recorded interviews were transcribed verbatim, and the data were transferred to NVivo 12Plus (QSR International Pty Ltd. Version 12, 2018). Deductive content analysis was conducted to organize the data into a systematically structured format. The data were then coded using a deductive framework (Gale et al. 2013) composed of the COM-B model and TDF by the first author (JS). The research team members (HN-V & AA) convened and compared the codes applied to the transcripts [21]. Consistent with the COM-B model, responses were grouped into the capability, opportunity, and motivation categories and included links to the TDF domains within the text.

Results

Participant characteristics

Eleven overweight women during pregnancy or immediate postpartum period (Table 1) and five public health nurses working in maternity clinics (Table 2) participated in the study.
Table 1
Characteristics of overweight women (n = 11)

| Characteristics                              | Overweight women (n = 11) |
|----------------------------------------------|---------------------------|
| Age (years), median (range)                  | 29 (22–41)                |
| BMI before pregnancy (kg/m²), n (%)          |                           |
| 25.0-29.9                                    | 3 (27%)                   |
| 30.0-34.9                                    | 7 (64%)                   |
| 35.0-39.9                                    | 0 (0%)                    |
| 40.0 or more                                 | 1 (9%)                    |
| Gestational diabetes, n (%)                  | 3 (27%)                   |
| Highest educational qualification, n (%)     |                           |
| Secondary education                          | 6 (55%)                   |
| College or University of applied sciences    | 4 (36%)                   |
| University                                   | 1 (9%)                    |
| Marital status, n (%)                        |                           |
| Married or living with partner               | 11 (100%)                 |
| Planned pregnancy, n (%)                     |                           |
| Yes                                          | 9 (82%)                   |
| No                                           | 1 (9%)                    |
| Missing value                                | 1 (9%)                    |
Weight management behaviors of overweight women during pregnancy and the postpartum period

The frequency with which the coded phrases corresponded to the COM-B components and TDF domains is reported in Table 3. Most of the data were coded into the TDF domains knowledge, social and professional role and identity and reinforcement.
Table 3  
The number of phrases coded under each COM-B component and TDF domain

| COM-B component | TDF domain                                      | Number of coded phrases by overweight women | Number of coded phrases by public health nurses (focus group interviews) |
|-----------------|-------------------------------------------------|---------------------------------------------|-----------------------------------------------------------------------|
| Capability      |                                                 |                                             |                                                                       |
|                  | Physical capability                              |                                             |                                                                       |
|                  | Skills                                           | 17 (3%)                                     | 9 (5%)                                                                |
|                  | Knowledge                                        | 86 (16%)                                    | 24 (12%)                                                              |
|                  | Memory, attention and decision processes         | 37 (7%)                                     | 9 (5%)                                                                |
|                  | Behavioral regulation                            | 25 (5%)                                     | 1 (1%)                                                                |
| Opportunity      |                                                 |                                             |                                                                       |
|                  | Physical opportunity                             |                                             |                                                                       |
|                  | Environmental context and resources              | 20 (4%)                                     | 13 (7%)                                                               |
|                  | Social opportunity                               |                                             |                                                                       |
|                  | Social influences                                | 54 (10%)                                    | 18 (9%)                                                               |
| Motivation       |                                                 |                                             |                                                                       |
|                  | Automatic motivation                             |                                             |                                                                       |
|                  | Reinforcement                                    | 66 (12%)                                    | 16 (8%)                                                               |
|                  | Emotions                                         | 44 (8%)                                     | 19 (10%)                                                              |
|                  | Reflective motivation                            |                                             |                                                                       |
|                  | Social/professional role and identity            | 93 (17%)                                    | 36 (19%)                                                              |
|                  | Beliefs about capability                         | 13 (2%)                                     | 20 (10%)                                                              |
|                  | Beliefs about consequences                       | 35 (6%)                                     | 18 (9%)                                                               |
|                  | Optimism                                         | 11 (2%)                                     | 2 (1%)                                                                |
|                  | Intentions                                       | 15 (3%)                                     | 6 (3%)                                                                |
|                  | Goals                                            | 27 (5%)                                     | 3 (2%)                                                                |
|                  | Total N of codes                                 | 543                                          | 194                                                                  |
Capability – Lack of a practical approach to lifestyle changes

Most participants reported that physical capability was not a problem in weight management. However, some women stated that they did not have the skills to carry out nutritional advice in practice. Public health nurses also stated that an increasing number of women lacked the skills to make healthy meals or did not know how to follow instructions regarding healthy lifestyles. In terms of psychological capability and further knowledge, overweight women wanted professional and well-argued information about risks that obesity poses to themselves and their unborn babies. Some women did not know how to exercise and were uncertain what would be beneficial or harmful during pregnancy or after delivery. Public health nurses reported collecting background information about women's life situations and lifestyles and counseled the women individually based on that information. They noticed that some pregnant women lacked knowledge about a healthy lifestyle, such as how to cook healthy food. In addition, public health nurses reported that they did not necessarily discuss weight as a number; instead, they were discussed healthy lifestyle changes and thought that this would bring the weight numbers down. Public health nurses wanted concrete and consistent ways to approach the subject.

“If you could get advice in a different way... not always like, ‘Add vegetables, reduce salt, and reduce sugar’...If you just don’t have what it takes to accomplish these things.” (ID4, pregnant woman)

“Surprisingly often, you encounter the fact that people have long intervals between meals, and they really eat very rarely, which of course leads to snacking.” (Focus Group 1, public health nurse)

Reflecting the memory, attention and decision processes, most women's stories contained apparent indifference towards their weight. Long-lasting overweight had become part of the women's identity. Some women even felt like outcasts who were not accepted in society. All women had previous experiences with losing weight; they had tried to change their eating habits and increase exercise, but every time, they failed to reach their goal. Some women had negative experiences during health care encounters because of their weight. Public health nurses also mentioned situations in which women had negative experiences and considered it a barrier to weight management. Furthermore, public health nurses said that they usually asked women's opinions about the most suitable weight management strategies. With multipara women, they also asked about previous pregnancies and weight management after delivery and utilized approaches that were effective before.

“When you have had a cough for three weeks and sleeping is not so good, the answer is to lose weight. Whatever the problem is, the answer is to lose weight. It is the answer to everything. So...it feels like this world doesn’t belong to you (cries).” (ID4, pregnant woman)

“At least I am used to mapping out the situation with the woman herself. I ask whether she has any ideas about why her weight has risen so much, how it feels, and what she has already tried.” (Focus Group 2, public health nurse)
Regarding *behavioral regulation*, most overweight women had experiences using smart watches to monitor their behavior. From the women's perspective, the feedback messages and color indicators concerning their physical activity were useful. Some women had kept food diaries and found the effective for self-monitoring eating habits. They thought these different self-monitoring strategies could be utilized in maternity clinics. Public health nurses also considered individualized self-monitoring techniques as concrete tools for broaching the subject. Data from a smartwatch or other device could be utilized in antenatal visits for goalsetting and evaluating sleeping and physical activity habits.

“You could write it down, for example, on your phone, or you could have an app or something where you write down the foods you have eaten during the day. You could keep such a diary every week or a couple of weeks at a time.” (ID7, pregnant woman)

“I think, at least, that I have noticed that [smart watches] are quite addictive...when you can follow how you really sleep and move.” (Focus Group 2, public health nurse)

**Opportunity – Difficulties in committing quickly to long-term change**

Overweight women reported pregnancy-related physical discomforts and varying life situations, as well as physical or mental illnesses, as barriers to successful weight management. These challenges reflected their *physical opportunity* and *environmental context and resources*. Public health nurses emphasized the limited timeframe of pregnancy as a major problem: lifestyle changes related to eating and exercise should occur unrealistically quickly during pregnancy. Furthermore, time was limited during each antenatal visit, as well as after delivery, and no additional resources existed to guide and support women. Limited time and resources were considered barriers to weight management counseling from the perspective of the public health nurses.

“I have had to eat quite often all the time, during my whole pregnancy; if I don't eat, I soon start feeling dizzy.” (ID2, pregnant woman)

“After the birth, or...? No, not any kind of counseling. We just focus on the baby, and the baby's weight gain...(laughs) At the postnatal check for the mother, she is weighed, and we see if she has reached her pre-pregnancy weight. If she is pretty close or has even reached her pre-pregnancy weight, she will be truly praised.” (Focus Group 1, public health nurse)

Regarding *social opportunity* and *social influences*, overweight women stated that one of the most important aspects of weight management was support from their partners and family. Without support, changing their lifestyle and, by implication, losing weight was considered impossible. One woman described her mother-in-law as constantly baking pastries, making it very hard for her to eat healthy. Peer support was also important. For example, friends in similar life situations or different exercise groups played a major role in weight management support. Public health nurses emphasized partners’
significant role as supporters in weight management. They thought it was important to give advice to partners as well, whenever possible. In addition, public health nurses described a lack of peer-support groups for women struggling with weight management.

“When there is someone who supports me, it is so important to me. When you start to feel like giving up, then there is someone who says, ‘No, do not give up.’” (ID10, postpartum woman)

“If the partner visits the maternity clinic with the woman, the partner is encouraged to be involved. You can see that [weight management] is also important for the partner.” (Focus Group 1, public health nurse)

Motivation – Feeling helpless in the face of overweight

Regarding automatic motivation and reinforcement, overweight women wanted individual and motivating weight management counseling, and they expected to receive feedback about their life habits. Women stated that encouraging them to make small changes and reinforcing the things that were already good was important. Public health nurses highlighted that the basis of weight management support was listening, the tone of voice, and positive feedback. They also utilized different counseling tools such as pictures of the food pyramid.

“Of course, the facts must be known... If you have eaten too much, it has to be said, but some kind of future orientation in weight management counseling is needed. It is better to emphasize the positive things, but of course, you can’t go too far, either. You can’t say, ‘Good work! Two bars of chocolate a day!’ (laughs) But constructive and positive but also arousing counseling is needed so you can actually identify the things you do.” (ID8, pregnant woman)

“When the woman describes her daily life and how she is doing, I give positive feedback about her everyday activity. I try to point out the good things and encourage her to continue.” (Focus Group 2, public health nurse)

Overweight women experienced feelings of despair and shame about their weight regarding the emotions. Some of them described indifference towards their weight, as well as acceptance in the form of body positivity. Denial and defense were the easiest reactions for many of them. Weight management was a very sensitive subject. Public health nurses thought many overweight women had low self-esteem and often had psychological reasons to eat, which required very discreet counseling.

“They should find a positive way to talk about weight management, so you don’t always feel like crap.” (ID4, pregnant woman)

“I don’t know whether [weight-management] is hard to broach, but how do you talk about it so she won’t be offended?” (Focus Group 1, public health nurse)
Regarding reflective motivation, and more specifically social/professional role and identity, overweight women expected a tougher stance and professional weight management counseling during pregnancy and after delivery, whereas public health nurses described themselves as advisors of pregnant women. Public health nurses said that they followed protocols for each prenatal visit. They also discussed the health-related risks of being overweight and its consequences for the child. Based on the nurses’ experiences, some women did not want to take responsibility for their own actions regarding weight management. Some overweight women used pregnancy as an excuse to eat unhealthy foods or not to exercise because they would gain weight anyway. However, other women described the unborn child as their main source of motivation and wanted their children to have a healthy lifestyle. Women also believed that breastfeeding was a way to lose weight, but some of them thought that when a woman breastfeeds, she can eat anything she wants. The unborn baby was not a source of motivation for all overweight women. In those cases, public health nurses thought it was their professional duty to defend and protect the unborn baby, and they sometimes had to be provocative and arouse emotions. One public health nurse described herself as a baby’s voice shouting, “Don't do this to me!” From the perspective of the public health nurses, multipara women had better motivation for weight management compared with primiparous women due to their previous experiences of gaining weight during pregnancy and losing weight after delivery, which reflected beliefs about consequences.

“I have gained a lot of weight in a few years, so I have risked my own health, but I don’t want to cause my baby those risks.” (ID5, pregnant woman)

“Women are worried about gaining as much weight as they lost after the previous pregnancy. They have put lots of effort into losing weight, and then all of a sudden, they are pregnant again and don’t want all that work to be wasted.” (Focus Group 1, public health nurse)

Overweight women had experiences in which their intentions to lose weight usually ended quickly. Some women had intentions to change their lifestyle after the baby was born because they were optimistic that they could exercise at the same level as before pregnancy. In addition, women thought that clear goals made in collaboration with public health nurses could form a basis for motivation, individual guidance, and support. Furthermore, women who had experience with smart watches suggested that they could make goals for a healthy lifestyle and monitor achieving those goals via the smart watch (i.e., daily physical activity such as steps and activity minutes, diet or a food diary, or weight gain). Women thought that the knowledge that they were being monitored would be motivating in itself. However, contrary to the women's wishes, public health nurses felt they could not make goals on the women's behalf. Instead, public health nurses said that they could offer weight management alternatives for the women to choose from. They also had experiences in which women were willing to change but lacked the motivation to make concrete changes.

“Goal setting supports coping in daily life and motivates you in the bad moments. Goals support me to make the choice to go for a jog rather than stay on the couch.” (ID4, pregnant woman)
“The women should set the goals themselves. If the goals are dictated and their actions are controlled by us, it won’t work for longer than a week, if at all.” (Focus Group 1, public health nurse)

Reflecting on beliefs about capability, overweight women felt that changing their lifestyle was quite difficult. They wanted to serve as role models to their children, but they had not lost weight despite their efforts. Public health nurses considered careful mapping of the women’s situation of life extremely important for identifying all factors and possible problems associated with weight management resources. Public health nurses also said that some women did not really want to change their lifestyles.

“I felt hopeless. I mean, we have a really healthy lifestyle. We eat really healthy, in my opinion: a lot of vegetables. I have always tried to be physically active. But...always, when I go to the scales, no results!” (ID1, postpartum woman)

“If there is too much stress in their life, they won’t have the energy to focus on [a healthy lifestyle].” (Focus Group 2, public health nurse)

The findings regarding identified target behaviors are presented in table 4.
| COM-B Component | TDF Domain | Target Behavior |
|-----------------|------------|-----------------|
| **Capability**  |            |                 |
| Physical capability | Skills | Barriers:       |
|                  |          | - Lack of skills needed to cook healthy food |
|                  |          | - Lack of skills needed to follow instructions for healthy lifestyle choices |
| Psychological capability | Knowledge | Barriers:       |
|                  |          | - Lack of professional information about the risks of obesity |
|                  |          | - Lack of concrete counseling on how to eat or exercise |
|                  |          | - Lack of consistent ways to broach the weight management topic |
| Memory, attention and decision processes | Barrier: | - Overweight as a part of women's identity |
| Behavioral regulation | Facilitator: | - Individual weight management counseling |
|                      | Facilitator or barrier: | - Previous experiences with weight management |
|                      | Facilitator: | - Utilizing information from health technology (smart wearables) in antenatal visits |
| **Opportunity**    |            |                 |
| Physical opportunity | Environmental context and resources | Barriers: |
|                    |          | - Pregnancy related physical discomfort |
|                    |          | - Lack of time during antenatal visits |
|                    |          | - Lack of postnatal counseling |
| Social opportunity | Social influences | Barrier: |
|                    |          | - Lack of perinatal peer-support groups |
|                    |          | Facilitators: |
|                    |          | - Support from partners and family |
| Motivation          | Reinforcement                                                                 | Facilitators:                                                            |
|---------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Automatic motivation| - Motivating counseling                                                        | - Positive feedback                                                      |
|                     | - Encouragement to make small changes                                           | - Asking questions and listening                                          |
|                     | Facilitator or barrier:                                                        | - Tone of voice                                                          |
| Emotions            | Barriers:                                                                     |                                                                          |
|                     | - Despair and feelings of shame                                                |                                                                          |
|                     | - Acceptance in the form of body positivity                                    |                                                                          |
|                     | - Denial and defense reactions                                                 |                                                                          |
|                     | - Low self-esteem                                                             |                                                                          |
|                     | - Psychological reasons for eating                                             |                                                                          |
| Reflection          | Barriers:                                                                     |                                                                          |
| motivation          | - Conflict: Public health nurses’ self-described role as advisors, which      | - Overweight women's reluctance to take responsibility for their actions |
|                     | conflicted with overweight women's expectation of a tough stance and         |                                                                          |
|                     | professional counseling                                                        |                                                                          |
| Beliefs about       | Barriers:                                                                     |                                                                          |
| capability          | - Difficult to change lifestyle                                                |                                                                          |
|                     | - Women's inability to lose weight in the past despite their efforts           |                                                                          |
|                     | - Other problems in women's lives that affect their capabilities               |                                                                          |
|                     | - Lack of desire to change their lifestyle on the part of some women           |                                                                          |
|                     | Facilitator:                                                                  |                                                                          |
|                     | - Mapping the women's life situations                                          |                                                                          |
Beliefs about consequences

| Barriers: | Facilitators: |
|-----------|--------------|
| - Pregnancy as an excuse | - Unborn child as a source of motivation |
| - Belief that women can eat anything they want while breastfeeding | - Positive effects of breastfeeding |
| - Public health nurses’ duty to defend and protect the unborn baby |

Optimism

| Facilitator: |
|--------------|
| - Women's belief that they could exercise after birth just as they did before pregnancy |

Intentions

| Barrier: | Facilitator: |
|----------|--------------|
| - Willingness to change but a lack of motivation to make concrete changes | - Intentions to change lifestyle after the baby’s birth |

Goals

| Barrier: | Facilitator: |
|----------|--------------|
| - Paternalistic goals made by public health nurses | - Goals made in collaboration with public health nurses |

Discussion

This study was aimed at identifying and describing weight management behaviors from the perspectives of both maternity care professionals and overweight women. A theory-based approach was used to identify target behaviors regarding weight management during pregnancy and the postpartum period. Our findings indicate that future weight management interventions for pregnant women should be targeted at providing a consistent way to broach the subject during antenatal visits and increasing overweight women’s knowledge about and motivation to pursue healthy lifestyles. Furthermore, there is an urgent need to continue to support weight management after birth. Public health nurses in maternity clinics need concrete tools to support and motivate women. Health technology and smart wearable devices could constitute one such possibility.

Regarding capabilities, there was a need to find consistent ways to broach the topic of overweight. Both health care professionals and obese pregnant women seem to avoid discussion regarding obesity and
weight-management [26]. Health technology, such as smart wearables could be utilized as part of antenatal care to broach the topic of weight and weight management. Smart wearables could also support evaluating overweight women's lifestyles [15, 16, 17]. In line with our findings, women reported a long history of weight struggles, and overweight had become a part of their identity. The women were accustomed to being overweight [11] and did not believe in themselves anymore. They needed motivating tools and a great deal of support in weight management. Some of the women had negative experiences during previous health care encounters due to their being overweight. Previous studies also reported similar findings; discussing weight during antenatal visits can be stigmatizing and can make women less receptive to advice or support [27, 28]. These experiences might inhibit women from accepting any attempts to intervene in their weight situation or provide weight management support. Personalized counseling and careful mapping of previous experiences should be promoted. Overweight women did not receive enough information about obesity risks, although public health nurses indicated the opposite. This conflict could be due to overly general counseling or having too many issues to discuss during antenatal visits. Previous qualitative interview studies reported inconsistent advice on weight management and knowledge gaps in diet or exercise recommendations during pregnancy, similar to our findings [12, 28]. A lack of skills needed to cook healthy meals and follow a healthy lifestyle was also identified. This could be addressed with technology enabled interventions to build cooking skills and populate a healthy recipe database [29].

Regarding weight management opportunities, public health nurses described a lack of resources as the reason counseling and support were missing after birth and weight-management was not part of standard care [30, 7]. Resources should be added postnatally for overweight women to facilitate personalized counseling [31]. We found that one of the important aspects of weight management was support from partners and family. Women's partners play a significant role in providing advice and are seen as invaluable support [7]. In addition, women described how their family, relatives, friends, and health care professionals influenced, for example, healthy food choices [32]. This is an important aspect that should be emphasized in future intervention studies and in practice. Furthermore, peer support was considered important. In a previous qualitative study, it was essential to engage women and their partners to discuss weight issues and deliver health counseling sensitively by focusing on individual needs and concerns [33].

Besides support from family, motivation was considered the most important aspect of weight management. In line with previous findings, pregnancy was considered an opportunistic and motivating time to undertake positive lifestyle changes [31, 12]. [12]. Although women knew the consequences of their actions and wanted a healthier lifestyle for their children, they still used pregnancy as an excuse for unhealthy eating and inadequate exercise, and they did not want to take responsibility for their weight gain or lifestyles. This might have occurred because they believed they would gain weight anyway during pregnancy, so there was no need for a healthy lifestyle. This apparent inconsistency was also found in previous research that reported pregnancy’s use as an excuse to indulge [32]. However, some women explained that responsibility for the unborn child was their main reason for being more conscious of their health behaviors [34, 32]. Overweight women wanted a more uncompromising stance on weight
management from maternity care professionals. Our findings also highlight that many overweight women had low self-esteem, which causes challenges and requires discreet counseling. Low self-esteem might cause avoidance toward broaching the topic of overweight. Respectful and honest communication about body weight can help women feel they have more control over managing their weight [35, 7].

The strength of our theory-based approach was that describing target behaviors enables further tailoring of a structured, evidence-based weight management intervention and related implementation strategies. Using a theoretical framework to understand behavior change permits a more comprehensive examination of potential barriers and facilitators, as well as mechanisms linking them to the target behavior, in future studies. Another strength of our study was that we investigated women and midwives’ experiences and perspectives on weight management for overweight women. Each TDF domain included the perspectives from overweight women and public health nurses. In many domains, overweight women and public health nurses amplified each other’s observations. However, some conflicts emerged. It was essential to identify these for utilization in future implementation research. Although the BCW has been used widely in implementation studies within the health care setting, most previous studies applied the theory to change behaviors at the organizational or system levels [22]. We utilized the BCW at the individual level to identify practical issues related to weight management behavior. However, our study has some limitations. First, the sample of overweight women might have been biased because some women might not feel comfortable discussing this sensitive subject. Thus, they might not have been interested in participating in this study. Second, the participants’ perspectives and experiences might not be transferable to overweight women and pregnancy care providers in other settings, although previous studies reported similar findings.

Conclusions

Identified barriers to the target behavior, such as lack of ways to broach the topic of overweight and to motivate women; consistent counseling, especially after birth; and awareness of risks associated with unhealthy gestational weight development will be targeted to address interventions in the future. Facilitators, such as individual and discreet counseling, goal setting, and utilization of support from family and partners, should be utilized as intervention components. In addition, wearable and health technology could be a valuable part of an intervention, as it might provide ways to broach the topic and support overweight women’s healthy lifestyle choices in maternity care settings. The BCW should be utilized to define intervention functions in future research. Our findings offer a theoretical basis for further intervention development, testing, and implementation to address barriers to weight management; offer clear advice; and provide non-judgmental support during pregnancy and after delivery targeting capability, opportunity, and motivation.

Abbreviations

BCW = Behaviour Change Wheel
BMI = Body mass index

BCTTv1 = Behaviour Change Technique Taxonomy (v1)

COM-B model = Capability, Opportunity, and Motivation behavior model

TDF = Theoretical Domain Framework

**Declarations**

**Ethics approval and consent to participate**

The study was performed in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the University of Turku in January 2019. Written informed consent was obtained from the participants and consent was confirmed verbally at the beginning of each interview.

**Consent for publication**

Consent for publication not applicable.

**Availability of data and materials**

The data will not be publicly available due to obligation to maintain confidentiality.

**Competing interests**

The authors declare that they have no competing interests.

**Funding**

This study was funded by the Academy of Finland awards (316810 and 316811).

**Authors’ contributions**

JS, HN-V and AA planned the study. JS and HN-V performed the interviews. JS analyzed the data with the help of HN-V and AA. JS drafted the manuscript. JS and HN-V translated the findings. All authors (JS, HN-V, AR and AA) contributed to the writing of the manuscript. All authors read and approved the final manuscript.
Acknowledgements

We would like to express our gratitude to all women who participated in the interviews and shared their experiences.

Corresponding author

Correspondence to Johanna Saarikko, e-mail: jpkssa@utu.fi

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