

1 **Effects of Online Support and Social Media Communities on Gestational Diabetes: A**  
2 **Systematic Review**

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4 Zilin Cheng, M.S.<sup>1</sup>, Haijing Hao, Ph.D.<sup>2</sup>, Fotini Tsofliou, Ph.D.<sup>3</sup>, Melissa D. Katz, M.D.<sup>4</sup>,  
5 Yiye Zhang, Ph.D.<sup>1</sup>

6  
7 <sup>1</sup>Population Health Sciences, Weill Cornell Medicine, New York, NY, USA

8 <sup>2</sup>Department of Computer Information Systems, Bentley University, Waltham, MA, USA

9 <sup>3</sup>Department of Rehabilitation & Sport Sciences, Bournemouth University, Bournemouth,  
10 UK

11 <sup>4</sup>Department of Medicine, Weill Cornell Medicine, New York, NY, USA

12  
13 **Contact information:**

14 Zilin Cheng, [zic4005@med.cornell.edu](mailto:zic4005@med.cornell.edu)

15 Haijing Hao, [hhao@bentley.edu](mailto:hhao@bentley.edu)

16 Fotini Tsofliou, [ftsofliou@bournemouth.ac.uk](mailto:ftsofliou@bournemouth.ac.uk)

17 Melissa D. Katz, [mdkatz@med.cornell.edu](mailto:mdkatz@med.cornell.edu)

18 Yiye Zhang, [yiz2014@med.cornell.edu](mailto:yiz2014@med.cornell.edu)

19  
20 **Corresponding author:**

21 Yiye Zhang

22 (646)962-9437

23 [yiz2014@med.cornell.edu](mailto:yiz2014@med.cornell.edu)

24 425 East 61<sup>st</sup> Street, New York, NY 10065

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37

1 **Abstract**

2 **Background:** Gestational diabetes mellitus (GDM) is a common complication in pregnancy  
3 that can lead to negative maternal and fetal outcomes. Online support interventions have been  
4 suggested as a potential tool to improve the management of GDM.

5 **Objective:** This systematic review aimed to summarize the effectiveness of social media and  
6 online support interventions for the management of GDM.

7 **Methods:** We conducted a thorough systematic search across Web of Science, Scopus, and  
8 PubMed, following PRISMA guidelines, and supplemented it with a manual search. Our  
9 results included both qualitative and quantitative research. We rigorously assessed  
10 quantitative studies for bias using ROBINS-I and RoB 2 tools, ensuring the reliability of our  
11 findings.

12 **Results:** We incorporated a total of 22 studies, which were comprised of ten qualitative and  
13 twelve quantitative studies. Online support interventions were found to have a positive  
14 impact on promoting self-care and improving healthcare outcomes for women with GDM.  
15 Individualized diet and exercise interventions resulted in lower odds of weight gain and  
16 GDM diagnosis, while online prenatal education increased breastfeeding rates. In addition,  
17 telemedicine options reduced the need for in-person clinical visits and improved patient  
18 satisfaction.

19 **Conclusions:** Online support interventions show potential to improve outcomes in patients  
20 with GDM in this small literature review. Future research is also necessary to determine the  
21 effectiveness of different types of online interventions and identify strategies to improve  
22 engagement and the quality of the information provided through online resources.

23  
24 **1. Introduction**

25 Gestational diabetes mellitus (GDM) is a common complication of pregnancy [1-3], affecting  
26 approximately 2%-10% of pregnancies in the United States each year [4], 7.8% of pregnant  
27 women in the U.S. were diagnosed with diabetes during pregnancy in 2020 [5]. GDM affects  
28 both maternal and newborn health and is associated with negative pregnancy outcomes [6].

29 Adverse health effects include hypertensive disorders during pregnancy, macrosomia,  
30 obesity, and increased risk of congenital abnormalities [1-4]. In addition, GDM has long-term  
31 health effects that place women and their offspring at higher risk for diabetes, obesity, and  
32 cardiovascular disease [7]. Therefore, the prevention and management of GDM play an  
33 important role in ensuring the health of pregnant women, and the improvement of diet and  
34 lifestyle is crucial in the management and prevention of GDM [2, 6, 8, 9].

35  
36 The rapid development of information communication technology (ICT) and mobile health  
37 (mHealth) has opened new health care avenues for GDM patients, providing more

1 possibilities to obtain medical care and support [10, 11]. Communication platforms on the  
2 Internet like social media and online forums attract a large number of women and provide  
3 access to additional information [12], though the majority if this information is not evidence-  
4 based and can be misleading also [13]. The COVID-19 pandemic has brought non-contact  
5 medical intervention and online support into the spotlight; semicolon in the setting of  
6 increased concern regarding the quality of care, safety, and health outcomes of these  
7 pregnancies [14, 15], and privacy concerns when using social media [16].

8  
9 Several systematic reviews have been conducted to investigate the usage of smartphone  
10 applications and mobile monitoring technologies in monitoring health indicators and  
11 providing medical feedback for individuals with diabetes [10, 17, 18]. These reviews provide  
12 a summary of the evidence for the effectiveness of mobile phone applications in facilitating  
13 lifestyle modifications for general diabetes or type 1 and type 2 diabetes, but do not provide a  
14 detailed analysis for gestational diabetes. Moreover, some systematic reviews have targeted  
15 GDM patients, demonstrating that telemedicine interventions can help lower blood glucose  
16 levels and reduce the risk of complications [19]; remote monitoring technologies can offer  
17 personalized solutions to improve the health of diabetic patients [20]; and digital tools can  
18 support self-management of healthy diet, behavior, and treatment adherence in women with  
19 GDM [21]. However, these studies tend to focus more on the health effects of telemedicine  
20 and mobile phone diabetes management applications on GDM patients, rather than the effects  
21 of social media, online forums, or online support on GDM patients. Furthermore, a previous  
22 systematic review has reported the positive effects of social media on the physical and mental  
23 health of pregnant and postpartum women [22]. However, the studies included in the review  
24 [22] were published prior to June 2018 and therefore may not account for the latest research  
25 developments.

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Therefore, the main objective of this systematic review was to evaluate the effectiveness of interventions using online support, online communities, and social media on the health outcomes of patients who have either experienced or were at risk of gestational diabetes, utilizing research conducted between 2019 and 2022. Additionally, this study also aims to comprehend patients' perspectives and obstacles concerning the use of these technologies.

**Research question 1:** How do current studies assess the effectiveness of online support interventions for GDM management?

**Research question 2:** What types of online support interventions should be used to determine their effectiveness in GDM management?

## **2. Research Design and Methods**

### **2.1 Design**

This systematic review was conducted according to the 2020 Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) checklist [23]. This research has been registered our research with the Open Science Framework (OSF) [24] and assigned a registration DOI of <https://doi.org/10.17605/OSF.IO/KQTRG>.

### **2.2 Search Strategy**

We conducted a thorough search across three prominent databases using six specific keywords (Appendix Table A1.), spanning the years 2019 to 2022. These databases encompassed Web of Science, regarded as the most esteemed, preeminent and established database of research publications and citations worldwide; Scopus, recognized as one of the most extensive abstract and citation databases, indexes over 25,000 journals, thereby

1 empowering researchers to investigate topics spanning various fields and fostering  
2 interdisciplinary research; and PubMed, primarily consisting of the MEDLINE database of  
3 references and abstracts pertaining to life sciences and biomedical subjects. To enhance the  
4 comprehensiveness of our search, we also performed a manual search on Google Scholar  
5 using the same keywords. We meticulously reviewed the first 100 search results for each  
6 keyword to include relevant studies. We also did manual search in the reference lists of other  
7 relevant studies. In light of the expeditious advancements in technology and social media, we  
8 searched for relevant studies in the past four years, published from Jan 1, 2019, to Dec 31,  
9 2022, investigating the effect of online support, online community, and social media for  
10 perinatal women with gestational diabetes mellitus.

11

12 With our research objectives in mind, we developed two sets of phrases. One focused on  
13 medical terms related to diabetes, describing patients' conditions, while the other centered  
14 around social media terms, representing the various online platforms to which patients might  
15 have been exposed. We conducted searches within the article titles and abstracts of three  
16 databases, using six distinct combinations of these two sets as our keywords: (1) medical  
17 terms, including "Gestational Diabetes" and "Diabetes"; (2) social media terms, including  
18 "Online Support," "Online Communities," and "Social Media." In addition to narrowing  
19 down our search by publication year, we also specified the article types to ensure the  
20 inclusion of relevant literature (Appendix Table A1.). Thereafter, we meticulously examined  
21 the titles, published journals, and published years of all identified articles to eliminate the  
22 duplicates.

23

### 24 **2.3 Eligibility criteria**

1 To be eligible for inclusion in the review, studies need to meet the following inclusion criteria  
2 included studies in which: (1) studies examining the effects of online support on gestational  
3 diabetes and GDM patients' health; (2) studies investigating the perspectives and experiences  
4 of women who have either experienced or were at risk of gestational diabetes through the use  
5 of online support; (3) studies conducting randomized or non-randomized controlled trials test  
6 aimed at evaluating the effectiveness of online support in promoting weight loss and diet  
7 control for managing gestational diabetes.

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9 We excluded studies if they are: (1) systematic review or review articles; (2) non-related  
10 articles to gestational diabetes or online community or social media or online support in  
11 pregnant women with GDM; (3) articles that only distribute questionnaires or recruit  
12 experimental or interview trial participants through social media or online; (4) articles about  
13 general diabetes not gestational diabetes.

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#### 15 **2.4 Data extraction and quality assessment**

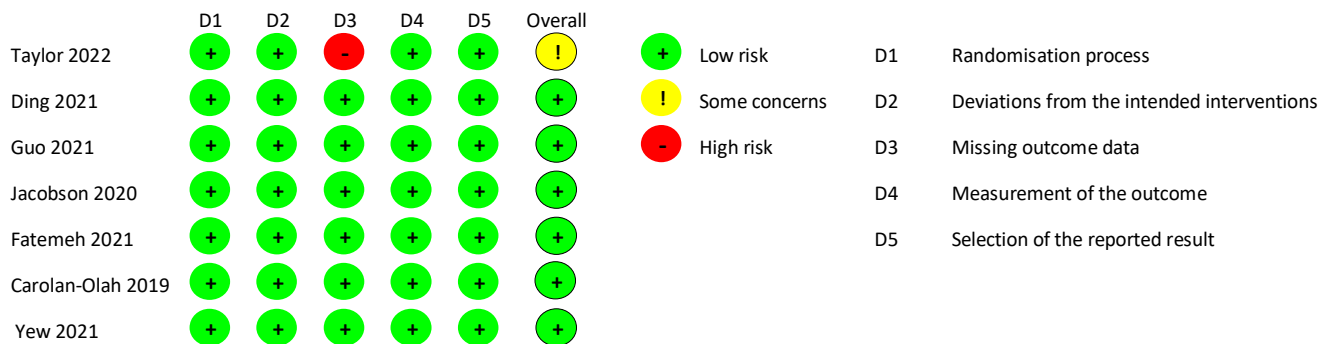
16 Publication information of the studies was extracted into customized Microsoft Excel sheets  
17 with the following headings: article title, source title, published year, abstract, and DOI  
18 number. More study details were extracted into designed standard tables in Microsoft Word  
19 with the information including title, aim, method, study population, location, author and  
20 conclusion. Titles, abstracts and full-text screening were performed by two reviewers (HH,  
21 ZC), and the screening results and reasons for acceptance were provided. Inconsistencies  
22 were resolved by consensus or by the third reviewer (YZ). The Cohen Kappa method was  
23 used to measure inter-reviewer reliability. Cohen Kappa coefficient is close to one, indicating  
24 a high level of agreement between reviewers.

25

1 **2.5 Bias assessment**

2 We conducted a risk of bias assessment for ten of the twelve quantitative studies, utilizing  
 3 appropriate bias assessment tools based on each study's design. Two descriptive studies were  
 4 excluded from this risk assessment due to their nature. The ROBINS-I tool was applied to the  
 5 three nonrandomized studies, while the Cochrane Collaboration's tool (RoB 2 version August  
 6 2019) was used for the other seven randomized trials. For each randomized trial, we assessed  
 7 the risk of bias related to the randomization process, deviation from the intended  
 8 interventions, missing outcome data, measurement of the outcome, and selection of the  
 9 reported result. Deviations were categorized as "low risk," "some concerns," or "high risk"  
 10 based on our judgment and the tool's algorithm.

11  
 12 There were eight out of the twelve quantitative studies assessed as having "low risk" of bias.  
 13 However, one study [25] was considered to have an overall level of bias that was "somewhat  
 14 concerning" due to the unavailability of outcome data for 70% of Cochrane tools, which is  
 15 insufficient. Additionally, another study [26] had a moderate level of bias, as controlling for  
 16 confounders was considered a concern in this non-randomized before-after study. The  
 17 evaluation results of the RoB 2 tool was presented in Figure 1.

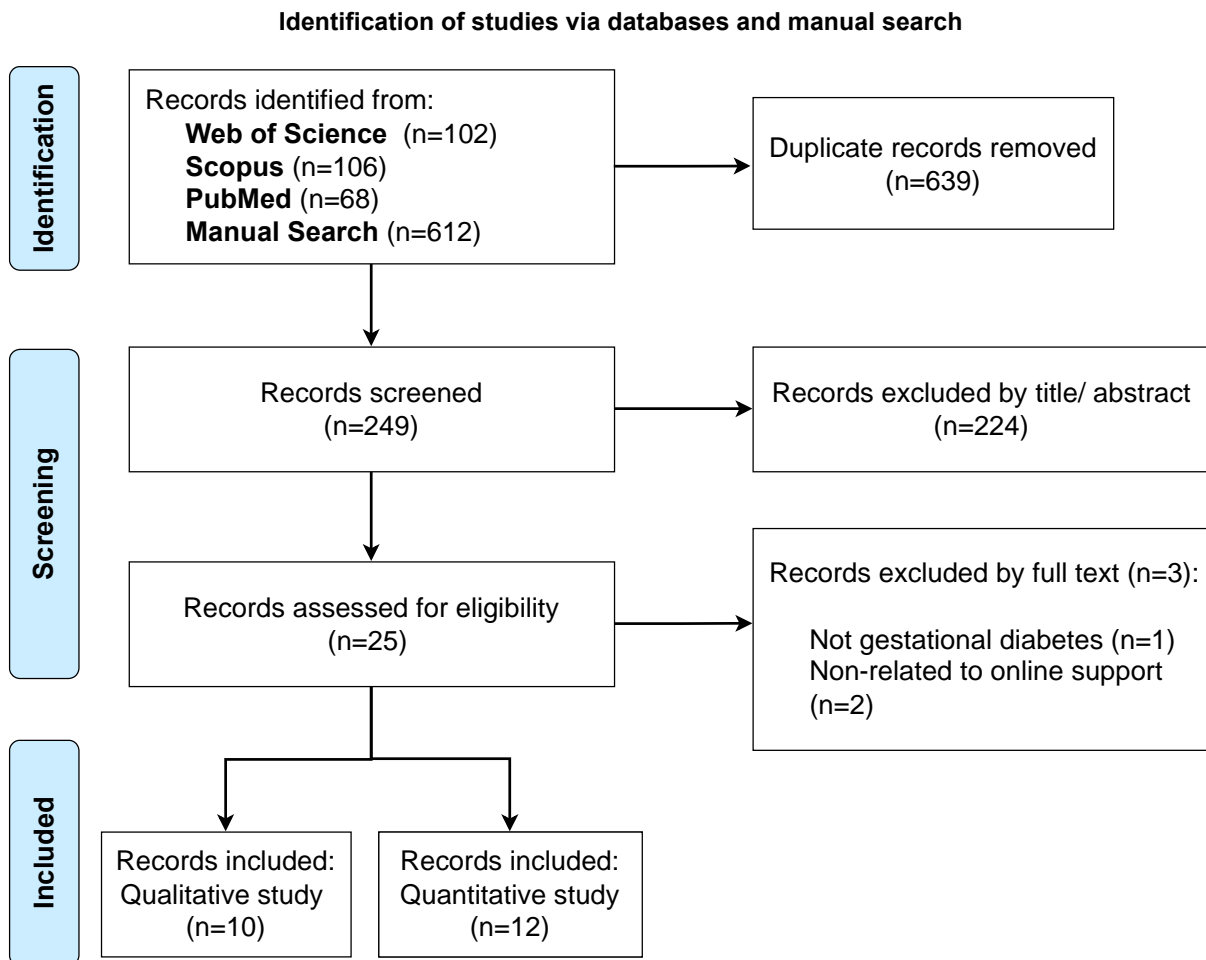


18  
 19 Figure 1. Bias assessment  
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21 **3. Results**

22 **3.1 Study Selection**

1 The selection process and results for the literature are illustrated in Figure 2. Initially, a total  
 2 of 888 papers were identified from the three databases and manual search, and 249 records  
 3 were left after being deduplicated. Titles and abstracts were screened according to the  
 4 eligibility criteria by two reviewers independently, and 22 records met the eligibility criteria  
 5 on the basis of a full-text review and were accepted for the systematic review.



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 7 Figure 2. PRISMA flow diagram for the search strategy and study selection process  
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### 9 **3.2 Description of Included Studies**

10 Among the 22 papers, five studies were conducted in the United Kingdom, five in Australia,  
 11 three in China, two in the United States, two in Canada, two in Singapore, two in Iran and one  
 12 in Israel. Ten out of 22 studies (45%) used qualitative methods to explore experiences and  
 13 perceptions of online support among people with GDM. Four of ten qualitative studies

1 engaged participants in semi-structured interviews, two other studies used online  
2 questionnaires to collect participants' insights. These questionnaires include a range of topics,  
3 including demographic information, awareness of diabetes risk, etc. Both questionnaires  
4 employed a combination of multiple-choice questions and Likert scales to gather responses,  
5 and one of the research studies that used questionnaires incorporated two specialized  
6 knowledge scales, namely the Diabetes Prevention Comprehensive Knowledge [27] and  
7 Reproductive Health Knowledge [28]. Moreover, other studies delved into patients'  
8 viewpoints by analyzing the posts in online communities or describing experiences with  
9 GDM patients in clinics. Twelve studies (55%) were conducted using quantitative methods,  
10 and seven of the twelve used randomized controlled clinical trial methods to set up control  
11 and treatment groups to evaluate the online support among the study population. Table 1  
12 summarizes study details and sample sizes for qualitative studies. Table 2 summarizes online  
13 intervention platforms in addition to study details for quantitative studies.

Table 1. Summary of qualitative studies

Reference, first author	Title	Journal	Year	Study Country	Sample size	Design
Lotte Elton [29]	Knowledge, community and care: Digital biocitizenship in gestational diabetes	Sociology of Health & Illness	2022	United Kingdom	18 participants	Semi-structured interview
Jie Shang [30]	Chinese women's attitudes towards postpartum interventions to prevent type 2 diabetes after gestational diabetes: a semi-structured qualitative study	Reproductive Health	2021	China	20 participants	Semi-structured interview (in-person)
Katie J.Edwards [31]	How do women with a history of gestational diabetes mellitus use mHealth during and after pregnancy? Qualitative exploration of women's views and experiences	Midwifery	2021	United Kingdom	10 participants	Semi-structured interview (on phone)
Audrey Buelo [32]	A novel research method for workshops and co-production of interventions: using a secret Facebook group	Pilot and Feasibility Studies	2020	United Kingdom	21 participants, 521 posts	Descriptive analysis
C. E. Eades [33]	Analysis of spontaneous, user-generated data about gestational diabetes on online forums: implications for diabetes prevention	Diabetic Medicine	2020	United Kingdom	646 posts	Descriptive analysis
Helen R Murphy [34]	Managing Diabetes in Pregnancy Before, During, and After COVID-19	Diabetes Technology & therapeutics	2020	United Kingdom	Not applicable	Descriptive analysis
Kristen J Nadeau [35]	Beta Testing of a Gestational Diabetes Risk Reduction Intervention for American Indian and Alaska Native Teens	J Pediatr Health Care	2020	United States	11 participants	Online questionnaires
Sharon Naveh [36]	Sense making in complex health situations Virtual health communities as sources of information and emotional support	Aslib J. Inf. Manag.	2019	Israel	507 posts	Deductive analysis
Kristy L. Gray [37]	Women's barriers to weight loss, perception of future diabetes risk and opinions of diet strategies following gestational diabetes: An online survey	Int. J. Environ. Res. Public Health	2020	Australia	429 participants	Online questionnaires
Sumali Hewage [38]	Barriers to Gestational Diabetes Management and Preferred Interventions for Women With Gestational Diabetes in Singapore: Mixed Methods Study	JMIR Form Res	2020	Singapore	15 participants	Semi-structured interview

Table 2. Summary of quantitative studies

Reference, first author	Title	Journal	Year	Study Country	Sample size	Intervention platform	Intervention	Design
Rachael Taylor [25]	Evaluation of a Type 2 diabetes risk reduction online program for women with recent gestational diabetes: a randomised trial	Int. J. Behav. Nutr. Phys. Act.	2022	Australia	76 participants (3 groups)	Body Balance Beyond (BBB) website	Dietary, exercise, stress management and sleep habits support	Randomized controlled trial
Amy Hui [26]	Impact of remote prenatal education on program participation and breastfeeding of women in rural and remote Indigenous communities	EClinicalMedicine	2021	Canada	233 participants (before), 231 participants (after)	Facebook and website	Pregnancy-related topics educational material	Before and after study
Bingjie Ding [39]	WeChat-assisted dietary and exercise intervention for prevention of gestational diabetes mellitus in overweight/obese pregnant women: a two-arm randomized clinical trial	Arch. Gynecol. Obstet.	2021	China	111 controls, 104 interventions	We-Chat	Dietary and exercise guidance	Two-arm randomized controlled trial
Ying Guo [40]	Application of online-offline integrated medical care management in patients with gestational diabetes	Ginekol Pol	2021	China	70 controls, 70 interventions	We-Chat	Precautions, diet, exercise guidance	Randomized controlled trial
Annie Lemelin [41]	Demonstrated Cost-Effectiveness of a Telehomecare Program for Gestational Diabetes Mellitus Management	Diabetes Technology & Therapeutics	2020	Canada	81 controls, 80 interventions (not randomized)	Telehomecare (THCa) system	Online analysis of blood glucose data	Controlled Clinical Trial
Lisette T Jacobson [42]	Electronic Monitoring Of Mom's Schedule (eMOMS (TM)): Protocol for a feasibility randomized controlled trial to improve postpartum weight, blood sugars, and breastfeeding among high BMI women	Contemp. Clin. Trials Commun.	2020	United States	72 participants (24 per group)	Facebook	Dietary, exercise and breastfeeding educational resources	Randomized controlled trial
Fatemeh Ghasemi [43]	Comparing the effect of individual counseling with counseling on social application on self-care and quality of life of women with gestational diabetes	Prim. Care Diabetes	2021	Iran	126 participants (42 per group)	WhatsApp	Counseling sessions on gestational diabetes self-care	Randomized controlled trial
Timothy L. Middleton [44]	Secular trends in information communications technology: Access, use, and attitudes of young and older patients with diabetes	Diabetes Spectr.	2020	Australia	614 participants (80 GDM patients)	-	-	Descriptive study
Mary Carolan-Olah [45]	A randomized controlled trial of a web-based education intervention for women with gestational diabetes mellitus	Midwifery	2019	Australia	110 participants	Website	Dietary and exercise support	Randomized controlled trial

Mohaddeseh Hosseinzadeh [46]	Comparison of the Effect of Face-to-face and Social Media-based Training on the Self-care of Women with Gestational Diabetes Mellitus (GDM) in Birjand	Modern Care J.	2022	Iran	73 participants (3 groups)	Telegram	Dietary and exercise support	Quasi-experimental
Marlien Varnfield [47]	M♡THER, an mHealth System to Support Women with Gestational Diabetes Mellitus: Feasibility and Acceptability Study	Diabetes Technology & Therapeutics	2021	Australia	23 participants	M♡THER	Motivational prompts and educational media	Descriptive study
Tong Wei Yew [48]	A Randomized Controlled Trial to Evaluate the Effects of a Smartphone Application-Based Lifestyle Coaching Program on Gestational Weight Gain, Glycemic Control, and Maternal and Neonatal Outcomes in Women With Gestational Diabetes Mellitus: The SMART-GDM Study	Diabetes Care	2021	Singapore	170 controls, 170 interventions	Habits-GDM	Dietary, exercise and weight tracking support	Randomized controlled trial

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1 A total of ten qualitative studies were screened and they were different in their approach to  
2 gathering experiences and perspectives of patients with gestational diabetes. Four studies  
3 used a design of semi-structured interviews, conducted in-person or over the phone; three  
4 analyzed posts in social media groups or forums; two used online questionnaires to gather  
5 patients' perspectives; yet another study combined broad narratives and individual cases. The  
6 sample size of these studies is not large given the semi-structured interviews study's  
7 characteristics, and all are between 10 and 21, as Table 1 shows. The sample size of the three  
8 studies analyzing the online posts was between 500 and 650, one online questionnaire had 11  
9 participants and another one had 429 participants. Of note, there was one study whose sample  
10 size was not applicable as it outlined changes in the management of gestational diabetes in  
11 the UK before and after the COVID-19 lockdown.

12

13 Among the twelve quantitative studies, seven were randomized controlled clinical trials  
14 (RCTs), two were descriptive studies, one was before and after study design, one was a  
15 controlled clinical trial and one was a quasi-experimental study. Eight studies had more than  
16 100 participants, and three studies that had three groups had samples of between 70 and 80  
17 participants. It is worth noting that the before-and-after study focused on participants from  
18 three rural or remote first nations communities in Manitoba. The pre-phase involved 233  
19 participants and the post-phase involved 231 participants, with different individuals  
20 comprising the cohorts before and after the study. The intervention platform for most studies  
21 was social media or websites through which text- or video-based interventions were  
22 delivered. One intervention using the telehomecare (THCa) system as a platform is email- or  
23 phone-based.

24

25 **Experiences and perceptions of online support among patients with gestational diabetes**

1 Findings from studies exploring the effectiveness of online support using qualitative research  
2 methods have been mixed, but the majority of women had a positive view of online support.  
3 Dietary strategy services provided by nutritionists or dieticians through online programs are  
4 favored among patients with GDM. Additionally, these patients also considered monitoring  
5 weight and formulating dietary plans via mobile applications to be beneficial approaches.[37]  
6 A study conducted in semi-structured interviews with 18 women with GDM found that an  
7 online GDM support community had a positive effect on promoting patients' self-care. [29]  
8 Another study's results align with this viewpoint, showing that in addition to healthcare  
9 professionals, the Internet stands out as the preferred source of information. [38] The network  
10 of peer support and knowledge-sharing in the online community advocated better healthcare,  
11 but the study also pointed out that scholarly engagement is limited [29]. A study found that  
12 online resources such as video consultations were popular during the UK's COVID-19  
13 lockdown, with remote testing dramatically improving the experience of women with  
14 gestational diabetes who needed face-to-face visits [34]. A study using a questionnaire found  
15 that e-books and videos for mother-daughter pairing GDM education worked well, and  
16 participants were satisfied with the educational approaches [35]. In another study on Chinese  
17 women's attitudes toward engaging in postpartum interventions to prevent gestational  
18 diabetes, 20 women were interviewed and expressed positive attitudes toward mHealth  
19 interventions [30]. Many patients hoped to make lifestyle changes to reduce their risk of  
20 GDM with the assistance of social media or mobile applications. However, some patients  
21 pointed out that their healthcare practitioners seldom proffered recommendations regarding  
22 online support. Consequently, they were obliged to conduct their own investigation, which  
23 yielded positive results in terms of the health-related knowledge obtained from social media  
24 [31]. Some women tried to use mobile Apps to change health behaviors, but bad designed  
25 features and poor engagement held them back. [33]

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In addition to obtaining patient opinions directly through interviews and questionnaires, three studies also explored patients' perceptions by analyzing posts in online forums or online communities. Two studies investigated the role of virtual health communities or social media groups as sources of information and social support for women with gestational [32, 36]. The social media group workshop received positive feedback, with 71% saying they were looking forward to attending such an event again, with some saying it was difficult to find time and depending on other circumstances [32]. Participants in the virtual health community said their emotional needs were met and they were supported with medical information and advice from other members [36]. Another study analyzing patients' perceptions of a GDM diagnosis found that content in an online forum conveyed an implicit message to readers that GDM was not a serious diagnosis that warranted undue attention, and that few users recognized the importance of their behavior and lifestyle. Research suggests that the information widely disseminated in these forums may not be conducive to preventing gestational diabetes [33].

### **Clinical effectiveness of online intervention for gestational diabetes mellitus**

Being overweight and obese are major risk factors for gestational diabetes in women, and there is evidence that breastfeeding reduces women's risk of gestational diabetes. Therefore, these twelve studies using quantitative methods focused on three different interventions, 1) assisting weight loss through diet and exercise interventions; 2) increasing breastfeeding rates through enhanced prenatal education; 3) monitoring patient status monitoring through telemedicine. For studies that used diet and exercise as the main intervention, the results showed positive effects. A Chinese study found that pregnant women who received a personalized diet and exercise intervention based on social media WeChat in the first trimester gained significantly less weight compared with a control group [39]. Online support

1 can also help pregnant women in managing their blood sugar levels [45], and one study  
2 showed that there was a 13.8% lower chance of being diagnosed with GDM in the mid-  
3 trimester [39]. A study of overweight Australian women with recent gestational diabetes  
4 through the Body Balance Beyond (BBB) online program also found the effectiveness of diet  
5 and physical activity interventions. This study has shown that patients who participated in the  
6 High Personalization group who receive personalized video-, website- and text-based  
7 resources have significant weight loss [25]. Counseling sessions conducted through  
8 WhatsApp have been shown to enhance knowledge regarding diet and physical activity  
9 among patients with GDM, resulting in an increase in self-care scores[43]. For studies  
10 evaluating breastfeeding-focused interventions, the results also found that online prenatal  
11 education can increase both breastfeeding rates and the duration of breastfeeding. A Canadian  
12 before-and-after study found that remote prenatal education facilitated by websites and social  
13 media increased breastfeeding rates in three rural or remote communities [26].

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15 Another study delivered intervention via Facebook also found that women who participated  
16 in the Diabetes Prevention Program (DPP) and used electronic Monitoring of Mom's  
17 Schedule lost more weight and breastfed longer at 3 and 6 months postpartum [42]. Two  
18 more studies evaluated outcomes in GDM patients using telemedicine or mHealth as an  
19 intervention and rated them positively[41, 48]. A controlled clinical trial showed that the  
20 group treated with Telehomecare (THCa) experienced a 56% reduction in doctor visits and a  
21 10-fold increase in nursing interventions by phone and email. Patients treated with THCa  
22 were able to decrease medical costs by 16% compared to the control group. In terms of health  
23 outcomes, there were no differences in diabetes control and complications between the two  
24 groups. Furthermore, patients using THCa reported high levels of satisfaction with their care  
25 [41]. Two studies gauging the satisfaction of GDM patients with mHealth tools also revealed

1 that GDM patients expressed satisfaction with the use of email and mHealth applications for  
2 managing their condition[44, 47]. Two additional studies conducted a comparison between  
3 online and offline management approaches for GDM patients. One study revealed that both  
4 face-to-face education and social media-based education were equally effective in supporting  
5 GDM patients[46]. In contrast, another showed that patients who received integrated online-  
6 offline medical management improved blood glucose levels, mental status, and pregnancy  
7 outcomes compared with patients who only received offline medical care [40].

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#### 9 **4. Discussion and Conclusions**

10 We narrowed down to 22 studies after screening three major literature databases and manual  
11 search in this systematic review on the effectiveness of social media and online support  
12 interventions for gestational diabetes, including ten qualitative and twelve quantitative  
13 studies. Regarding the first research question on the effectiveness of online support  
14 interventions for GDM, our systematic review found that the studies have shown mixed  
15 results. For the qualitative studies, the majority of participants in those studies had a positive  
16 view of online support, with many agreed that online support was helpful for promoting self-  
17 care and providing a network of peer support and knowledge-sharing. However, some women  
18 pointed out that some online support was inadequate with limited engagement and poor  
19 features. For the quantitative studies regarding the clinical effectiveness of online  
20 interventions for GDM, studies have focused on three main interventions: weight loss  
21 through diet and exercise, increased breastfeeding rates through enhanced prenatal education,  
22 and patient status monitoring through telemedicine. These studies have found positive effects,  
23 with personalized diet and exercise interventions resulting in weight loss and a lower chance  
24 of GDM diagnosis, online prenatal education increasing breastfeeding rates, and telemedicine  
25 reducing doctor visits and increasing patient satisfaction. Overall, online interventions have

1 the potential to improve outcomes for patients with GDM, but more research is needed to  
2 fully understand their effectiveness.

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4 Moving on to our second research question, which types of online intervention should be  
5 used to identify effective GDM management, our literature review suggests that more  
6 quantitative research is needed to identify effective online support interventions in improving  
7 GDM management. The lack of quantitative data in many studies underscores the need for  
8 more rigorous research to understand the effectiveness of different interventions. Although  
9 there are applications like Noom [49] that can help people manage their diabetes and lose  
10 weight, few studies have evaluated their impact specifically on GDM. With the immersion of  
11 artificial intelligence technology such as ChatGPT [50] in the general public, we expect more  
12 and more online interventions to be developed for patients. However, there are also  
13 limitations and challenges associated with online support, such as limited engagement,  
14 inadequate information and non-personalized information provided by some mHealth  
15 resources. Further research is needed to better understand the effectiveness of different types  
16 of online interventions and to identify strategies to improve engagement and the quality of the  
17 information provided through online resources.

18

19 A limitation of the studies reviewed is that many studies relied primarily on qualitative  
20 research methods, which do not quantify the effectiveness of online interventions.

21 Furthermore, most studies did not have a long-term follow-up to provide information on the  
22 long-term effectiveness of the interventions. Diabetes is a chronic disease that requires  
23 sustained lifestyle changes and it is important to understand the long-term efficacy and  
24 effectiveness of online support interventions for pregnant women. Future studies may address  
25 this gap with longer follow-up periods and analyses of long-term outcome data.

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Overall, our review highlights the potential benefits of online support interventions for GDM management but also emphasizes the need for more rigorous research to fully understand their effectiveness. Healthcare providers and policymakers must carefully consider the potential benefits and limitations of online support when developing and implementing interventions for GDM.

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Authors' contributions:

ZC: Conceptualization, Methodology, Software, Investigation, Writing—original draft, Writing—review & editing. HH: Conceptualization, Methodology, Supervision, Software, Writing—review & editing. FT: Methodology, Writing—review & editing. MK: Writing—review & editing. YZ: Conceptualization, Methodology, Supervision, Writing—review & editing.

1 Summary Table

<b>Topic</b>	Effects of Online Support and Social Media Communities on Gestational Diabetes: A Systematic Review
<b>What is Already Known</b>	<ol style="list-style-type: none"> <li>1. Gestational diabetes mellitus (GDM) is a prevalent pregnancy complication that impacts both maternal and newborn health and raises long-term health risks.</li> <li>2. Information communication technology (ICT) and mobile health (mHealth) provide new healthcare avenues for GDM patients, including telemedicine interventions and mobile monitoring technologies</li> <li>3. Previous reviews highlighted the positive effects of telemedicine and mobile diabetes management apps on GDM patients but paid less attention to social media, online forums, and online support.</li> </ol>
<b>What this Paper Adds</b>	<ol style="list-style-type: none"> <li>1. This review assessed the effectiveness of online support, communities, and social media interventions on health outcomes for patients with, or at risk of, GDM, using research from 2019-2022.</li> <li>2. Online support interventions for GDM showed mixed effectiveness, with positive effects in personalized diet/exercise interventions, increased breastfeeding rates via online prenatal education, and reduced doctor visits and enhanced patient satisfaction through telemedicine.</li> <li>3. Further quantitative research is needed to determine effective online support interventions for GDM management and to comprehend their long-term efficacy.</li> <li>4. Challenges with online support involve limited engagement, insufficient and non-personalized information from some mHealth resources, necessitating more research to enhance engagement and information quality.</li> </ol>

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1 Appendix Table A1. Article types and keywords used in three databases

Database	Type	Keywords
Web of Science	Article; Early Access	"Gestational Diabetes Online Support",
Scopus	Article	"Gestational Diabetes Online Communities",
PubMed	Classical Article; Clinical Conference; Clinical Study; Clinical Trial; Clinical Trial Protocol; Clinical Trial, Phase I; Clinical Trial, Phase II; Clinical Trial, Phase III; Clinical Trial, Phase IV; Controlled Clinical Trial; Evaluation Study; Multicenter Study; Observational Study; Pragmatic Clinical Trial; Preprint; Randomized Controlled Trial; Research Support, American Recovery and Reinvestment Act; Research Support, N.I.H., Extramural; Research Support, N.I.H., Intramural; Research Support, Non-U.S. Gov't; Research Support, U.S. Gov't, Non-P.H.S.; Research Support, U.S. Gov't, P.H.S.; Research Support, U.S. Gov't; Technical Report	"Gestational Diabetes Social Media", "Diabetes Online Support", "Diabetes Online Communities", "Diabetes Social Media"

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