

COVID-19 Quarantine is a Risk Factor for Poor Pregnancy Outcomes in GDM Patients: A Retrospective Study

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Abstract

Aims: This study was to evaluate the effects of the home quarantine on pregnancy outcomes of gestational diabetes mellitus (GDM) patients during the COVID-19 outbreak.

Methods: The complete electronic medical records of GDM patients with home quarantine history were collected and classified into the home quarantine group from 24 February 2020 to 24 November 2020. The same period of GDM patients without home quarantine history was included in the control group from 2018 and 2019.

Results: A total of 1358 GDM patients were included in the analysis, including 484 in 2018, 468 in 2019, and 406 in 2020. GDM patients with home quarantine in 2020 had higher glycemic levels and worse pregnancy outcomes than 2018 and 2019, including higher cesarean section rate, lower Apgar scores, and higher incidence of macrosomia and nuchal cord. More importantly, the second trimester of home quarantine had brought a broader impact to pregnant women and fetuses.

Conclusion: Home quarantine has aggravated the condition of GDM pregnant women and brought more adverse pregnancy outcomes during the COVID-19 outbreak. Therefore, we suggested that governments and hospitals should strengthen lifestyle guidance, glucose management, and antenatal care for GDM patients with home quarantine during public health emergencies.

Introduction

A new coronavirus that caused severe acute respiratory syndrome (SARS-CoV-2, COVID-19) emerged in late 2019, which has caused over 184 million infections and more than 3984000 deaths (<https://covid19.who.int>). COVID-19 can directly cause severe complications, including cough, fevers, myalgia, pharyngitis, dyspnea, pneumonia, even acute respiratory distress syndrome (ARDS), and multisystem organ failure [1, 2]. The rapid spread of the epidemic around the world not only brought suffering and life threats to the infected individuals and their families but also seriously affected the economy and health of uninfected people. Varying degrees and types of lockdowns are effectively used to prevent the widespread of COVID-19, which has significantly changed the daily lifestyle of the people, including sports activities decreased, sleep time increased, increased intake of high-calorie food, and so on [3, 4]. Lockdown made them more vulnerable to over-eating and sedentary that leading to further weight gain and increased cardiovascular risk [5]. These changes have indirectly brought a threat to uninfected people, such as the worsening of sleep quality, increased risk of adolescent psychiatric disorder, impaired immune function, and increased risk of infections and autoimmunity [6–9].

Gestational diabetes mellitus (GDM) is a typical metabolic disorder closely associated with diet and exercise [10]. Numerous evidences showed that active exercise is beneficial to weight control, glycemic control, reduce the risk of large for gestational age (LGA) and postpartum depression of GDM patients [11, 12]. In contrast, GDM patients with high fat, high carbohydrate, high energy, and low fibrous diet will lead to impaired gut microbiota which can be transmitted to the offspring and further increasing the risk of type 2 diabetes mellitus (T2DM) and cardiovascular disease (CVD) in GDM patients and their offspring lastly [13–16]. The retrospective studies of GDM patients during the COVID-19 pandemic lockdown also showed that the reduced physical activity, modified dietary habits, and anxiety exacerbated the glycemic out of control [17, 18]. Although these studies showed that home quarantine has changed the lifestyle of GDM patients and further affected their health, it is still unclear whether home quarantine has an impact on pregnancy outcomes.

During the outbreak of COVID-19 in China, Chongqing has been taken strict home quarantine from 24 January 2020 to 20 April 2020. During the lockdown, only essential activities were allowed, and mobility of most people was limited to the acquisition of food and medicines; living at home was compulsive. Therefore, a retrospective cohort study was conducted on women diagnosed with GDM during the lockdown, aiming to study the effects of lifestyle change on GDM patients and newborns. This study was hopeful to guide antenatal care and clinical decision-making of GDM patients during public health emergencies.

Materials And Methods

Study design and participants

This was a single-center retrospective cohort study; information about the subjects was collected in *The First Affiliated Hospital of Chongqing Medical University*, which is a Grade B and Grade A hospital with an average of 10000 births per year. Only participants with complete clinical information were included in the analysis, and all participants were clinically diagnosed with GDM, according to the Chinese OGTT biochemical criterion. Moreover, venous plasma glucose that is analyzed, and that at least one glucose threshold value must be equalled or exceeded to define the patient as having gestational diabetes. All participants who attended the clinic visit were offered a 75 g oral glucose tolerance test (OGTT) after 8–10 h of overnight fasting. With GDM diagnosed from venous samples according to the IADPSG/WHO 2010

criteria (fasting plasma glucose ≥ 5.1 mmol/L, 1 h plasma glucose ≥ 10.0 mmol/L or 2 h plasma glucose ≥ 8.5 mmol/L) (IADPSG), which was the clinical guideline in use during the study [19]. Subjects were excluded if they had chronic medical conditions, including hypertension, type 2 diabetes mellitus, and heart or kidney diseases. The time of home quarantine of the GDM patients was inferred from their gestational weeks and delivery date, and who with at least one month home quarantine was included in the analysis. It is worth noting that none of the patients during the COVID-19 pandemic were diagnosed with the SARS-CoV2 infection. Since the strict epidemic lockdown is from 24 January 2020 to 20 April 2020 in Chongqing, China, therefore, the complete clinical information of patients from 24 February 2020 to 24 November 2020 was collected and classified into the home quarantine group, and the data of the same period in 2018 and 2019 were also collected and classified into the control group (Fig. 1). Then, these GDM patients were further divided into three groups according to different periods of pregnancy during home quarantine to explore the effects of home quarantine in different periods on pregnancy outcomes (Fig. 1). This study was approved by the ethics committee of the First Affiliated Hospital of Chongqing Medical University (ID: 20200501).

Data collection

All data were collected from hospital electronic medical records, including maternal characteristics, management, and maternal and fetal outcomes.

Statistical analyses

All statistical analyses were performed using the SPSS software program, version 22.0 (IBM, Armonk, NY, USA). Continuous variables were presented as mean \pm SD, and categorical variables were presented as percentage and count. Chi-square or Fisher's exact test was used for categorical variables including the incidence of GDM, and one-way analysis of variance was used to compare basic characteristics of the pregnant woman of different groups. Post hoc analysis involving pairwise comparisons was performed if there are ≥ 3 independent groups, using L-S-D correction results, and results with significant differences between two groups have been shown in tables.

Multiple logistic regression was used to compare the outcomes of pregnant women and fetuses and obstetric complications, such as placental factors, umbilical factors, and macrosomia of different groups. Potential covariates that may be associated with the outcomes of pregnant woman and fetus, abnormal placentation, macrosomia, and other obstetric complications were adjusted in the model, including age, parity, gestational age, and fetal number. In addition, multiple logistic regression was used in pregnancy BMI, one-minute Apgar scores, delivery pattern, OGTT biochemical criterion, and obstetric complications. Thus, other variables are considered as continuous variables such as neonatal weight, body length, placental weight, and length. Results are presented as OR or Adjusted OR with 95% CI.

Results

Clinical characteristics of GDM patients in 2018, 2019, and 2020.

The electronic medical records of all maternity were counted from 24 February to 24 November in 2018, 2019, and 2020, respectively. The data showed no significant difference in the incidence of GDM among the three years (Fig. 2). After screening the electronic medical records according to the above inclusion and exclusion criteria, a total of 1358 GDM patients were used for subsequent analysis. The further study of the clinical characteristics of 1358 GDM patients showed that GDM patients in 2020 (home quarantine group) had the maximal average age, 31.69 years ($P=0.029$), but had the minimum gestational week, 38.91 ($P=0.025$; Table 1).

Table 1
Basic characteristics of GDM patients.

Variables	2018(N= 484)	2019(N= 468)	2020(N= 406)	χ^2/F	<i>P</i>
Age (years) ^{†§}	31.00 ± 4.27	31.07 ± 4.04	31.69 ± 3.99	3.551	0.029*
Gestational age (week) [§]	38.98 ± 0.97	39.12 ± 1.04	38.91 ± 1.07	3.711	0.025*
Gestational weight gain	13.18 ± 4.87	12.18 ± 5.03	12.82 ± 4.62	0.665	0.515
Parity ^{†§}	0.00(0.00,1.00)	0.00(0.00,1.00)	1.00(0.50,2.00)	140.03	< 0.001**
Gravidity	2.00(1.00,3.00)	2.00(1.00,3.00)	2.00(1.00,3.00)	7.520	0.023*
Fetal sex				0.245	0.885
Male	246(50.80%)	244(52.10%)	204(50.60%)		
Female	238(49.20%)	224(47.90%)	199(49.40%)		
Fetal number	1.00(1.00,1.00)	1.00(1.00,1.00)	1.00(1.00,1.00)	1.980	0.139
Pre-pregnancy BMI (kg/m ²)				0.245	0.060
< 18	32(6.70%)	24(5.60%)	30(7.60%)		
18-23.9	346(72.40%)	306(71.00%)	296(75.30%)		
24-27.9	81(16.90%)	84(19.50%)	53(13.50%)		
> 28	19(4.00%)	17(3.90%)	14(3.60%)		
†: There was statistically significant difference between 2018 and 2020.					
§: There was statistically significant difference between 2019 and 2020.					
*: <i>P</i> < 0.05, **: <i>P</i> < 0.001.					

Maternal outcomes of GDM patients in 2018, 2019, and 2020.

Logistic regression showed that GDM patients in 2020 had shorter gestational week than 2019 (OR: 1.20, 95% CI, 1.05–1.31, *P* = 0.007), and GDM patients in 2020 had a higher cesarean section rate than 2018 (AOR: 1.62, 95% CI, 1.18–2.22, *P* = 0.003) and 2019 (AOR: 1.63, 95% CI, 1.18–2.24, *P* = 0.003; Table 2). Biochemical criterion was also used to evaluate pregnant outcomes of GDM patients. GDM patients in 2020 had higher blood glycemetic level than 2018 (AOR: 0.32, 95% CI, 0.23–0.43, *P* < 0.001) and 2019 on 0 min OGTT (AOR: 0.66, 95% CI, 0.49–0.90, *P* = 0.009; Table 2). Additionally, GDM patients in 2020 also had higher blood glycemetic level of 60 min OGTT (AOR: 0.71, 95% CI, 0.53–0.96, *P* = 0.026) and 120 min OGTT than 2018 (AOR: 0.58, 95% CI, 0.43–0.79, *P* = 0.001; Table 2).

Table 2
Pregnant outcomes of GDM patients.

Variables	2018				2019			
	Crude OR (95%-CI) †	<i>P</i> †	Adjusted OR (95%-CI) §	<i>P</i> §	Crude OR (95%-CI) †	<i>P</i> †	Adjusted OR (95%-CI) §	<i>P</i> §
Gestational weight gain	1.92(0.99,1.04)	0.330	1.01(0.98,1.04)	0.695	1.01(0.99,1.04)	0.325	1.01(0.98,1.04)	0.498
Gestational age(week)	1.08(0.96,1.23)	0.213	0.97(0.83,1.14)	0.739	1.20(1.05,1.37)	0.007*	1.10(0.94,1.30)	0.239
Delivery patten	1.11(0.85,1.45)	0.438	1.62(1.18,2.22)	0.003*	1.14(0.87,1.49)	0.347	1.63(1.18,2.24)	0.003*
Pregnancy BMI after(kg/m ²)	0.88(0.61,1.12)	0.519	0.97(0.57,1.63)	0.893	0.72(0.47,1.08)	0.112	0.82(0.48,1.42)	0.486
18-23.9								
24-27.9	0.83(0.61,1.12)	0.213	0.95(0.64,1.40)	0.791	0.77(0.57,1.05)	0.096	0.93(0.62,1.38)	0.701
28	Ref		Ref		Ref		Ref	
0 min OGTT	0.30(0.27,0.47)	< 0.001**	0.32(0.23,0.43)	< 0.001**	0.73(0.56,0.96)	0.024*	0.66(0.49,0.90)	0.009*
60 min OGTT	0.77(0.57,0.99)	0.041*	0.71(0.53,0.96)	0.026*	1.02(0.78,1.34)	0.873	1.06(0.78,1.44)	0.720
120 min OGTT	0.53(0.39,0.71)	< 0.001**	0.58(0.43,0.79)	0.001**	0.77(0.58,1.02)	0.071	0.85(0.63,1.17)	0.340
2020 was used as reference group.								
†: Single variable logistic regression analysis.								
§: Adjust: Age, Gravidity, Parity, Gestational age, Fetal number, Pre-pregnancy BMI.								
*: <i>P</i> < 0.05, **: <i>P</i> < 0.001.								

Fetal outcomes of GDM patients in 2018, 2019, and 2020.

Logistic regression showed that GDM patients in 2020 had longer abdominal circumference (AOR: 0.99, 95% CI, 0.98-1.00, *P*= 0.044), head circumference (AOR: 0.98, 95% CI, 0.96–0.99, *P*= 0.005), and body length (AOR: 0.89, 95% CI, 0.81–0.98, *P*= 0.019) than 2018, but there was no difference in fetal outcomes between 2019 and 2020 (Table 3). Furthermore, GDM patients in 2020 had thicker (AOR: 0.95, 95% CI, 0.91–0.97, *P*= 0.007) and larger size of placenta than 2018 (width: AOR: 0.89, 95% CI, 0.82–0.98, *P*= 0.015; length: AOR: 0.90, 95% CI, 0.83–0.97, *P*= 0.008; Table 3). GDM patients in 2020 had more amniotic fluid volume than both 2018 (AOR:1.01, 95% CI, 1.00-1.02, *P*= 0.045; and 2019 (AOR: 1.01, 95% CI, 1.000-1.02, *P*= 0.023; Table 3). In addition, GDM patients in 2020 had lower score about one-minute Apgar scores of fetal than 2018 (AOR: 0.49, 95% CI, 0.35–0.69, *P*< 0.001) and 2019 (AOR: 0.47, 95% CI, 0.33–0.63, *P*< 0.001; Table 3).

Table 3
Fetal outcomes of GDM patients.

Variables	2018				2019			
	Crude OR(95%-CI) †	<i>P</i> †	Adjusted OR(95%-CI) §	<i>P</i> §	Crude OR(95%-CI) †	<i>P</i> †	Adjusted OR(95%-CI) §	<i>P</i> §
Neonatal weight(g)	1.00(1.00,1.00)	0.231	1.00(1.00,1.00)	0.219	1.00(1.00,1.00)	0.859	1.00(1.00,1.00)	0.893
Abdominal circumference(cm)	1.00(1.00,1.00)	0.083	0.99(0.98,1.00)	0.044*	1.00(0.99,1.01)	0.656	1.00(0.99,1.01)	0.600
Head circumference(cm)	0.98(0.97,0.99)	0.001*	0.98(0.96,0.99)	0.005*	1.00(0.99,1.02)	0.628	1.00(0.99,1.02)	0.790
Body length(cm)	0.92(0.82,0.99)	0.032*	0.89(0.81,0.98)	0.019*	1.04(0.96,1.13)	0.315	1.05(0.96,1.16)	0.281
Placental weight(g)	1.00(0.99,1.01)	0.748	1.00(0.99,1.01)	0.463	0.93(0.91,0.94)	0.004*	0.93(0.91,0.95)	0.004*
Placental thickness(mm)	0.94(0.91,0.97)	< 0.001**	0.95(0.91,0.97)	0.007*	0.99(0.96,1.03)	0.636	1.00(0.97,1.04)	0.967
Placental length(cm)	0.89(0.82,0.96)	0.003*	0.89(0.82,0.98)	0.015*	0.99(0.91,1.07)	0.706	0.98(0.90,1.08)	0.695
Placental width(cm)	0.89(0.83,0.96)	0.003*	0.90(0.83,0.97)	0.008*	1.01(0.94,1.08)	0.832	1.00(0.93,1.08)	0.968
Umbilical cord length(cm)	0.99(0.97,1.01)	0.365	0.99(0.97,1.01)	0.333	0.99(0.9,1.02)	0.746	0.99(0.98,1.02)	0.934
Amniotic fluid volume(ml)	1.01(1.00,1.02)	0.016*	1.01(1.00,1.02)	0.045*	1.01(1.00,1.02)	0.005*	1.01(1.00,1.02)	0.023*
One minute Apgar scores 9	0.46(0.34,0.63)	< 0.001**	0.49(0.35,0.69)	< 0.001**	0.46(0.33,0.62)	< 0.001**	0.47(0.33,0.63)	< 0.001**
10	Ref				Ref			
2020 was used as reference group.								
†: Single variable logistic regression analysis.								
§: Adjust for Age, Gravidity, Parity, Gestational age, Fetal number, Pre-pregnancy BMI.								
*: <i>P</i> < 0.05, **: <i>P</i> < 0.001.								

The labor complications were further analyzed to evaluate the effects of home quarantine on fetal outcomes. Multivariate logistic regression was used to control for the following covariates, age, gravidity, parity, gestational age, fetal number, as well as pre-pregnancy BMI; the data showed that the incidence of fetal macrosomia in 2020 was higher than in 2018 (AOR: 0.82, 95% CI, 0.71–0.98, *P*= 0.046; Table 4). Besides, the incidence of the nuchal cord has also increased in 2020 (AOR: 0.63, 95% CI, 0.44–0.90, *P*= 0.003; Table 4). Macrosomia is typically defined as a birth weight above the 90th percentile for gestational age or > 4,000 g.

Table 4
Obstetric complications of GDM patients.

Variables	2018				2019			
	Crude OR (95%-CI) †	<i>P</i> †	Adjusted OR (95%-CI) §	<i>P</i> §	Crude OR (95%-CI) †	<i>P</i> †	Adjusted OR (95%-CI) §	<i>P</i> §
Placental implantation	1.33(0.82,2.14)	0.250	1.17(0.69,1.97)	0.562	0.97(0.62,1.53)	0.971	0.88(0.53,1.48)	0.637
nuchal cord	0.75(0.51,1.11)	0.149	0.67(0.47,0.96)	0.028*	0.67(0.45,0.99)	0.450	0.63(0.44,0.90)	0.010*
Fetal macrosomia	0.56(0.52,1.65)	0.102	0.82(0.71,0.98)	0.046*	1.17(0.71,1.93)	0.548	1.44(0.81,2.56)	0.210
2020 was used as reference group.								
†: Single variable logistic regression analysis.								
§: Adjusted for age, gravidity, parity, gestational age, fetal number, pre-pregnancy BMI.								
*: <i>P</i> < 0.05, **: <i>P</i> < 0.001.								

Effects of home quarantine during different gestational periods on pregnancy outcomes in GDM patients.

These 1358 GDM patients were further divided into three groups according to different periods of pregnancy during home quarantine, including 1st, 2nd, and 3rd trimester. The data showed that a significant difference in pre-pregnancy BMI (*P* = 0.002) in the 2nd trimester in 2018 and 2020, 2019, and 2020 (Supplemental Table 1). GDM patients in 1st trimester of 2020 had a higher glycemic level in 0 min OGTT than 2019 (1st, AOR: 0.46, 95% CI, 0.26–0.82, *P* = 0.008), while the glycemic in 2nd trimester of 2020 also showed a higher level than 2018 (AOR: 0.40, 95% CI, 0.22–0.71, *P* = 0.002) and 2019 (AOR: 0.47, 95% CI, 0.26–0.84, *P* = 0.011; Supplemental Table 2).

The cesarean section rate was significantly increased in both 1st (AOR: 2.51, 95% CI, 1.37–4.58, *P* = 0.003) and 3rd trimester of 2020 than 2018 (AOR: 1.69, 95% CI, 1.04–2.74, *P* = 0.036). A significantly increase of cesarean section rate was also observed in 2nd (AOR: 1.79, 95% CI, 1.01–3.16, *P* = 0.046) and 3rd trimester of GDM patients in 2020 than 2019 (AOR: 1.85, 95% CI, 1.10–3.10, *P* = 0.021; Supplemental Table 2). GDM patients in 1st (AOR: 0.85, 95% CI, 0.74–0.99, *P* = 0.033) or 3rd of 2020 have a heavier (OR: 0.89, 95% CI, 0.79–0.99, *P* = 0.049) and thicker placenta than 2018 (AOR: 0.94, 95% CI, 0.89–0.99, *P* = 0.025); however, the placenta of patients in 2nd trimester of 2020 was lighter (AOR: 1.011, 95% CI, 1.007–1.016, *P* < 0.001) and thinner than 2019 (AOR: 1.39, 95% CI, 1.14–1.69, *P* = 0.001; AOR: 1.16, 95% CI, 1.00–1.35, *P* = 0.047; Supplemental Table 2). Besides, GDM patients in 2nd trimester of 2020 had higher placenta implantation rate than both 2018 (AOR: 0.17, 95% CI, 0.05–0.60, *P* = 0.006) and 2019 (AOR: 0.19, 95% CI, 0.05–0.71, *P* = 0.013), and which also had more amniotic fluid volume than 2018 (AOR: 1.01, 95% CI, 1.00–1.02, *P* = 0.004) and 2019 (AOR: 1.01, 95% CI, 1.00–1.02, *P* = 0.006).

We further analyzed the effects of different pregnant periods during home quarantine on fetal outcomes. The fetus in the 2nd trimester of 2020 presented a heavier weight (AOR: 1.01, 95% CI, 1.00–1.02, *P* = 0.001) and longer body than 2019 (AOR: 1.32, 95% CI, 1.10–1.58, *P* = 0.003). Meanwhile, GDM patients in 2020 had lower one-minute Apgar score than all trimesters of 2018 (AOR: 0.41, 95% CI, 0.21–0.82, *P* = 0.001; AOR: 0.52, 95% CI, 0.29–0.96, *P* = 0.007; AOR: 0.39, 95% CI, 0.23–0.64, *P* < 0.001) and 1st, 2nd trimester of 2019 (AOR: 0.32, 95% CI, 0.16–0.63, *P* = 0.012; AOR: 0.43, 95% CI, 0.23–0.79, *P* = 0.036; Supplemental Table 2). More importantly, fetus in 1st (AOR: 0.05, 95% CI, 0.01–0.43, *P* = 0.005) and 2nd trimester of 2020 had a higher incidence of nuchal cord increased than 2018 (AOR: 0.29, 95% CI, 0.14–0.64, *P* = 0.002; Supplemental Table 2). In summary, the home quarantine of all three pregnant periods would bring different degrees of harm to pregnant women and fetuses, especially 2nd trimester had brought a wider impact on pregnancy outcomes.

Discussion

Until now, COVID-19 is still raging around the world, and numerous countries are forced to adopt varying degrees and forms of lockdown to prevent the broader spread of the virus effectively. These lockdowns have brought many challenges to the economic development and lives of people, which have dramatically changed the diet and exercise of people, even aggravated the symptoms of many diseases, especially for metabolic diseases [20–22]. Therefore, this retrospective study of GDM patients was used to investigate the impacts of home quarantine on pregnant women and their pregnancy outcomes during the COVID-19 outbreak. The data showed that delivery volume from February 2020 to November 2020 was significantly lower than that in the same period of 2018 and 2019, while no significant difference was observed in the incidence of GDM. It has been reported that a significant increase in the number of GDM patients during the lockdown [17]. By interviewing doctors and women, we speculated that there might be the following reasons: 1) Fertility intention of women were inhibited because of the decreased income during home quarantine; 2) Although the better medical conditions of *The First Affiliated Hospital of Chongqing Medical University* will attract more pregnant women, the epidemic led more pregnant women chose to deliver nearby that resulting in a decline in

hospitalization rate; 3) The detection rate of GDM decreased since a significant number of pregnant women changed their antenatal examination plans without the permission of their doctors due to the fear of infection; 4) During the epidemic outbreak, online consultation was widely carried out in hospitals, which may lead to a further decline in the detection rate of GDM. Therefore, multicenter data is needed to determine whether home quarantine would lead to a change in GDM incidence.

Although the increase of GDM incidence was not observed, the data indicated that the 0 min OGTT of GDM patients in 2020 was significantly higher than that in 2018 and 2019. Further clinical data from different trimesters showed that home quarantine increased the 0 min OGTT of GDM patients, especially in the second trimester. In addition, the home quarantine group had thicker and heavier placenta than GDM patients of 2018 and 2019, which will lead to macrosomia in most GDM patients [23]. These findings suggested that home quarantine may aggravate the condition of GDM patients.

According to the analysis of pregnancy outcomes, the cesarean section rate of GDM patients in 2020 was significantly higher than that in 2018 and 2019; meanwhile, significant increases were also observed in fetal head circumference, body length, and incidence of macrosomia in GDM patients of 2020. The high-fat and high-calorie diet will not only increase the occurrence of GDM but also increase the probability of macrosomia, while the increase of depression, anxiety, and stress during the lockdown will make pregnant women more inclined to a high-calorie or high-fat diet [24–26]. Thus, we speculated that anxiety or other factors during the lockdown made the maternal diet style change, resulting in excessive nutrient transport to the fetus and placenta which further leading to fetal macrosomia. Studies have found that moderate exercise is helpful to improve GDM condition, especially benefiting from walking [27–29]. The light regulation of circadian rhythm has also been found to be essential for fetal development. On the one hand, home quarantine had greatly limited the exercise of GDM patients; on the other hand, the residential structure and climate in Chongqing greatly limited the light exposure of pregnant women. These might also be the reasons for the decline of various clinical indicators in GDM pregnant women and increased incidence of macrosomia. Macrosomia will cause postpartum bleeding and vaginal lacerations and lead to an increased risk of fetal dystonia, collarbone fracture, and brachial plexus injury, which further increases the rate of admission to the neonatal intensive care unit [30]. Thus, pregnant women with macrosomia generally adopted the cesarean section in clinical treatment, which gives a possible explanation for the increase of cesarean section rate in 2020. Moreover, the data confirmed that one-min Apgar scores in 2020 were significantly lower than in 2018 and 2019, and the incidence of the nuchal cord increased significantly. Clinically Apgar score is widely used to evaluate various neonatal indexes, such as hypotonia, pulse, skin color, respiration, breath, response to stimulation, and so on [31]. Previous studies have shown that the nuchal cord could cause breathing difficulties and distress in newborns [32], which may cause the decrease in Apgar scores in 2020.

Conclusions

In conclusion, our findings suggested that home quarantine will aggravate the condition of GDM pregnant women and further bring more adverse pregnancy outcomes, such as macrosomia and nuchal cord. More importantly, the analysis of the different trimesters showed that home quarantine in the second trimester would bring more extensive adverse effects on GDM patients compared to the first and third trimester, including neonatal weight, body length, placental weight, placental size, amniotic fluid volume, and the risk of placental implantation. Comprehensive current research and our research, we proposed that the GDM patients should actively adjust their emotions, have a proper diet, and exercise moderately during home quarantine, especially those in the 2nd trimester. Besides, all hospital levels should intensify movement guidance and dietary management for pregnant women during the pandemic lockdown.

Declarations

Author Contributions.

Q.C., X.L., and T.L. designed the study. Q.C., L.R., D.W., H.C., S.Y., and W.L. contributed to data collection and data cleaning. Q.C., Y.Y., and T.L. were involved in the data analysis, interpreted the findings, and wrote the manuscript. Y.Y., L.R., X.L. and T.L. reviewed and edited the manuscript. All authors gave final approval for publication. T.L. is the guarantor of this work and, as such, had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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Competing interests.

The authors declare that they have no conflict of interest.

Availability of data and materials

All data are available upon request from the authors.

Consent for publication

All authors gave their consent for publication of this manuscript.

Ethics approval and consent to participate

This study was approved by the ethics committee of the First Affiliated Hospital of Chongqing Medical University (ID: 20200501).

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Figures

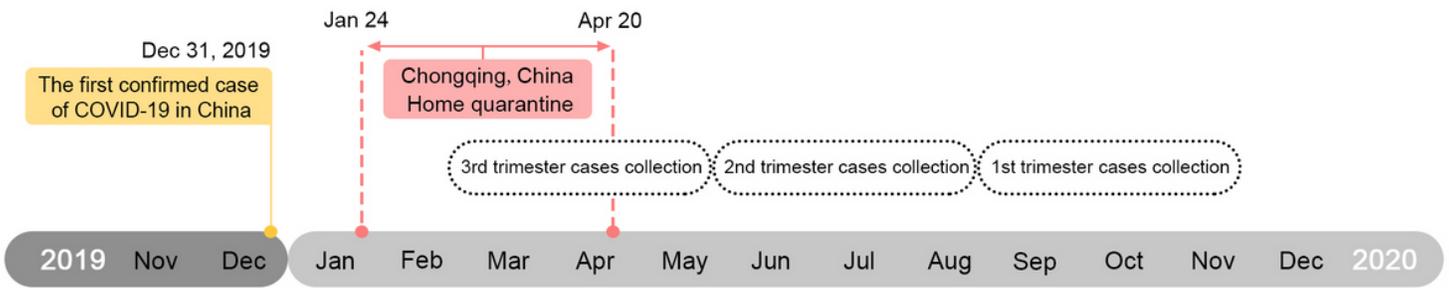


Figure 1

The timeline of home quarantine was used to collect the clinical information of GDM patients during the COVID-19 outbreak. The GDM patients were further divided into three groups according to different periods of pregnancy during home quarantine, including first (from 24 February to 24 May), second (from 25 May to 24 August), and third (from 25 August to 24 November) trimester. The non-home quarantine groups were collected from the same period of 2018 and 2019.

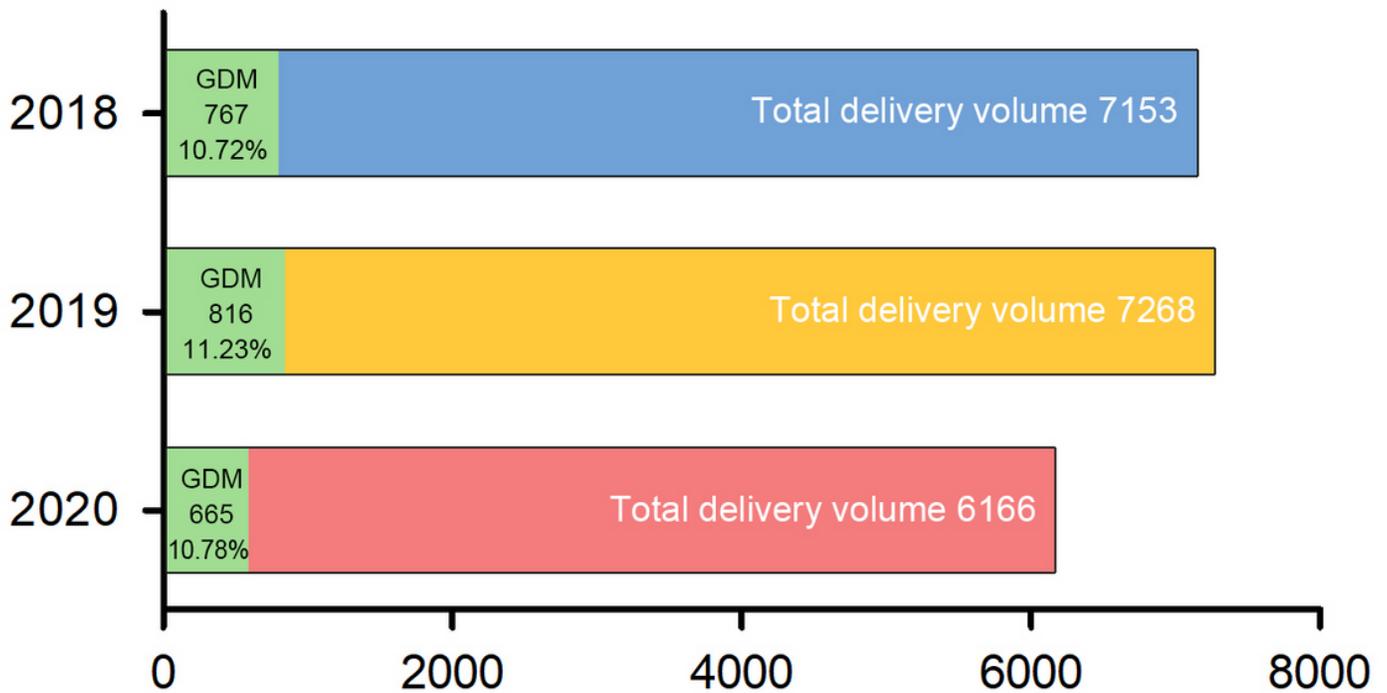


Figure 2

The total delivery and GDM patients in 2018, 2019, and 2020.