BMJ Open

Inability to control gestational weight gain: an interpretive content analysis of pregnant Chinese women

Xiuting Mo ,[1] Jiangxia Cao,[2] Hong Tang,[3] Kikuko Miyazaki,[1] Yoshimitsu Takahashi,[1] Takeo Nakayama[1]

To cite: Mo X, Cao J, Tang H, *et al*. Inability to control gestational weight gain: an interpretive content analysis of pregnant Chinese women. *BMJ Open* 2020;**10**:e038585. doi:10.1136/bmjopen-2020-038585

► Prepublication history and supplemental material for this paper is available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2020-038585).

Received 17 March 2020
Revised 09 November 2020
Accepted 23 November 2020

[1]Department of Health Informatics, Kyoto University Graduate School of Medicine & School of Public Health, Kyoto, Japan
[2]Department of Women's Healthcare, Wuhan Children's Hospital (Wuhan Maternal and Child Healthcare Hospital), Tongji Medical College, Huazhong University of Science & Technology, Wuhan, China
[3]Obstetrics and Gynecology Clinic, The Fourth Hospital of Jinan, Jinan, China

Correspondence to
Xiuting Mo; moxiuting@qq.com

ABSTRACT

Objective This study aims to explore barriers to controlling gestational weight gain in pregnant Chinese women.

Design Data were collected through semistructured interviews with pregnant women experiencing excessive gestational weight gain who struggled with weight management, and the data were examined using an interpretive content analysis.

Settings and participants Fifty participants (≥18 years, with excessive gestational weight gain) were recruited when they visited the hospital for antenatal health checkups in Wuhan city (n=36) and Jinan city (n=14) between September and October 2018.

Results Interpretive content analysis identified 75 barriers after examining diet, physical activity levels and general issues stemming from knowledge and beliefs, and physical, social, logistical, emotional and structural characteristics. Compared with reported deductive codes, this study inductively extracted 15 new codes. The most frequent codes showed that expectant grandparents greatly influenced pregnant women's lifestyles, through overprotection, traditional and conservative ideas and practices, and a lack of reliable knowledge or acceptable guidance on gestational weight control.

Conclusions This study provides a better understanding of the most important obstacles faced during decision making about gestational weight control in Chinese settings, especially the influence of traditional ideas/practices and expectant grandparents. Identifying the specific barriers to weight control should facilitate potential tailored supportive interventions. More efforts on health education for the whole family and a better use of maternal handbooks would be particularly beneficial.

Strengths and limitations of this study

- This is the first study to explore barriers of gestational weight management for pregnant Chinese women.
- This study used interpretive content analysis, a combination of deductive and inductive approaches that allows the generation of codes with Chinese characteristics to be as comprehensive as possible.
- Potential biases in the sample selection and limited information from pregnant women in remote rural areas are the limitations of the study.
- Another limitation is that because the data collection was done in the hospital's waiting room, interview time was relatively limited.

INTRODUCTION

From 2005 to 2014, in China, the number of overweight pregnant women increased by 71.2%.[1] In general, about 25%–45.9% of pregnant women experience gestational weight gain (GWG) above the range recommended by the US Institute of Medicine (IOM, 2009).[2–4] Excessive GWG puts both mother and baby at risk for obesity, which has been linked to an increased risk of complications during pregnancy and birth, including pregnancy-induced hypertension, gestational diabetes mellitus,[5] increased emergency and elective caesarean section rates,[6] increased induction of labour rates, venous thromboembolism and increased postpartum haemorrhage.[7]

There are also increased risks for the child, including preterm birth, shoulder dystocia, admission to a neonatal unit, birth defects (eg, spina bifida, omphalocele), stillbirth, macrosomia, fetal and neonatal death and poor Apgar scores.[8 9] In addition, these infants are less likely to be breastfed[10] and more likely to be overweight during childhood.[7] Consequently, health service costs are significantly higher for overweight and obese pregnant women, compared with women in the normal weight range.[11] Antenatal care costs may be 5–16 times higher in overweight and obese women.[8]

Many studies have tried to find potential barriers for pregnant women in controlling GWG, including biological and socioenvironmental factors.[12–15] One systematic review and meta-synthesis of qualitative research on pregnant women's perceptions of GWG comprehensively summarised barriers and facilitators according to papers published between 2005 and 2015.[12] According to the

study, these barriers were distributed among women's eating habits, physical activity and general ideas on weight control. Generally, insufficient knowledge, incorrect beliefs and limited social and economic resources lead to women's unhealthy behaviours, including excess nutrient intake and insufficient exercise.[12] Later studies have stressed the need for increased—and more detailed and personalised—health and dietary advice from healthcare providers, who are the most trusted source of knowledge for pregnant women.[13 15 16] One study made the point that women's behaviours are often driven by the idea of compartmentalising how they perceive their body into 'my pregnancy' (the bump) and 'me' (the rest of my body), which is a central concept in pregnant women's beliefs about diet and physical activity: limiting weight gain for 'me,' but gaining enough weight for 'baby.'[15] Some challenges for obese women in minority groups have also been discussed,[17 18] and a culturally tailored term (instead of obesity) was found for them.[18]

However, related qualitative studies in China and other parts of Asia are limited. Most existing literature on this topic focuses on high-income countries;[12] however, China is a developing Asian country and has different cultural and healthcare systems, which could lead to different barriers to controlling GWG for pregnant Chinese women. Several related surveys on pregnant Chinese women showed a very low awareness rate for healthy gestational weight control (20–30%) and low health literacy.[19–21] Therefore, this study aimed to determine the most strongly held beliefs that influence weight control intentions among Chinese pregnant women, as well as any barriers that prevent positive eating habits and exercise.

METHODS

In this study, interpretive content analysis from a constructivist, epistemological perspective was used to interpret the qualitative data and identify potential barriers for pregnant Chinese women.[22] This analysis deductively drew from ideas present in prior literature, yet each code was inductively supported by content found in the participants' comments.

Participants

Pregnant women (outpatients) attending antenatal health checkups at the Maternal and Child Health Centre in Wuhan and No. 4 Hospital in Jinan were recruited for the study. Inpatient pregnant women and new mothers (those who gave birth up to 1 week prior) were also visited. They were approached by local healthcare providers, and those with excessive GWG (above the range recommended by the IOM, as of 2009) were introduced to XM (female) and provided with information about the research study. Those who were willing to participate in an interview read and signed a written informed consent form. Participants included women in different gestational weeks, women with different body mass index (BMI) scores prior to pregnancy (pre-BMIs), and women with different socioeconomic backgrounds. After the interview, a gift valued at ¥500 was given to each participant.

Data collection

Using convenience sampling, individual semistructured interviews with a short questionnaire were carried out between September and October 2018. Interviews lasted approximately 15–30 min while the women were either waiting for or had already finished their check-ups. Interviews with outpatients were conducted in a specially designated area near the waiting room while interviews with inpatients were conducted in the ward, both conditions without other people in the vicinity. A few interviews were conducted in the presence of someone who had accompanied the participant to the check-up in the ward, and only at the participant's request. The short questionnaire included participants' demographic information and smoking and alcohol consumption habits. Qualitative data about diet and exercise (usual practice, any changes before and after pregnancy) and weight management (general idea, adequate weight gain, health information resources and living environment) were collected using open-ended questions.

All interviews were conducted by XM (female, researcher) and supported by KM (female, gynaecologist) and HT (female, nurse). Data collection took place in Wuhan, the capital city of Hubei Province, located in central China, and Jinan, the capital city of Shandong Province, located in northeast China. As the last three participants repeated information on potential barriers to gestational weight control that had been provided by previous participants, data saturation was assumed, at which point sampling was stopped.

Qualitative data were collected from questions about participants' pregnancy environment, information sources and reliability, diet and exercise behaviours, and opinions on weight management. All interviews were audio recorded and transcribed by XM.

Data analysis

Descriptive statistical analysis of questionnaire data was performed using EXCEL to summarise the demographic and gestational information. Qualitative data were managed and analysed using NVivo V.11.

Both inductive and deductive codes were generated in this study. First, a deductive coding framework was developed by an expert panel of three midwives (Ueda Kayo, Takeshita Mai and Marui Kanae) and one researcher (XM).[12] Then, inductive emergent codes were generated on the basis of interview data to replenish the reported code list by two independent coders (XM and Gong Yixiong). The data were then back-translated into English. XM and GY reviewed the first 15 samples in Chinese, compared the original coding framework, reconciled any differences, and then finalised a preconsolidated code list in Chinese. According to that code list, MXT finished the rest of the coding. The preconsolidated code list was discussed in a qualitative study group,

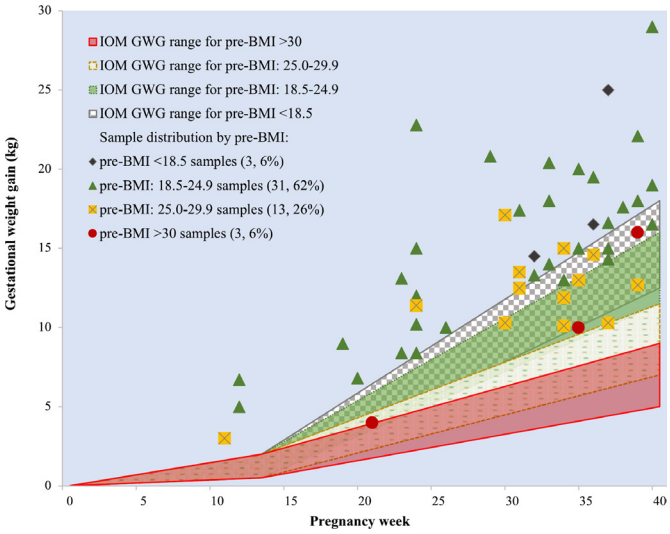

Figure 1 Pregnant women's pregnancy week and GWG. Pregnant women (dots) with different pre-BMIs have different GWG upper threshold recommendations in different colours. BMI, body mass index; GWG, gestational weight gain; IOM, Institute of Medicine.

and code frequencies were displayed in order to compare them with studies from other countries. The entire analysis was conducted under the supervision of KM and TN. We used the Consolidated criteria for Reporting Qualitative research in describing the results (see online supplemental table 1).[23]

Patient and public involvement

Neither the patients nor the public were involved in either the design or analysis of the study. However, prior to the main interviews, telephone interviews on pregnant women were conducted from December 2017 to January 2018 in order to better develop the questionnaire and interview outline. As we did not have direct contact with our interviewees, we were unable to offer them access to the study results; however, we plan to publish via open access, so interested participants can access these results.

RESULTS

Participants characteristics

Fifty-one pregnant women responded, and 50 were included in the analysis; one did not complete the interview and was thus excluded. Thirty-six were from Wuhan (31 outpatient and 5 inpatient) and 14 were from Jinan (10 outpatient and 4 inpatient). Mean participant age was 31 years (range: 22–40); mean height was 162.4 cm (range: 148.0–172.0 cm). Of the participants, 23 (46%) had a college degree and 5 (10%) had a graduate degree; 29 (58%) were expecting their first baby. Prior to pregnancy, 13 (26%) were overweight, 3 (6%) were obese, 31 (62%) were at a normal weight and 3 (6%) were underweight. A total of 30 (60%) participants stated they had no job or quit their jobs after pregnancy; 14 (28%) had a sedentary job. Over half (29, 58%) had an unexpected and/or unplanned pregnancy, 18 (36%) reported having had an abortion, and three did answer the question. Most (30, 60%) were living with their parents, and 29 (58%) had family members who smoked. No participants reported a smoking history, but 5 (10%) reported an alcohol history (see online supplemental table 2).

Figure 1 shows the distribution of participants' GWG when they were interviewed. Pregnant women (dots) with different pre-BMIs have different GWG recommendation ranges (stacking areas). Women who experienced excessive GWG are displayed as dots above their respective recommended stacking areas.

Specific barriers

In the systematic review, barrier factors included diet, physical activity and general perspectives with three domains and seven subdomains (knowledge, beliefs, physical characteristics, social characteristics, logic, emotional/psychosocial characteristics and structural characteristic).[12] Fifteen inductive codes were generated after repeated comparison of the contexts to the original dictionaries (72 reported codes). Meanwhile, 12 reported codes were not mentioned in this study or combined into new codes (eg, 04 was combined into a9). In total, 75 (15–12+72) specific barriers were summarised and are displayed in table 1.

Figure 2, a tree map of all codes sized by their frequency, demonstrates the whole framework of barriers in three domains (general, diet and physical activity), indicating seven categories (knowledge, beliefs, physical, social, logistic, emotional and structural) and prominent codes in this study. Larger areas indicate a larger amount of coding (how many pregnant women referred to the specific code/the total coding frequency among all pregnant women). The most frequent codes hinted at several influential factors attributed to GWG: family members (especially expectant grandparents) greatly influenced pregnant women's lifestyles through overprotection, traditional and conservative ideas and practices, and a lack of reliable knowledge or acceptable guidance on gestational weight control. The 10 most frequent codes (corresponding categories) were as follows:

- a2 Family members cook rich food (diet, social).
- 10 Quality, not quantity of food is what is important (diet, beliefs).
- 35 Pregnancy is a time for rest (physical activity, beliefs).
- 09 Pregnancy is a time to eat for two (diet, beliefs).
- 33 Physical activity can harm fetus (physical activity, beliefs).
- 49 Does not understand importance of weight control (general, knowledge).
- 34 Gentle exercise (eg, walking or stretching) is sufficient (physical activity, beliefs).
- a6 Internet information is confusing and unreliable (general, knowledge).
- a3 Compensating for insufficient nutrition (with sugar-dense fruits) (diet, emotional).

Table 1 Codes and frequencies

	Diet	Physical activity	General
Knowledge	01 Does not understand how to eat healthily (0/0) 02 Lack of cooking skills (1/1) 03 Nutritional advice not culturally relevant (1/1) 04 Nutritional info contradictory, confusing, changing (a7)	29 Does not know suitable exercises, intensity, duration for pregnancy (3/4) 30 Does not know about importance of exercise during pregnancy (9/11) 31 Healthcare provider advises very conservative exercise regimen (5/5)	49 Does not understand importance of weight control (22/27) 50 Inconsistent messages about weight from healthcare providers (1/1) 51 Information received too late in pregnancy (13/16) 52 Does not understand how to achieve weight control (8/11) 53 Information alone not sufficient to motivate change (12/12) a6 Internet information is confusing and unreliable (21/24) a7 Insufficient guidance on maternal handbook as an education tool (12/12)
Beliefs	05 Assumes quick postpartum weight loss (4/5) 06 Pregnancy is a vacation from worrying about weight (2/2) 07 Pregnancy is a time to enjoy foods normally avoided (1/1) 08 Concern about providing enough nutrients for baby (3/5) 09 Pregnancy is a time to eat for two (24/29) 10 Quality, not quantity, of food is what is important (32/49) 11 Cravings, aversions determined by baby, body's way of communicating what food to eat or avoid (3/3) a1 Pregnant women cannot eat some foods (taboo) (10/16)	32 Activity in everyday life is sufficient physical activity (9/9) 33 Physical activity can harm foetus (22/30) 34 Gentle exercise (eg, walking or stretching) is sufficient (21/24) 35 Pregnancy is a time for rest (26/35) 36 Not motivated to exercise (11/14) a4 Caesarean delivery, does not need exercise (3/3)	54 Disagrees with healthcare provider advice about weight control in pregnancy (1/2) 55 Health of baby determines appropriate weight gain (7/10) 56 Big babies are healthy babies (4/4) 57 Lifestyle, listening to baby is more important than scale (2/3) 58 Understanding of target weight inconsistent with Institute of Medicine guidelines (9/13) 59 Inaccurate understanding of prepregnancy weight status (4/4) 60 Desire for individualised recommendations (3/4) 61 wt gain and retention is uncontrollable (11/16) a8 Miscarriage happens easily in the first 3 months (16/23) a9 Having a girl means more weight gain (1/1)
Physical	12 Intense hunger (7/9) 13 Nausea and aversions (12/15) 14 Sugar helps overcome fatigue (1/1) 15 Cravings (12/14)	37 Fatigue (6/7) 38 Nausea (3/3) 39 Pregnancy-related soreness, pain, mobility limitation (12/16) 40 Shortness of breath (0)	62 Genetics (6/9) 63 Maternal age (5/9) 64 Medical conditions (5/6) a10 Sleep issues (6/10)
Social	16 Frequently eating outside the home (2/2) 17 Encouragement from friends, family to overeat or gain weight (8/9) 18 Family members have preferences for unhealthy food (2/2) 19 Judgement about diet, weight gain from family members, friends (3/3) 20 Loneliness, isolation, lack of social support (2/2) a2 Family members cook rich food (33/39)	41 Stigma of exercising while obese overweight (0/0) 42 Family, partner preventing activity, removing active tasks (5/8) 43 Loneliness, isolation, lack of social support that encourages activity (3/4)	65 Crude or cruel comments from others (2/3) 66 Pressure to follow family advice over healthcare provider's advice (1/1) 67 Stigma of weight affects interactions with healthcare professionals (0/0) a11 Husband does not pay attention to antenatal care (5/5) a12 Family members think the fatter the better (6/8) a13 A common phenomenon of being overweight (9/10)

Continued

Table 1 Continued

	Diet	Physical activity	General
Logistic	21 Lack of time for planning, shopping, cooking (1/1)	44 Childcare (4/5) 45 Lack of time (physical activity) (3/3) 46 Sedentary job (7/7) 47 Weather prohibitive to outdoor activity (6/9)	68 Rely on healthcare provider to alert to a weight issue (3/4) 69 No regular weight monitoring (4/4) 70 Struggle to maintain lifestyle changes over time (3/3) a14 Weight regain after pregnancy (4/5)
Emotional	22 Compensating for other deprivations (alcohol, cigarettes) with junk food (0/0) 23 Emotional eating as a reaction to stress, depression (1/1) 24 Pleasure from junk food (4/4) a3 Compensating for insufficient nutrition (with sugar-dense fruits) (18/22)	–	71 Feelings of guilt and blame for weight lead to overeating (0/0) 72 Not ready to change lifestyle while pregnant (1/1) a15 Getting used to being overweight (10/10)
Structural	25 Accessibility, prevalence of fast food (4/4) 26 Financial (0/0) 27 Difficulty accessing healthy, fresh food (0/0) 28 Chronic stress (2/2)	48 Finances (0/0) a5 Difficulty accessing a gym for pregnant women (2/2)	–

Initial letter 'a' means added inductive codes. The numbers in the parenthesis represent how many pregnant women referred to the specific code/the total coding frequency among all pregnant women.

- a8 Miscarriage easily happens in the first 3 months (general, beliefs).

Figure 2 shows that the belief barriers (squares in red colour), knowledge barriers (in blue) and social barriers (in yellow) were mentioned most frequently. Detailed explanations and quotes are discussed below.

Inductive codes related to belief barriers

a1 Pregnant women cannot eat some foods (taboo)

Few women said that they 'do not understand how to eat healthy' (code 01). Conversely, pregnant women paid much attention to their daily diet (code 10). Several women mentioned that pregnant women should not eat any food that may break the body's yin-yang balance, like 'Shang huo' food, which is considered to generate too much heat in the body and thus break this balance (such as longan, spicy food, barbecue). 'Cold' food (such as crab) is also taboo and was talked about frequently.

> …everyone says that pregnant women cannot eat longan. (No.11)

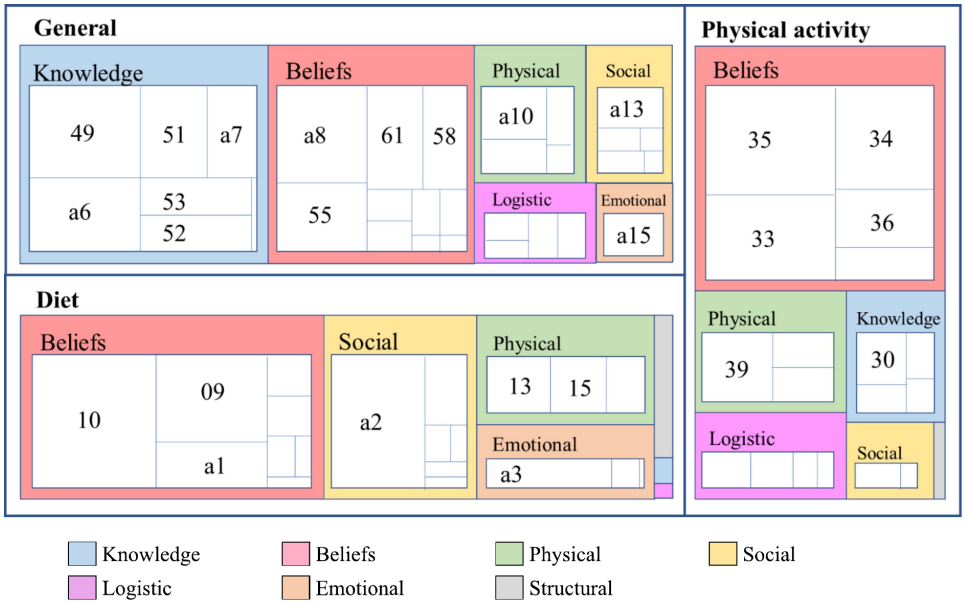

Figure 2 Tree map of specific barriers for pregnant Chinese women. Under the three domains of eating habits, physical activity and general, there were seven subdomains, which are displayed in different colours. larger areas are displayed at the top or on the left of the chart and indicate a larger amount of coding. A code number was marked on this chart if its frequency was more than or equal to 10.

Yes, my diet changed a lot compared with before. I loved spicy food very much before pregnancy and there was no food taboo to me… I stopped eating it when I got pregnant… I would say 'Baidu (the most popular search engine in China)' to search whether it can be eaten or not. You know that crab cannot be eaten, never…I dare not eat it, even though I love crab every much. I could eat 4–5 crabs in one breath before pregnancy, during this time of year. (No. 15)

Some women also expressed high concern for food safety, hygiene and food additives.

I don't eat outside. It's not clean; I'm afraid of diarrhea… (No.8)

The vegetables I buy now are generally not good. I soak them for a long time before I cook. The vegetables were all sprayed with pesticides, a lot of pesticides…I always think our generation is not as healthy as my parents' generation, because they used to eat natural food; what we eat now is all chemicals. (No.15) a4 Cesarean delivery does not need exercise

Exercise during pregnancy does help with a natural delivery; however, some pregnant women used this as an excuse for not exercising, as they had a history of caesarean delivery.

The doctor said even 10 minutes walking every day (would help); besides, the weather has also cooled down, and it would help for functional training in later pregnancy if I want a natural delivery. But the thing is, I wasn't thinking about natural delivery…My first baby was by cesarean section. (No.23)

At that time, I thought I would do cesarean delivery anyway, so I didn't want to exercise. (No. 27) a8 Miscarriage happens easily in the first three months

Quite a few women mentioned a 'Baotai' experience in their early stage of pregnancy, which is Chinese for being hospitalised to prevent a miscarriage. Some of them experienced 'bleeding,' 'low-lying placenta,' or 'lack of progesterone' in the early stage, so they were advised to 'lie in bed' (No. 01).

One participant mentioned fear of miscarriage due to a previous miscarriage experience: I had one, but miscarried at less than two months. Then, this one moved again at less than three months, so I went to the hospital to Baotai. At that time, I just slept all day. I did not move much and got fat. The doctor advised me not to move. The first time I miscarried, and the second one moved again. Of course I was scared. (No. 09)

It is natural that a mother will do anything to protect her baby. Some women thought that not moving, or limiting movement to some extent, protected the fetus, even though they were taught that appropriate exercise is not harmful. I didn't move much in the first three months… For example, a fast walk is definitely a no. You know there is a baby in your belly; you wouldn't dare to mess around. (No. B00)

In the first three months, it was not stable, so I just ate and slept. No walking, and I stayed at home. Now, I go out, because it is stable now. (No. 14)

Personally, it is too hard for me to gain only around ten kg. Because the fetus was not stable in the early stage, I didn't dare to move. There was no exercise and mainly resting in bed. (No. 17)

a9 Having a girl means more weight gain

One pregnant woman mentioned that 'the others all said that if you are having a girl, your whole body would plump out and your skin looks better.' (No. 37) Some folk sayings about how to predict a fetus's gender are very popular in China, as identifying a baby's sex before birth is illegal there.

Inductive codes related to social barriers

a2 family members cook rich food

Similar to codes 17 and 18, which expressed the pressure or influence from family members to overeat or gain weight, this code described a common phenomenon in China in which the parents (usually the mother or mother-in-law) make every effort to take care of their pregnant daughter for fear of insufficient nutrition or miscarriage. For example, they may prepare special meals and Chinese soup for better nutrition.

My mum cooked for me. She cooked the soup for me on time, and she would pay attention to taboos when she cooked the meal… I don't know (taboo), my mum knows, and prepared the food I can eat. (07)

Because I eat too well (I got overweight). For example, the elderly (mother-in-law) either cooked this or cooked that for me, say steamed bun, Caibing, or some rice. Anyway, every day is different at dinner. Anyway, I don't know how to cook and don't want to cook. My mother-in-law does all the cooking… (No. 54)

My parents prepared my meals. Before I got GDM, I had to eat everything they prepared. Otherwise, they would feel unhappy about it: 'it is not easy to make a meal for you, right?' After I found out I had GDM, I found out that I should not eat too much… They think it is better to eat more. Heavy oil and heavy salt, meat. Some opinions differ from [those of] young people. (No. 35) a11 Husband/partner does not pay attention to antenatal care

Although it is women who get pregnant, their partners play a key role in antenatal healthcare. Some women mentioned that their husbands did little in regard to antenatal care. My husband knew even less (about antenatal care). Also, he didn't attend the education class in the hospital, because both of us are too busy at work. (No. 03)

He is insensitive and pays no attention to these (antenatal care). (No. 38)

a12 Family members think the fatter the better

As mentioned above (a3), Chinese mothers or mothers-in-law often play a big part in a woman's pregnancy. The traditional view that 'fatter is better' greatly influences pregnant women's lifestyles. This old view is not limited to elderly family members, but younger relatives as well.

> The old generation is different from us. They don't care about being overweight. I told them that I gained too much actually… But they don't believe me… they think the fatter the better.

a13 A common phenomenon of being overweight

Some pregnant women do not consider being overweight to be a problem, due to the common phenomenon of pregnant women being overweight. Some of them also had an experience of being overweight previously.

> I don't know how much weight is appropriate, but I know many are like me, gaining a lot of weight. For example, my sister gained over 25 kg. (No. 28)

> I gained 25 or 30 kg when I was having the first baby. I was 60 kg before but when I gave birth, I was over 90 kg. In 2008 in my hometown, I did the health checkup normally too, but the others didn't say I was overweight. (No. 08)

Inductive codes related to knowledge barriers

A6 internet information is confusing and unreliable

A percentage of pregnant women complained about the low quality of health-related information on the Internet (21, 42%), while even more (44, 88%) mentioned the Internet as being their main health-related information resource. Participants commented on various concerns, including 'all the ads' (No. 05), '(too horrible) makes me want to die' (No. 08), '(information) not consistent' (No. 22) and 'it makes me think too much' (No. 41).

> I don't believe in Baidu, as what Baidu recommended is all ads. None really answer questions, [they're only] all the hospital ads. (No. 05)

> I don't believe in the Internet (information); (too horrible) it makes me want to die… I check the info on the net, but I don't believe it. I consult the doctor. (No. 08)

> The statements from the Internet are not consistent. Sometimes it says I can eat this, I cannot eat that. But when I search on another site, it says the opposite. (No. 22)

In contrast, only 4 (8%) women said that their doctor was their main information resource, 9 (18%) mentioned books and 19 (38%) mentioned relatives or friends.

a7 Insufficient guidance on maternal handbook as an education tool

> It (weight gain recommendation) should be written in the handbook, but I don't know how much is appropriate. (No. 28)

During the interview, we noticed that among 50 pregnant women, only one woman tried to draw a weight gain chart but gave up midway. 'I think the weight gain chart is unreasonable, because it doesn't matter how fat or how thin (I am)' (No. 35). Unfortunately, she misunderstood the chart and had no specific guidance on how to use the tool. The other pregnant women just ignored the related educational information and left the chart blank.

> The doctor didn't tell me about it. (No. 38, 40)

> Some women mentioned that their doctors were not being educators. Often, rather than educating in advance, doctors gave advice or a reminder after women had already gained excessive weight. When my weight increased from 83.9 kg to 86.1 kg, the doctor reminded me to watch out for weight…If I had conscious control (over my weight), I would never eat like that. (No.33)

Along with the barriers listed above, other newly added inductive codes also deserve attention (see online supplemental table 3), for example, emotional barrier a3 (Compensating for insufficient nutrition with sugar-dense fruits) induced by 'bad appetite during pregnancy' and 'perceiving fruits to have high nutritional value.' Emotional barrier a15 (Getting used to being overweight) draws from women with high pre-BMIs, who tried many times to lose weight but failed. Logistical barrier a14 (Weight regain after pregnancy) explained the sharp weight rebound for those women with higher weights who maintained a strict diet to prepare for pregnancy but suddenly stopped dieting after pregnancy. Further, perceived sleep issues (a10) due to insomnia or sleeplessness and difficulties accessing a gym for pregnant women (a5) were also added.

DISCUSSION

This qualitative research reveals specific barriers to gestational weight control in Chinese culture. Our findings about diet, physical activity, and general perspectives confirm and extend previous research. Further, our data emphasise several points.

1. Overprotection and traditional ideas and practices: Conservative ideas such as 'eat for two,' 'time for rest' and 'physical activity harms the fetus are very common in pregnant women with excessive GWG. Instead of a lack of attention to antenatal care, pregnant Chinese women devote particular care to their daily diet, for example, by avoiding taboo foods and wanting perceived proper nourishment (codes 10 and a1). The concepts of taboo foods and proper nourishment during pregnancy are very popular in China and are greatly influenced by traditional Chinese medicine/Chinese food therapy.[24 25] In addition, overprotection is easy to understand because of the 'precious baby' idea in China, due to the long-lasting one-child policy (1982–2016) and the soaring infertility rate.[26]

2. Expectant grandparents greatly influence pregnant women's lifestyles: As mentioned above, the 'precious baby' usually carries three families' hopes and love, which means multiple caregiving by two parents and four grandparents. It is common, especially in urban areas, for grandparents to be responsible for cooking and childcare, while the middle generation goes off to work.[27] As some women mentioned, it is very difficult to refuse their parents' 'soup,' full of kindness and deep love.
3. A lack of reliable knowledge and acceptable guidance on gestational weight control: Pregnant women heavily rely on the Internet for health-related information. The internet can greatly improve convenience in obtaining information, but also contains some fake or confusing information, which may cause worries or even depression. Generally, information about recommended weight gain for pregnant women is printed as a weight gain chart in the Maternal and Child Handbook, which is given to women when they create a profile for their pregnancy at a healthcare centre or hospital. However, the Maternal and Child Handbook was not found to play a role as an educational tool, but mainly served as a place to record health check-up results.

Strengths and limitations

To our knowledge, this was the first study to use qualitative study methods to explore barriers for pregnant Chinese women trying to control GWG. It used a framework that allowed for the generation of codes with Chinese characteristics to be as comprehensive as possible. A strength of this work is that we used interpretive content analysis, a combination of both deductive and inductive approaches to understanding and performing coding, which both explores answers beyond descriptive questions of 'what' and 'how' and provides inferences about 'why,' 'for whom,' and 'to what effect.' It also goes beyond a simple frequency approach and provides data for making inferences from the content.[28]

Participants came from Wuhan (an urban area) and Jinan (an urban to rural area), including people from central and northeastern China, among whom the majority were living in urban areas. We recruited participants in the hospital, which naturally excluded those who may not be able or unwilling to attend health check-ups. Thus, there may have been a selection bias involving socioeconomic background, and some groups of women (eg, minorities, those in remote areas or those with difficulties in accessing health checkups) may tell very different stories. However, it was difficult to recruit participants from all of China, which is one of the limitations to this study. Another limitation is the fact that the interviews lasted for a relatively short time. In the field, our participants collaborated well with us and were willing to talk about their daily life issues. Hence, we believe we collected enough information, due to our intelligible research topic and non-sensitive interview questions in the Chinese culture.

Clinical implications

The barriers to controlling gestational weight identified in this study can inform antenatal healthcare services. In light of the results presented above, health education related to gestational weight control is far from sufficient. In China, it would be very difficult for already busy healthcare providers to offer additional one-on-one counselling about diet and weight management. However, the existing Maternal and Child Handbook could be better used as a tool for both education and self-monitoring. Devoting a little more time to educating pregnant women about how to use the handbook in advance could play a big role in antenatal and postpartum healthcare. Further, community health service centres should put forth more efforts in community health education, especially by including grandparents, who play a significant role in the healthcare of young mothers.

Future research

These results inform the development of future interventions to improve gestational weight control. How to diet and exercise is dependent on the individual pregnant women themselves, and different families have different situations. More work is needed to explore personalised feasible and effective intervention components. One possible approach is that families, communities and hospitals could be invited to design interventions and conduct research together, for a better protocol as well as higher motivation.

Acknowledgements We extend our greatest appreciation to participants who, by sharing their stories, made this research possible. We also thank Gong Yixiong, Ueda Kayo, Takeshita Mai, and Marui Kanae for their advice and assistance, and all the support from the qualitative study group in Kyoto University, Health Informatics classroom. We would like to thank Editage (http://www.editage.com) for editing and reviewing this manuscript for English language.

Contributors XM designed and developed the study, analysed and interpreted and data, and drafted the initial manuscript. HT and JC were involved in the field acquisition of data. KM assisted with analysis and interpretation of data. YT and TN revised the drafts and edited the manuscript. All authors reviewed and approved the final draft.

Funding The primary researcher, XM, was supported by JSPS KAKENHI Grant Number 18J22137. JC was funded by the 2019 BiosTime project in the National Center for Women and Children's Health, National CDC (2019FYH027).

Disclaimer The funders did not have any role in the study design, data collection and analysis, interpretation of data, or the writing of the manuscript.

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval Ethical approval was obtained from the Kyoto University Graduate School and Faculty of Medicine Ethical Committee (R1613), the Wuhan Maternal and Child Care Service Centre Ethical Committee (EC/SC-08/01.0), and the Jinan No. 4 People's Hospital Ethical Committee (LL-20170001).

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. The data used to support the findings of this study are available from the corresponding author on request.

ORCID iD

Xiuting Mo http://orcid.org/0000-0002-3844-3064

REFERENCES

1 Chen C, Xu X, Yan Y. Estimated global overweight and obesity burden in pregnant women based on panel data model. *PLoS One* 2018;13:e0202183–e83.
2 Li DT, Liang Y, Gong YH, *et al*. [Relations between pregestational body mass index, gestational weight gain and birth weight of neonates among women in the Southwest areas of China: A prospective cohort study]. *Zhonghua Liu Xing Bing Xue Za Zhi* 2018;39:1319–23.
3 Li C, Liu Y, Zhang W. Joint and independent associations of gestational weight gain and pre-pregnancy body mass index with outcomes of pregnancy in Chinese women: a retrospective cohort study. *PLoS One* 2015;10:e0136850.
4 Dai ZY, Liu D, Li R, *et al*. [Association between gestational weight gain per trimester/total gestational weight gain and gestational diabetes mellitus]. *Zhonghua Liu Xing Bing Xue Za Zhi* 2016;37:1336–40.
5 Torloni MR, Betrán AP, Horta BL, *et al*. Prepregnancy BMI and the risk of gestational diabetes: a systematic review of the literature with meta-analysis. *Obes Rev* 2009;10:194–203.
6 Sheiner E, Levy A, Menes TS, *et al*. Maternal obesity as an independent risk factor for caesarean delivery. *Paediatr Perinat Epidemiol* 2004;18:196–201.
7 Margerison Zilko CE, Rehkopf D, Abrams B. Association of maternal gestational weight gain with short- and long-term maternal and child health outcomes. *Am J Obstet Gynecol* 2010;202:574.e1–574.e8.
8 John E, Cassidy DM, Playle R, *et al*. Healthy eating and lifestyle in pregnancy (help): a protocol for a cluster randomised trial to evaluate the effectiveness of a weight management intervention in pregnancy. *BMC Public Health* 2014;14:439.
9 Mi J, Liu F. Rate of caesarean section is alarming in China. *Lancet* 2014;383:1463–4.
10 Amir LH, Donath S. A systematic review of maternal obesity and breastfeeding intention, initiation and duration. *BMC Pregnancy Childbirth* 2007;7:9.
11 Scott-Pillai R, Spence D, Cardwell CR, *et al*. The impact of body mass index on maternal and neonatal outcomes: a retrospective study in a UK obstetric population, 2004-2011. *BJOG* 2013;120:932–9.
12 Vanstone M, Kandasamy S, Giacomini M, *et al*. Pregnant women's perceptions of gestational weight gain: a systematic review and meta-synthesis of qualitative research. *Matern Child Nutr* 2017;13:e12374. doi:10.1111/mcn.12374
13 Whitaker KM, Wilcox S, Liu J, *et al*. Patient and provider perceptions of weight gain, physical activity, and nutrition counseling during pregnancy: a qualitative study. *Womens Health Issues* 2016;26:116–22.
14 Wang ML, Arroyo J, Druker S, *et al*. Knowledge, attitudes and provider advice by pre-pregnancy weight status: a qualitative study of pregnant Latinas with excessive gestational weight gain. *Women Health* 2015;55:805–28.
15 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.
16 Criss S, Oken E, Guthrie L, *et al*. A qualitative study of gestational weight gain goal setting. *BMC Pregnancy Childbirth* 2016;16:317.
17 Knight-Agarwal CR, Williams LT, Davis D, *et al*. The perspectives of obese women receiving antenatal care: a qualitative study of women's experiences. *Women Birth* 2016;29:189–95.
18 Kominiarek MA, Gay F, Peacock N. Obesity in pregnancy: a qualitative approach to inform an intervention for patients and providers. *Matern Child Health J* 2015;19:1698–712.
19 Hui Y. Survey and analysis of the pregnant women's knowledge of nutrition, exercises, and weight management during pregnancy (in Chinese). *Modern Hospital* 2013;13:151–4.
20 Liu Y, Qingqing W, Qiannan L, *et al*. Survey of pregnant women on gestational weight and behavior management (in Chinese). *Maternal & Child Health Care of China* 2017;32:3616–8.
21 Aihua F. *Research on health literacy and pregnancy outcomes among pregnant women (in Chinese*. Jinan: Shandong University, 2013.
22 Krippendorff K. *Content analysis: an introduction to its methodology*. Thousand Oaks, California: Sage Publications, 2018.
23 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;19:349–57.
24 Shi H, Zhu W-L, Yuan Y-M, *et al*. Introducing Chinese food therapy: a review of origin, developing course and modern application. *TMR Integrative Nursing* 2018;2:42–8.
25 Xian-yuan H. Study on characteristics of pregnancy taboo of traditional Chinese medicine resources. *J Anhui Agric Sci* 2013;6:30.
26 Zhou Z, Zheng D, Wu H, *et al*. Epidemiology of infertility in China: a population-based study. *BJOG: Int J Obstet Gy* 2018;125:432–41.
27 Goh E. *China's one-child policy and multiple caregiving: Raising little suns in Xiamen*. London: Routledge, 2011.
28 Drisko JW, Maschi T. *Content analysis*. New York: Oxford University Press, 2015.