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Reducing risk of type 2 diabetes after gestational diabetes:

a qualitative study to explore the potential of technology in primary care

Abstract

Background

Despite the seven-fold increased risk of type 2 diabetes mellitus (T2DM) among females previously diagnosed with gestational diabetes (GD), annual rates of follow-up in primary care are low. There is a need to consider how to reduce the incidence of progression to T2DM among this high-risk group.

Aim

To examine the views of females diagnosed with GD to ascertain how to improve primary care support postnatally, and the potential role of technology in reducing the risk of progression to T2DM.

Design and setting

A qualitative study of a purposive sample of 27 postnatal females leaving secondary care with a recent diagnosis of GD.

Method

Semi-structured interviews were conducted with 27 females, who had been previously diagnosed with GD, at around 6–12 weeks postnatally. Interviews were audiotaped, transcribed, and analysed thematically.

Results

Facilitators and barriers to engaging in a healthy postnatal lifestyle were identified, the most dominant being competing demands on time. Although females were generally satisfied with the secondary care they received antenatally, they felt abandoned postnatally and were uncertain what to expect from their GP in terms of follow-up and support. Females felt postnatal care could be improved by greater clarity regarding this, and enhanced by peer support, multidisciplinary input, and subsidised facilities. Technology was seen as a potential adjunct by providing information, enabling flexible and personalised self-management, and facilitating social support.

Conclusion

A more tailored approach for females previously diagnosed with GD may help reduce the risk of progression to T2DM. A need for future research to test the efficacy of using technology as an adjunct to current care was identified.

Keywords

gestational diabetes; health promotion; primary health care; risk reduction behaviour; telemedicine; type 2 diabetes mellitus.

INTRODUCTION

Gestational diabetes (GD) is glucose intolerance with its onset during pregnancy.¹ In the UK, 4.4% of pregnant females develop GD and prevalence is increasing.² A diagnosis of GD doubles the risk of being diagnosed with type 2 diabetes mellitus (T2DM) in the 4-month period after giving birth,³ and females with GD are 7.4 times more likely to develop T2DM than females with a normoglycaemic pregnancy.⁴ The health consequences of T2DM are well documented and include an average reduction of life expectancy by 10 years.⁵ Being born to a mother with GD also increases the child's subsequent risks of developing T2DM, obesity, and cardiovascular disease.⁶

Females with GD receive intensive antenatal specialist care to minimise risks of adverse materno-fetal outcomes, including an antenatal behaviour change intervention (BCI) to promote increased activity levels and modify diet. Antenatally, the UK National Institute for Health and Care Excellence (NICE) guidance to support females with GD is generally well adhered to in secondary care.⁷ Primary care provisions postnatally are less satisfactory, with annual rates of long-term follow-up for GD in primary care around 20%.⁸ Bearing in mind the challenges facing primary care

in terms of growing workload, declining workforce, and pressures on funding,⁹ there is a need to consider innovative ways in which to reduce the risk of progression from GD to T2DM.

Qualitative work examining the experiences of females after a diagnosis of GD has highlighted important issues for future interventions.¹⁰ Although females diagnosed with GD are aware of their increased risk of T2DM, they do not always act on this knowledge, and, though pregnancy motivates health behaviour change, this is often not maintained postnatally. Barriers to health behaviour change include fatigue and the demands of family and childcare; facilitators to change include weaning and provision of long-term support for self-management.¹¹ Although a number of BCIs have been aimed at reducing the risk of T2DM among females with a previous diagnosis of GD, only two randomised controlled trials have shown a significant impact on the development of T2DM, and these were highly intensive interventions that could not be easily delivered in community settings.^{11,12}

Smartphones and wearable devices have the potential to improve public health,¹³ and have shown some success in health behaviour change interventions.^{14,15} These new technologies could shift the need for

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How this fits in

Despite the seven-fold increased risk of type 2 diabetes mellitus (T2DM) among females previously diagnosed with gestational diabetes (GD), annual rates of follow-up in primary care are low and females previously diagnosed with GD are not eligible for the National Diabetes Prevention Programme (NDPP) unless they have an HbA1c of ≥ 42 mmol/mol. Additional support in the primary care setting postnatally could help reduce the risk of progression to T2DM. Greater clarity regarding the annual HbA1c test, signposting to pre-existing community resources, and greater use of technology as an adjunct to care could help reduce the feeling of abandonment that females report after being discharged back into primary care.

intensive face-to-face interventions towards an interactive, self-directed, personalised, and cost-effective lifestyle intervention for mothers following a diagnosis of GD. One study noted that *women in the postnatal period require flexible, longer-term approaches that accommodate their family and work commitments, and new information technologies may have potential to support this*,¹⁰ but did not go on to consider how these new information technologies could be incorporated into BCIs. The present study provides insight into how this might be achieved.

Mobile health applications show potential to track and record goals and behaviour, and facilitate access to health advice and information, but there are concerns regarding accuracy, legitimacy, security, effort required, and immediate effects on mood.¹⁶ Although there have been a number of studies published examining the role of mobile health (mHealth) in diabetes management,¹⁷ only two have examined the use of mobile technology in this specific population, and both focused on self-monitoring of blood glucose levels during pregnancy.^{18,19} Experiences of using mobile technologies to aid health behaviour change has not, to date, been explored in a sample of new mothers with previous GD.

A theoretically informed, affordable BCI that is acceptable and accessible to females from the early postnatal period, in order to enable a sustained change in diet and exercise, is urgently needed.² This qualitative study therefore aimed to:

- elicit the barriers and facilitators to sustaining a healthy postnatal lifestyle

among females with a prior diagnosis of GD;

- deepen the understanding of how secondary care interventions for females with a prior diagnosis of GD could best be followed up in primary care postnatally; and
- ascertain the views of females on the potential role of technology in supporting a healthy postnatal lifestyle.

METHOD

Invitations to participate were sent out to females recently diagnosed with GD along with appointment letters for a postnatal oral glucose tolerance test (OGTT) at their local hospital. These females were invited to take part in face-to-face interviews when attending their OGTT at around 6 weeks postnatally. A purposive approach was used to achieve a maximum-variety sample of early postnatal females (age, parity, socioeconomic status, and ethnicity) with previous GD, including outpatient OGTT non-attenders, by sending further study invitations offering a home visit or telephone interview to maximise participation in the study.

Semi-structured interviews

A semi-structured topic guide was developed after an extensive participatory and observational stage before undertaking this study. Preparatory study included attendance at a mother and toddler group in the community, and observation of the antenatal education sessions. The topic guide, including questions on demographics, was developed with reference to the literature, feedback from a patient and public involvement exercise,²⁰ and discussions with an expert steering group. (Further information is available from authors.)

Informed consent was obtained from all participants before the interviews were conducted. Interviews were conducted between May 2016 and January 2017 with 27 postnatal females with an antenatal diagnosis of GD.

Analysis

Interviews were audiorecorded and transcribed, and two interviewers made notes on the interviews, highlighting key points from each. These transcripts and notes were imported into NVivo (version 11). The analysis was conducted using a thematic analysis approach.²¹ This involved six phases; data familiarisation; coding; identification of candidate themes; review and revision of themes; definition and naming of themes; and analysis and interpretation of patterns across the

Table 1. Participant demographic characteristics (N= 27)

Characteristic	n	%
Marital status		
Married	20	74.1
Cohabiting	7	25.9
Ethnicity		
White	20	74.1
Asian	3	11.1
Black African	1	3.7
Arab	3	11.1
Previous pregnancies		
0	9	33.3
1	9	33.3
2	7	26.0
≥3	2	7.4
Previous live births		
0	10	37.0
1	11	40.7
2	5	18.5
≥3	1	3.7
Diabetes history		
Family history of T2DM	21	77.8
Previous GD	4	14.8
Education		
Degree level	18	66.7
Further education	3	11.1
School to 16 years of age	3	11.1
School to ≤16 years of age	3	11.1
Occupation		
Professional	10	37.0
Sales/customer service	5	18.5
Caring/leisure/other	4	14.8
Admin/secretarial	2	7.4
Associate/technical	2	7.4
Self-employed	1	3.7
Not working	3	11.1

GD = gestational diabetes. T2DM = type 2 diabetes mellitus.

data. Constant comparative analysis was undertaken by reviewing the scripts and exploring identified themes in subsequent interviews until data saturation was achieved. Data saturation was achieved by analysis of interview 21 but a further six interviews were undertaken to achieve a maximum-variety sample. This further purposive sampling included significant efforts to interview females who did not attend the OGTT at the hospital.

At each step of this process discussions among the team, which incorporated independent verification of emergent themes, ensured consistency and helped identify key issues. The researchers sought to enhance dependability of the findings by involving an independent researcher to examine both the process and product of the study. In keeping with the thematic analysis approach, the researchers did not engage in prevalence counts or triangulation with interviewees.²¹

RESULTS

Demographics

The 27 females interviewed had a mean age of 33 years (SD 5.8; range 22–44 years). The mean BMI of the sample was 30 kg/m² (SD 8.0; range 17.6–48.1 kg/m²). Two females were underweight (BMI <18.5 kg/m²), five were a healthy weight (BMI 18.5–24.9 kg/m²), and the remainder were overweight or obese. Table 1 shows the demographic characteristics of the study sample.

Barriers and facilitators to a healthy postnatal lifestyle

There were a number of external and internal barriers and facilitators to a healthy postnatal lifestyle. External barriers and facilitators included: practical, social, cultural, environmental, financial, and technological factors. Practical barriers were the most important external influence, and, of these, *competing demands on time* was the theme that garnered the most discussion. Physical activity and healthy eating were both seen as time-consuming activities, for example, time taken to prepare meals, and it was common for the females to feel resigned to prioritising the needs of their baby and family over their own health:

'I'm basically eating what I want ... foods that you can open with one hand and eat quickly within the three seconds between ... Sometimes I find myself going a whole day with just eating biscuits, which is awful ... but you know it's ... you just have to do what you have to do.' (Participant(P) 2, aged 37 years)

'I know that breakfast is the most important meal of the day ... but that's the time of the day that it's chaotic. So, you've got to feed a baby, your husband's walking out the door, you've got a toddler to get to nursery and then you need to try and cook scrambled eggs because you can't have cereal. It's like, "What am I supposed to do?"' (P16, aged 36 years)

There was also a perception of exercise as something distinct from physical activity, and as being incompatible with family life:

'Weekends, that's the only time we'll, like, get off all together as a family, so I don't really want to be, like, disappearing to the gym or whatever when we can be, like, going out for the day.' (P5, aged 22 years)

Internal barriers and facilitators included psychological, behavioural, physical, or genetic factors. Psychological factors related to motivation, emotions, knowledge, and personality (or 'type'), with motivational factors being the most important. Just as the females often prioritised their baby when faced with competing demands on their time, they also prioritised their baby when it came to their motivations for adopting a healthy lifestyle. The motivation to be healthy during pregnancy was mainly due to a concern for the baby's health, whereas postnatally this motivation weakened:

'When I was pregnant, obviously it was the fact that I was carrying a baby and it was right. I'm not being selfish, it's not just about me, whereas now I'm not carrying a baby and it is just me that has got my body.' (P4, aged 31 years)

Reaching or avoiding particular milestones, and having specific goals, helped improve motivation for healthy behaviours. Important motivators included: avoiding reaching a particular weight, no longer being able to fit into certain clothes, or wanting to lose weight for a special occasion such as a wedding.

Physical and genetic factors were also identified as important influences on behaviour. A degree of fatalism was displayed in the interviews around genetic or hormonal causes of GD. Physical limitations were commonly mentioned as barriers to exercise such as: pre-existing health conditions, recovering from a normal delivery, or having had a caesarean section.

Views on support received from healthcare professionals

Participants were generally satisfied with

the support received from healthcare professionals (HCPs) antenatally. An exception to this was the manner in which they received the diagnosis of GD, with several females stating they would have preferred to receive this information via a phone call rather than a letter. There were some mixed views regarding the style and content of the workshop that the females attended shortly after receiving their diagnosis, with some liking the social nature of the group, while others preferring a one-to-one consultation at this stage. The high levels of satisfaction with antenatal support received contrasted sharply with how the females felt postnatally. An important theme identified in the interviews was the feeling of being abandoned after having their baby:

'You feel kind of abandoned, you have this horrendous situation where everything you eat has to be checked and then suddenly they kind of go, "well off you go then".' (P23, aged 37 years)

There was a lack of clarity regarding what should be done with regards to their diet postnatally, and how they would be followed up in primary care:

'I spoke to two midwives and said, "What do I do now?"; and one said, "Oh you should just carry on the way you have been, keep cutting out the carbs"; another one said, "Oh go back to eating normally."' (P23, aged 37 years)

'My GP was never really involved at all ... It was all done through the hospital ... I mean my midwife was aware but the GP certainly wasn't aware when I went for a check-up the other week.' (P19, aged 44 years)

Many of the females were unaware that they needed an annual HbA1c test, and those that were aware seemed uncertain about how it would be arranged:

'We kind of discussed it briefly, and I remember saying, I sort of asked her [GP], "Should I come and see you ... or ... will you contact me?";... or whatever. And I think her advice was that well this should happen, but just to make sure you might want to stick it in your diary.' (P2, aged 37 years)

Participant suggestions to improve postnatal support

Discussions regarding the level of support received from HCPs generated many suggestions for improving care. Enabling

social support via 'mums' groups' was the most common suggestion for the postnatal period, with some suggesting this could take the form of an online forum. Other suggestions included community centres, walking groups, or subsidised baby-friendly leisure facilities.

Participants also suggested ways in which GPs could play a role in providing additional postnatal support. These suggestions ranged from having videos about GD played in waiting rooms, to a 3-monthly telephone follow-up. Others also suggested input from dieticians, nutritionists, health visitors, diabetic nurses, or weight loss services. Some suggested that GP surgeries could offer more postnatal support through their practice websites, or an annual review in addition to the annual HbA1c test. There were differing opinions on the best timing for this additional postnatal support, but the majority felt that around the time of the postnatal check was ideal. Weaning was also suggested as a good time to provide additional support:

'Around the weaning stage ... because you're thinking about food ... you're thinking about things that are good for him ... Oh you know ... I might as well make something nice for myself as well.' (P2, aged 37 years)

Views on the potential of technology to assist in maintaining a healthy lifestyle

A wide range of technologies were discussed including hardware such as: pedometers, mobile phones, tablets, wearable devices, games consoles, and body-fat monitors. Types of technological software interfaces discussed included websites, blogs, forums, chatrooms, social networking sites, newsfeeds, e-mail alerts, and mobile apps. Participants identified a number of mechanisms by which technology might support a healthy postnatal lifestyle by enabling:

- access to information;
- personalised self-management; and
- social interaction.

Almost all the participants used technology as a means of finding out information about GD, and, for some, one major advantage was the fact that the information was available in their own language. Google was unsurprisingly the most popular starting point, followed by topic-specific websites, and then forums. Most of those who reported using forums did not register or post questions themselves but instead found answers

by searching pre-existing posts. Some participants also reported using apps as a source of information (for example, Slimming World or Weight Watchers for information about diet), while others used newsfeeds or e-mail updates. Technology was used to supplement the care given by HCPs, especially when the care was difficult to access or if patients were unhappy with it. Most participants viewed NHS online information positively and it was generally the most trusted source, but some were less satisfied and sought out patient-led sources of information:

'... there was a lady ... she found that when she was diagnosed a few years ago, she didn't find there was any information at all. So, she's done her own research and she's got her own web site ... Gestational Diabetes UK, I think. And they give a lot of information that I think [sic] not necessarily ... given by midwives.' (P15, aged 36 years)

Additional information obtained via the use of technology was not always beneficial, and several females spoke of how they stopped reading about pregnancy-related problems due to the anxiety this produced.

Participants discussed various ways in which technology can enable personalised self-management of their health including goal-setting, reminders, self-monitoring, feedback, and rewards. Technology could enable goal-setting via features such as BMI calculators, suggestions regarding recommended levels of activity, or by encouraging users to set limits on calorie intake.

Some participants reported using pedometers, smart watches, or apps to track their weight, activity levels, and/or calorie intake. One advantage of such self-monitoring is that participants could be made more aware of the 'diet-exercise trade-off'. Participants reported that receiving feedback was a positive experience, and one noted, specifically, how technology could act as a substitute for human encouragement:

'The thing that appeals to me about things like weight loss clubs is that you get a shiny sticker and it's always very nice to be patted on the back isn't it, so I think with a Fitbit ... it's just another way of sort of checking and saying, yeah I'm doing enough.' (P22, aged 35 years)

Another important reported benefit of technology was that it could be flexible enough to fit around busy schedules:

'I haven't got time to sit down with books and calorie count and look at the back of packets. I can literally pick up a tin of tuna, zap it with a barcode scan on my iPhone and it tells me that I can or can't eat it and what's in it.' (P16, aged 36 years)

'Wii Fit ... I did that quite recently ... it's convenient for me because say if [baby's name] is sleeping then that's when I can do it instead of like trying to find somebody.' (P5, aged 22 years)

Several participants discussed how technology can help them feel less isolated. Social networking enabled participants to become aware of local group activities, and some went on to form friendships with those they met online. There could be a negative side to the social interactions that technology enabled, however, and some participants noted how social comparisons could be unhealthy, or that they might be subjected to unwanted criticism online:

'When I think of online forums I just think online trolls, like, I just think you put an opinion and then a thousand people attack you for it — keyboard warriors.' (P8, aged 28 years)

Many of the discussions regarding technology were concerned with the actual interface. Characteristics that participants reported would encourage the use of technology included speed and ease of use. The ubiquity of mobile phones was generally seen as something that facilitated the use of technology, though some participants raised concerns about the extent to which smartphones were part of their lives and reported trying to limit their use:

'... 90% of the population my age have sort of, you know ... surgically attached to their phone. I try not to be, I have to have like a phone curfew myself after a certain time in the evening.' (P8, aged 28 years)

Other barriers to using technology included restricted access at work, or not being a 'techy type'. Some concerns were raised about the quality and reliability of some apps and websites, and one participant suggested that wearable devices may be novelty items for which she could not justify the cost.

DISCUSSION

Summary

Competing demands on time is the most important barrier to maintaining a healthy postnatal lifestyle, and females prioritise other tasks over this, especially looking after

their baby. In the antenatal period the main motivator for maintaining a healthy lifestyle is the health of the unborn baby. Postnatally this motivation is weakened, and healthy eating and exercise are viewed as time-consuming tasks that are de-prioritised. Motivational facilitators to maintaining a healthy lifestyle postnatally are important.²²

Females generally feel well supported in secondary care with regards to their GD during the antenatal period, but feel abandoned by the healthcare system postnatally. There is a lack of clarity regarding the role of primary care in the postnatal period, and a lack of awareness regarding the need for an annual HbA1c test, and how this will be arranged. Females with GD feel there is a need for additional support in the postnatal period. Suggestions regarding the form this support might take include facilitated social support, subsidised baby-friendly leisure facilities, and access to ongoing dietary advice.

Females felt there was a role for technology to support an ongoing healthy lifestyle in the postnatal period. Technology is not only a useful vehicle by which to access information, but can also enable personalised self-management of health in the postnatal period by mechanisms such as goal-setting, reminders, milestones, self-monitoring, feedback, and rewards. One advantage of such use of technology is that it can be flexible enough to fit around a busy schedule. Technology can also facilitate social support, though there is a potential negative side to this with some reporting problems with others being overly judgemental online.

Strengths and limitations

The strengths of this study include the diversity of the sample in terms of age, parity, socioeconomic status, and ethnicity, and the focus on the potential role for technology in supporting a healthy lifestyle postnatally. This research has offered interesting insights into what females feel might support them in having a healthy lifestyle in the postnatal period, thus reducing their risks of T2DM.

There were a number of limitations to this study. First, the interviews were conducted relatively soon after the females had given birth. It may be that different factors influence the ability to maintain a healthy postnatal lifestyle at a later stage, and future research may wish to follow females up for a longer period. Despite this, the authors believe the early postnatal period is a key time point to intervene to help maintain the healthy behaviours that

have been encouraged antenatally. Second, the lead researcher (who conducted the first 21 interviews) is a male GP and health psychologist. The second interviewer was a female research associate. Participants were informed that the interviewers were researchers, but their backgrounds may have influenced the dynamic of the interviews and subsequent findings. Consideration of reflexivity was important, and discussions with the rest of the research team helped to avoid an overly narrow interpretation of the findings. Third, the study examined factors that females reported to be important in influencing their ability to maintain a healthy lifestyle postnatally rather than making observations of what actually takes place, which may differ. A critical realist perspective was taken, commonly adopted in qualitative research, which holds that some degree of truth can be ascertained through the examination of qualitative data, while acknowledging that this is nuanced by human interpretation.²¹ Future intervention studies will cast more light on the degree of significance that stated barriers and facilitators have on actual behaviour.

Another potential criticism is that frequency counts were not conducted when considering the importance of themes within data from this study. Although many qualitative researchers do report frequencies, the researchers of this study wished to stay true to the thematic analysis approach of Braun and Clarke,²¹ who argue that, although the use of terms such as 'several' or 'many' are sometimes criticised for being vague, 'frequency does not determine value'. Although some qualitative approaches (such as content analysis) do depend on counting the instances of a theme's occurrence, Braun and Clarke argue that it is the researcher's role to highlight the importance of issues in the data without the inclusion of frequencies.²¹

Comparison with existing literature

The study findings resonate with previous qualitative work in this area. For example, the finding that females are motivated to maintain a healthy lifestyle antenatally for the benefit of the unborn child, but that this wanes postnatally, has been described previously.^{8,23} The theme of competing demands on time overlaps with previous work that identified fatigue and demands of the family and childcare as barriers to a healthy lifestyle.¹⁰ The knowledge-behaviour gap identified in previous research²⁴ was something that the females in this study felt could be addressed via support postnatally, for example, from a dietician. This need

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Ethical approval

NHS Health Research Authority Approval was applied for through the IRAS online form (IRAS Project ID: 192921) and ethical approval was granted by the proportionate review sub-committee of the Wales Research Ethics Committee 7 (REC reference 16/WA/0084) on 14 March 2016. NHS permission for research to commence was granted by the Sheffield University Teaching Hospital NHS Foundation Trust (SUHT) on 6 April 2016 (ref: STH19316).

Provenance

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Competing interests

The authors have declared no competing interests.

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for longer-term support and facilitation of self-management has also been identified previously,²⁵ but the present study has cast further light onto what form this longer-term support might take. In particular, this study examined how technology might help facilitate the maintenance of a healthy lifestyle postnatally. There is a growing body of evidence to suggest that technology can play a role in preventing health problems, for example, a recent systematic review has found that interventions using computers, mobile phones, or wearable technology can be effective in reducing sedentary behaviour,²⁶ echoing a previous systematic review demonstrating that interventions employing technology can improve diet, increase physical activity, and reduce adiposity.¹⁵

Implications for research and practice

Females who have had GD require ongoing support postnatally and this article has highlighted a number of ways this might be achieved. There is a need to ensure that females do not feel abandoned postnatally and one simple measure might be to ensure that a brief discussion regarding follow-up of GD is incorporated into the postnatal check. Females with a prior diagnosis of GD could be coded as being at high risk of diabetes in the electronic record to help ensure reminders are sent for the annual HbA1c blood test. Although additional resources would clearly be needed to provide ongoing dietary advice postnatally,

this study suggests that females would benefit from receiving clear information antenatally regarding the nature of their diet postnatally. Females would benefit from signposting to baby-friendly community-based physical activities, such as buggy-walking groups, something that again could easily be incorporated into the primary care postnatal check.

Primary care practitioners could consider recommending technologies that might help facilitate maintenance of a healthy postnatal lifestyle. Although this is a relatively new field, evidence is growing for the use of mobile technologies in health behaviour change.^{26,27} The ongoing evaluation of digital approaches to T2DM prevention, commissioned by NHS England, may provide clinicians with further quality-assured technologies that they can safely recommend to patients.²⁷

There is a clear need for a low-cost postnatal intervention aimed at females who have had GD to reduce their significant risk of developing T2DM. Such an intervention might combine and tailor pre-existing community-based, baby-friendly physical activity groups with technology. Technology could be used to facilitate social support, provide access to ongoing dietary advice, and help with goal-setting, feedback, and rewards for both physical activity and dietary behaviours. Although technology is unlikely to replace the need for quality face-to-face contact, it has potential to be used as an adjunct to care, at scale, in this population.

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