Women's experiences with using a smartphone app (the Pregnant+ app) to manage gestational diabetes mellitus in a randomised controlled trial

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ABSTRACT

Objective: The purpose of this study was to explore the experiences of women with gestational diabetes mellitus (GDM) with controlling their blood glucose values and receiving health and nutrition information using a smartphone app (the Pregnant+ app).

Design and participants: The study utilised the interpretative phenomenological analysis method. Semi-structured interviews were conducted with 17 participants among those participating to the randomised controlled trial. Results: The women experienced sorrow and disappointment when they were diagnosed with GDM, but they all went through a process of learning to self-manage their condition that was strongly motivated by their desire to care for their unborn babies. The women found that the app increased their confidence in their self management of GDM and their motivation for behavioural change. For some women, the app contributed to feelings of frustration or obsession. In addition, some technological problems and a lack of support from health-care professionals limited several women from using the app.

Key conclusions and implications for practise: The findings suggest that a smartphone app may have potential for supporting women with GDM, particularly in their blood glucose management. However, it also highlights some of the potential challenges of using mHealth technologies. The findings indicate that a closer collaboration between health-care professionals and patients is of great importance in the implementation of apps for women with GDM.

Introduction

Gestational diabetes mellitus (GDM), defined as glucose intolerance with first onset or recognition during pregnancy, is an increasing health challenge worldwide (Ferrara, 2007; Galtier, 2010). According to a previous population-based study, the prevalence rate of GDM varies from 1% to 22% (Galtier, 2010). This large range may be attributable to differences in screening and diagnostic criteria, as well as heterogenic study populations (Buckley et al., 2012). Risk factors for developing GDM include obesity, advanced maternal age, a family history of diabetes, GDM in a previous pregnancy and ethnicity (Hoffmann et al., 1998; Schneider et al., 2011). Although blood glucose values stabilise after birth for most women, both the women diagnosed with GDM and their offspring have an increased risk of developing diabetes type 2 (T2DM) later in life (Ferrara, 2007; Kim, 2010).

A past review of the experiences of women with GDM emphasised the need for individually tailored and culturally appropriate informa-tion, as well as the importance of developing a GDM management routine that is in line with the context of a woman's life, values and priorities (Devsam et al., 2013).

Mobile health (mHealth) technologies can potentially serve as a new tool for managing chronic disease and promoting healthy behaviour (WHO, 2011). There is growing evidence on the impact of mHealth interventions for the management of diabetes outside pregnancy (Liang et al., 2011; Wu et al., 2017). For example, a recent systematic review on mobile app–based interventions to support diabetes self-management suggested that these interventions led to a clinically significant HbA1c reduction among adult outpatients with diabetes, especially those with T2DM (Wu et al., 2017). Further, a review on the use of telemedicine technology for managing diabetes in pregnancy (not just GDM) showed a modest but statistically significant improvement in HbA1c levels (Ming et al., 2016). These authors called for more studies focused on patient satisfaction and the costs of care delivery, which may be where the use of these technologies is the most

helpful (Ming et al., 2016). Therefore, while the use of smartphone apps for the management of GDM appears promising, more studies are needed (Mackillop et al., 2014; Ming et al., 2016).

In response to the positive attention that mHealth and self-monitoring have received in the medical and public health literature, critical discourses of the use of mHealth are also emerging (Lupton, 2013; Sharon, 2016). Critics of mHealth claim that most research to date has focused on the impact on behavioural change, the medical accuracy of app content and legal and regulation issues, while little is known about the experiences of people using these technologies (Lupton, 2013).

According to Lupton (2013), these technologies involve a shift in the understanding of the body. While people used to rely on their own sensations, these technologies produces a virtual body considered more objective than personal experiences. The fear is that people's trust in subjective and intuitive knowledge will decrease (Lupton, 2013). Another critical aspect of mHealth is that these technologies encourage individuals to take responsibility for their own health. This may add further to the burden of those who are ill or can not 'choose health' (Lupton, 2013). Moreover, while mobile technology has many potential advantages for providing health information, content usability, literacy levels, app security and user privacy are limitations that need to be considered (Boulos et al., 2014).

Due to their complexity, mHealth interventions are hard to evaluate (Maar et al., 2017). However, evaluation of the implementation process can reveal how an intervention works, how it is received by different recipients and any unanticipated effects (Maar et al., 2017). Qualitative studies can contribute to this process by assessing an intervention (i.e., the use of mHealth technology) from the patient's or provider's point of view (Maar et al., 2017; Pludvinski et al., 2015).

The Pregnant+ RCT

Current treatment for women with GDM in Norway includes recording their blood glucose levels and providing them with verbal health and nutrition information with accompanying written information (Borgen et al., 2017). In the Pregnant+ RCT, the use of a smartphone app as an addition to the standard follow-up process for GDM has been tested and compared to the standard follow-up process at five different diabetes outpatient clinics in Norway (Borgen et al., 2017). A total of 240 women were included in the study. The smartphone app analysed in the study supports the automatic transfer of blood glucose values from the measurement device to the app and includes a graphic overview of blood glucose values over time. In addition, it provides tailored information about health and nutrition for women with GDM in Norwegian, Urdu and Somali (Garnweidner-Holme et al., 2015). The aim of the RCT was to determine whether the use of the app contributed to better blood glucose values for the women with GDM, as measured by an oral glucose test at 3 months postpartum (Borgen et al., 2017).

Aim of the study

The aim of this study was to explore the participants' experiences with using the app to control their blood glucose values and to receive health and nutrition information. It therefore provides insight into the usefulness of smartphone apps for managing medical conditions and identifies important factors for developing and implementing these types of apps, particularly for women with GDM.

Methods

The interpretative phenomenological analysis (IPA) inspired the research process. This methodology is suitable for exploring individuals' perspectives and experiences (Smith et al., 2009) and was therefore considered appropriate for exploring the experiences of

women using the Pregnant+ app to manage GDM. IPA has previously been used to explore the experiences of women with GDM (Carolan, 2013; Evans and O'Brien, 2005).

Interviews

Semi-structured interview were used for data collection. The first author (JBS) and the second author (LGH) conducted the interviews. Two pilot interviews were conducted to determine the effectiveness of the interview guide. The interviews lasted for about 30 minutes and were conducted at the diabetes outpatient clinics, at health clinics or in the participants' homes between October 2016 and February 2017.

Selection of participants and recruitment

As we focussed exclusively on the experiences of using the Pregnant + app, we included women from the intervention group only. Purposive sampling was used to select participants from all five diabetes outpatient clinics. In addition to having been in the intervention group that had access to the app, the women had to have completed all parts of the Pregnant+ RCT (including three questionnaires and an oral glucose tolerance test 3 months after birth). The women were interviewed 3 to 10 months postpartum. Potential interviewees were contacted by phone and were given oral and written information about the study. They were recruited continuously through the research process, and recruitment continued until we had enough data to answer the research questions. Of the 22 women who were asked to participate in the interviews, 5 women declined. Two women were abroad, while the rest of the women did not have time to participate. Therefore, a total of 17 women were interviewed.

Analysis

The interviews were recorded and transcribed verbatim. The first author carried out the data analysis, while potential themes and subthemes were discussed with the research team. The software program NVivo (11) was used to identify and manage new themes. The analysis was guided by IPA (Smith et al., 2009) and included the following steps: (1) reading and rereading, (2) initial noting, (3) developing emergent themes, (4) searching for connections between emergent themes and clustering them into subthemes and (5) arranging the subthemes into superordinate themes related to the research questions.

Results

Characteristics of study participants and their use of the Pregnant+ app

The participants were either of ethnic Norwegian (*n* = 10) or immigrant backgrounds (here defined as having been born in another country and later moving to Norway). The women with immigrant backgrounds (*n* = 7) came from Poland, Bulgaria, Turkey, Pakistan, Palestine and Sweden. Two of the women had been diagnosed with GDM in a previous pregnancy. Of the women interviewed, some used the app daily for blood glucose management (*n* = 10), some used it for information only (*n* = 5) and two women did not download the app even though they were allocated in the RCT to using it. Table 1 describes the characteristics of the participants and their use of the app.

Experiences with the use of the app

We found that the women had different reactions to GDM and different experiences with the app. Five main themes related to the research questions were identified: Reaction to diagnosis, management of GDM, experience using the Pregnant+ app, the app's impact on the