Original Article
Effects of WeChat platform-based nursing intervention on disease severity and maternal and infant outcomes of patients with gestational diabetes mellitus

Lufang Chen, Wei Zhang, Aiping Fu, Lin Zhou, Shuixian Zhang

Department of Obstetrics, Affiliated Hangzhou First People's Hospital, Zhejiang University School of Medicine, Hangzhou 310006, Zhejiang, China

Abstract: Objective: To determine the effects of WeChat platform-based nursing intervention on the disease control and pregnancy outcomes of patients with gestational diabetes mellitus (GDM). Methods: A total of 112 patients with GDM treated in our hospital from December 2018 to December 2020 were enrolled, and their clinical data were retrospectively analysed. Among them, 61 pregnant women were given routine nursing as the control group (Con group), and the other 51 were given WeChat platform-based interactive continuous nursing intervention as the observation group (Obs group). The blood glucose (BG) of the two groups before and after nursing was compared, and their self-management level and nursing satisfaction were evaluated. The maternal and infant outcomes of the two groups were also compared. Results: Before nursing, BG and glycosylated hemoglobin (HbA1c) levels in the two groups were comparatively high, without notable difference between the two groups (P>0.05); after nursing, the levels of fasting blood glucose, 2 hour postprandial blood glucose (2h-PG), and HbA1c in the Obs group decreased significantly, and were significantly lower than those in the Con group (P<0.05). Additionally, the two groups were similar in self-management level scores before nursing (P>0.05), while after nursing, the scores of diet management, exercise management, BG monitoring management and foot care management in the Obs group increased and were significantly higher than those in the Con group (P<0.05). The Obs group expressed significantly higher nursing satisfaction than the Con group (χ^2=6.078, P<0.05). The total incidence of adverse pregnancy outcome in Obs group was lower than that in Con group (χ^2-5.566, P<0.05). According to the analysis of risk factors, older age, pre-pregnancy BMI ≥24 kg/m^2, and history of diabetes mellitus were independent risk factors for adverse pregnancy outcomes of pregnant women, while WeChat platform-based interactive continuous nursing was a protective factor against adverse pregnancy outcome (P<0.05). Conclusion: WeChat platform-based interactive continuous nursing intervention can help patients master comprehensive self-management skills to achieve good control of GDM, improve their satisfaction toward nursing and lower the risk of adverse outcome.

Keywords: WeChat platform, nursing intervention, gestational diabetes mellitus, adverse maternal and child outcomes

Introduction

Gestational diabetes mellitus (GDM) is a common clinical disease of pregnant women [1]. Pregnant women suffer hyperglycemia during pregnancy because of glucose intolerance and abnormal glucose tolerance, and thus have obvious symptoms of diabetes mellitus (DM) [2]. According to statistics, at present, GDM shows a global incidence of over 14%, with notable influences on pregnant women and infants, and it is predicted that the number of GDM patients will reach 550 million in 2030 [3]. As the economy develops, Chinese people are enjoying a constantly improving living standard, and thus the body mass index (BMI) of pregnant women is much higher than before [4]. In addition, with the opening of China's three-child policy, the number of pregnant women at advanced maternal age is gradually growing, which is accompanied by a growing incidence of GDM. The high incidence of GDM will bring about an increase of medical expenses, long-run susceptibility to type 2 DM, and adverse pregnancy outcomes, so it is a global public health problem [5].

There are various clinical treatments for GDM. In clinical practice, insulin hypoglycemic therapy is primarily applied for GDM, which can regulate the blood glucose (BG) to a certain extent, but the effect of its single application is unsatisfactory, and education management is required [6]. The occurrence of GDM is strongly related to the diet of pregnant women during pregnancy, and intensive dietary guidance and health education can effectively improve the pregnancy outcome of women with GDM [7]. However, the mode of routine health education during pregnancy is simple, and there are some shortcomings in carrying out health education through manual education and distribution of brochures and other related methods, such as poor timeliness and poor communication experience.

Over the past few years, with the rapid development of the Internet and the popularity of smart phones, various ways of knowledge transmission, including videos and live streaming, have gradually become popular and efficient learning platforms, with the advantages of simple and fast communication and efficient access to information [8]. According to the results of 42nd *China Internet Report*, the number of internet users in China has reached 829 million as of December 2018, of which 47.3% are female users and 26.8% of the internet users fall into the age group of 20-39 years old, with 98.6% of the mobile internet usage rate, and 27.3 hours of weekly internet usage on average [9].

In the medical field, internet can convey knowledge to pregnant women more intuitively, simply and vividly, and it is convenient for pregnant women to use, which helps to improve their learning, and communication between doctors and patients [10]. As a modern communication tool, WeChat can transmit information to people in the form of text, video, and pictures. It has the advantages of being easy to use, high privacy, and wide application [11]. The purpose of this study was to determine the impact of WeChat platform-based nursing intervention on the disease severity and maternal and infant prognosis of GDM patients.

Methods and data

Clinical data

A total of 112 patients with GDM treated in our hospital during December 2019 and December 2021 were enrolled, and their clinical data were retrospectively analysed. Among them, 61 pregnant women were given routine nursing as the control group (Con group) and the other 51 were given WeChat platform-based interactive continuous nursing intervention as the observation group (Obs group). This study was performed with permission from the Medical Ethics Committee of our hospital (Ethics Approval number: LL2019 (Review) 084A (approve)).

Inclusion and exclusion criteria

Inclusion criteria: Pregnant women confirmed to have GDM through clinical diagnosis; pregnant women who were examined and delivered in our hospital during this time; pregnant women with good cognitive, understanding and communication skills, and normal ability of WeChat use for communication; pregnant women with singleton pregnancy; and those who provided a signature on informed consent forms after being apprised of the study.

Exclusion criteria: pregnant women comorbid with tumor, pregnancy-induced hypertension, kidney disease or thyroid disease; pregnant women with pre-pregnancy DM; pregnant women with alcohol or tobacco addiction; patients with other complications during pregnancy; and pregnant women with mental illness, speech disorder or cognitive impairment.

Intervention plan

The Con group was given routine nursing. The nursing staff were arranged to strengthen the monitoring of pregnant women's BG, educate and inform them of the pathogenesis and harm of GDM to improve their understanding. Timely admission education was provided to make pregnant women familiar with the hospital environment and responsible nurses to help them build trust and eliminate strangeness and cooperate with nurses in various degrees. The nursing staff were told to guide the pregnant women's diet to help them have a reasonably mixed diet under the premise of controlling the excessive intake of sugar and fat, and to require them to exercise properly. Pregnant women who need medication must be informed of the dosage and usage of medication, and close attention should be paid 30 minutes after medication to avoid adverse events. Finally, preg-

nant women were required to regularly cooperate with birth check-ups and medical staff.

The Obs group was given WeChat platform-based interactive continuous nursing additionally (**Table 1**) on the basis of nursing to the Con group.

Outcome measures

Primary outcome measures: The BG level (fasting blood glucose (FPG), 2 hour postprandial blood glucose (2h-PG), and glycosylated hemoglobin (HbA1c), and BG control) of pregnant women before and after intervention (1 day before delivery) was evaluated; the two groups were compared in maternal and infant outcomes. Logistics regression was adopted for analyzing the risk factors of adverse outcomes (premature delivery, postpartum hemorrhage, macrosomia and neonatal asphyxia).

Secondary outcome measures: The negative emotional changes of pregnant women before and after intervention were evaluated by the self-rating anxiety scale (SAS) [12] and self-rating depression scale (SDS) [13].

A total of 40 questions were scored, with a total rough score of 1-4 for each question. The rough score * 1.25 = standard score. A total score less than 50 indicates normal anxiety/depression; a total score of 50-60 indicates mild anxiety/depression; a total score of 61-70 points indicates moderate anxiety/depression; a total score over 70 points indicates severe anxiety/depression. A higher score indicates more severe anxiety/depression. The Self-Management Ability Questionnaire for Gestational Diabetes Mellitus Patients (SMQ-GDM) [14] was adopted to evaluate and compare the self-management level between the two groups. The nursing satisfaction of the two groups was compared and evaluated by Newcastle Nursing satisfaction scale (NSNS) [15]. The delivery mode and baseline data of the two groups were also evaluated.

Statistical analyses

SPSS 20.0 was adopted for data processing. Measured data were compared by the t test. Inter-group comparison was conducted by the independent-samples T test, while intra-group comparison was conducted by the paired t test.

Counted data were compared by the χ^2 test. The receiver operating characteristic (ROC) curves were drawn to analyze the predictive value of meaningful indexes in multivariate logistic regression in forecasting adverse outcomes of pregnant women. P<0.05 suggested a significant difference.

Results

Comparison of baseline data

According to comparison, the two groups were not significantly different in age, BMI, previous medical history, pregnancy length, education level, occupation or per capita monthly household income (all P>0.05, **Table 2**).

Comparison of BG control

After the intervention, the levels of serum FPG, 2h-PG, and HbA1c in both groups decreased significantly (P<0.05), with significantly lower levels in the Obs group than in the Con group (P<0.05, **Figure 1**), which indicated that the scheme for the Obs group can greatly contribute to controlling BG in pregnant women.

Comparison of negative emotions

The negative emotions of the two groups after intervention were evaluated. The analysis revealed that the SAS and SDS scores of the two groups decreased significantly after the intervention (P<0.05), with significantly lower SAS and SDS scores in the Obs group than in the Con group (P<0.05, **Figure 2**), which indicated that the scheme for the Obs group could substantially alleviate the negative emotions in pregnant women.

Comparison of self-management level score

The SMQGDM was adopted to evaluate and compare the self-management level of pregnant women before and after intervention. Analysis showed that after the intervention, the scores of mastry of disease-associated knowledge, management methods and behaviors, attitudes and beliefs, and social support of both groups increased significantly (P<0.05), with higher scores in the Obs group than in the Con group (P<0.05, **Figure 3**), suggesting that the scheme for the Obs group can improve the self-management ability of pregnant women.

Table 1. WeChat-based interactive continuous nursing plan

Step	Mode
Team setup	A continuous nursing group with integration of medical care was set up, including attending physician, head nurse, nursing staff, etc. All of them learned the methods of integration of medical care, continuous nursing and WeChat interaction. The attending physician evaluated the condition of pregnant women and formulated a corresponding treatment plan; the head nurse coordinated nursing staff to carry out nursing work, held regular meetings for summarization; the medical staff jointly discussed the nursing problems of pregnant women and made corresponding suggestions.
Disease assessment	The hospital conducted routine physical examination for pregnant women. On the night after the examination results came out, the doctor informed the pregnant women of the specific examination results through telephone and required them to come to the hospital to have physical re-examination to further clarify their disease. The pregnant women were guided to the nutrition department first when they came to the hospital for medical treatment, and the nutrition doctor would give specific guidance on the nutritional status of the pregnant women. Then the obstetrics department would issue a BG monitoring form for the pregnant women, and they were required to monitor their BG according to the contents of the form. In order to urge pregnant women to seriously complete daily BG monitoring and realize the necessity of it, nursing staff called back to them from time to time to ask about their BG and told them to remember to complete BG monitoring. Pregnant women could send the BG monitoring form to nursing staff by WeChat, and nursing staff would give the form to doctors who would evaluate the results of the form, summarize the progress of pregnant women's illness and give corresponding suggestions. The nursing staff would give timely feedback to pregnant women.
Psychological guidance	Nursing staff were made to understand the disease development and psychological status of pregnant women, monitor the changes of their BG, take insulin treatment in the case of any abnormality, increase communication with pregnant women, explain to them the self-protection skills of diseases and matters needing attention in childbirth, conduct psychological counselling in time when pregnant women have negative emotions to relieve their anxiety and increase their treatment compliance. The diet plan for pregnant women was jointly formulated by nursing doctors and dieticians to ensure nutrition balance.
WeChat platform-based interactive plan	A WeChat group was established, with which nursing staff published GDM-related knowledge from time to time and encouraged pregnant women to share their good self-control experience in the group. The staff regularly summarized and answered the questions of pregnant women in the group every day and provided encouragement. The staff also conducted one-to-one WeChat guidance three times a week, 15 min/time. The staff emphasized the importance of continuous monitoring of pregnant women and encouraged them to record all monitoring results and feedback to medical staff on time as the basis of their follow-up treatment.
Follow up nursing	Telephone follow-up was conducted for pregnant women once a week, 10 min/time. Based on the follow-up results and WeChat platform-based communication records and telephone inquiries, the compliance behavior and psychological state of pregnant women were evaluated, and psychological comfort was provided. Pregnant women were required to have re-examination and follow up regularly, and health education was conducted for pregnant women to correct their misconceptions.
Regular content push	According to the real feedback of reading, such as the "I have read it" or "I do not understand it" below the article, the nurse registered the feedback information of pregnant women on WeChat official account or WeChat group and sorted it out once a week. For pregnant women with a feedback rate of less than 95%, the nurse kept track of them and kept pushing articles to them every day. For contents with 10 cases of "I have read it" and 10 cases of "I do not understand it", the nurse organized pregnant women to communicate within the group within the specified time and answered questions again to consolidate knowledge.
Auxiliary guidance	For pregnant women with poor knowledge mastery ability, their questions were solved and answered in time, and for pregnant women with poor execution ability, nurses gave "one-on-one" independent video or voice guidance to correct their wrong behaviors and habits. Nurses should guide pregnant women to record and monitor their BG regularly and control their diet and exercise reasonably and to supervise themselves strictly according to the doctor's advice.

Table 2. Baseline data of pregnant women

Indexes	Control group (n=61)	Observation group (n=51)	x^2-Value	P-value
Age (years)			1.446	0.229
≥25	22	13		
<25	39	38		
Gestational age (week)			0.244	0.621
≥25	20	19		
<25	41	32		
Pre-pregnancy BMI (kg/m^2)			0.601	0.273
≥24	22	16		
<24	39	35		
Past medical history				
History of hypertension	10	8	0.010	0.919
History of diabetes mellitus	17	11	0.588	0.443
Abortion history	19	10	1.786	0.181
Pregnancy times			0.108	0.742
Primipara	28	25		
Multipara	33	26		
Education level			0.364	0.546
≥ senior school	30	28		
< senior school	31	23		
Occupation			0.514	0.916
Worker	10	9		
Farmer	8	7		
Technician	25	23		
Other	18	12		
Per capita monthly household income (yuan)			0.118	0.732
≥5000	22	20		
<5000	39	31		

Note: Body Mass Index (BMI).

Comparison of delivery modes of pregnant women

The delivery mode of the two groups after intervention was compared. The Con group had a lower proportion of natural deliveries but higher rates of vaginal midwifery and cesarean section than the Obs group (P<0.05, **Table 3**), which suggested that the scheme for the Obs group can improve the natural delivery rate in pregnant women.

Comparison of nursing satisfaction

According to comparison of nursing satisfaction between the two groups, the Con group expressed lower nursing satisfaction than the Obs group (P<0.05, **Table 4**).

Analysis of risk factors of adverse pregnancy outcome

According to the statistics of adverse pregnancy outcomes of the two groups, the Con group had a significantly higher incidence of adverse pregnancy outcomes than the Obs group (P<0.05, **Table 5**). The pregnant women with adverse pregnancy outcomes were assigned to the adverse group and those with normal pregnancy to the normal group. Their clinical data were all collected (**Table 6**). Univariate analysis showed that age, BMI, abortion history, diabetes history, and interactive continuous nursing based on WeChat platform were predictors of adverse pregnancy outcome (P<0.05, **Figure 4A**). Multivariate regression analysis showed
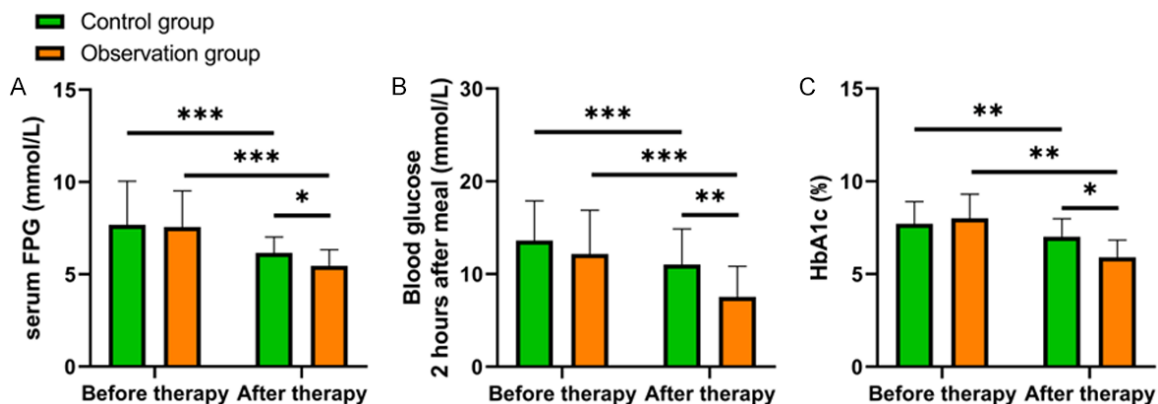
Figure 1. Blood glucose control of pregnant women. A. Changes in FPG of pregnant women before and after intervention. B. Changes in 2h-PG of pregnant women before and after intervention. C. Changes in HbA1c of pregnant women before and after intervention. *P<0.05, **P<0.01, ***P<0.001, fasting blood glucose (FPG), and glycosylated hemoglobin (HbA1c).
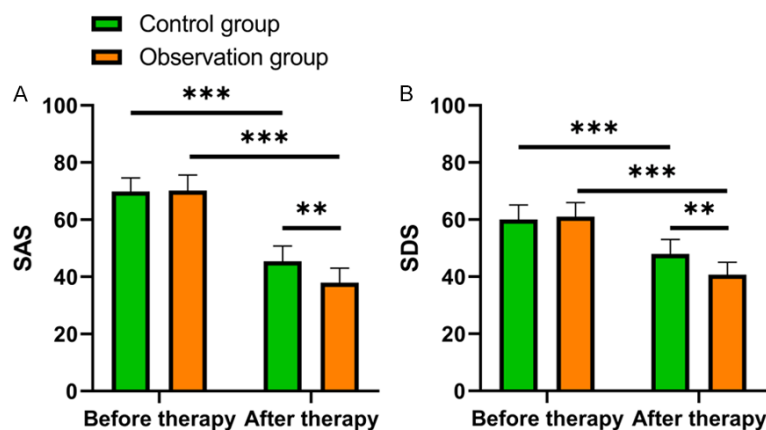

Figure 2. Comparison of SAS and SDS scores of pregnant women. A. Changes in SAS scores of pregnant women before and after intervention. B. Changes in SDS scores of pregnant women before and after intervention. **P<0.01, ***P<0.001, self-rating anxiety scale (SAS), self-rating depression scale (SDS).

that old age, pre-pregnancy BMI ≥24 kg/m², and history of DM were independent risk factors for adverse pregnancy outcomes of pregnant women, while WeChat platform-based interactive continuous nursing was a protective factor against adverse pregnancy outcome (P<0.05, **Figure 4B**). Further analysis based on ROC curves showed that the combined analysis result of age, BMI, history of DM and nursing plan can be adopted as outcome measures to forecast adverse outcomes in pregnant women (**Figure 4C**).

Discussion

GDM is a common pregnancy complication. Patients with GDM have abnormal glucose metabolism or potential impaired glucose tolerance before pregnancy, and their poor control of BG will have serious impact on the maternal and infant outcomes [16]. The causes of GDM are complicated, so it is mainly treated by insulin therapy in clinical practice, which alleviates the disease by controlling the BG of pregnant women [17]. However, some pregnant women have poor long-term BG control due to sports, psychological status, diet and other related factors, so it is of crucial importance to supplement scientific health education in the treatment process [18]. Routine health education can help pregnant women understand GDM and improve their diet and exercise behavior, but it lacks comprehensiveness and pertinence in contents, so it is difficult to meet the health needs of pregnant women.

Early research has found an association of self-management level of pregnant women who have GDM with pregnancy outcome; that is, pregnant women with a good self-management level have a significantly lower incidence of perinatal complications than those with a poor self-management level [19]. However, most pregnant women with GDM have poor self-control ability, which is likely to give rise to adverse pregnancy outcomes [20]. With the continuous
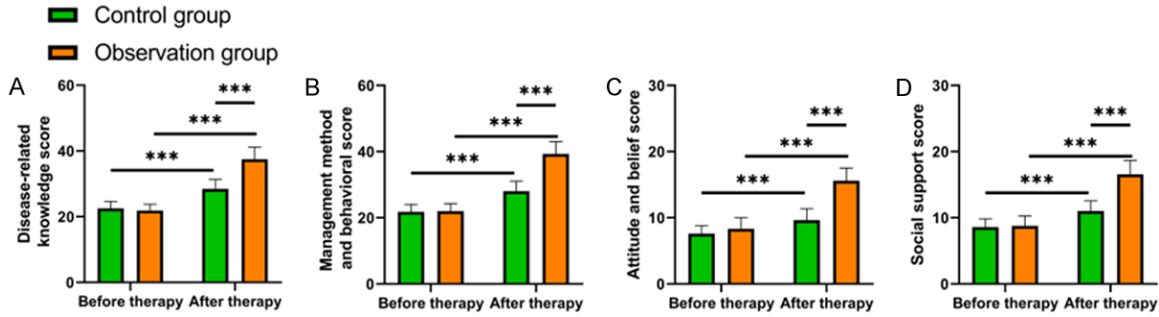
Figure 3. Changes in self-management scores of pregnant women. A. Changes in disease-related knowledge scores before and after intervention. B. Changes in management methods and behavior scores before and after intervention. C. Changes in attitude and belief scores before and after intervention. D. Changes in social support scores before and after intervention. ***P<0.001.

Table 3. Delivery mode of pregnant women

Group	Natural delivery	Vaginal midwifery	Cesarean section
Control group (n=61)	26 (42.62)	19 (31.15)	16 (26.23)
Observation group (n=51)	39 (76.47)	7 (13.73)	5 (9.80)
x^2-value	13.067	4.730	4.919
P-value	0.001	0.030	0.027

Table 4. Nursing satisfaction

Group	Very satisfied	Satisfied	Dissatisfied
Control group (n=61)	30	19	12
Observation group (n=51)	38	9	4
Z value		-2.752	
P-value		0.006	

development of the economy, the Internet has been extensively used. WeChat, as an effective social tool, has also been extensively used by the public. With WeChat, there is better communication between nurses and patients and between doctors and patients after establishing a WeChat group [21]. On the basis of internet communication, people with the same disease experience are brought together to form peer support education. They exchange and share the treatment experience and prevention knowledge related to GDM through online communication, which helps control BG, improving self-management ability and rational eating of pregnant women and reducing perinatal and perinatal complications [22]. Our study analyzed the influence of WeChat platform-based interactive continuous nursing on GDM of pregnant women. According to the results, the Obs group showed significantly

decreased BG and significantly better self-control ability and relieved negative emotion after intervention. Chen et al. [23] have found that continuous nursing can improve the self-control ability of pregnant women and alleviate their negative emotion. We believe nursing staff, nursing platform, and nursing mode in WeChat platform-based interactive continuous nursing have great advantages. It is convenient to communicate with pregnant women by using WeChat, which offers an effective implementation platform for continuous nursing, extends nursing service to patients after discharge from hospital and even the whole pregnancy course, and provides professional guidance for the patients, thus improving their BG, negative emotions, and self-control [24, 25].

Our study also found a significantly higher natural vaginal delivery rate and lower rates of vaginal midwifery rate and caesarean section in the Obs group than in the Con group. This is because patients' self-management ability was improved under the intervention of WeChat platform-based interactive continuous nursing service, which further promotes the improvement of pregnancy outcome. Lastly, our study counted the adverse pregnancy outcomes of pregnant women. The Obs group had a significantly lower incidence of adverse pregnancy outcomes than the Con group. In addition, according to the statistics of regression equation in our study, old age, pre-pregnancy BMI ≥24 kg/m², and history of DM were indepen-

Table 5. Maternal and infant pregnancy outcomes

Group	Premature delivery	Postpartum hemorrhage	Macrosomia	Neonatal asphyxia	Adverse pregnancy outcome (%)	Normal pregnancy outcome (%)
Control group (n=61)	12	4	6	4	26 (42.62)	35 (57.38)
Observation group (n=51)	7	2	1	1	11 (21.57)	40 (78.43)
x^2-value					5.566	
P-value					0.018	

Table 6. Assignment

Factor	Assignment
Age	≥25 years old =1, <25 years old =0
Gestational age	≥25 weeks =1, <25 weeks =0
Pre-pregnancy BMI	≥24 (kg/m^2) =1, <24 (kg/m^2) =0
History of hypertension	Yes =1, No =0
History of DM	Yes =1, No =0
History of abortion	Yes =1, No =0
Pregnancy times	Multipara =1, primipara =0
Education level	≥ senior school =1, < senior school =0
Occupation	Workers =0, farmers =1, technicians =2, others =3
Per capita monthly household income	≥5000 yuan =1, <5000 yuan =0
Nursing plan	Routine care =1, WeChat platform-based interactive continuous care =0
Adverse pregnancy outcome	Adverse =1, normal =0

Note: Body Mass Index (BMI).

dent risk factors for adverse pregnancy outcomes of pregnant women, and WeChat platform-based interactive continuous nursing was an protective factor against adverse pregnancy outcomes. Age affects the occurrence of GDM, and pregnant women at an older age are more likely to be diagnosed with GDM at earlier gestational age. Among the pregnant women who can be diagnosed with DM before 24 weeks of pregnancy, 63.7% of them are 30 years old or older, while only 45.2% are diagnosed after 24 weeks of pregnancy [26]. In addition, older pregnant women have a poorer ability of regulating body function and glucose and lipid metabolism than younger pregnant women, so they face a higher risk of adverse pregnancy outcome [27]. Similar to our results, prior research has revealed that pre-pregnancy BMI and weight gain during pregnancy are risk factors for adverse outcomes of newborns; that is, the greater pre-pregnancy BMI and weight gain during pregnancy, the greater the risk of adverse outcomes of newborns [28]. This may be related to the fact that the increased risk of cardiovascular diseases in pregnant women caused by pre-pregnancy obesity leads to the disorder of glucose and lipid metabolism, and then makes it difficult for GDM patients to control BG. According to a related study [29], the risk of GDM in pregnant women with a history of GM is 3.46 times higher than that in pregnant women without such a history, which is in agreement with the results of our study. Lastly, we found that pregnant women given routine nursing had 3.20 times of adverse pregnancy outcomes than pregnant women given WeChat platform-based interactive continuous nursing intervention, which indicated that WeChat could reduce the probability of adverse pregnancy outcome. We believe that health education based on a WeChat platform can further enhance pregnant women's understanding of gestational diabetes, pregnancy health care, diet and exercise knowledge, and improve their initiative, enthusiasm and compliance to participate in the management of blood glucose, control stable blood glucose levels, and thus reduce adverse pregnancy outcomes such as cesarean section and postpartum hemorrhage.
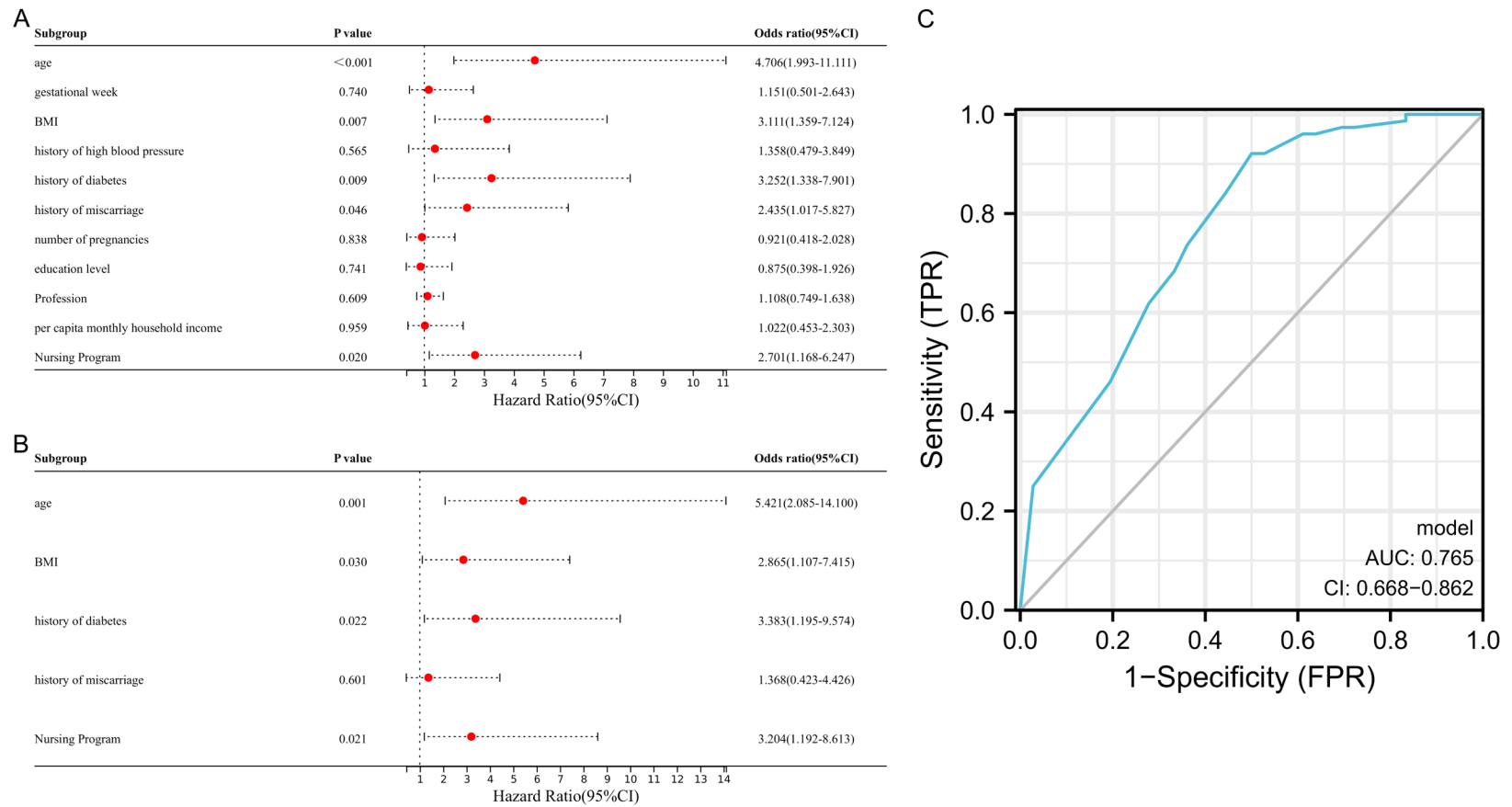
Figure 4. Logistics regression analysis of risk factors of adverse pregnancy outcomes. A. Univariate analysis of adverse pregnancy outcomes. B. Multivariate analysis of adverse pregnancy outcomes. C. Combined ROC curve.

Through retrospective study and analysis, our study has determined that WeChat platform-based interactive continuous nursing can alleviate the diseases of pregnant women with GDM and enhance their self-management. In addition, analysis of risk factors showed that WeChat platform-based nursing can reduce patients' adverse pregnancy outcomes. However, this study has some limitations. First, as a retrospective study, this study only collected the relevant information through data, and did not follow up the patients. Secondly, due to a small sample size in the retrospective study samples, comparison of the clinical data between the two groups still cannot rule out the bias in the results. Therefore, we hope to conduct a prospective study with more patients and follow-up to solidify our conclusions.

To sum up, WeChat platform-based interactive continuous nursing intervention can help patients master comprehensive self-management skills to achieve good control of the illness, improve their satisfaction toward nursing services, and lower the risk of adverse outcome.

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Disclosure of conflict of interest

None.

Address correspondence to: Wei Zhang, Department of Obstetrics, Affiliated Hangzhou First People's Hospital, #261 Huansha Road, Hangzhou 310006, Zhejiang, China. Tel: +86-13575450912; E-mail: 20180036@zcmu.edu.cn

References

[1]   Johns EC, Denison FC, Norman JE and Reynolds RM. Gestational diabetes mellitus: mechanisms, treatment, and complications. Trends Endocrinol Metab 2018; 29: 743-754.

[2]   Chiefari E, Arcidiacono B, Foti D and Brunetti A. Gestational diabetes mellitus: an updated overview. J Endocrinol Invest 2017; 40: 899-909.

[3]   ACOG practice Bulletin No. 190: gestational diabetes mellitus. Obstet Gynecol 2018; 131: e49-e64.

[4]   Weir CB and Jan A. BMI classification percentile and cut off points. StatPearls: Treasure Island (FL); 2022.

[5]   Hager M, Ott J, Castillo DM, Springer S, Seemann R and Pils S. Prevalence of gestational diabetes in triplet pregnancies: a retrospective cohort study and meta-analysis. J Clin Med 2020; 9: 1523.

[6]   Chavez-Garcia L, Valle-Leal JG, Jimenez-Mapula C, Quintero-Medrano SM and Lopez-Villegas MN. Gestational diabetes adherence to treatment and metabolic control. Rev Med Chil 2019; 147: 574-578.

[7]   Rasmussen L, Poulsen CW, Kampmann U, Smedegaard SB, Ovesen PG and Fuglsang J. Diet and healthy lifestyle in the management of gestational diabetes mellitus. Nutrients 2020; 12: 3050.

[8]   Howerton DA. Medical information on the internet. J Pastoral Care Counsel 2019; 73: 52-54.

[9]   Li YY, Sun Y, Meng SQ, Bao YP, Cheng JL, Chang XW, Ran MS, Sun YK, Kosten T, Strang J, Lu L and Shi J. Internet addiction increases in the general population during COVID-19: evidence from China. Am J Addict 2021; 30: 389-397.

[10]   Faculty perceptions of curiosity in the education of nursing and health science students. Journal of Modern Nursing Practice and Research 2022.

[11]   Jiang Y, Liu F, Guo J, Sun P, Chen Z, Li J, Cai L, Zhao H, Gao P, Ding Z and Wu X. Evaluating an intervention program using wechat for patients with chronic obstructive pulmonary disease: randomized controlled trial. J Med Internet Res 2020; 22: e17089.

[12]   Lin CH, Lu MJ, Wong J and Chen CC. Comparison of physician-rating and self-rating scales for patients with major depressive disorder. J Clin Psychopharmacol 2014; 34: 716-721.

[13]   Dunstan DA and Scott N. Norms for Zung's self-rating anxiety scale. BMC Psychiatry 2020; 20: 90.

[14]   Peleg M, Shahar Y, Quaglini S, Broens T, Budasu R, Fung N, Fux A, Garcia-Saez G, Goldstein A, Gonzalez-Ferrer A, Hermens H, Hernando ME, Jones V, Klebanov G, Klimov D, Knoppel D, Larburu N, Marcos C, Martinez-Sarriegui I, Napolitano C, Pallas A, Palomares A, Parimbelli E, Pons B, Rigla M, Sacchi L, Shalom E, Soffer P and van Schooten B. Assessment of a personalized and distributed patient guidance system. Int J Med Inform 2017; 101: 108-130.

[15]   Rodriguez-Herrera C, Lopez-Jimenez JJ, Del Toro-Valero A, Torres-Carrillo NM, Torres-Carrillo N, Godinez-Pena CA, Mendez-Magana AC, Herrera-Godina MG and Fletes-Rayas AL. The Newcastle satisfaction with nursing scales in a Mexican Oncology Hospital. Afr Health Sci 2021; 21: 60-66.

[16]   Perez-Perez A, Vilarino-Garcia T, Guadix P, Duenas JL and Sanchez-Margalet V. Leptin

and nutrition in gestational diabetes. Nutrients 2020; 12: 1970.

[17] Szmuilowicz ED, Josefson JL and Metzger BE. Gestational diabetes mellitus. Endocrinol Metab Clin North Am 2019; 48: 479-493.

[18] Plows JF, Stanley JL, Baker PN, Reynolds CM and Vickers MH. The Pathophysiology of Gestational Diabetes Mellitus. Int J Mol Sci 2018; 19: 3342.

[19] Mahajan A, Donovan LE, Vallee R and Yamamoto JM. Evidenced-based nutrition for gestational diabetes mellitus. Curr Diab Rep 2019; 19: 94.

[20] Egan AM and Dunne FP. Optimal management of gestational diabetes. Br Med Bull 2019; 131: 97-108.

[21] Chen Y, Qiu C, Chen J, Li L, Xu J and Sheng Z. Effect of the internet combined with exercise-based individualized nursing intervention in patients with gestational diabetes mellitus. Diabetol Metab Syndr 2021; 13: 125.

[22] Eades CE, Clarke KM, Cameron DM, Coulson N and Evans JMM. Analysis of spontaneous, user-generated data about gestational diabetes on online forums: implications for diabetes prevention. Diabet Med 2020; 37: 2058-2066.

[23] Chen YH. Effect of continuous nursing on postpartum blood glucose in patients with gestational diabetes mellitu. New World of Diabetes 2021; 24: 105-108+113.

[24] Guo Y, Zhou L, Sun B, Wang C and Zhang J. Application of online-offline integrated medical care management in patients with gestational diabetes. Ginekol Pol 2021; 92: 720-725.

[25] Ding B, Gou B, Guan H, Wang J, Bi Y and Hong Z. 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; 304: 609-618.

[26] Juan J and Yang H. Prevalence, prevention, and lifestyle intervention of gestational diabetes mellitus in China. Int J Environ Res Public Health 2020; 17: 9517.

[27] Homayouni A, Bagheri N, Mohammad-Alizadeh-Charandabi S, Kashani N, Mobaraki-Asl N, Mirghafurvand M, Asgharian H, Ansari F and Pourjafar H. Prevention of gestational diabetes mellitus (GDM) and probiotics: mechanism of action: a review. Curr Diabetes Rev 2020; 16: 538-545.

[28] Dachew BA, Ayano G, Betts K and Alati R. The impact of pre-pregnancy BMI on maternal depressive and anxiety symptoms during pregnancy and the postpartum period: a systematic review and meta-analysis. J Affect Disord 2021; 281: 321-330.

[29] Moosazadeh M, Asemi Z, Lankarani KB, Tabrizi R, Maharlouei N, Naghibzadeh-Tahami A, Yousefzadeh G, Sadeghi R, Khatibi SR, Afshari M, Khodadost M and Akbari M. Family history of diabetes and the risk of gestational diabetes mellitus in Iran: a systematic review and meta-analysis. Diabetes Metab Syndr 2017; 11 Suppl 1: S99-S104.