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Assessment of Barriers toward Initiating Insulin among Gestational Diabetes Pregnant Women, Diabetes Center, Hera'a General Hospital, Makkah

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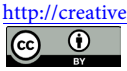

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Abstract

Background: Gestational diabetes mellitus (GDM) is one of the most common pathologies in pregnancy. Unfortunately, both clinicians and patients are often reluctant to begin insulin therapy, a phenomenon that has been known as psychological insulin resistance (PIR). **Objectives:** To assess the barriers of initiating insulin among GDM pregnant women. **Patients and Methods:** An observational cross-sectional study was conducted in the GDM clinic, Diabetes Center in Hera'a General Hospital, Makkah, Saudi Arabia in a period of 4 months. A self-administered validated questionnaire was adopted. It included socio-demographic data of women, perceived (personal, social, pharmacological, occupational and misconception) barriers towards insulin therapy and possible solutions to overcome these barriers. **Results:** A total of 164 pregnant women with gestational diabetes were included in the study. The age of 36.4% of them exceeded 35 years. Among personal barriers, preferring other treatment methods over insulin (56.4%) and unaware of insulin dose control method (45.4%) were commonly reported. Regarding family barriers, 23.6% reported past family experience of insulin-related complications. Concerning side effects, fear of hypoglycemia (59.4%) and fear of weight gain (50.9%) were most frequently reported barriers against use of insulin. Regarding misconceptions about insulin injections, 26% believed that insulin is addictive; the injection will continue for life. Among work-related barriers, irregular eating times during working hours and long working hours (55.2%) were barriers for insulin use. Facilitating access to healthcare services (94%), engage the patient in decision-making and development of the treatment plan (91.6%), activate virtual clinics and social media for re-

mote follow-up (86.6%) and organize social support groups for pregnant women who use insulin to share their experiences were the most frequently reported possible solutions to initiate and commit to insulin therapy. **Conclusion:** Various barriers were identified against initiation of insulin therapy in the management of gestational diabetes; mostly due to personal factors, misconception and work-related factors. Prompt actions are needed to overcome these barriers.

Keywords

Insulin, Gestational Diabetes, Barriers, Saudi Arabia

1. Introduction

Gestational diabetes (GD) is one of the most common pathologies in pregnancy. Gestational diabetes has been defined as any degree of glucose intolerance with onset or first recognition during pregnancy [1]. Many factors like age, diet, obesity, ethnicity, family history, history of GDM in a previous pregnancy, macrosomia, hypertension or pregnancy-related hypertension, history of spontaneous abortions, and unexplained stillbirths cause an increased risk of glucose intolerance in pregnant women [2]. The prevalence of GDM ranges from 1% - 14% based on the population under investigation; the prevalence is increasing worldwide [3] [4] [5]. The global prevalence of hyperglycemia in pregnant women of 20 - 49 years was supposed to be 16.9% and affected 21.4 million live births in 2013 [6].

Maternal hyperglycemia correlated with GDM has a serious complication that can lead to short and long-term health risks for the mother and her baby [7]. Optimal blood glucose regulation within suggested glycemic targets using lifestyle variations and/or pharmacological therapies aims to reduce or prevent the adverse outcomes connected with GDM [8]. A woman's thoughts of GDM may influence whether she adopts any lifestyle changes, complies with the advised therapy, and achieves optimal blood glucose control [9].

The successful control of diabetes depends on keeping blood glucose levels within a recommended target range, as well as suitably modifying other cardiovascular risk factors like dyslipidemia and hypertension. For example, early blood glucose control has been shown to decrease the risks of morbidity and mortality from the coronary artery disease [10].

Unfortunately, both clinicians and patients are often reluctant to begin insulin therapy, a phenomenon that has been known as psychological insulin resistance (PIR) [11]. Clinicians may choose to delay initiation only after alternative therapies have been attempted and have failed to achieve or maintain glycemic control [12]. However, this procedure runs the risk of initiating insulin only when the disease has significantly advanced, and the patient has experienced more ad-

vanced complications [13]. Additional clinician barriers to insulin initiation that can be recognized as clinical realities of initiating insulin therapy include 1) concern that patients would resist insulin treatment, 2) the effect on the practice's resources, such as the time required to properly educate patients and their families on the role of insulin replacement treatment, 3) the intensive monitoring required when the initial phase of insulin initiation and titration, 4) the learning required for the control of any crises, and 5) the risk of hypoglycemia from insulin therapy [14]. Finally, clinicians may be apprehensive about weight gain with insulin [15].

For the insulin-naïve patient, PIR may be rooted in logistical obstacles to initiating insulin, such as difficulties in self-injecting the insulin and the ability to appropriately estimate and time doses with meals [16]. Other common barriers to insulin initiation among insulin-naïve patients include 1) misconceptions regarding insulin risk, 2) beliefs that needing insulin reflects a personal failure, 3) concerns that insulin is ineffective and that insulin injections are painful, and 4) anxiety about long-term complications and side effects of therapy, loss of independence, and cost [16].

Pervious international studies reported some common barriers to insulin initiation among GDM patients, however to our knowledge; there are no similar studies in Saudi Arabia. Therefore this study was conducted to identify the barriers of initiating insulin among GDM pregnant women in Makkah, Saudi Arabia.

2. Patients and Methods

An observational cross-sectional study through collection of data using a questionnaire was conducted in the GDM clinic, Diabetes Center in Hera'a General Hospital, Makkah, Saudi Arabia in a period of 4 months during their routine antenatal visits in GDM clinic. Inclusion criteria were age above 18 years old, pregnant women with Gestational diabetes, and with pre-existing type 2 diabetes not on insulin prior to pregnancy. Pregnant women on Insulin pump therapy were excluded from the study. No other exclusion criteria were specified.

Sample size was calculated using online Raosoft sample size calculator for population survey (https://www.raosoft.com/samplesize.html) assuming that the margin of error as 5%, estimated target population of 723 (based on total number of attendees during 2020), at confidence level of 90%, estimated prevalence of 50%, the minimum sample size was 198 patients. Data were collected over a period of 4 months (approximately 16 weeks). It has been estimated that about 12 patients with the inclusion criteria attended the weekly gestational diabetic clinic at Hera'a General Hospital, based on previous experience. Thus, all patients who attended the clinic throughout the period of data collection were included.

The main tool in this study was a self-administered questionnaire structured by the researcher, from review of similar literature and validated by three con-

sultants. The questionnaire is divided into three parts:

- First, socio-demographic data (age, nationality, number of parity, number of children, the trimester of pregnancy, history of gestationaldiabetes mellitus, history of insulin treatment during pregnancy).
- Second, perceived (personal, social, pharmacological, occupational and misconception) barriers towards insulin therapy.
- Third, Solutions to overcome the above-mentioned barriers.

The barriers/perceptions part was designed with five points Likert scale answers ranging from strongly agree, agree to strongly disagree to measure the patients' perceptions about the insulin therapy barriers. Questionnaires were distributed by triage nurses to the randomly selected participants (hand to hand) and were collected by the same triage nurse on the same day.

2.1. Data Entry and Analysis

The data were entered and analyzed using SPSS 26.0 version. Descriptive statistics in the form of frequency and percentage were used for categorical variables. Chi-square or Fisher's exact test (in case of small frequencies) were used in statistical analysis. A p-value of <0.05 was used to report the statistical significance of results.

2.2. Ethical Considerations

Prior permission was obtained from the concerned authorities after explaining the objectives of this study. All information of hospitals was kept confidential and data were used for the proposed research. Data were collected after obtaining the ethical approval from the Institutional Review Board (IRB) of Diabetes Centre in Hera Hospital.

3. Results

3.1. Sociodemographic Characteristics

A total of 164 pregnant women with gestational diabetes were included in the study with a response rate of 82.8%. Their sociodemographic characteristics are presented in **Table 1**. The age of 36.4% of them exceeded 35 years. Majority of them (82.3%) were unemployed and the monthly income of 41.7% of them ranged between 3000 and 5000 Saudi Riyals. Most of them (59.8%) were university educated or postgraduates. Half of them had between 2 and 4 children.

3.2. Obstetric History

Primigravidae represented 13.7% of the participants whereas more than 4 gravity women represented 36.6% of them. More than half of them (55.8%) were in the third trimester of pregnancy (**Table 2**).

Past history of gestational diabetes mellitus was reported by 50.6% of the women as displayed in **Figure 1** while past history of treatment with insulin during pregnancy was reported by 31.4% of them as seen in **Figure 2**.

Table 1. Sociodemographic characteristics of the participants (n = 165).

Sociodemographic characteristics	Frequency	Percentage
Age (years) (n = 162)		
18 - 25	13	8.0
26 - 30	35	21.6
31 - 35	55	34.0
>35	59	36.4
Employment status (n = 164)		
Employed	29	17.7
Unemployed	135	82.3
Monthly income (Saudi Riyals/month) (n = 91)		
3000 - 5000	38	41.7
5001 - 10,000	28	30.8
>10,000	25	27.5
Educational level (n = 164)		
Primary school	15	9.1
Intermediate school	17	10.4
Secondary school	34	20.7
University/postgraduate	98	59.8
Number of children (n = 158)		
None	10	6.3
1	40	25.3
2 - 4	79	50.0
5 and more	29	18.4

Table 2. Obstetric history of the participants (n = 165).

Variables	Frequency	Percentage
Gravity (n = 161)		
Primigravidae	22	13.7
Second	21	13.0
Third	37	23.0
Fourth	22	13.7
More than fourth	59	36.6
Trimester of the current pregnancy (n = 156)		
First	28	17.9
Second	41	26.3
Third	87	55.8

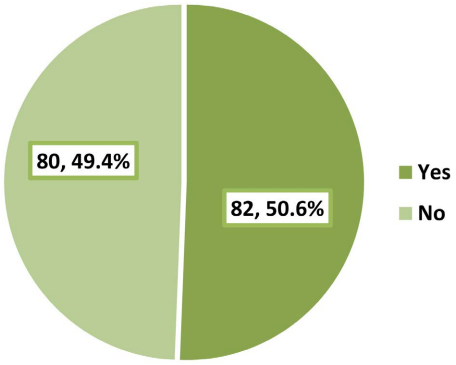

Figure 1. Past history of gestational diabetes mellitus among the participants (n = 162).

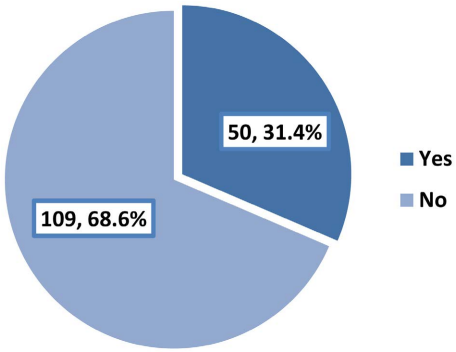

Figure 2. Past history of treatment with insulin during pregnancy among the participants (n = 159).

3.3. Barriers to Initiate Insulin Therapy

3.3.1. Personal Barriers

Among studied personal barriers, more than half (56.4%) of the participants preferred other treatment methods over insulin and 45.4% were unaware of insulin dose control method while 41.2% fear of needles and pain at the injection site and 40.6% were unawareness of the injection method. More than one-third of patients (35.2%) reported forgetfulness as a personal barrier.

3.3.2. Family (Social) Barriers

Abound a quarter of women (23.6%) reported past family experience of insulin-related complications while 15.8% reported lack of family support for taking insulin injections.

3.3.3. Side Effects Barriers

More than half of the women reported that fear of hypoglycemia (59.4%) and fear of weight gain (50.9%) are barriers against use of insulin in the management of gestational diabetes whereas 41.2% reported Fear of allergic reactions at the injection site as a barrier.

3.3.4. Misconceptions about Insulin Injections

More than one-quarter of women (26%) agreed that insulin is addictive; the injection will continue for life whereas 15.2% and 12.2% agreed that insulin may

lead to stillbirth and negatively affects sexual desire, respectively.

3.3.5. Work-Related Barriers

Among employed women, 55.2% agreed that irregular eating times during working hours and long working hours are barriers for insulin use in the management of gestational diabetes while lack of privacy during injection was agreed upon by 48.3% of patients.

3.4. Factors Associated with Barriers to Initiate Insulin Therapy

3.4.1. Patients' Age

Younger patients (18 - 25 years) were more likely than older patients (>35 years) to agree that unawareness of insulin dose control method (69.2% vs. 35.6%), p = 0.021 and religious beliefs (15.4% vs. 5.1%), p = 0.047 are barriers to initiate insulin therapy while those aged 26 - 30 years were more likely than those in the age group 31 - 35 years to agree that feeling stigmatized is a barrier to initiate insulin therapy (20% vs. 1.8%), p = 0.009 (Table 3).

3.4.2. Patients' Employment Status

Unemployed women were more likely than employed women to agree that lack of family support for taking insulin injections is a barrier to initiate insulin therapy (18.5% vs. 3.4%), p = 0.031 while employed women were more likely than unemployed women to agree that insulin negatively affects sexual desire (24.1% vs. 9.6%), p = 0.030 (Table 4).

3.4.3. Patients' Income

Patient with moderate income (5001 - 10,000 SR/month) were more likely than those of low income (3000 - 5000 SR/month) to agree that long working hours (39.3% vs. 7.9%), p = 0.009, irregular eating times during working hours (39.3% vs. 5.3%), p = 0.002 and lack of privacy during injection (25% vs. 5.3%), p = 0.050 are a barrier to initiate insulin therapy (Table 5).

3.4.4. Patients' Educational Level

More than half (56.1%) of university graduated patients compared to only 20% of primary school educated patients agreed that unawareness of insulin dose control method is a barrier to initiate insulin therapy in the management of gestational diabetes, p = 0.006. Similarly, university graduated patients were more likely than primary school educated patients to agree that long working hours (22.4% vs. zero), p = 0.007 and irregular eating times during working hours (23.5% vs. zero) are barrier to initiate insulin therapy in the management of gestational diabetes (Table 6).

3.4.5. Patients' Number of Children

Women with one child were more likely than those with ≥5 children to agree that unawareness of insulin dose control method is a barrier to initiate insulin therapy in the management of gestational diabetes (70% vs. 10.3%), p < 0.001. Also women with 2 - 4 child were more likely than those with no children to

Table 3. Association between gestational diabetes patients' age and barriers to initiate insulin therapy.

	18 - 25 N = 13 N (%)*	26 - 30 N = 35 N (%)*	31 - 35 N = 55 N (%)	>35 N = 59 N (%)	p-value˚
Personal barriers					
Unawareness of the injection method.	7 (53.8)	18 (51.4)	21 (38.2)	20 (33.9)	0.275
Unawareness of insulin dose control method.	9 (69.2)	22 (62.9)	23 (41.8)	21 (35.6)	0.021
Doubt about the efficacy of insulin.	2 (15.4)	6 (17.1)	8 (14.5)	9 (15.3)	0.990
Fear of (needles, pain at the injection site).	5 (38.5)	18 (51.4)	20 (36.4)	24 (40.7)	0.555
Preference for other treatment methods over insulin.	8 (61.5)	21 (60.0)	31 (56.4)	32 (54.2)	0.935
Past personal experience of insulin-related complications.	0 (0.0)	5 (14.3)	5 (9.1)	10 (16.9)	0.302
Treatment plan complexity.	5 (38.5)	7 (20.0)	6 (10.9)	16 (27.1)	0.068
Relying on others to take insulin.	3 (23.1)	8 (22.9)	11 (20.0)	5 (8.5)	0.200
Religious beliefs.	2 (15.4)	4 (11.4)	0 (0.0)	3 (5.1)	0.047
Lack of confidence in doctors' opinions.	1 (7.7)	1 (2.9)	2 (3.6)	4 (6.8)	0.763
Forgetfulness.	6 (46.2)	12 (34.3)	17 (30.9)	22 (37.3)	0.740
Family (social) barriers					
Lack of family support for taking insulin injections.	2 (15.4)	8 (22.9)	7 (12.7)	8 (13.6)	0.584
Feeling stigmatized.	0 (0.0)	7 (20.0)	1 (1.8)	4 (6.8)	0.009
Past family experience of insulin-related complications.	4 (30.8)	10 (28.6)	10 (18.2)	15 (25.4)	0.613
Side effects barriers					
Fear of hypoglycaemia.	8 (61.5)	21 (60.0)	26 (47.3)	42 (71.2)	0.079
Fear of weight gain.	8 (61.5)	19 (54.3)	23 (41.8)	32 (54.2)	0.420
Fear of allergic reactions at the injection site.	4 (30.8)	15 (42.9)	17 (30.9)	30 (50.8)	0.151
Misconceptions about insulin injections					
Insulin may lead to stillbirth.	1 (7.7)	3 (8.6)	9 16.4)	11 (18.6)	0.495
Insulin is addictive; the injection will continue for life.	2 (15.4)	11 (31.4)	14 (25.5)	15 (25.4)	0.725
Insulin causes aging.	1 (7.7)	4 (11.4)	4 (7.3)	6 (10.2)	0.908
Insulin negatively affects sexual desire.	0 (0.0)	4 (11.4)	8 (14.5)	8 (13.6)	0.535
Work-related barriers					
Long working hours.	1 (7.7)	6 (17.1)	5 (9.1)	12 (20.3)	0.317
Irregular eating times during working hours.	1 (7.7)	7 (20.0)	5 (9.1)	12 (20.3)	0.268
Lack of privacy during injection.	0 (0.0)	4 (11.4)	4 (7.3)	12 (20.3)	0.084

*Percentage of agreement, ˚Chi-square test.

Table 4. Association between gestational diabetes patients' employment status and barriers to initiate insulin therapy.

	Employed N = 29 N (%)*	Unemployed N = 135 N (%)*	p-value
Personal barriers			
Unawareness of the injection method.	8 (27.6)	59 (43.7)	0.109˚
Unawareness of insulin dose control method.	13 (44.8)	62 (45.9)	0.914˚
Doubt about the efficacy of insulin.	3 (10.3)	22 (16.3)	0.312#
Fear of (needles, pain at the injection site).	9 (31.0)	58 (43.0)	0.236˚
Preference for other treatment methods over insulin.	14 (48.3)	78 (57.8)	0.350˚
Past personal experience of insulin-related complications.	2 (6.9)	18 (13.3)	0.270#
Treatment plan complexity.	3 (10.3)	31 (23.0)	0.098#
Relying on others to take insulin.	2 (6.9)	25 (18.5)	0.099#
Religious beliefs.	1 (3.4)	8 (5.9)	0.505#
Lack of confidence in doctors' opinions.	1 (3.4)	7 (5.2)	0.571#
Forgetfulness.	11 (37.9)	47 (34.8)	0.750˚
Family (social) barriers			
Lack of family support for taking insulin injections.	1 (3.4)	25 (18.5)	0.031#
Feeling Stigmatized.	0 (0.0)	12 (8.9)	0.088#
Past family experience of insulin-related complications.	6 (20.7)	33 (24.4)	0.667˚
Side effects barriers			
Fear of hypoglycaemia.	17 (58.6)	80 (59.3)	0.949˚
Fear of weight gain.	14 (48.3)	69 (51.1)	0.782˚
Fear of allergic reactions at the injection site.	11 (37.9)	56 (41.5)	0.724˚
Misconceptions about insulin injections			
Insulin may lead to stillbirth.	3 (10.3)	22 (16.3)	0.312#
Insulin is addictive; the injection will continue for life.	6 (20.7)	37 (27.4)	0.456˚
Insulin causes aging.	3 (10.3)	13 (9.6)	0.565#
Insulin negatively affects sexual desire.	7 (24.1)	13 (9.6)	0.030˚

*Percentage of agreement, ˚Chi-square test. #Fischer Exact test.

Table 5. Association between gestational diabetes patients' income and barriers to initiate insulin therapy.

	3000 - 5000 N = 38 N (%)*	5001 - 10,000 N = 28 N (%)*	>10,000 N = 25 N (%)	p-value˚
Personal barriers				
Unawareness of the injection method.	14 (36.8)	11 (39.3)	9 (36.0)	0.966

Continued

Unawareness of insulin dose control method.	12 (31.6)	15 (53.6)	13 (52.0)	0.131
Doubt about the efficacy of insulin.	2 (5.3)	6 (21.4)	2 (8.0)	0.099
Fear of (needles, pain at the injection site).	12 (31.6)	15 (53.6)	7 (28.0)	0.099
Preference for other treatment methods over insulin.	20 (52.6)	18 (64.3)	12 (48.0)	0.459
Past personal experience of insulin-related complications.	4 (10.5)	2 (7.1)	2 (8.0)	0.879
Treatment plan complexity.	6 (15.8)	4 (14.3)	1 (4.0)	0.340
Relying on others to take insulin.	6 (15.8)	2 (7.1)	5 (20.0)	0.386
Religious beliefs.	3 (7.9)	0 (0.0)	0 (0.0)	0.115
Lack of confidence in doctors' opinions.	3 (7.9)	0 (0.0)	1 (4.0)	0.301
Forgetfulness.	13 (34.2)	11 (39.3)	10 (40.0)	0.869
Family (social) barriers				
Lack of family support for taking insulin injections.	5 (13.2)	3 (10.7)	2 (8.0)	0.813
Feeling Stigmatized.	1 (2.6)	0 (0.0)	0 (0.0)	0.494
Past family experience of insulin-related complications.	12 (31.6)	3 (10.7)	4 (16.0)	0.093
Side effects barriers				
Fear of hypoglycaemia.	16 (42.1)	16 (57.1)	15 (60.0)	0.298
Fear of weight gain.	18 (47.4)	16 (57.1)	11 (44.0)	0.599
Fear of allergic reactions at the injection site.	13 (34.2)	14 (50.0)	10 (40.0)	0.433
Misconceptions about insulin injections				
Insulin may lead to stillbirth.	8 (21.1)	3 (10.7)	4 (16.0)	0.533
Insulin is addictive; the injection will continue for life.	9 (23.7)	2 (7.1)	6 (24.0)	0.170
Insulin causes aging.	4 (10.5)	1 (3.6)	3 (12.0)	0.493
Insulin negatively affects sexual desire.	3 (7.9)	2 (7.1)	6 (24.0)	0.100
Work-related barriers				
Long working hours.	3 (7.9)	11 (39.3)	7 (28.0)	0.009
Irregular eating times during working hours.	2 (5.3)	11 (39.3)	8 (32.0)	0.002
Lack of privacy during injection.	2 (5.3)	7 (25.0)	6 (24.0)	0.050

*Percentage of agreement, ˚Chi-square test.

Table 6. Association between gestational diabetes patients' educational level and barriers to initiate insulin therapy.

	Primary N = 15 N (%)*	Intermediate N = 17 N (%)*	Secondary N = 34 N (%)	University N = 98 N (%)	p-value˚
Personal barriers					
Unawareness of the injection method.	6 (40.0)	4 (23.5)	12 (35.3)	45 (45.9)	0.309
Unawareness of insulin dose control method.	3 (20.0)	4 (23.5)	13 (38.2)	55 (56.1)	0.006

Continued

Doubt about the efficacy of insulin.	1 (6.7)	2 (11.8)	5 (14.7)	17 (17.3)	0.716
Fear of (needles, pain at the injection site).	3 (13.3)	6 (35.3)	18 (52.9)	41 (41.8)	0.071
Preference for other treatment methods over insulin.	6 (40.0)	7 (41.2)	20 (58.8)	59 (60.2)	0.274
Past personal experience of insulin-related complications.	1 (6.7)	2 (11.8)	4 (11.8)	13 (13.3)	0.910
Treatment plan complexity.	1 (6.7)	4 (23.5)	6 (17.6)	23 (23.5)	0.470
Relying on others to take insulin.	2 (13.3)	3 (17.6)	9 (26.5)	13 (13.3)	0.344
Religious beliefs.	1 (6.7)	1 (5.9)	2 (5.9)	5 (5.1)	0.994
Lack of confidence in doctors' opinions.	1 (6.7)	2 (11.8)	3 (8.8)	2 (2.0)	0.197
Forgetfulness.	3 (20.0)	3 (17.6)	12 (35.3)	40 (40.8)	0.161
Family (social) barriers					
Lack of family support for taking insulin injections.	2 (13.3)	6 (35.3)	4 (11.8)	14 (14.3)	0.139
Feeling Stigmatized.	0 (0.0)	2 (11.8)	3 (8.8)	7 (7.1)	0.615
Past family experience of insulin-related complications.	2 (13.3)	4 (23.5)	4 (11.8)	29 (29.6)	0.142
Side effects barriers					
Fear of hypoglycaemia.	7 (46.7)	8 (47.1)	22 64.7)	60 (61.2)	0.457
Fear of weight gain.	5 (33.3)	7 (41.2)	20 (58.8)	51 (52.0)	0.355
Fear of allergic reactions at the injection site.	2 (13.3)	7 (41.2)	17 (50.0)	41 (41.8)	0.116
Misconceptions about insulin injections					
Insulin may lead to stillbirth.	2 (13.3)	3 (17.6)	3 (8.8)	17 (17.3)	0.673
Insulin is addictive; the injection will continue for life.	3 (20.0)	4 (23.5)	8 (23.5)	28 (28.6)	0.856
Insulin causes aging.	1 (6.7)	3 (17.6)	4 (11.8)	8 (8.2)	0.614
Insulin negatively affects sexual desire.	1 (6.7)	3 (17.6)	3 (8.8)	13 (13.3)	0.714
Work-related barriers					
Long working hours.	0 (0.0)	1 (5.9)	1 (2.9)	22 (22.4)	0.007
Irregular eating times during working hours.	0 (0.0)	1 (5.9)	1 (2.9)	23 (23.5)	0.005
Lack of privacy during injection.	0 (0.0)	1 (5.9)	2 (5.9)	17 (17.3)	0.093

*Percentage of agreement, ˚Chi-square test.

agree that fear of (needles, pain at the injection site). Is a barrier to initiate insulin therapy in the management of gestational diabetes (51.9% vs. 20%), p = 0.029. Majority of women with no children (90%) compared to 41.4% of those with five children and more agreed that fear of hypoglycaemiais a barrier to initiate insulin therapy in the management of gestational diabetes, p = 0.018. Women with 2 - 4 child were more likely than those with no children to agree that insulin is addictive; the injection will continue for life is a barrier to initiate insulin therapy in the management of gestational diabetes (39.2% vs. zero), p = 0.004 (Table 7).

Table 7. Association between gestational diabetes patients' number of children and barriers to initiate insulin therapy (n = 158).

	None N = 10 N (%)*	1 N = 40 N (%)*	2 - 4 N = 79 N (%)	≥5 N = 29 N (%)	p-value°
Personal barriers					
Unawareness of the injection method.	4 (40.0)	21 (52.5)	32 (40.5)	9 (31.0)	0.343
Unawareness of insulin dose control method.	6 (60.0)	28 (70.0)	37 (46.8)	3 (10.3)	<0.001
Doubt about the efficacy of insulin.	0 (0.0)	4 (10.0)	16 (20.3)	4 (13.8)	0.236
Fear of (needles, pain at the injection site).	2 (20.0)	16 (40.0)	41 (51.9)	7 (24.1)	0.029
Preference for other treatment methods over insulin.	4 (40.0)	24 (60.0)	49 (62.0)	14 (48.3)	0.387
Past personal experience of insulin-related complications.	0 (0.0)	3 (7.5)	11 (13.9)	7 (24.1)	0.128
Treatment plan complexity.	1 (10.0)	9 (22.5)	16 (20.3)	7 (24.1)	0.805
Relying on others to take insulin.	3 (30.0)	6 (15.0)	14 (17.7)	4 (13.8)	0.762
Religious beliefs.	0 (0.0)	6 (15.0)	3 (3.8)	1 (3.4)	0.072
Lack of confidence in doctors' opinions.	0 (0.0)	2 (5.0)	5 (6.3)	1 (3.4)	0.812
Forgetfulness.	2 (20.0)	14 (35.0)	31 (39.2)	9 (31.0)	0.617
Family (social) barriers					
Lack of family support for taking insulin injections.	1 (10.0)	4 (10.0)	15 (19.0)	5 (17.2)	0.591
Feeling Stigmatized.	1 (10.0)	3 (7.5)	6 (7.6)	1 (3.4)	0.859
Past family experience of insulin-related complications.	1 (10.0)	12 (30.0)	21 (26.6)	5 (17.2)	0.426
Side effects barriers					
Fear of hypoglycaemia.	9 (90.0)	22 (55.0)	53 (67.1)	12 (41.4)	0.018
Fear of weight gain.	7 (70.0)	20 (50.0)	43 (54.5)	12 (41.4)	0.414
Fear of allergic reactions at the injection site.	3 (30.0)	15 (37.5)	38 (48.1)	10 (34.5)	0.423
Misconceptions about insulin injections					
Insulin may lead to stillbirth.	1 (0.0)	4 (10.0)	15 (19.0)	5 (17.2)	0.591
Insulin is addictive; the injection will continue for life.	0 (0.0)	6 (15.0)	31 (39.2)	6 (20.7)	0.004
Insulin causes aging.	0 (0.0)	1 (2.5)	11 (13.9)	4 (13.8)	0.147
Insulin negatively affects sexual desire.	0 (0.0)	4 (10.0)	13 (16.5)	3 (10.3)	0.411
Work-related barriers					
Long working hours.	2 (20.0)	6 (15.0)	13 (16.5)	3 (10.3)	0.848
Irregular eating times during working hours.	2 (20.0)	6 (15.0)	14 (17.7)	3 (10.3)	0.797
Lack of privacy during injection.	3 (30.0)	4 (10.0)	12 (15.2)	1 (3.4)	0.129

*Percentage of agreement, °Chi-square test.

3.4.6. Patients' Gravidity

Second gravidity women were more likely than more than fourth gravidity women to agree that unawareness of insulin dose control method is a barrier to initiate insulin therapy in the management of gestational diabetes (76.2% vs. 27.1%), p = 0.001. However, women with more than fourth gravidity were more likely than primigravidae and those with second gravidity to agree that past personal experience of insulin-related complications is a barrier to initiate insulin therapy in the management of gestational diabetes (23.7% vs. zero), p = 0.014 (Table 8).

3.4.7. Patients' Trimester of the Current Pregnancy

As shown in Table 9, there was no statistically significant difference between women's trimester of the current pregnancy and their agreement regarding barriers to initiate insulin therapy in the management of gestational diabetes (p > 0.05).

3.4.8. Past History of Gestational Diabetes Mellitus

It is realized from Table 10 that there was no statistically significant association between women's past history of gestational diabetes and their agreement regarding barriers to initiate insulin therapy in the management of gestational diabetes.

3.4.9. Past history of Treatment with Insulin during Pregnancy

Women with no past history of insulin therapy were more likely than those with such history to agree that unawareness of the injection method (47.7% vs. 26%), p = 0.010 and insulin is addictive; the injection will continue for life (31.2% vs. 16%), p = 0.044 are barriers to initiate insulin therapy in the management of gestational diabetes. On the other hand, women with post history of insulin therapy were more likely than those without such history to agree that barriers to initiate insulin therapy in the management of gestational diabetes include long working hours (24% vs. 11%), p = 0.034 and lack of privacy during injection (24% vs. 7.3%), p = 0.003 (Table 11).

3.5. Possible Solutions to Initiate and Commit to Insulin Therapy

From Table 12, it is realized that majority of the participants either strongly agreed or agreed that facilitate access to healthcare services (94%), engage the patient in decision-making and development of the treatment plan (91.6%), activate virtual clinics and social media for remote follow-up (86.6%) and organize social support groups for pregnant women who use insulin to share their experiences are the possible solutions to initiate and commit to insulin therapy. Also, 78.8% and 77.8% of them either strongly agreed or agreed that promote family, peer, and community support and conducting training courses to teach insulin injection and improve awareness, respectively are possible solutions to initiate and commit to insulin therapy.

Table 8. Association between gestational diabetes patients' gravidity and barriers to initiate insulin therapy (n = 158).

	Primi N = 22 N (%)*	Second N = 21 N (%)*	Third N = 37 N (%)	Fourth N = 22 N (%)	>Fourth N = 59 N (%)	p-value°
Personal barriers						
Unawareness of the injection method.	9 (40.9)	13 (61.9)	14 (37.8)	9 (40.9)	21 (35.6)	0.324
Unawareness of insulin dose control method.	12 (54.5)	16 (76.2)	21 (56.8)	9 (40.9)	16 (27.1)	0.001
Doubt about the efficacy of insulin.	2 (9.1)	3 (14.3)	6 (16.2)	2 (9.1)	12 (20.3)	0.650
Fear of (needles, pain at the injection site).	6 (27.3)	8 (38.1)	14 (37.8)	12 (54.5)	26 (44.1)	0.428
Preference for other treatment methods over insulin.	13 (59.1)	12 (57.1)	17 (45.9)	12 (54.5)	37 (62.7)	0.609
Past personal experience of insulin-related complications.	0 (0.0)	0 (0.0)	4 (10.8)	3 (13.6)	14 (23.7)	0.014
Treatment plan complexity.	5 (22.7)	6 (28.6)	7 (18.9)	3 (13.6)	13 (22.0)	0.807
Relying on others to take insulin.	5 (22.7)	3 (14.3)	10 (27.0)	3 (13.6)	7 (11.9)	0.350
Religious beliefs.	2 (9.1)	3 (14.3)	1 (2.7)	2 (9.1)	2 (3.4)	0.335
Lack of confidence in doctors' opinions.	2 (9.1)	0 (0.0)	3 (8.1)	0 (0.0)	3 (5.1)	0.432
Forgetfulness.	9 (40.9)	7 (33.3)	11 (29.7)	11 (29.7)	22 (37.3)	0.902
Family (social) barriers						
Lack of family support for taking insulin injections.	3 (13.6)	1 (4.8)	8 (21.6)	2 (9.1)	10 (16.9)	0.430
Feeling Stigmatized.	1 (4.5)	2 (9.5)	4 (10.8)	1 (4.5)	3 (5.1)	0.772
Past family experience of insulin-related complications.	6 (27.3)	5 (23.8)	7 (18.9)	8 (36.4)	13 (22.0)	0.627
Side effects barriers						
Fear of hypoglycaemia.	14 (63.6)	11 (52.4)	24 (64.9)	15 (68.2)	31 (52.5)	0.577
Fear of weight gain.	13 (59.1)	10 (47.6)	15 (40.5)	13 (59.1)	31 (52.5)	0.571
Fear of allergic reactions at the injection site.	7 (31.8)	9 (42.9)	13 (35.1)	10 (45.5)	27 (45.8)	0.725
Misconceptions about insulin injections						
Insulin may lead to stillbirth.	1 (4.5)	1 (4.8)	7 (18.9)	4 (18.2)	12 (20.3)	0.252
Insulin is addictive; the injection will continue for life.	2 (9.1)	5 (23.8)	9 (24.3)	8 (36.4)	18 (30.5)	0.266
Insulin causes aging.	0 (0.0)	1 (4.8)	3 (8.1)	4 (18.2)	8 (13.6)	0.220
Insulin negatively affects sexual desire.	0 (0.0)	4 (19.0)	3 (8.1)	5 (22.7)	8 (13.6)	0.146
Work-related barriers						
Long working hours.	2 (9.1)	3 (14.3)	6 (16.2)	6 (27.3)	6 (10.2)	0.349
Irregular eating times during working hours.	2 (9.1)	3 (14.3)	7 (18.9)	5 (22.7)	7 (11.9)	0.635
Lack of privacy during injection.	2 (9.1)	3 (14.3)	5 (13.5)	6 (27.3)	3 (5.1)	0.092

*Percentage of agreement, °Chi-square test.

Table 9. Association between gestational diabetes patients' trimester of the current pregnancy and barriers to initiate insulin therapy (n = 158).

	First N = 28 N (%)*	Second N = 41 N (%)*	Third N = 87 N (%)	p-value˚
Personal barriers				
Unawareness of the injection method.	7 (25.0)	20 (48.8)	40 (46.0)	0.102
Unawareness of insulin dose control method.	11 (39.3)	22 (53.7)	42 (48.3)	0.502
Doubt about the efficacy of insulin.	4 (14.3)	7 (17.1)	13 (14.9)	0.938
Fear of (needles, pain at the injection site).	11 (39.3)	19 (46.3)	36 (41.4)	0.815
Preference for other treatment methods over insulin.	15 (53.6)	25 (61.0)	49 (56.3)	0.813
Past personal experience of insulin-related complications.	3 (10.7)	6 (14.6)	11 (12.6)	0.889
Treatment plan complexity.	5 (17.9)	14 (34.1)	15 (17.2)	0.083
Relying on others to take insulin.	4 (14.3)	5 (12.2)	19 (21.8)	0.355
Religious beliefs.	1 (3.6)	3 (7.3)	6 (6.9)	0.792
Lack of confidence in doctors' opinions.	1 (3.6)	1 (2.4)	6 (6.9)	0.520
Forgetfulness.	8 (28.6)	12 (29.3)	36 (41.4)	0.276
Family (social) barriers				
Lack of family support for taking insulin injections.	2 (7.1)	5 (12.2)	17 (19.5)	0.230
Feeling Stigmatized.	1 (3.6)	5 (12.2)	6 (6.9)	0.383
Past family experience of insulin-related complications.	6 (21.4)	12 (29.3)	20 (23.0)	0.685
Side effects barriers				
Fear of hypoglycaemia.	18 (64.3)	24 (58.5)	53 (60.9)	0.891
Fear of weight gain.	18 (64.3)	21 (51.2)	44 (50.6)	0.430
Fear of allergic reactions at the injection site.	13 (46.4)	16 (39.0)	36 (41.4)	0.823
Misconceptions about insulin injections				
Insulin may lead to stillbirth.	1 (3.6)	5 (12.2)	18 (20.7)	0.074
Insulin is addictive; the injection will continue for life.	5 (17.9)	13 (31.7)	22 (25.3)	0.430
Insulin causes aging.	1 (3.6)	5 (12.2)	9 (10.3)	0.462
Insulin negatively affects sexual desire.	3 (10.7)	5 (12.2)	10 (11.5)	0.982
Work-related barriers				
Long working hours.	3 (10.7)	6 (14.6)	14 (16.1)	0.784
Irregular eating times during working hours.	4 (14.3)	5 (12.2)	15 (17.2)	0.749
Lack of privacy during injection.	5 (17.9)	6 (14.6)	9 (10.3)	0.540

*Percentage of agreement, ˚Chi-square test.

Table 10. Association between gestational diabetes patients' past history of gestational diabetes and barriers to initiate insulin therapy.

	Yes N = 82 N (%)*	No N = 80 N (%)*	p-value˚
Personal barriers			
Unawareness of the injection method.	30 (36.6)	36 (45.0)	0.276
Unawareness of insulin dose control method.	38 (46.3)	36 (45.0)	0.864
Doubt about the efficacy of insulin.	12 (14.6)	13 (16.3)	0.776
Fear of (needles, pain at the injection site).	36 (43.9)	32 (40.0)	0.615
Preference for other treatment methods over insulin.	45 (54.9)	46 (57.5)	0.737
Past personal experience of insulin-related complications.	10 (12.2)	11 (13.8)	0.768
Treatment plan complexity.	15 (18.3)	20 (25.0)	0.300
Relying on others to take insulin.	15 (18.3)	13 (16.3)	0.731
Religious beliefs.	5 (6.1)	5 (6.3)	0.968
Lack of confidence in doctors' opinions.	3 (3.7)	5 (6.3)	0.346
Forgetfulness.	28 (34.1)	29 (36.3)	0.779
Family (social) barriers			
Lack of family support for taking insulin injections.	13 (15.9)	11 (13.8)	0.706
Feeling Stigmatized.	6 (7.3)	6 (7.5)	0.965
Past family experience of insulin-related complications.	19 (23.2)	19 (23.8)	0.931
Side effects barriers			
Fear of hypoglycaemia.	47 (57.3)	51 (63.7)	0.402
Fear of weight gain.	38 (46.3)	45 (56.3)	0.207
Fear of allergic reactions at the injection site.	34 (41.5)	34 (42.5)	0.894
Misconceptions about insulin injections			
Insulin may lead to stillbirth.	8 (9.8)	17 (21.3)	0.043
Insulin is addictive; the injection will continue for life.	21 (25.6)	21 (26.3)	0.926
Insulin causes aging.	6 (7.3)	10 (12.5)	0.269
Insulin negatively affects sexual desire.	9 (11.0)	11 (13.8)	0.591
Work-related barriers			
Long working hours.	14 (17.1)	10 (12.5)	0.413
Irregular eating times during working hours.	15 (18.3)	10 (12.5)	0.308
Lack of privacy during injection.	10 (12.2)	10 (12.5)	0.953

*Percentage of agreement, ˚Chi-square test.

Table 11. Association between gestational diabetes patients' past history of treatment with insulin and barriers to initiate insulin therapy.

Income in Saudi Riyals/month	Yes N = 50 N (%)*	No N = 109 N (%)*	p-value
Personal barriers			
Unawareness of the injection method.	13 (26.0)	52 (47.7)	0.010
Unawareness of insulin dose control method.	22 (44.0)	50 (45.9)	0.826
Doubt about the efficacy of insulin.	5 (10.0)	19 (17.4)	0.224
Fear of (needles, pain at the injection site).	20 (40.0)	47 (43.1)	0.711
Preference for other treatment methods over insulin.	25 (50.0)	64 (58.7)	0.304
Past personal experience of insulin-related complications.	9 (18.0)	12 (11.0)	0.227
Treatment plan complexity.	11 (22.0)	23 (21.1)	0.898
Relying on others to take insulin.	5 (10.0)	22 (20.2)	0.112
Religious beliefs.	2 (4.0)	8 (7.3)	0.338˚
Lack of confidence in doctors' opinions.	1 (2.0)	7 (6.4)	0.221˚
Forgetfulness.	15 (30.0)	40 17.4)	0.410
Family (social) barriers			
Lack of family support for taking insulin injections.	5 (10.0)	19 (17.4)	0.224
Feeling Stigmatized.	6 (12.0)	6 (5.5)	0.150
Past family experience of insulin-related complications.	10 (20.0)	27 (24.8)	0.509
Side effects barriers			
Fear of hypoglycaemia.	27 (54.0)	69 (63.3)	0.265
Fear of weight gain.	26 (52.0)	54 (49.5)	0.773
Fear of allergic reactions at the injection site.	21 (42.0)	45 (41.3)	0.932
Misconceptions about insulin injections			
Insulin may lead to stillbirth.	6 (12.0)	18 (16.5)	0.460
Insulin is addictive; the injection will continue for life.	8 (16.0)	34 (31.2)	0.044
Insulin causes aging.	4 (8.0)	12 (11.0)	0.392
Insulin negatively affects sexual desire.	7 (14.0)	13 (11.9)	0.714
Work-related barriers			
Long working hours.	12 (24.0)	12 (11.0)	0.034
Irregular eating times during working hours.	12 (24.0)	13 (11.9)	0.052
Lack of privacy during injection.	12 (24.0)	8 (7.3)	0.003

*Percentage of agreement, ˚Chi-square test.

Table 12. Possible solutions to initiate and commit to insulin therapy according to the participants' opinions.

	Strongly Agree N (%)	Agree N (%)	Neutral N (%)	Disagree N (%)	Strongly Disagree N (%)
Activate virtual clinics and social media for remote follow-up.	103 (62.4)	40 (24.2)	20 (12.1)	0 (0.0)	2 (1.2)
Engage the patient in decision-making and development of the treatment plan.	93 (56.4)	58 (35.2)	12 (7.3)	0 (0.0)	2 (1.2)
Facilitate access to healthcare services.	95 (57.6)	60 (36.4)	7 (4.2)	0 (0.0)	3 (1.8)
Promote family, peer, and community support.	82 (49.7)	48 (29.1)	29 (17.6)	3 (1.8)	3 (1.8)
Organize social support groups for pregnant women who use insulin to share their experiences.	82 (49.7)	57 (34.5)	21 (12.7)	4 (2.4)	1 (0.6)
Conducting training courses to teach insulin injection and improve awareness.	71 (43.0)	59 (35.8)	30 (18.2)	2 (1.2)	3 (1.8)

4. Discussion

Achieving glycemic control is challenging among pregnant women with GDM and initiation of insulin therapy is one of these challenges to achieve the glycemic control [17]. American Diabetes Association [18] and Diabetes Canada Clinical Practice Guidelines Expert Committee [19] have recommended insulin as the first-line of antihyperglycemic therapy for treating GDM. Additionally, use of insulin decreases both fetal and maternal morbidity [20] [21]. Up to our knowledge, this study is unique in its nature to assess the attitude of GDM pregnant women toward different patients' related barriers to initiate insulin therapy as well as to identify possible solutions to overcome those barriers.

In the current study, the most commonly reported personal barriers to initiate insulin therapy for management of GDM were preferring other treatment methods over insulin, unawareness of insulin dose control method, fear of needles and pain at the injection site, unawareness of the injection method and forgetfulness. Younger patients in this study were more likely than older patients to consider unawareness of insulin dose control method and religious beliefs as barriers to initiate insulin therapy. Higher educated women were more likely to consider unawareness of insulin dose control method as a barrier to initiate insulin therapy in the management of GDM. Women with one child were more likely than those with ≥5 children to consider unawareness of insulin dose control method while those with 2 - 4 child were more likely than those with no children to agree that fear of (needles, pain at the injection site)is a barrier to initiate insulin therapy in the management of GDM. Women with low gravidity

were more likely than those with high gravidity to consider unawareness of insulin dose control method. However, women with high gravidity were more likely than those with low gravidity to consider past personal experience of insulin-related complications as a barrier to initiate insulin therapy in the management of GDM. Women with no past history of insulin therapy were more likely than those with such history to be unaware of the injection method. Kalra S, *et al.* reported that barriers could be classified as patient/community, drug/device, and physician/provider barriers. The patient barriers included high cost and inadequacy. The patient's barriers were affected by the education of the patient, counseling, and support [22].

As regards Family (social) barriers, past family experience of insulin-related complications and lack of family support for taking insulin injections were the most frequently reported barriers. Unemployed women were more likely than employed women to consider lack of family support for taking insulin injections as a barrier to initiate insulin therapy. Feeling stigmatized was more considered as a barrier to initiate insulin among relatively younger women. Stigmatization and lack of family support were reported as barriers to initiate insulin therapy by others [22] [23] [24] [25].

In the present study, fear of hypoglycemia, weight gain and allergic reactions at the injection site were considered by most of women as barriers against use of insulin in the management of GDM. Women with no children were more likely than those with high number of children to consider fear of hypoglycemiaas a barrier to initiate insulin therapy in the management of GDM. This is might be due to lack of family support in this group of women. Injection phobia and fear of hypoglycemia were also mentioned by others as barriers to initiate insulin therapy [26] [27] [28].

In this study, 26% of patients believed that insulin is addictive whereas a considerable proportion of them believed that insulin may lead to stillbirth and negatively affects sexual desire. Women with no past history of insulin therapy were more likely than those with such history to believe that insulin is addictive; the injection will continue for life. This is expected as those with no history of insulin therapy depended on misconceptions taken from others while those with previous history of insulin therapy depend on their own experience. Additionally, those with children were more likely than those with no children to believe that insulin is addictive; the injection will continue for life. Employed women were more likely than unemployed women to believe that insulin negatively affects sexual desire. In agreement with that, Karter *et al.* reported that subjects failing to initiate prescribed insulin commonly reported misconceptions regarding insulin risk [26].

Among employed women in the current study, 55.2% considered irregular eating times during working hours and long working hours as main barriers for insulin use in the management of gestational diabetes while lack of privacy during injection was considered a barrier by 48.3% of patients. Women with past history of insulin therapy were more likely than those without such history to

consider long working hours and lack of privacy during injection as barriers to have insulin. This is again is expected due to their previous experience. Higher educated women were more likely to consider long working hours and irregular eating times during working hours as barrier to initiate insulin therapy in the management of GDM. Women with moderate income were more likely than those of low income to consider long working hours, irregular eating times during working hours and lack of privacy during injection as barriers to initiate insulin therapy. Hui *et al.* reported that quick adaptation to dietary management in a short time period created challenges for women with GDM [29].

The current study revealed that facilitating access to healthcare services, engaging the patient in decision-making and development of the treatment plan, activate virtual clinics and social media for remote follow-up and organize social support groups for pregnant women who use insulin to share their experiences are the most frequently reported possible solutions to initiate and commit to insulin therapy. These strategies may assist women as well as their health professionals concerning how best to meet the needs of women with gestational diabetes as well as their families to achieve optimal glycemic control and consequently reduce adverse outcomes for those women and their babies [17] [30] [31].

Few but important limitations of this study should be addressed. First of all, being a single center study is an important limitation that could affect negatively the ability to generalize the findings over other settings. Utilizing a self-administered tool to collect data is another limitation, which is subjected to bias. Despite of those limitations, the study could have both clinical as well as public health importance in detecting important barriers to initiate insulin in women with GDM and set possible solutions to overcome these barriers.

In conclusion, various barriers were identified against initiation of insulin therapy in the management of gestational diabetes; mostly due to personal factors, misconception and work-related factors. Facilitating access to healthcare services, engaging the patient in decision-making and development of the treatment plan, activate virtual clinics and social media for remote follow-up and organize social support groups for pregnant women who use insulin to share their experiences were the most frequently reported possible solutions recommended by women to initiate and commit to insulin therapy. Further multi-center study is needed to have a much better overview of the situation in Makkah.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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