



# Mothers' experiences of a lifestyle intervention for weight reduction 12 months after gestational diabetes mellitus: Qualitative findings from the PAIGE2 study

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## ABSTRACT

The standardised pooled prevalence of gestational diabetes mellitus (GDM) globally is approximately 14 %, a reflection of increasing rates of obesity in women of childbearing age. Lifestyle interventions to reduce GDM and subsequent type 2 diabetes (T2D) have been deemed a research priority but are challenging to perform and have variable success rates. The PAIGE2 study was a pragmatic lifestyle randomised controlled trial for women with GDM and body mass index  $\geq 25$  kg/m<sup>2</sup>, which began during pregnancy and continued for one year postnatally. The primary outcome was weight loss 12 months postnatally compared with mothers receiving standard maternity care. Qualitative results are presented from end of study focus groups conducted amongst intervention mothers to gather feedback and determine acceptability of the PAIGE2 intervention. In total, 19 mothers participated in five virtual focus groups. Content analysis explored general study experience, longer term changes to lifestyle and suggested improvements of intervention components including monthly phone calls, motivational text messages, Fitbit experience, Slimming World, and study contact timings. Overall, most mothers found the individual PAIGE2 intervention components enjoyable, although opinions differed as to which were the most effective. Several mothers claimed the intervention helped them make long-term changes to their behaviours. A common suggested improvement was the establishment of a local group where mothers could share their experiences. In conclusion, most mothers deemed the intervention acceptable, and felt that with minor enhancements, it could be utilised as an effective tool to support weight loss after pregnancy and reduce future risk of obesity and T2D.

## Introduction

In 2021, the pooled prevalence of gestational diabetes mellitus (GDM) globally was approximately 14 % (Wang et al., 2022), most likely as a result of the increasing rates of type 2 diabetes (T2D) and obesity in women of childbearing age (Ogunwale et al., 2021; Williams & Kreider, 2021). In the United Kingdom (UK), GDM occurs in up to 5 % of pregnancies (Diabetes.co.uk, 2022). In Northern Ireland, it was estimated that among a population of 1.9 million, 2522 women were diagnosed with GDM in 2021/2022 compared with 1984 women in 2018/2019, a 30 % increase in just four years (Health Intelligence Unit, n.d.). The

clinical implications of GDM include a greater than 50 % risk of developing subsequent GDM in future pregnancies, as well as a 10-fold increase in risk of developing T2D, compared to women without GDM (Vounzoulaki et al., 2020). In addition, obesity during pregnancy is associated with an increased risk of pre-eclampsia, and adverse birth outcomes such as miscarriage, macrosomia, instrumental delivery, and caesarean section (McAuley et al., 2023; Scott-Pillai et al., 2013). Although excessive gestational weight gain occurs during pregnancy, it is recognised as causing postpartum weight retention, which is difficult to lose (Calfas & Marcus, 2007; Farpour-Lambert et al., 2018), and is also a risk factor for chronic obesity after pregnancy (Endres et al., 2015;

**Abbreviations:** GDM, gestational diabetes mellitus; UK, United Kingdom; T2D, type 2 diabetes; RCT, randomised controlled trial; CWMO, commercial weight management organisation; SW, slimming world; TP, timepoint.

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Gunderson et al., 2008).

There have been several reports of pre-pregnancy interventions to reduce women's risk of developing GDM (Lin et al., 2020), with varying success rates due to difficulties recruiting high-risk women and lower than anticipated conception rates (Phelan et al., 2023; Rönö et al., 2018). A meta-analysis of 29 randomised controlled trials (RCTs) involving 11,487 pregnant women in 2016 found that lifestyle modification before 15 weeks gestation could reduce the risk of developing GDM (relative risk: 0.80, 95 % CI 0.66–0.97) (Song et al., 2016), although not after 15 weeks. Structured lifestyle interventions during pregnancy have been reported not only to be economically attractive, but also to reduce adverse health outcomes for women during pregnancy and postpartum (Lloyd et al., 2023).

#### *The PAIGE study*

The PAIGE pilot study was a randomised lifestyle postnatal intervention to promote weight loss for overweight women with previous GDM. The results showed significantly greater weight loss up to 6 months postpartum compared to usual care, highlighting the potential for such interventions to produce longer-term health improvement and reduce the risk of obesity, GDM, and T2D in the future (Holmes et al., 2018). A recommendation from the PAIGE study was to consider beginning the intervention earlier than 6 weeks postnatally. Congruently, a recent systematic review determined that lifestyle interventions conducted both during and after pregnancy could reduce health risks associated with GDM, particularly T2D (Huang et al., 2022).

#### *The PAIGE2 study*

The PAIGE2 intervention, informed by the PAIGE pilot study (Holmes et al., 2018), incorporated both the successful components and recommendations from the PAIGE study, and suggestions from other research supporting the need for a pragmatic lifestyle intervention for women both during and after pregnancy. The PAIGE2 study was a two parallel arm, 12-month, RCT conducted across 3 maternity clinics in Northern Ireland (Royal Victoria Hospital, Antrim Area Hospital and Ulster Hospital), involving 237 women with GDM and a body mass index (BMI)  $\geq 25 \text{ kg m}^{-2}$  who were recruited during pregnancy (McAuley et al., 2023). The primary outcome was the difference in weight loss from 6 weeks postnatally to 12 months postpartum between the intervention and a control group receiving conventional follow up maternity care. Between 32–36 weeks gestation (time point 1; TP1), women in the intervention group received a one-hour virtual educational programme providing information on the causes, consequences, difficulties, and implications of GDM and overweight/obesity, a healthy nutritional approach to improving their lifestyle, and the effectiveness of physical activity as an alternative treatment for the prevention of subsequent GDM and T2D including recommendations, barriers and strategies (McAuley et al., 2023). Postnatally, the intervention group received monthly phone calls (carried out by a member of the PAIGE2 research team including information of physical activity, barriers to achieving diet and physical activity goals, as well as suggested solutions, where progress was documented and monitored on each individual participants Case Report Form), weekly motivational text messages, weekly step counts (using a free Fitbit provided, where mothers were encouraged via the weekly text messages to set physical activity and step goals such as increasing their daily/weekly step counts), a complementary voucher to attend a Commercial Weight Management Organisation (CWMO), Slimming World (SW) for any three consecutive months during the 12 month postpartum period of the intervention after their 6 week clinic appointment, and access to a private Facebook group (moderated and updated by the PAIGE2 research team) for the PAIGE2 study that posted tips and information relating to diet, physical activity, sleep, and general lifestyle advice. The control group received usual care as offered by their local maternity hospital. Three postnatal study visits

took place for all study participants to obtain anthropometric and clinical measurements, fasting blood samples, and to complete questionnaires pertaining to their health, wellbeing, and physical activity at 6 weeks (TP2), 6- and 12-months postpartum (TP3 and TP4, respectively) (McAuley et al., 2023).

This manuscript documents the experiences of the women who completed the PAIGE2 intervention, to obtain feedback on the study, determine acceptability, and gain insight into suggested improvements for the future. We focused exclusively on the experiences of women in the intervention group.

#### *Methods*

This qualitative study used end of study focus groups to collect feedback on the PAIGE2 study from a purposive sample of intervention mothers, to determine the acceptability of the intervention. Questions were asked in relation to the mothers' overall experience of the study, together with their specific views on the individual study components including the educational programme and corresponding educational booklet content, monthly phone calls and motivational text messages, a Facebook group to receive lifestyle advice, usefulness of a Fitbit activity tracker, attendance at SW, family/friend support, their motivation throughout the study, study time points, whether the study had helped them make any longer term changes to their lifestyle, and any suggested improvements for the future. Data collection was carried out by the PAIGE2 research team, who at the time of the focus groups consisted of two Research Midwives, two Research Nutritionists and a Research Dietitian. The focus groups were facilitated by the lead author, who was female, working as a Research Nutritionist on the PAIGE2 study, had a PhD and was trained in qualitative research. A relationship was established solely through recruitment of the intervention mothers to the focus groups, whereby participants were aware why the facilitator/research team were carrying out the research and their reasons and interests in the topic.

#### *Study participants*

Participants were contacted via telephone, having provided consent to be contacted to take part in the focus groups. Inclusion criteria for the PAIGE2 study (McAuley et al., 2023):

1. Women aged  $\geq 18$  years.
2. Booking BMI  $\geq 25 \text{ kg m}^{-2}$  at  $<14$  weeks gestation.
3. GDM diagnosed in the current pregnancy based on World Health Organization (2013) criteria (World Health Organization, 2014).
4. Women could continue in the study if their fasting plasma glucose the morning after delivery or at 6 weeks postpartum was either normal or consistent with impaired fasting plasma glucose outside of pregnancy (i.e.,  $<7 \text{ mmol/l}$ ).

#### *Data collection*

Focus groups were conducted via Microsoft Teams, whereby mothers took part from their own home. The focus groups were facilitated by the lead author with an additional member of the research team present to take field notes and directed using a topic guide constructed and reviewed by the PAIGE2 research team. Each question was supported by prompts. The facilitator ensured all participants had the opportunity to contribute, and clarification was sought if further information was required (Kemp et al., 2022). All focus groups were video/audio recorded to support transcription and facilitate analysis and lasted approximately 1 hour and 15 minutes.

#### *Data analysis*

The focus groups data were analysed verbatim and anonymised. The women were given a focus group and participant number e.g., FG1, P1,

to aid pseudonymised identification (Kemp et al., 2022). Once transcribed, qualitative content analysis was conducted using a deductive approach to code the data directly from the transcribed text (Hsieh & Shannon, 2005). Frequency and context of codes were reported across the focus groups (Elo & Kyngäs, 2008; Hsieh & Shannon, 2005; Krippendorff, 2004; Morgan, 1993). The PAIGE2 research team openly coded the transcripts, then the codes were collated into subcategories, and subsequently, final categories (Elo & Kyngäs, 2008). Coding was carried out by three members of the research team, and peer-checked by additional research team members to reach agreement on final categories and subcategories, verifying uniformity.

### Ethical considerations

The study conformed with the principles outlined in the Declaration of Helsinki (World Medical Association, 1964). Research governance approval was obtained from the Belfast Health and Social Care Trust (18/NI/0228), and ethical approval was obtained from the Office of Research Ethics in Northern Ireland. Participants provided both written consent prior to commencing in the PAIGE2 study including their consent to be contacted regarding participation in the focus groups, and verbal consent before the focus groups began. The women's details and recordings were held in accordance with General Data Protection Regulations.

### Results

Of the 53 intervention mothers who had completed TP4 and consented to be contacted regarding focus group participation, 35 mothers agreed to participate, of which 19 finally contributed across five focus groups. Sixteen mothers did not attend the scheduled focus groups. All mothers were white/Caucasian, the mean ( $\pm$  standard deviation) age, years in education and BMI was  $32.5 \pm 3.53$  years,  $16.05 \pm 2.34$  years, and  $34.43 \pm 4.14$  ( $\text{kg}/\text{m}^2$ ) respectively. Of the 19 mothers, 12 were employed full-time, six were part-time employed, and one was a full-time homemaker; 10 women were married, seven were cohabiting, one mother was divorced, and one mother was single. For four women, this was their first-born child, for eight women this was their second-born child, for five women this was their third-born child, and for two women, this was their fifth-born child.

Qualitative content analysis resulted in 12 categories, reported as follows: overall experience in the study; the educational programme; the PAIGE2 booklet; monthly phone calls and motivational text messages; the Facebook group; Fitbit; SW; family/friend involvement; motivation throughout the study; timings of the study; longer term changes to lifestyle; and feedback/suggested improvements for the future. All quotes relating to the categories listed can be found in Table 1.

### Overall experience

Overall, 15 of the 19 mothers in the intervention group explicitly stated they had a positive PAIGE2 study experience. Three mothers felt that the PAIGE2 study provided them with reassurance regarding their diagnosis of GDM, and the lifestyle changes they needed to make after their diagnosis. Six mothers described positive contact experience with the PAIGE2 research team throughout the study, both with respect to not feeling judged, and the level of support/duty of care they received. Unfortunately, the mothers whose experience wasn't so positive were due to personal circumstances, including maternal mental health, and themselves or their child(ren) not being well throughout the intervention, which impacted their involvement and thus their experience.

### The educational programme

There were variable responses regarding the one-hour education session, as seven of the 19 mothers were unable to remember specific

**Table 1**  
Categories and corresponding quotes.

Category	Quote
<b>Overall experience</b>	<p>"...it was definitely good. I mean, that was my third pregnancy and I'd had diabetes with all three and there was nothing like this, you know, the 1st or the 2nd. So, for me, this was a big, it was a lot more, Umm, I don't know, you felt like you actually knew what was going on more so, than the other two. The other two was just like "right, here's some leaflets and, you know, take your stuff and good luck", you know. And just, just try and do your best. And that was it, whereas this one? It was more, it was more together, it was more planned. You felt like if there was a problem, we were able to talk to someone... I thought this was far better. I'd definitely think it, em, a lot of people who benefit from it, you know. Definitely." (FG2, P3)</p> <p>"Yeah, it was definitely good just having that wee bit of reassurance or something. If you did have any questions about, you know, anything to do with gestational diabetes because like not many people have had it that I know, and you know what I mean? Like there was nobody really who could give you that kind of support. So, I found it really good from that point of view." (FG3, P3)</p> <p>"I thought the duty of care and stuff, like during the intervention was really good and the support. And no judgment as well was great." (FG2, P2)</p> <p>"And I wish other women would have had [PAIGE2] from the start. You know it's something that is great and needs to, in my opinion, to continue if it could because even the support side of it alone. And even just to know that you're not the only one. Because at the time you feel like you are the only one and like 'oh my God, I don't know what to do' and then you see that there are other people." (FG2, P3)</p>
<b>The educational programme</b>	<p>"Yeah, I think mine was in person. And I think she came and saw me. I think it was at the same time I got the Fitbit – it was good cause it was a one to one at the time. And so, if you had any questions, you could ask them... Yeah. But it was positive. I don't-t- There's nothing negative to say about it." (FG5, P6)</p>
<b>PAIGE2 educational booklet</b>	<p>"Yeah, I agree. I think an app would be good and the book, it's easy to put down and lose it, whereas everything tends to be on your phone now days. So, I think that would have been good if you did have 5 minutes or if you're feeding the wee one, you could just click into it and you're able to access it. So, I think I agree, I think it app would be more beneficial than the booklets." (FG2, P1)</p>
<b>Monthly phone calls and motivational text messages</b>	<p>"I like the part where you's would message me every now and again, like. You know if I was feeling a bit lazy, or if I forgot to put the Fitbit on. And then I would get a wee text message. So I kind of liked that aspect of it because although some- a lot of the time I wasn't actively dieting and trying to be good, it kinda made me think 'ohh, I really need to start, I need to start' and although a lot of the times I didn't, it's still, it was more on my mind I think than what it would be if I didn't have the Fitbit and if it didn't have the text messages, if that makes sense." (FG4, P1)</p>
<b>PAIGE2 Facebook group</b>	<p>"I followed it... Yeah. I do recall seeing random kind of posts like sporadically over the year, kind of Umm and they were relevant to what was kind of like, you know, trying to be fit and active and healthy and things like that there like. But I did notice that they never really, you know, garnered an awful lot of like engagement that</p>

(continued on next page)

Table 1 (continued)

Category	Quote
Fitbit	<p>that didn't seem to be an awful lot of engagement with them... I didn't find them engaging enough for me to click and read sort of thing so." (FG5, P3)</p> <p>"It was wee- just wee simple changes like that or trying to get out and be more active, you know? Knowing that your Fitbit was on your arm and probably subconsciously you know thinking, God I better go and get my steps up here. So, I definitely think it did, it did help." (FG1, P1)</p> <p>"So, they're good, like I love, I do like a Fitbit, but my issue with a Fitbit is it always kind of stopped syncing. For some bizarre reason, and it's a pain to try and get it to sync. So, there is so many weeks that I would get a message to say, 'your steps haven't synced' and I'd have to go back and try and put, like manually push it through. So that was kind of the most annoying thing about the Fitbit." (FG3, P1)</p>
Slimming World	<p>"I love Slimming World, like I literally will only ever do Slimming World. I won't listen to anybody talk about anything else because I just think it is the best thing ever. Because as [P6] says, you can literally eat everything, I've done slimming world on and off for years. So, I did the whole way through my pregnancy. I had gestational diabetes, and during my pregnancy and I'm- I managed it on that alone, the actual dietitian said that I was a walking, talking advertisement for Slimming World, so I just went- I'll just carry straight on." (FG5, P5)</p> <p>"I think group things, I'm not really good with group, like going to group things and stuff like that. And then the fact of even trying to get a bit of bloody babysitter to mind all of them so that I can go was just a nightmare as well. I know you are only there for a small amount of time but to be there you need to be there for the hour and need to sit with a group and it's just I had far too much on... But I just found it very daunting, and even now even the thought of going and I'm a lot fitter and more myself- I still just, I don't know, it's just it's something that that's not really for me" (FG2, P3)</p> <p>"Although, when I was in Slimming World, I was motivated to use the full 12 weeks, but like I want to get that stone award. That was what I was aiming for during that point, but once that was done, it was like no, be done with that" (FG3, P3)</p> <p>"I enjoyed the consultant. I just didn't feel it worked for me. I did the 12 weeks well, I did 10 out of the 12... I was losing a pound, putting a pound back on. And then I found it very frustrating and that I wasn't succeeding." (FG2, P1)</p> <p>"So, I sort of thought whenever didn't really succeed the first sort of 12 weeks, then maybe if I went again for the further 12 weeks then maybe. But I still I didn't, it was the timing. It just wasn't the right time for me." (FG2, P2)</p> <p>"I found it strange, coming out of gestational diabetes diet. And then, it was OK for the first few months, and then we were got given the Slimming World, we got to go to Slimming World, and it was a bit strange going from "you can't have much carbs, they have to be smaller than the size of your palm", to "Oh, you can have as many chips and as much rice, all the carbs you want". And I was like "oh, this does not make sense". Although it was a bit restricting when you were in, you know when you were pregnant, and you had to kind of restrict it. It's just that part of it. It doesn't, to me, that didn't make sense going from one extreme to the other, with the diet wise." (FG3, P1)</p>

Table 1 (continued)

Category	Quote
Family/friend involvement	<p>"I had a Fitbit years and years ago, but to get one again like it was, I found it motivating and then my husband got one as well as part of it. And like every night we want to be like how many steps you on or you know what I mean? Like it would have been encouraging, you know, it did encourage us both actually to like, there was just a bit of competitiveness. You know what I mean? Like the steps and things. So, like, I thought that was really useful that you're kind of like, you know, it was the house doing it, rather than just you on your own..." (FG3, P3)</p> <p>"It was quite nice going out and getting your steps. And the child's sleeping in the pram and giving your head a bit of a time to clear. I guess. I'm not saying going out with family and your other half isn't great like, but sometimes you just need that time to yourself. So, I don't know whether- he hates walking anyway, so I don't even know why he accepted it in the first place, but sometimes it's just nice to get that break, you know, especially when baby's been crying all day you know." (FG5, P6)</p>
Motivation	<p>"I just didn't want to get diabetes... I only had gestational diabetes for five weeks. But I found it just horrendous, just the whole like counting the f*****g carbs and like not being able to eat all, awe it was awful. I just thought it was so crap... And I just found the whole experience just awful. And that was my biggest motivator that I was determined. I just didn't want to get diabetes because I thought God help those people that have to live with it, because it's awful." (FG5, P3)</p>
Timing of study contacts	<p>"Yeah, I think the six weeks after it was just a blur again because it was just like, no, no, no sleeping. So, I was like, yeah, I don't know what's happening. Don't even know what to do here, but. Yeah, probably the six weeks- If it was a wee bit longer just to kind of, when we're getting our head around things. Umm, but before while I was pregnant, I was completely fine. It was like, yeah, yeah, no problem at all. And then six months, you kinda got your feet on the ground by that stage, but it was just that six weeks it was complete blur. I can't actually even remember it." (FG5, P2)</p>
Longer term changes	<p>"Yes, I move more. I eat less. Quite simply made a massive difference. Like I said before, for years we kept going the same way we knew we were doing wrong. Like it just takes something to do, and I honestly didn't think anything would be able to, to help us out, but this really really did so. It's not a miracle thing like, but it's certainly really, really helped. So yeah, it's encouraged me to move more and eat less." (FG5, P6)</p>
Feedback/suggested improvements	<p>"I think if there was, I know you can't really have, but if it was like a mother and toddler group you would kind of go to it. So, if there was like a diabetic group thing, like a walking group or something. And there is people going through the same journey as you, you know, because as much as my husband has been supportive. He has never had diabetes. He doesn't know, sort of. You know, yes, he can watch you go through it, but he's not experienced it... But if you were going through the journey with other people. That maybe just had a baby, you know, to go and do it together that, I think that would be more beneficial. You know, having that connection with people that have just had a baby that had, you know, the risk of diabetes as well to all meet up in a wee group... So, I think that would have been really beneficial if that had been an option." (FG2, P1)</p>

content. Of the 12 mothers who had more specific recollection, the feedback was generally positive, and the content and structure of the session were deemed helpful.

#### *PAIGE2 educational booklet*

Eight mothers thought the PAIGE2 booklet was a valuable source of information, however, 12 mothers admitted they did not use the booklet much, because of being busy with a new baby or misplacing it. A common recommendation ( $n = 11$ ) was for a virtual format, whether that be an app, podcast/audio, website or simply a PDF that could be accessed on their phones.

#### *Monthly phone calls and motivational text messages*

Most mothers thought the monthly phone calls and text messages were a motivating factor throughout the intervention, as well as a reminder to continue to make lifestyle changes, particularly using their Fitbit and increasing their steps.

#### *PAIGE2 facebook group*

The consensus was that the mothers did not avail of the information provided on the PAIGE2 Facebook group. Although some mothers chose to be a part of the group, they did not feel there was much engagement with the information posted.

#### *Fitbit*

Five mothers had previously owned or used a Fitbit before their participation in the study. Most participants ( $n = 14$ ) considered the Fitbit to be useful and motivating, particularly for increasing their daily step count. Although the mothers generally found the Fitbits helpful, eight mothers described problems with their activity trackers. These ranged from skin irritation to the device not syncing correctly with their phones, to not recording steps whilst pushing their prams.

#### *Slimming world*

Of the 19 mothers, eight mothers used SW, with several stating they enjoyed their experience. Nine did not use the complementary SW vouchers provided as part of the PAIGE2 intervention. Although only five of the mothers had attended SW before, this did not necessarily translate into mothers availing of the vouchers provided to attend for at least 12 weeks. Of those nine mothers who didn't attend SW, their reasons varied and included attempting their own diet modifications, inability to source help to look after their children while attending the sessions, and a negative view of CWMOs. Of the mothers who attended SW, some reported finding the experience enjoyable, though there were varied results of weight loss and what motivated the women throughout the 12–24 weeks offered. Some mothers thought the timing of their attendance at SW may have impacted their results. Four mothers commented on finding the information provided by SW contradictory to the GDM diet they were told to follow during pregnancy, or generally didn't feel they agreed or liked what SW promoted.

#### *Family/friend involvement*

Of those who did have the support of a family member or partner in the intervention with them ( $n = 14$ ), most involvement was through the common wearing of the Fitbit they received at TP2, and opinions were mixed as to whether the concept was helpful.

#### *Motivation*

There were several key aspects of the PAIGE2 intervention that

mothers found motivating, including staff check-in's ( $n = 5$ ), monitoring their weight throughout the intervention ( $n = 5$ ), monitoring their activity ( $n = 7$ ), monitoring their blood results ( $n = 5$ ), and knowing they were reducing their risk of developing diabetes ( $n = 5$ ).

#### *Timing of study contacts*

The most common feedback for the timing of the PAIGE2 intervention was that mothers felt they needed time to adjust to having a newborn baby ( $n = 7$ ). There was no consensus as to the correct timing of the intervention, though beginning the intervention during pregnancy was well-received.

#### *Longer term changes*

Several mothers reported they felt the PAIGE2 intervention made the greatest impact on their physical activity levels, including encouraging mothers to move more throughout the day. Some mothers also thought the intervention helped them to reduce their snack intake or choose healthier snacks moving forward.

#### *Feedback/suggested improvements*

The most consistent recommendation from the PAIGE2 intervention was the establishment of a group, whether it be face-to-face or virtual, where mothers in the intervention could talk and share their experiences of having GDM throughout their pregnancy, and ways in which they were changing their lifestyles after pregnancy. Mothers felt this would have been beneficial throughout the PAIGE2 intervention and think it would be important for other mothers in the future.

### **Discussion**

This study aimed to explore the experiences of mothers who participated in the PAIGE2, lifestyle intervention trial for women with GDM to reduce their weight 12 months postpartum. Overall, the mothers generally found their involvement in the study enjoyable. Feedback on their experience of various components of the study, including the use of a Fitbit, monthly phone calls and motivational text messages were largely positive, whilst other components such as attending SW and use of the Facebook group were less consistent amongst all participating mothers. Several mothers also provided useful feedback for improvement of the intervention as discussed below.

#### *Overall experience*

Overall, the women reported a generally positive experience of the intervention regardless of whether they lost weight at 12 months postpartum. The challenges of weight loss in postpartum women are well recognised (Calfas & Marcus, 2007). A recent study evaluating mothers' experiences of a weight management intervention embedded within the national child immunisation programme claimed mothers were keen to lose weight after giving birth (Tyldesley-Marshall et al., 2021), however, this contrasts with other research reporting that a significant proportion of mothers retain up to 5 kg of body weight postpartum (Calfas & Marcus, 2007; McAuley et al., 2023). Positive weight loss results at 6 months postnatal were reported in the PAIGE pilot study (Holmes et al., 2018), while results from the PAIGE2 study are still awaited. The positive feedback and acceptability of the intervention from the focus group might point to the success of the intervention for these mothers at this qualitative stage of reporting study outcomes (Deaton & Cartwright, 2018).

#### *The educational programme*

Regarding the mothers who couldn't remember specific information



from the 1 h education session, some of these women had completed the educational session two or three years prior to the focus groups, as they were some of the first women to come through this intervention. This could explain why some mothers did not remember some of the information provided.

#### *PAIGE2 educational booklet*

A consistent view was the preference for converting the content of the paper based PAIGE2 educational booklet onto a virtual platform or PDF. This finding appears to contradict some literature regarding the delivery method of patient information, as one study conducted in Sweden found that although patients were open towards the delivery of patient information electronically, most still prefer printed materials in pharmacy settings (Hammar et al., 2016). On the other hand, another study found that males diagnosed with prostate cancer ( $n = 78$ ), only 32 % ( $n = 13$ ) reported a preference for paper format participant information leaflets compared with an informational website with the addition of videos (Miah et al., 2022). However, it is worth noting those populations and settings are significantly different to postpartum mothers in their own homes. The women in our study highlighted that the women often lost or forgot about the PAIGE2 educational booklet. This would seem to support an electronic format or database, which mothers could access from a saved virtual location as and when they wished, and is consistent with the growing evidence-base in favour of smartphone applications and eHealth/mHealth for disseminating patient information (Timmers et al., 2020), along with the increased demand to include more digitised systems across healthcare (Mitchell & Kan, 2019).

#### *Monthly phone calls and weekly text messages*

The monthly phone calls and weekly text messages used throughout the intervention were informed by the PAIGE pilot study and in PAIGE2 were considered beneficial by several of the focus group mothers to motivate and remind them to make necessary lifestyle changes. It is known that goal setting and monitoring of progress are common behaviour change techniques used within interventions as a means to achieve desired outcomes (Michie et al., 2014), though are to some extent dependent on the specific intervention. The positive responses obtained from mothers in the PAIGE2 study were concordant with those of a 12-week pilot RCT in Denmark where patients with T2D received phone calls and text messages to monitor goal progress to increase their time spent walking weekly (Valentiner et al., 2019).

#### *Fitbit*

Although the PAIGE pilot study used a pedometer to record step count, uptake was variable, and as per feedback (Holmes et al., 2018), Fitbit activity trackers were substituted in the PAIGE2 study so more information could be gathered regarding the average weekly step count for the participants. It was also felt that this could potentially guide the research team to convey more customised motivational text messages and customised physical activity advice (McAuley et al., 2023). The Fitbits were well-received by the mothers based on the focus group feedback. A recent systematic review and meta-analysis found that Fitbits used in interventions produce positive outcomes in promoting healthy lifestyles through physical activity and weight loss in both adults who either had or were at risk of cardiovascular or cardiometabolic disease (Ringeval et al., 2020). This was congruent with a text message and pedometer programme which proved efficient in promoting physical activity in those at high risk of T2D (Morton et al., 2015). In addition, a small USA pilot study ( $n = 17$ ) of pregnant mothers (between 10 and 27 weeks gestation) with either T2D or GDM, found that recording their daily steps with a Fitbit for 12 weeks until either 36 weeks gestation or 1 week before birth was highly acceptable, was

effective in increasing daily step count, and was considered to be a low burden (Larsen et al., 2020). Whilst a few pilot studies have reported promising positive results of Fitbits as a means of increasing physical activity and step counts in pregnant and postpartum mothers (Cheung et al., 2019), and in studies to indicate acceptability of these activity trackers to increase steps taken daily/weekly of these women (Ehrlich et al., 2021), to our knowledge, the PAIGE2 study is one of the only full-scale RCTs that displays promising positive experiences from the use of a Fitbit for postpartum mothers with previous GDM to help reduce their weight up to 12 months after delivery.

#### *Slimming World*

Attendance at SW appeared to be the most polarising intervention component, as while some mothers thoroughly enjoyed the group and its ethos, other mothers did not attend due to varying reasons, including conflicting advice with the GDM diet encouraged during pregnancy, their own past experiences, or simply that they did not wish to attend. While the results of a 2019 intervention of postpartum mothers who attended SW ( $n = 193$ ) found a reduction in weight at both 6 months and 12 months postpartum (6 months: -9.56 % (-8.74 kg, 95 % CI -1.66 (-4.49 to 1.16)); 12 months: -11.48 % (-10.26 kg (95 % CI -3.63 (-6.45 to -0.81)) (p-values not reported) (Bick et al., 2020), such results are yet to be reported concerning the influence of SW on weight loss for the mothers who did attend in the PAIGE2 study. As some PAIGE2 mothers did not attend SW for logistical reasons, an online service, which SW alternatively offer, might facilitate greater engagement and adherence, or a provision of local specifically tailored group that could provide dietetic advice more consistent with that received by the mothers during their pregnancy, as suggested by some mothers in PAIGE2.

#### *Facebook group*

Although in this study there was little engagement of the mothers in the focus group with the PAIGE2 Facebook group, social media delivered interventions previously have been found to be somewhat effective. In an uncontrolled pilot study seeking to determine the feasibility and acceptability of delivering a postpartum weight loss intervention via Facebook, the average weight lost by 19 mothers was 4.8 %  $\pm$  4.2 %, where 11 mothers (58 %) lost more than 5 % body weight in just 12 weeks (Waring et al., 2018). Despite mothers in the PAIGE2 study suggesting the implementation of a forum within the intervention in which they could communicate with each other to share experiences, the PAIGE2 Facebook group in our intervention did not appear to be the platform that worked for them. As suggested by Waring et al. (2018), more research is required to better understand the best platform and engagement strategies to capture mothers' attention and encourage their participation in a group-based communication/social media forum.

#### *Timing of the intervention*

As for the timing of the intervention, some mothers found the intervention occurring from 6 weeks postpartum appropriate, whilst others found the timing too soon. This suggests that the intervention could be tailored for individual mothers going forward, but this is not something that can be planned pre-pregnancy, and thus would be problematic in a structured RCT. As there was such a mixed response with the timing of the intervention, it is difficult to provide a recommendation for future researchers. Those carrying out intervention like PAIGE2 in the future would need to consider if personalisation of the study timing for individual mothers would be feasible.

#### *Suggestions for improvement*

Lastly, the most frequent suggestion for improvement from the focus

group mothers regarding future implementation of the intervention, was the option of a local group that mothers could attend to meet-up with each other, whether virtually or in-person, to share their experiences. Social support has been highlighted for many years as being an essential tool for maintaining both psychological and physical health (Ozbay et al., 2007), and fits well within the PAIGE2 study for both those aspects. Although uptake with both SW and the Facebook group in PAIGE2 was limited, this recommendation may strengthen the case for a specialised group specifically for these mothers. Psychosocial support interventions have been shown to positively impact lifestyle changes in women with GDM (Jung et al., 2021), and therefore should be taken into consideration for the future implementation of this intervention, especially as it was so commonly requested by the intervention mothers.

### Limitations and strengths

The strengths of the study include the uniqueness of this study in providing the views of mothers regarding their experience in a lifestyle intervention. Additionally, the honest and candid feedback of these mothers in relation to what aspects of the service they considered to be helpful (methods of contact etc.) and what might be improved (the Facebook group/communication Forum etc.) to maximise engagement of the women with the intervention throughout the 12 months. A limitation was the fact that the focus group feedback was based on only 36 % of mothers from the intervention group, and that our sample is not racially diverse as all mothers were Caucasian. Future studies should include aim to include perspectives from mothers of different ethnicities.

### Conclusion

This study reports the experiences of mothers in the pragmatic multicomponent PAIGE2 lifestyle intervention both during and after pregnancy to aid weight loss up to 12 months postpartum. Most mothers felt the intervention was enjoyable and helped them successfully make healthier lifestyle changes. Most mothers utilised several of the intervention components, such as the Fitbit and monthly phone calls and thought these were most useful, whilst other mothers struggled or did not avail of some intervention components, such as SW or the PAIGE2 Facebook group. This qualitative data will be used to improve the intervention for future mothers and address any aspects that did not work as well as intended. The data will also help address the gap in the literature of the experiences of mothers with previous GDM in a UK lifestyle intervention to reduce weight 12 months postpartum.

### CRediT authorship contribution statement

**Bridie J Kemp:** Conceptualization, Methodology, Data curation, Writing – original draft, Writing – review & editing. **Rachel M Creighton:** Conceptualization, Methodology, Data curation, Writing – original draft, Writing – review & editing. **Gina Cupples:** Conceptualization, Methodology, Data curation, Writing – original draft, Writing – review & editing. **Bronagh Kelly:** Conceptualization, Methodology, Data curation, Writing – original draft, Writing – review & editing. **Emma McAuley:** Conceptualization, Methodology, Data curation, Writing – original draft, Writing – review & editing. **Olwen Fleck:** Conceptualization, Methodology, Data curation, Writing – original draft, Writing – review & editing. **Helen Wallace:** Writing – review & editing, Data curation. **Una Graham:** Writing – review & editing, Data curation. **David R McCance:** Conceptualization, Methodology, Data curation, Writing – original draft, Writing – review & editing.

### Declaration of Competing Interest

The authors declare there is no conflict of interest.

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