www.elsevier.com/locate/midw

Influences on the food choices and physical activity behaviours of overweight and obese pregnant women: a qualitative study

Orna A. O'Brien, Karen L. Lindsay, Mary McCarthy, Aileen F. McGloin, Maria Kennelly, Helena A. Scully, Fionnuala M. McAuliffe

PII: S0266-6138(17)30101-8
DOI: http://dx.doi.org/10.1016/j.midw.2017.02.003
Reference: YMIDW1989

To appear in: *Midwifery*

Cite this article as: Orna A. O'Brien, Karen L. Lindsay, Mary McCarthy, Aileen F. McGloin, Maria Kennelly, Helena A. Scully and Fionnuala M. McAuliffe, Influences on the food choices and physical activity behaviours of overweight and obese pregnant women: a qualitative study, *Midwifery* http://dx.doi.org/10.1016/j.midw.2017.02.003

Title: Influences on the food choices and physical activity behaviours of overweight and obese pregnant women: a qualitative study.

Authors: Orna A. O'Brien[a], Karen L. Lindsay[a], Mary McCarthy[b], Aileen F. McGloin[c], Maria Kennelly[a], Helena A. Scully[a], Fionnuala M. McAuliffe[a]*

[a]UCD Obstetrics and Gynaecology, School of Medicine and Medical Science, University College Dublin, National Maternity Hospital, Dublin, Ireland.

[b] Food Business and Development, University College Cork (UCC), Cork, Ireland.

[c]School of Public Health, Physiotherapy and Population Science, University College Dublin (UCD), Dublin, Ireland.

*** Corresponding author:**

Prof Fionnuala McAuliffe, Professor of UCD Obstetrics & Gynaecology, School of Medicine and Medical Science, University College Dublin, National Maternity Hospital, Dublin, Ireland.

65-66 Lower Mount Street, Dublin 2, Ireland.

Tel: +353 1 6373216

Fax: +353 1 6627586

Email: fionnuala.mcauliffe@ucd.ie

ABSTRACT

Objective: To qualitatively explore influences identified by overweight/obese pregnant women on food choices and physical activity (PA) behaviours; to determine the impact of

pregnancy on these factors; and to inform development of future lifestyle interventions during pregnancy.

Design: Cross-sectional interview study.

Setting: Maternity Hospital, Ireland.

Participants: Pregnant women (n = 22), early pregnancy Body Mass Index > 25kg/m^2

Measures: Barriers to and facilitators of healthy eating and PA in overweight/obese pregnancy. Interviews were transcribed verbatim and analysed using inductive thematic analysis.

Findings: Overweight/obese women perceived the following factors to influence their food choices and PA behaviours: personal (e.g. age, enjoyment, health, aesthetic appearance, and response to fatigue); social (e.g. social support, food modelling, social facilitation and weight bias) and environmental (e.g. food salience and the obesogenic environment). These factors affected PA and food choice trajectories differently according to socio-economic and socio-cultural context.

Conclusion and Implications: Personal, social and environmental factors affect food choices and PA behaviours. Pregnancy is a powerful stimulus for positive changes in food choices particularly. This change is driven by desire for healthy pregnancy outcome, and is not intrinsically motivated. Healthy lifestyle interventions should aim to sustain positive changes beyond pregnancy through: empowerment, intrinsic motivation, family-centred approach, and behavioural goals.

Keywords: Qualitative research; food preference; physical activity; health behavior; pregnancy; lifestyle change.

Food choice and physical activity behaviours are influenced by many factors. These factors may be personal factors such as ideals, or they may be social, contextual or environmental factors (Edwards & Tsouros, 2006; Furst et al., 1991). These influencing factors are embedded within the life course and fluctuate across the life course (Devine *et al.*, 2000; Devine & Olsen, 1991; Devine & Olsen, 1992). Pregnancy may be considered a life event which can alter the trajectory of food choices and physical activity behaviours (Bassett-Gunter et al., 2013).

The antenatal period represents an optimal time for lifestyle intervention because pregnant women have regular contact with health care professionals, and are often motivated to make health behavioural changes that may optimise the outcome of their pregnancy (Anderson, 2001; Inskip et al., 2009; Ruggiero et al., 2000). This potential window for lifestyle change is particularly important for overweight (body mass index (BMI) $\geq 25 kg/m^2$) and obese (BMI $\geq 30 kg/m^2$) pregnant women, who account for approximately 50% of all pregnancies in Western countries (Branum et al., 2016; Health and Social Care Information Centre, 2015; McKeating et al., 2015; National Maternity Hospital, 2011). Research indicates that this obstetric group is at significantly higher risk of adverse pregnancy outcomes compared to normal-weight women. These adverse outcomes include hypertension and gestational diabetes (GDM) for the mother (Arendas et al., 2008; Frederick et al., 2006; O'Brien et al., 2003) and birth injury and risk of childhood and adulthood obesity for the baby (Adamo et al., 2012; Gardiner et al., 2011; Guihard-Costa et al., 2004; Weisman et al., 2010). Maternal obesity also incurs a greater financial cost for obstetric care (Department of Health (UK), 2013; Safefood, 2012). Furthermore, it has been found that pregnant women typically have poor compliance with dietary and physical activity guidelines during pregnancy

(McGowan & McAuliffe, 2013; Siega-Riz et al., 2002) and often exceed gestational weight gain recommendations (Walsh et al., 2012).

To change the health behaviours of women of childbearing age, it is important to gain a comprehensive understanding of these influencing factors on physical activity and food choice trajectory within the life course, and particularly throughout pregnancy (Devine et al., 2000; Devine & Olsen, 1991; Devine & Olsen, 1992). Identification of the factors that influence overweight and obese pregnant women may assist in developing more targeted lifestyle interventions during pregnancy, which may lead to greater acceptability of and compliance with lifestyle interventions during pregnancy. To date, there have been several qualitative studies examining the factors that overweight and obese women perceive to influence their food choices and physical activity behaviours during pregnancy (Atkinson et al., 2016; Bianchi et al., 2016; Heery et al., 2013; Jelsma et al., 2016; Padmanabhan et al., 2015; Sui et al., 2013; Sui et al., 2013a; Weir et al., 2010). However, much of this research focuses on exploring the event of pregnancy itself, with little emphasis placed on the role of historical context - past events and experiences - which may have shaped the beliefs and attitudes of these women before they even approach the life event that is pregnancy.

The primary aim of the current study was to qualitatively explore the various factors within the life course, both past and present, that overweight and obese pregnant women perceive to influence their food choice and physical activity behaviours. The study also endeavoured to inform the development of future lifestyle interventions during pregnancy.

METHODS

Ethical Approval

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human participants were approved by the X Ethics Committee. Written informed consent was obtained from all participants upon recruitment.

Theoretical Framework

A cross-sectional interview study was conducted according to the recommendations of the consolidated criteria for reporting qualitative research (COREQ) (Tong et al., 2007). The study explored factors that overweight and obese pregnant women perceived to influence their food choices and physical activity behaviours. The theoretical framework of the study was grounded in the Food Choice Process Model (Furst et al., 2006) and the Social Ecological Model of the Determinants of Physical Activity (Edward & Tsouros, 2006). The Food Choice Process Model categorises influences as ideals, personal factors, resources, social factors and contexts. The Social Ecological Model of the Determinants of Physical Activity illustrates how, in order to impact physical activity in the modern societal structure, a multitude of factors need to be addressed. It is therefore important to maximise the effectiveness of lifestyle interventions taking place during pregnancy by determining what factors this population group perceive to facilitate or hinder healthier lifestyle choices. These influences can affect people's behaviour indirectly by acting as barriers or enablers to motivation (Lent et al., 2000). This study employed inductive thematic analysis methodology to explore these influences, which future interventions promoting healthy eating and physical activity in pregnancy may incorporate as an evidence-based framework.

Participant Selection

The interview component of the study comprised of twenty-two women who were purposively sampled from the outpatient department in the X. Inclusion criteria stipulated that the women must be aged between 18 and 45 years, have a singleton pregnancy, have an early pregnancy BMI ranging between 25.0 kg/m^2 and 39.9 kg/m^2, and have no history of diabetes or other relevant medical disorders. Purposive sampling (Murray, 1999) was used to ensure equal representation of parity and educational attainment. Educational attainment was categorised into the highest level of completed education – either completion of secondary school only or completion of higher levels of education. Equal representation of parity was considered important because published studies in this area indicate that parity influences women's food choices and physical activity behaviours (Olson, 2005), the central theme of the current study. Educational attainment is a known indicator of socio-economic group (Galobardes et al., 2006). Several published studies suggest that women with lower educational attainment tend to have poorer health behaviours than their non-disadvantaged counterparts (McCartney et al., 2013). Therefore, it was deemed prudent to include participants of various parity and educational attainment in order to capture the views from women across different life stages and socio-economic strata, which may influence food choices and physical activity behaviours.

Eligible women were approached in person at their 28-week antenatal appointment, and the purpose and methods of the interview were explained. Recruitment occurred between July 2013 and January 2014, allowing for a staged interview process that accommodated all participants being interviewed at approximately the same point of their pregnancy. Women who agreed partook in a face-to-face interview at 34 weeks' gestation. Recruitment ceased when no new relevant information was acquired from the interviews which indicated that data saturation was reached (Strauss & Corbin, 1990). Participants were not offered financial incentives to participate in the study.

Setting

The study took place at the X, Ireland. The interviews were conducted in a meeting room in the maternity hospital during the 34th week of pregnancy.

The Interview

Semi-structured in-depth interviews were co-ordinated by an Irish, nulliparous female research dietitian with interviewing skills and knowledge of maternal nutrition. While incongruity between the interviewer and participants of other backgrounds can sometimes present problems, the selection of a settings-based, informal discussion format, and particularly the familiarity of the interviewer, who was engaged with the women from the time of initial recruitment, appeared to overcome any such issues. Several steps were taken to minimise social desirability bias. For example, participants were assured by the interviewer at the opening of the interview that their responses would have no impact on their antenatal care or treatment by the research team; the pressure of social desirability bias was highlighted by the interviewer and participants were encouraged to provide an honest account of their experience rather than what they thought the interviewer wanted to hear; and leading questions were avoided. No other persons were present during the interviews.

Each interview followed a qualitative topic list (see Supplementary Material) based on a range of *a priori* themes:

i. Perceptions of a healthy diet and physical activity;
ii. Perceived barriers to healthy eating and physical activity;
iii. Perceptions of the impact of pregnancy on health-related behaviours.

These themes had been highlighted in the literature and during research team discussions as factors that influence diet and physical activity behaviours among pregnant women. The list was also informed by observations from quantitative fieldwork that had been carried out previously on this cohort, both from data captured in questionnaires, and from further *ad hoc* commentary by participants. The topic list was guided by the life course perspective, allowing consideration of the origins of behaviours and allowing history and context to explain current thoughts, feelings and actions around diet and exercise. To minimise potential interview bias, the provisional topic list was piloted with the first five participants. Following these initial five qualitative interviews, the topic list was carefully reviewed against the interview transcripts and found to be valid. Therefore, no changes were made to the list and the data collected from the initial five interviews were also included in the final analysis.

The interviews focused primarily on the women's behaviours, attitudes (including perceived influences) and knowledge, both prior to and during pregnancy. Prior to each interview, the purpose and nature of the interview was verbally explained to the participant, and participants were assured of confidentiality and anonymity. The interviews were digitally recorded. Field notes describing body language, speech inflections and nuances were also noted after each interview to provide a richer understanding of the interview (Charmaz, 2006). The audio files were transcribed verbatim by an outsourced transcription service, and were checked and anonymised using WavePad Sound Editor – Masters Edition (© NCH Software, Colorado) by the interviewer. Transcripts from each interview were discussed with members of the research team for dependability and amendments were made as appropriate. They were then coded on Microsoft® Word (2010) with a unique identifier prior to analysis.

Data Analysis

All transcripts were manually analysed by the interviewer (X) using inductive thematic analysis. This involved separation of the constituent elements of the discussion into a hierarchy of thematic categories (Braun & Clarke, 2006). Several steps were taken to enhance the reliability and validity of the research: leading questions were avoided throughout all interviews; memory checks were carried out at the end of each interview; and a sample of the transcripts were independently thematically analysed by a separate researcher (X) to avoid inter-observer bias when interpreting the interviews. Due to time constraints, transcripts were not returned to participants for comment, and participants were not invited to provide feedback on the subsequent findings.

RESULTS

Participant Demographics

Forty-two women were invited to participate in interviews. Eight women were excluded due to medical complications, such as placenta previa or rupture of membranes, because their antenatal experience may not have been representative of the vast majority of participants. Four women were excluded due to GDM diagnoses at 28 weeks' gestation. Six of the forty-two eligible women declined participation, citing occupation-related time constraints or child-minding responsibilities as reasons for non-participation. A further two women could not attend the interview as scheduled. Twenty-two women completed one interview each between July 2013 and January 2014 (64.7% response rate). Table 1 presents the demographic characteristics of these participants who completed interviews. The mean length of the interviews was 46 minutes (range 24–63 minutes).

The names of respondents and any other identifying information were changed to protect their anonymity. Many influences on food choice and physical activity were identified by participants. The women endeavoured to make positive food choices during pregnancy, while they reported a significant decline in physical activity during pregnancy. Their perceived influences are presented below as personal, social and environmental factors. In reality, it is likely that these elements interact at a functional level to create a complex 'web' of interrelated factors which either support or undermine food choices and physical activity behaviours.

Personal Factors

Throughout the interviews, many of the women cited personal factors such as fatigue, age, and taste preferences as primary determinants of food choice and physical activity behaviours outside of pregnancy. Response to these personal factors appeared to be culturally learned, whereby sub-cultural differences emerged between groups. Beliefs and ideals about food and physical activity varied greatly across the lifespan. For example, many of the women described how, prior to pregnancy, they had previously practiced cognitive dietary restraint in order to achieve an aesthetically-pleasing or desired body weight and shape. The younger women in their twenties appeared more likely to choose food based on convenience, taste, cravings and most commonly 'weight-restriction', with little regard for the impact on their health (Figure 1).

However, this fixation on calories appeared to weaken with age and with the onset of pregnancy, as their trajectories became more heavily influenced by food quality and health-giving properties of 'healthy' food and physical activity, rather than energy content and its

effect on aesthetic appearance. Appreciation of the health-giving benefits of physical activity was heavily influenced by socio-cultural context whereby women of higher educational attainment and older age demonstrated a high level of future salience, believing exercise would improve both their short- and long-term health (Figure 2).

Equally, while there was a tacit acceptance of the role that physical activity played in a 'healthy' pregnancy among younger women of lower educational attainment, this often didn't extend to more abstract concepts like the protective effect of these behaviours on *long-term* health. The exception to this was parity, whereby multiparous women perceived a 'healthy' diet and physical activity as key factors in longevity, and described how this motivated them to exercise (Figure 3).

Parity appeared to have a mixed effect on the women's physical activity behaviours. Multiparous women claimed to have a higher level of 'informal' physical activity, for example, carrying children or running after a child in the home, but a lower level of 'formal' activity, for example, exercise classes or gym membership. However, these multiparous women also regarded physical activity as a key value that they wanted to pass on to their children. They felt that by partaking in regular physical activity they were acting as good role model for their children (Figure 4).

Similar to the potent effect of parity and age on health behaviours, the period of pregnancy represented an even more powerful stimulant for positive behavioural change. The women appeared to be primarily motivated to change behaviour due to a sense of responsibility for their unborn baby and a desire for healthy fetal development and pregnancy outcome. In essence, they perceived any healthy lifestyle changes as a sacrificial necessity for the benefit of others, rather than being a pleasurable change that was intrinsically motivated or for personal gain (Figure 5).

Social Factors

In addition to the personal factors above, the women recognised external social influences in their microenvironments as being determinants of their food choices and physical activity behaviours. For example, the women were highly influenced by social facilitation – when eating in the presence of others, usually their partner or close friends or peers who consistently ate either a lot or a little, the women tended to mirror this behaviour by also eating similar quantities. They perceived pressure when eating in certain groups to eat more, and to eat less healthily, particularly during social 'occasions'. However, contrary to social facilitation, when the women ate in the presence of others who they perceived to be observing or evaluating them, they tended to eat less than they would otherwise eat alone. Social support from these groups appeared to provide motivation, improved self-efficacy, companionship, and a greater likelihood of engaging in physical activity. This suggests that family, friends and partners may play a significant role in influencing these women's behaviours, particularly during periods of lifestyle change, such as pregnancy (Figure 6).

The women alluded to food—and physical activity—modelling as affecting positive behavioural changes in their lives, but through two manifestations. Firstly, they perceived their parents to be powerful role models who were central to the embedding of lifelong diet and exercise habits from childhood onwards. Their dietary habits and experience of physical activity in their childhood seemed to significantly influence their health behaviours as adults. Secondly, the women appeared to mirror their parents' behaviours towards their own children, or carried the intention to do so, in the case of the nulliparous women. They regarded themselves as role models for their children and were eager to instil healthy lifestyle habits in their offspring (Figure 4).

While close social relationships appeared to foster healthier behaviours, for some, the influence of the wider social environment was often identified as being less nurturing. Some obese women recalled feeling victimised by others due to their weight, often through prejudicial weight-based stereotyping, which attributed negative characteristics such as laziness, poor willpower or inferiority. One woman provided a particularly illuminating insight into the nature and origins of weight bias and its damaging consequences on self-efficacy, confidence and body image (Figure 7).

Environmental Factors

While the above personal and social factors were found to play active roles in these women's food choices and physical activity behaviours, situational context also impacted the women in many ways. Both micro-environmental phenomena, such as food salience within the home, and macro-environmental phenomena, such as the obesogenic and economic environments, profoundly influenced these women's food choices and physical activity behaviours. Within the micro-environment of the home, increased food salience in one's environment appeared to increase food consumption. Many women described how stocking the store cupboard with unhealthy snack foods detrimentally affected their diets, with some women reciting "If it's not there, it cannot be eaten".

This embedded desire to avoid an obesogenic environment within the home was also apparent on a substantially larger scale within the society in which these women live. Although some women believed unprocessed foods were less expensive than high-fat and high-sugar processed foods, the general consensus was that the environment in which these women live is one in which the healthy choice is not the easy choice. Participants raised a plethora of factors that they believed contributed to obesity levels, including the cost of fruit,

vegetables and lean meat, large portion sizes in food and beverage outlets, and a lack of food skills. These contradictory statements highlighted that while these women desire to make good food choices, they perceived the environment in which they live as a powerful determinant of their ability to do so.

Similar perceptions were identified for the effect of the built environment on physical activity behaviours. The women made reference to the urbanisation that has occurred rapidly in the last 30 years, and how in some instances, this has led to poorly-designed environments which place little priority for 'active transport' between the infrastructures. For example, the women felt that the urban and suburban environments in which they live were primarily designed for cars rather than walking or cycling. Furthermore, they perceived the lifestyle associated with an urban setting to focus on inactive pastimes such as cinema trips, eating out or ordering takeaways, with each of these activities displacing a potential opportunity for physical activity (Figure 8).

The women's experience of their environment was also dependent on situational context and past experiences. For example, several women identified socio-cultural upbringing and educational attainment as determinants of what foods they were exposed to and, by extension, what eating behaviours were formed. These factors determined the availability of resources to purchase healthier, more nutrient-rich food, as well as a distinctly superior knowledge of healthy eating guidelines (Figure 9).

Principal findings

The data presented above indicates that pregnancy is indeed a powerful stimulant for positive behavioural change. However, during this life event, overweight and obese pregnant women perceive healthy changes to their food choices and physical activity behaviours to be sacrificial necessities for the benefit of their growing offspring, rather than being a pleasurable change that is intrinsically motivated for their own personal gain. This raises the question of whether lifestyle changes are likely to be sustained post-partum, once the reason for positive behavioural change no longer exists.

Secondly, close social relationships appeared to foster healthier behaviours during pregnancy; parental influence from their childhood and positive reinforcement from their partners and family shape their current habits; and the women themselves regarded themselves as role models for their children and were eager to instil healthy lifestyle habits in their offspring. However, our findings indicate that some obese pregnant women will have experienced weight bias and victimisation in the past by the wider social environment, resulting in poor self-efficacy, confidence and body image. This suggests that healthy lifestyle interventions for overweight and obese pregnant women should focus on healthy food choices and physical activity behaviours rather than numerical goals which may seem unattainable to them, or warnings about the dangers of obesity in pregnancy, as most of them are already acutely aware of the adverse effect their obesity could have on their pregnancy (Nitert et al., 2011).

Lastly, environmental factors appear to exert either positive or negative influences on pregnant women's lifestyle behaviours depending on one's locus of health control. In essence, those with an 'internal health locus' perceived their health to be under their own control, while those with an 'external health locus' appear to perceive their health to be

determined by chance or external factors over which they have no control. For example, the women attempted to manipulate their micro-environments to support healthy behaviours, although they felt that the wider obesogenic macro-environment in which they lived undermined their efforts to do so. This sense of control was governed by individual socio-economic context, with those who considered themselves to be of higher socio-economic status to have more control over their present and future health behaviours. This finding is supported by previous work demonstrating the association between locus of health control, socio-economic status and dietary and physical activity habits (Callaghan, 1998; Lachman & Weaver, 1998; Martikainen et al., 2003; Wardle & Steptoe, 2003).

Comparison with literature in the area

Whilst there is increasing research interest in healthy lifestyle interventions during overweight and obese pregnancy, only a few studies to date have explored the factors that these women perceive to influence their food choices and/or physical activity behaviours (Atkinson et al., 2016; Bianchi et al., 2016; Heery et al., 2013; Jelsma et al., 2016; Padmanabhan et al., 2015; Sui et al., 2013; Sui et al., 2013a; Weir et al., 2010). Our findings are consistent with prior research showing that a healthy pregnancy outcome is a major motivating factor to make healthier food choices during pregnancy (Bianchi et al., 2016; Jelsma et al., 2016; Padmanabhan et al., 2015; Sui et al., 2013; Weir et al., 2010). This supports our hypothesis that overweight and obese pregnant women are not intrinsically motivated – they make healthy changes not for their own benefit, and therefore may be unlikely to sustain these changes postpartum (Braver et al., 2014).

Our findings highlighted that this group of women are likely to have struggled with weight management in the past, and this has impacted their confidence and self-efficacy to make and sustain positive lifestyle choices in the present and future. This corroborates the

findings of Sui et al. (2013) and Weir et al. (2010) that overweight and obese pregnant women often have low self-efficacy in their ability to make healthy lifestyle changes, even if they are eager to do so. Cramp et al. (2009) also identified that higher levels of self-efficacy to exercise are associated with more physical activity during pregnancy. It strengthens the case to be made for healthy lifestyle interventions that incorporate strategies to enhance self-efficacy. This may also explain the low levels of adherence to antenatal diet and exercise interventions that have been described in similar populations.

Previous research has similarly identified that support from family and friends is a particularly strong enabler of healthy lifestyle change in pregnancy (Heery et al., 2013; Jelsma et al., 2016; Sui et al., 2013). This once again highlights the importance of involving family and friends in future health interventions during pregnancy.

While our study provided many findings consistent with published research in the area, a novel, although unsurprising, finding of our research was the influence that historical context exerts over present-day beliefs, ideals and habits regarding food choices and physical activity behaviours. However, the fundamental value of this study is that it corroborates previous findings in this area in an Irish population. In doing so, it adds to the weight of evidence from similar qualitative studies conducted in developed countries, thereby increasing confidence that previous findings were not limited to their particular participants and are likely to be reflected globally in communities with a similar socio-economic diversity.

Implications for practice

The findings of this qualitative study have numerous implications for future lifestyle interventions for overweight and obese pregnant women. The findings indicate that pregnancy is undoubtedly a stimulus for positive changes in food choices, and to a lesser

extent, physical activity behaviours. It is important that healthcare professionals take advantage of this window of opportunity to instil healthy behaviours in overweight and obese pregnant women as this is a time when they are truly open to receiving health messages.

i. Intrinsic motivation to extend healthy behaviours beyond pregnancy

Our findings highlighted that overweight and obese pregnant women are primarily motivated to change behaviour due to external factors, e.g. healthy fetal development, rather than their own desire to make healthy changes for personal gain. This raises the question that if health behavioural changes made during pregnancy are viewed as short-term 'sacrifices' rather than long-term lifestyle changes, they may be unlikely to be sustainable after pregnancy. This supposition identifies the need to communicate alternative reasons to make sustainable, long-term health behavioural changes, aside from the association between adequate nutrition and physical activity with healthy pregnancy outcome. These women appear to identify with a 'carer' role and therefore targeting other factors that they perceive to influence food choice and physical activity behaviours may increase intrinsic motivation to sustain healthy behavioural changes both during and after pregnancy. Bianchi *et al*. (2016) also identified this shift in motivation locus, and suggested that focussing on the wellbeing of both fetus *and* mother could 'positively internalise' motivation. For example, an intervention could highlight the importance of being a good role model for their children who primarily learn early food habits from their parents (Østbye *et al.*, 2013). Similarly, multiparous overweight and obese women could be motivated to exercise if they understand its association with healthy gestational weight gain and improved fitness which may help them to 'keep up with' their children (Gardiner *et al.*, 2012). Highlighting the impact of healthy lifestyle changes on risk of chronic diseases may also improve long-term adherence to behaviour change in older or higher-educated women, who displayed greater future salience than their opposite counterparts.

ii. Use a family-centred and socially-supported approach:

Women's friends, families and particularly children are crucial for building a support network throughout the course of the interventions. Lifestyle interventions must be tailored to work around family life, for example, activities with children, easily-prepared meals that the rest of the family will eat too. By exploiting their self-perception as a role model for their children, the importance of lifestyle change may be understood to a greater extent. Similar to the findings of previous studies (Heery et al., 2013), multiparous women recalled being much busier than they had been during their first pregnancy, largely due to child-minding and occupational responsibilities. These women perceived a good support system in one's social environment as essential for adhering to healthy behaviours despite their demanding lifestyle. The findings of the current analysis support the theory by Heery et al. (2013) that multiparous women may benefit from antenatal education that incorporates time-efficient strategies for integrating healthy eating and physical activity into their daily routines during pregnancy, for example, recommending physical activities that centre around family activities and which do not require a child-minder, or provision of healthy meal ideas that are suitable and acceptable to all family members.

iii. Empowerment

While it is evident that these women are eager to make healthy lifestyle choices, they feel that the wider obesogenic macro-environment in which they live undermines their efforts to do so. Maintaining an internal locus of health control empowers people to make healthier choices despite the challenges in their environment. Therefore, healthy lifestyle interventions for overweight and obese pregnant women should address the barriers to healthy living that are most commonly cited by this population group – these factors have been identified by Sui et al. (2013a) as pregnancy symptoms, psychological feelings, low income, the environment, lack of time and child care. The same study also found that overweight and obese pregnant

women are more women were more sensitive to barriers than enablers, indicating that future studies promoting healthy eating and physical activity should address barriers; by challenging these barriers to change, the locus of health control may be re-aligned to an internal locus.

Furthermore, accounts from the women indicate that many of them have a history of dieting and may have experienced weight bias in the past, resulting in low self-efficacy and little confidence in their ability to make and sustain positive dietary and physical activity changes. Therefore, the use of *behavioural* goals rather than *numerical* targets may be more empowering and attainable for these women. For example, instead of describing the amount of weight that they should gain during pregnancy, set a goal of 30 minutes of moderate intensity exercise at least 5 days per week, and discuss how this might realistically fit in to their lifestyle. The rate of weight gain varies significantly throughout pregnancy, and if the woman is gaining over or under this rate, it may cause her unnecessary anxiety. Choosing behavioural goals gives the woman a sense of control and ownership over weight gain; she will know that regardless of her rate of weight gain, she is completing the recommended amount of exercise for a healthy pregnancy. Additionally, exploring strategies that have worked in the past; encouraging the women to talk about their past and present successes; and drawing attention to success in other areas of their life can also be empowering and help to raise confidence in their ability to make and sustain healthy behavioural changes (Rapoport & Pearson, 2007).

Strengths and limitations

This paper adds value to the weight of evidence from other qualitative studies conducted in developed countries which explore overweight and obese women's perspectives on perceived influences on food choice and physical activity. Our findings confirm that, in an Irish pregnant population, women's barriers and enablers to engaging in exercise and making

healthy food choices during pregnancy are similar to those reported elsewhere. Thus, future behaviour-change healthy lifestyle interventions among overweight and obese pregnant women, that may be found to induce positive changes, may indeed be translatable to numerous populations. The reported findings were strengthened using COREQ (Tong et al., 2007), the consolidated criteria for reporting qualitative research. Purposive sampling using a large sample ensured representation of all levels of educational attainment and parity was a key strength of the study. A wide range of measures were employed to strengthen the validity of the data, including triangulation analysis by a third party. The women were also interviewed in late pregnancy (34 weeks' gestation), which allowed them to describe their changing food choice and physical activity trajectory prior to and during each stage of pregnancy. However, while social desirability bias was minimised, lifestyle behaviours are self-reported, and may be subject to bias. It is also possible that the women recruited to take part in these qualitative interviews were more motivated and interested in healthy eating and exercise than the general pregnancy population, by the very nature of their interest in partaking in the qualitative interviews. Another limitation of the study is that results may not be generalisable to pregnant women with a BMI less than 25kg/m^2. However, the purpose of qualitative research is to gain deeper understanding, not to generate generalisable results.

Conclusions

The current study identified that pregnancy is a powerful stimulus for positive changes in food choices and, to a lesser extent, physical activity behaviours. This change is driven by a sense of duty to the fetus, and a desire for healthy pregnancy outcome; therefore, as this change is not intrinsically motivated, changes made during pregnancy may not be sustained long-term. Healthy lifestyle interventions for overweight and obesity should aim to sustain positive changes beyond pregnancy by intrinsically motivating and empowering these

women, and by employing a family-centred and socially-supported approach which focuses on behavioural goals, rather than numerical targets.

Unanswered questions and future research

The potential of sustaining positive antenatal behavioural changes beyond pregnancy itself needs to be investigated further, as well as the influence of including partners, family and friends in these antenatal interventions, as well as the role that empowerment and self-efficacy plays in this behavioural change. A randomised controlled trial incorporating these elements in the intervention group would be useful to establish the specific type of antenatal intervention that will support overweight and obese pregnant women to make and sustain healthier food choices and physical activity during pregnancy and beyond.

Acknowledgements

O.O.B., M.M.C. and F.M.M. designed the study. O.O.B conducted the interviews and thematic analysis and drafted the manuscript. M.K. assisted in recruitment of the patients, H.A.S helped draft and edit the manuscript, K.L. contributed to data interpretation so as to minimise interpreter bias. M.M.C., F.M.M., K.L., H.S., M.K. and A.M.G. reviewed and approved the final manuscript. Equip Business Solutions provided transcription services. This work was supported by the National Maternity Hospital Medical Fund, University College Cork and University College Dublin who had no role in the design, analysis or writing of this article.

REFERENCES

Adamo KB, Ferraro ZM, Brett KE. Can we modify the intrauterine environment to halt the intergenerational cycle of obesity? Int J Environ Res Public Health 2012;9:1263-1307.

Anderson AS. Symposium on 'nutritional adaptation to pregnancy and lactation'. Pregnancy as a time for dietary change? Proc Nutr Soc 2001;60:497-504.

Arendas K, Qiu Q, Gruslin A Obesity in pregnancy: pre-conceptional to postpartum consequences. J Obstet Gynaecol Can 2008;30:477-488.

Atkinson L, Shaw RL, French DP. Is pregnancy a teachable moment for diet and physical activity behaviour change? An interpretative phenomenological analysis of the experiences of women during their first pregnancy. Br J Health Psychol 2016;21(4):842-858.

Bandura A. Social Learning Theory. Englewood Cliffs, NJ: Prentice Hall. 1977.

Bassett-Gunter RL, Levy-Milne R, Naylor PJ, Symons Downs D, Benoit C, Warburton DER *et al.* Oh baby! Motivation for healthy eating during parenthood transitions: a longitudinal examination with a theory of planned behavior perspective. Int J Behav Nutr Phys Act 2013;10:88.

Bianchi CM, Huneau JF, Le Goff G, Verger EO, Mariotti F, Gurviez P. Concerns, attitudes, beliefs and information seeking practices with respect to nutrition-related issues: a qualitative study in French pregnant women. BMC Pregnancy Childbirth 2016;16(1):306.

Branum AM, Kirmeyer SE, Gregory ECW. Pre-pregnancy body mass index by maternal characteristics and state: data from the birth certificate, 2014. National Vital Statistics Reports. 2016;65(6):1-10. Hyattsville, MD: National Centre for Health Statistics.

Braun V & Clarke V. Using thematic analysis in psychology. Qualitative research in psychology. 2006;3:77-101.

Braver TS, Krug MK, Chiew KS, Kool W, Westbrook JA, Clement NJ Mechanisms of motivation–cognition interaction: challenges and opportunities. Cogn Affect Behav Neurosci 2014 14(2): 443–472.

Callaghan P. Social support and locus of control as correlates of UK nurses' healthrelated behaviours. J Adv Nurs 28;1998:1127-1133.

Charmaz K. Constructing grounded theory: A practical guide through qualitative analysis: Thousand Oaks, CA:Sage; 2006.

Department of Health (UK). Reducing obesity and improving diet. 2013. [https://www.gov.uk/government/policies/reducing-obesity-and-improving-diet]. Accessed 23 May 2013.

Devine CM & Olson CM. Women's dietary prevention motives: Life stage influences. J Nutr Educ 1991;23:269–274.

Devine CM & Olson CM. Women's perceptions about the ways social roles promote or constrain personal nutrition care. Women Health 1992;19:79–95.

Devine CM, Bove CF, Olson CM. Continuity and change in women's weight orientations and lifestyle practices through pregnancy and the postpartum period: the influence of life course trajectories and transitional events. Soc Sci Med 2000;50:567-82.

Edward P & Tsouros A. Promoting physical activity and active living in urban environments. The role of local governments. Geneva: World Health Organization. 2006.

Furst T, Connors M, Bisogni CA, Sobal J, Falk LW. Food choice: a conceptual model of the process. Appetite 1996;26, 247-65.

Frederick IO, Rudra CB, Miller RS, Foster JC, Williams MA. Adult weight change, weight cycling, and prepregnancy obesity in relation to risk of preeclampsia. Epidemiology 2006;17:428-434.

Guihard-Costa AM, Papiernik E, Kolb S. Maternal predictors of subcutaneous fat in the term newborn. Acta Paediatr 2004;93:346-349.

Gardiner B, Croker H, Barr S, Briley A, Poston L, Wardle J on behalf of the UPBEAT Trial. Psychological predictors of dietary intentions in pregnancy. J Hum Nutr Diet 2012;25:345-353.

Galobardes B, Shaw M, Lawlor DA, Lynch JW. Indicators of socioeconomic position (part 1). J Epidemiol Community Health 2006;60(1):7-12.

Health and Social Care Information Centre. Statistics on obesity, physical activity and diet, England – 2015. ISBN 978-1-78386-335-8. Available at: http://www.hscic.gov.uk/pubs/sopad15 [Accessed 5 November 2016]

Heery E, McConnon Á, Kelleher CC, Wall PG, McAuliffe FM. Perspectives on weight gain and lifestyle practices during pregnancy among women with a history of macrosomia: a qualitative study in the Republic of Ireland. BMC Pregnancy Childbirth 2013;13:202.

Inskip HM, Crozier SR, GodfreyKM, Borland SE, Cooper C, Robinson SM. Women's compliance with nutrition and lifestyle recommendations before pregnancy: general population cohort study. BMJ 2009;338,b481.

Jelsma JG, van Leeuwen KM, Oostdam N, Bunn C, Simmons D, Desoye G, et al. Beliefs, Barriers, and Preferences of European Overweight Women to Adopt a Healthier Lifestyle in Pregnancy to Minimize Risk of Developing Gestational Diabetes Mellitus: An Explorative Study. J Pregnancy 2016;3435791.

Lachman ME & Weaver SL. The sense of control as a moderator of social class differences in health and well-being. J Pers Soc Psychol1998;74:763-773.

Lent RW, Brown SD, Hackett G. Contextual supports and barriers to career choice: a social cognitive analysis. J Couns Psychol 2000;4:36-49.

Martikainen P, Brunner E & Marmot M. Socioeconomic differences in dietary patterns among middle-aged men and women. Soc Sci Med 2003;56:1397-1410.

McCartney DMA, Younger KM, Walsh J, O'Neill M, Sheridan C, Kearney JM. Socio-economic Differences in Food Group and Nutrient Intakes among Young Women in Ireland. BJN, 2013;110(11):2084-97.

McGowan CA & McAuliffe FM. Maternal dietary patterns and associated nutrient intakes during each trimester of pregnancy. Public Health Nutr 2013;16:97-107.

McKeating A, Maguire PJ, Daly N, Farren M, McMahon L, Turner MJ. Trends in maternal obesity in a large university hospital 2009–2013. Acta Obstet Gynecol Scand 2015; 94(9): 969–975.

Miller WR & Rollnick S. Motivational Interviewing: Preparing people too change addictive behaviour. New York: Guildford Press. 2002.

Murray SA. Experiences with "rapid appraisal" in primary care: involving the public in assessing health needs, orientating staff, and educating medical students. BMJ 1999;318:440-444.

National Maternity Hospital (NMH). Clinical report for the year 2011. 2011.

Nitert MD, Foxcroft KF, Lust K, Fagermo N, Lawlor DA, O'Callaghan M, et al. Overweight and obesity knowledge prior to pregnancy: a survey study. BMC Pregnancy and Childbirth 2011;11:96.

Olson CM. Tracking of food choices across the transition to motherhood. J Nutr Educ Behav 2005;37(3):129-36.

O'Brien TE, Ray JG, Chan WS. Maternal body mass index and the risk of preeclampsia: a systematic overview. Epidemiology 2003;14:368-374.

Østbye T, Malhotra R, Stroo M, Lovelady C, Brouwer R, Zucker N et al. The effect of the home environment on physical activity and dietary intake in preschool children. Int J Obes (Lond) 2013;37:1314-1321.

Padmanabhan U, Summerbell CD, Heslehurst N. A qualitative study exploring pregnant women's weight-related attitudes and beliefs in UK: the BLOOM study. BMC Pregnancy Childbirth 2015;15:99.

Rapoport L & Pearson D. Changing health behaviour. In 'Manual of Dietetic Practice. 4th edition.' Eds. Thomas B, Bishop J. Blackwell publishing, Oxford, 2007:46-58.

Rollnick S, Mason P, Butler C. Health Behaviour Change. Edinburgh: Churchill Livingstone. 1999.

Ruggiero LJ, Tsoh Y, Everett K, Fava JL, Guise BJ. The trans-theoretical model of smoking: comparison of pregnant and non-pregnant smokers. Addict Behav 2000;25:239-251.

Safefood. The cost of overweight and obesity on the island of Ireland. 2013. [http://www.safefood.eu/SafeFood/media/SafeFoodLibrary/Documents/Publications/Research%20Reports/Final-Exec-Summary-The-Economic-Cost-of-Obesity.pdf]. Accessed 30 April 2013.

Siega-Riz AM, Bodnar LM, Savitz DA (2002) What are pregnant women eating? Nutrient and food group differences by race. Am J Obstet Gynecol 2002;186:480-486.

Strauss AL & Corbin JM. Basics of qualitative research: grounded theory procedures and techniques. Newbury Park, Calif: Sage Publications. 1990.

Sui Z, Turnbull DA, Dodd JM. Overweight and obese women's perceptions about making healthy change during pregnancy: A mixed method study. Matern Child Health J 2013;17(10):1879-1887.

Sui Z, Turnbull D, Dodd J. Enablers and barriers to making healthy change during pregnancy in overweight and obese women. AMJ 2013a;6(11):565-577.

Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. Int J Qual Health Care 2007;19:349-357.

Wardle J & Steptoe A. Socioeconomic differences in attitudes and beliefs about healthy lifestyles. J Epidemiol Community Health 2003;57:440-443.

Weir Z, Bush J, Robson SC, McParlin C, Rankin J, Bell R. Physical activity in pregnancy: A qualitative study of the beliefs of overweight and obese pregnant women. BMC Pregnancy Childbirth 2010;10:18.

Weisman CS, Hillemeier MM, Downs DS, Chuang CH, Dyer AM. Preconception predictors of weight gain during pregnancy: prospective findings from the Central Pennsylvania Women's Health Study. Womens Health Issues 2010;20:126-132.

Walsh JM, McGowan CA, Mahony R, Foley ME, McAuliffe FM. Low glycaemic index diet in pregnancy to prevent macrosomia (ROLO study): randomised control trial. BMJ 2012;345:e5605.

FIGURES

Figure 1: Personal quote from semi-structured interview with study participant

Figure 2: Personal quote from semi-structured interview with study participant

Figure 3: Personal quote from semi-structured interview with study participant

Figure 4: Personal quote from semi-structured interview with study participant

Figure 5: Personal quote from semi-structured interview with study participant

Figure 6: Personal quote from semi-structured interview with study participant

Figure 7: Personal quote from semi-structured interview with study participant

Figure 8: Personal quote from semi-structured interview with study participant

Figure 9: Personal quote from semi-structured interview with study participant

TABLES

Table 1. Characteristics of interview participants as recorded in early* pregnancy (*n* = 22)

TABLES

Table 1. Characteristics of interview participants as recorded in early* pregnancy (*n* = 22)

	Mean	**SD**
Age (y)	32.3	4.5
Early pregnancy weight (kg)	76.0	9.5
Height (m)	1.67	0.1
BMI (kg/m^2)	27.4	2.6
	n	**%**
BMI category		
Overweight	19	86.4
Obese	3	13.6
≥3rd level education†	12	54.5
Smoker	2	9.1
Irish Caucasian‡	21	95.5
Primiparous	9	40.9

* Data recorded between 12-18 weeks gestation; †Attainment of college/university bachelor degree or higher; ‡Other ethnic background of cohort was Caucasian European.

"My main concern is kind of losing weight – not nutrition."

– Deirdre, age 22, nulliparous, BMI 29, white Irish, 2nd level education

"I suppose just as the years progress, you know, you have to think for the future, because what you do right now will definitely benefit you for the future. And that's the way I look on it, you know. I think in your early twenties, you're out and what not and you know, your whole perspective on life completely changes." – Mary, age 30, nulliparous, BMI 25, white Irish, 3rd level education

"To keep myself healthy, I have two young kids you know I want to be able to see them grow up." – Deborah, age 44, parity 2, BMI 26, white Irish, 2nd level education

"I don't want to sit there on the side line, clapping and thinking that they're great and knowing me, a big fat ass, as I'm driving them to all their sporting activities…. When I had my daughter, I just thought I have to get myself under control, because I never want her to be battling with her weight. And the only way I can do that is by sorting myself out and that she'll only ever see me as being active and fit and healthy… For her I wanted her to know that it wasn't good enough to be getting heavy and to be suffering with health problems and your weight going up and down." – Nicole, age 36, parity 4, BMI 25, white Irish, 3rd level education

"All of a sudden you get pregnant and you're like, right, I really should be doing A, B, C and D… If you're so used to yourself there's a certain sense of I suppose complacency there, whereas suddenly when you're pregnant, it's novel, you've never been pregnant before, you don't know what to do, right, but you know the way you're going isn't the way you know…. When you have a little one inside you have a responsibility to the little one, you've a responsibility to yourself and you have a responsibility to your partner because they are too involved in this, like they have created the little one too." – Dianne, age 39, parity 0, BMI 25, white Irish, 2nd level education

"I think in all honesty if there was somebody with me, like as in 'Come on now, Wednesday at seven we are going to the gym' or knocking on your door and 'We are going for the walk' I wouldn't bail, I'd be very committed. But because I can bail on myself I'll just think 'Oh, I'll do it tomorrow'." – Gwen, age 33, parity 1, BMI 27, white Irish, 2nd level education

"I was always heavy and tall and so school sport, I hated it, and then the argue of the teacher that 'You can't', you know, 'You're not living up to the standards'. But what was the problem… That the teacher is already having the mark on you 'Oh you're overweight and you're heavy and you're just fat and lazy' and so it doesn't ... that person doesn't have the time nor the will to guide you to do the kind of sport that suits your certain state... going into a gym and seeing all these muscles around is for me just a kind of parade of arrogance. I mean you know they don't need to go to the gym… I didn't fit in." – Susan, age 35, parity 1, BMI 38, White European, 3rd level education

"I think city life is probably not good for me...Takeaways and stuff, everything is delivered, you find stuff to do that's not even that active, like go to the cinema… It's just too easy to be bold."
– Polly, age 29, parity 1, BMI 26, white Irish, 3rd level education

"It used to be so expensive for Cornflakes and so cheap for porridge and it was always if you had less money you made you already made better choices… Now I don't know how they are doing chocolate and doughnuts so cheap… The people eating free range eggs and wholegrain bread are middle class… They are educated people."
– Kelly, age 34, nulliparous, BMI 26, white Irish, 3rd level education

Highlights (for review)

Key Messages:

- Personal, social and environmental factors affect food choice/physical activity behaviours.
- Pregnancy was a stimulus for positive changes in food choices.
- Motivated by duty to baby and desire for healthy fetal development/pregnancy outcome.
- Strategies: behavioural goals, intrinsically motivate/empower, ensure social support.