
Prevalence of Diabetes Mellitus Among Pregnant Women Receiving Health Services at the Puerto Rico University Hospital, Puerto Rico, 1997-1998

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Objective. To estimate the prevalence and to describe the clinical characteristics of gestational diabetes mellitus (GDM) in pregnant women receiving health care services at the Puerto Rico University Hospital from 1997 to 1998.

Methods. The study design was cross-sectional. All medical records available of pregnant women diagnosed with GDM were retrospectively reviewed. Descriptive statistics such as frequency distributions and summary measures (mean and standard deviation) were used. Annual and 18-month period prevalences of GDM were calculated. Fisher's exact test was used to compare proportions.

Results. A total of 78 medical records were available during the 18-month study period (June 1997 to December 1998). The estimated prevalence of GDM was 2% for the total study period (18-month) as well as for

the year 1998. The highest proportion (52.3%) of GDM cases was found in the 30 years or less age group. Forty-eight percent had a body mass index (BMI) ≥ 30 m/kg² (obese) before pregnancy; however, the weight gained during the last pregnancy was higher than 15 pounds (57%). Sixty-four percent of the cases had a family history of diabetes, meanwhile, 34.7% reported a history of GDM during previous pregnancies. During the first prenatal visit, 80.5% reflected glucose levels higher than 110 mg/ml. Preeclampsia (6.4%) and macrosomia (14%) were the most frequent complications for the mother and the fetus, respectively.

Discussion. More epidemiological studies about GDM in Puerto Rico need to be performed to better describe the prevalence of the condition in the island.

Key words: Gestational diabetes mellitus, Puerto Rico, Prevalence.

Gestational diabetes mellitus (GDM) is a transient condition defined as glucose intolerance occurring during pregnancy that has been associated to various factors that predispose its development. Usually this form of diabetes disappears by six weeks postpartum (1). Among the factors that have been consistently associated with this condition are the

following: maternal age (1-12), parity (1,4,7,12-13), obesity (1-3,6-7,10,12-15), high-fat diet (16), ethnic group (2-4,6,12), and diabetes family history (1-2,6,12,15). This condition has adverse effects in the mother as well as in the fetus. In the mother, GDM can increase the risk of developing hypertension, preeclampsia, and cesarean section (5,11-12). In the fetus, it increases the risk of developing birth defects and macrosomia, among other conditions (17-19).

In 1996, data from the Behavioral Risk Factor Surveillance System (BRFSS), a self-reported survey conducted by the Centers for Disease Control and Prevention (CDC) in Atlanta, reported a GDM prevalence of 0.7% in Puerto Rico (20). GDM has a significant impact in health services utilization, mainly reflected in diagnosis and treatment of the condition. Similarly, GDM has a negative impact in the family and social structure of the people affected by the condition, primarily by the emotional impact that is evident with the stressing events

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that occur as possible complications of the mother and fetus before and after pregnancy.

The objective of the present study was to describe the GDM prevalence in pregnant women receiving health services at the Puerto Rico University Hospital from July 1997 to December 1998. Furthermore, GDM-related factors were identified as well as health services utilization characteristics at the Puerto Rico University Hospital.

Methods

A cross-sectional study was designed to estimate the prevalence of GDM and describe socio-demographic characteristics, prenatal care, and risk factors associated with the condition. The study population consisted of all pregnant women receiving health services at the Puerto Rico University Hospital from July 1997 to December 1998. All available medical records of women diagnosed with GDM of the Puerto Rico University Hospital during the study period were retrospectively reviewed. The data was collected using an abstracting form designed after revising the medical records at the University Hospital and a literature review in which GDM associated risk factors were identified. A pilot test to determine the quality and availability of the data requested for the study was done.

All medical records of pregnant women classified by the University Hospital as having GDM during the study period were identified. Of a total of 3,447 pregnant women who received services at the University Hospital during the study period, 123 medical records were identified with GDM, of which, 78 (63.4%) were available during the data collection period.

Screening for GDM at the University Hospital is performed with a 50 grams oral glucose load followed by a glucose determination one hour later. It is recommended that screening should be performed between 24 and 28 weeks of gestation. However, patients with risk factors such as previous history of GDM or a family history of diabetes may require an earlier screening. Since this hospital is primarily a referral hospital (tertiary level), we recorded the glucose level at the first visit to the hospital, which may not reflect the screening date. However, it is assumed that a GDM case was defined as a patient having a positive screening value greater than 140 mg/dl. The 100 grams 3-hour oral glucose tolerance test performed after an overnight fasting remains the standard for diagnosis of gestational diabetes (American College of Obstetrics and Gynecology, 1994), and two abnormal values are required to diagnose GDM (Table 1).

Medical records with a positive diabetes mellitus diagnosis before pregnancy were excluded. Some variables such as: maternal age, mother's weight before

Table 1. American College of Obstetrics and Gynecology (1994) criteria for diagnosis of GMG using 100g of glucose orally

Timing of measurement	Plasma glucose (mg/dl)
Fasting	105
1 hour	190
2 hour	165
3 hour	145

pregnancy, mother's weight gained during pregnancy, marital status, smoking and alcohol ingestion habits, blood pressure, diabetes family history, childbearing history, previous health conditions, pregnancy characteristics and previous childbirths were evaluated.

Descriptive statistics such as frequency distributions and summary measures (mean and standard deviation) were used. Two separate prevalences were calculated. First, the GDM prevalence was determined using as denominator all pregnant women that received medical services at the Puerto Rico University Hospital, and as numerator all available medical records with a GDM diagnosis at the University Hospital during the 18 month study period (July 1997-December 1998). Finally, to determine the annual prevalence of GDM only those cases reported during 1998 were included. Fisher's exact test was used to compare proportions. Odds ratios (OR) and 95% confidence intervals (CI) were computed to quantify the magnitude of the association between study characteristics and macrosomia. All analyses were performed using the Epi-Info statistical package (21).

Results

The estimated GDM prevalence among pregnant women using the medical records available for the 18-month study period was similar to the prevalence estimated for 1998 (2%). However, if we assume that unavailable records were correctly classified as GDM cases, the estimated prevalence would increase to 4% (123/3,447).

Table 2 shows the socio-demographic characteristics of women with GDM. The median age was 29 years, and it ranged from 15 to 45 years. The age group with the highest prevalence was 30 years or less (52.3%). When GDM cases were compared by health region, the highest proportion was found in the Metropolitan Region (66.7%), followed by the Bayamón Region with 19.2%. The gynecologic/obstetric history reflected that the majority of cases (45.5%) had their first menstrual period between 7 and 9 years of age, 35.6% of women had one to two children, and 48.5% were obese (≥ 30 m/kg²).

Nearly 57% of cases reported a weight gain of 15 pounds or more during pregnancy (Table 3). The family history of

Table 2. Sociodemographic Characteristics of Pregnant Women with Gestational Diabetes Mellitus receiving Health Care Services at the Puerto Rico University Hospital from 1997 thru 1998

	Cases (N=78)	%
Age group (years)		
15-20	13	16.7
21-25	18	23.1
26-30	10	12.8
31-35	17	21.8
36-40	16	20.5
41-45	4	5.1
Marital status		
Never married	21	26.9
Married	51	65.4
Consensual	5	1.3
Separate	1	6.4
Municipality (Health Region)		
Caguas	1	1.3
Mayaguez	1	1.3
Arecibo	1	1.3
Bayamón	15	19.2
Metropolitan	52	66.7
Fajardo	7	9.0
Unknown*	1	1.3
Educational level		
Intermediate	17	21.8
Superior	37	47.4
University	21	26.9
Unknown*	3	3.8
Occupation category		
White collar	17	21.8
Housewife	52	66.7
Student	7	9.3
Services	2	2.7

*Unknown - Records that did not have the information.

previous health conditions recorded in the medical records revealed that 64% of women with GDM had a diabetes family history (Figure 1).

Figure 2 shows the health conditions present prior to pregnancy. It was observed that 34.7% developed GDM on a previous pregnancy, and hypertension was the most prevalent condition (13.5%) during the present pregnancy.

When childbearing history was analyzed, 70.6% of women had vaginal childbirths with 32.3% of newborns

Table 3. Obstetric and Gynecologic History of Pregnant Women with Gestational Diabetes Mellitus receiving Health Care Services at the Puerto Rico University Hospital from 1997 thru 1998

	Cases (N=78)	%
Age at First menstrual period (years) (n=66)		
7-9	30	45.5
10-12	24	36.4
13-15	8	12.1
16-18	4	6.1
Fecundity (n=59)		
None	5	
1	21	26.9
2	21	65.4
≥3	12	1.3
Number of previous pregnancies (n=77)		
0	18	23.4
1	19	24.7
2	20	26.0
≥3	20	26.0
Weight gained during pregnancy (pounds) (n=56)		
≤15	24	43.0
>15	32	57.0

having a birth weight between 8.00 (3.6 kg) and 8.99 pounds (4 kg) (Table 4).

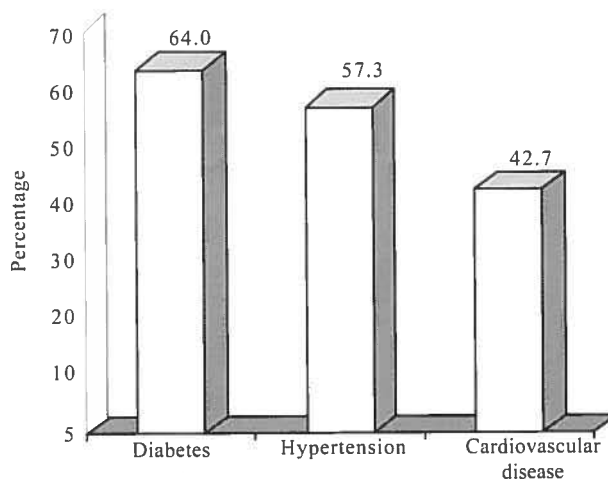


Figure 1. Family history of chronic diseases reported by pregnant women with gestational diabetes mellitus receiving services at the Puerto Rico University Hospital from July 1997 through December 1998.

Table 4. Childbirth History of Pregnant Women with Gestational Diabetes Mellitus receiving Health Care Services at the Puerto Rico University Hospital from 1997 thru 1998

	Cases (N=78)	%
Route of childbirth (n=68)		
Natural (Vaginal)	48	70.6
Surgery (Cesarean)	20	29.4
Weight of newborn (pounds) (n=62)		
≤3.99	3	4.8
4.00-5.99	3	4.8
6.00-7.99	35	56.5
8.00-9.99	20	32.3
≥10.00	1	1.6

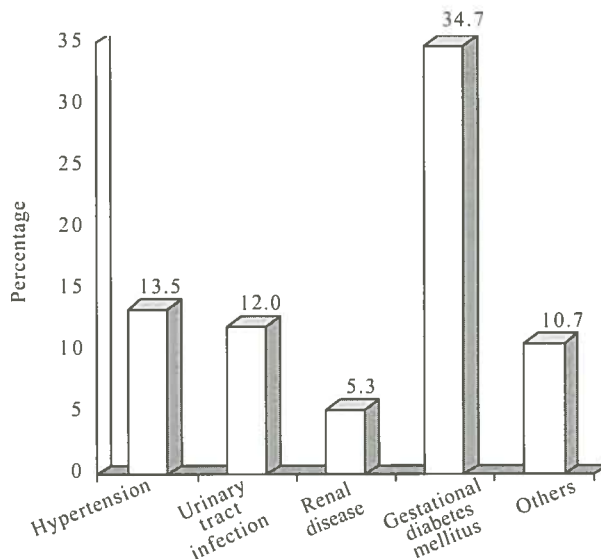


Figure 2. Previous conditions reported by pregnant women with gestational diabetes mellitus receiving services at the Puerto Rico University Hospital from July 1997 through December 1998.

The analysis of glucose level in blood fasting or one-hour test reported in the first recorded visit showed that the majority of cases (80.5%) had blood glucose levels higher than 110 mg/dl. Nearly 28.2% of pregnant women initiated their prenatal care during the first trimester, and the majority of cases (61.5%) had less than 13 prenatal care visits (data not shown).

The analysis of complications during pregnancy reflected that preeclampsia (6.4%) was the most prevalent complication in the mother (Figure 3). Macrosomia was present in about 14% of newborns.

Obesity before pregnancy, previous GDM, and previous pregnancy with GDM were significantly associated with

macrosomia in the newborn ($p < 0.05$). However, blood glucose level during the first prenatal care visit and mother's age were not significantly associated with macrosomia ($p > 0.05$) (Table 5).

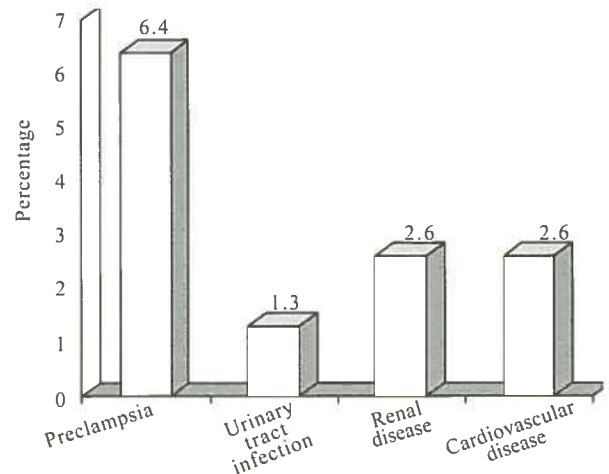


Figure 3. Health conditions during pregnancy among women with gestational diabetes mellitus receiving services at the Puerto Rico University Hospital from July 1997 through December 1998.

Table 5. Association between Infant Macrosomia and Selected Characteristics of Pregnant Women with Gestational Diabetes Mellitus receiving Health Care Services at the Puerto Rico University Hospital from 1997 thru 1998 (n=78)

	Macrosomia		
	OR	95% CI	p-value
Age group (years)			
≤30	3.49	0.74-18.44	0.103
>30			
Body mass index (m/kg²) before pregnancy			
20-29	9.67	1.08-22.81	0.002
≥30			
Previous GDM			
Yes	4.14	0.93-19.51	0.04
No			
Glucose level (mg/dl)			
≤110	1.88	0.17-47.68	1.00
>110			
Previous pregnancy with GDM			
Yes	20.0	2.24-455.24	0.0006
No			

Discussion

The GDM prevalence in this study (2%) was higher than the prevalence estimated by the BRFSS data in Puerto Rico (0.7%). However, if we assume that the medical records not available at the time of the study were GDM cases, the total prevalence would be 4%, which compares with the general prevalence estimated for this condition in the United States (3%-5%). These results do not represent the total number of pregnancies in Puerto Rico given that the population included in the study were cases available at the Puerto Rico University Hospital. The difference in the prevalence of GDM could suggest that the estimate obtained from the BRFSS is underreported or that the prevalence of GDM at the Puerto Rico University Hospital was higher because it is a hospital that manages complicated or high-risk patients.

We found that the majority of GDM cases were 30 years or less (52.3%) with a mean age of 29 ± 7.3 years. Studies have previously shown that the mean age at GDM diagnosis is significantly higher than the one observed in this study (4-7,10). However, in 1998, Coustan et al., observed that among 6,214 women who were pregnant, 56% of the 125 diagnosed with GDM had less than 30 years of age, similar to our finding (8).

The Metropolitan Region had the highest proportion of GDM cases followed by the Bayamón Region. This could be partially explained by the fact that the Puerto Rico University Hospital mainly offers its services to the Metropolitan area residents.

Consistent with previous studies, the majority of GDM cases reported a higher body mass index before pregnancy (1-3,6-7,10,12,14,16). Prior studies have established that approximately 35% of GDM cases reported a diabetes family history (1-2,6,12,16). In this study, 64% of the pregnant women reported a diabetes family history and this finding was statistically significant ($p < 0.01$). This difference may be attributed to information bias, a higher prevalence of diabetes in Puerto Rico, or misclassification of GDM.

More than half of the GDM women reported a family history of hypertension followed by a family history of cardiovascular disease. Some studies suggest that these conditions increase the risk of GDM in pregnant women (5,12). Findings from this study indicated that a third of the cases had GDM diagnosed in previous pregnancies, similar to other studies (13,15,22). We found that hypertension, kidney problems and cardiovascular diseases were the health conditions or diseases most commonly reported during pregnancy. These conditions are the same obstetric complications that increase significantly the maternal morbidity reported in the literature review.

A higher proportion of GDM cases (45.5%) in the present study reported an age of menarche between 7 and 9 years of age. No evidence was found in the literature review that sustains any association between age at menarche and GDM.

In this study, more than 90% of cases reported previous pregnancies. An association between parity and GDM was previously reported (1,4,7,12-13). Similarly, it has been reported that pregnant women with a body mass index of 30 m/kg^2 or higher are at increased risk of developing GDM. This study confirms these findings.

The medical literature has evidenced that GDM is associated with overweight newborns, and as a consequence, the cesarean operation is needed more frequently. In this study, contrary to the literature review, nearly 75% of the childbirths were born vaginally. However, 45% of women with macrosomic newborns had cesarean operation when compared with 54.5% of the newborns that had normal weights. The average number of visits of this group was 13. However, this figure may not represent the average number of visits of those patients during pregnancy since most of the cases are referred from primary care services, and previous visits in this setting were lacking in the majority of records.

One study limitation was the small sample size achieved decreasing the precision of the OR estimates. Based on these findings, more epidemiological studies about GDM in Puerto Rico need to be performed in order to better describe the prevalence of the condition in the island. Similarly, it is recommended that medical records should be adequately completed and fully documented for future research. Due to lack of complete medical history from referred institutions, a copy of each patient's old medical record should be available to complete the clinical evaluation and management.

Finally, even when these findings are not representative of the GDM prevalence in the island, it is expected that this study serves as baseline information to develop preventive and educational campaigns for women of reproductive age emphasizing the risk factors associated to GDM.

Resumen

El objetivo de este estudio fue estimar la prevalencia y describir las características clínicas de la diabetes mellitus gestacional (DMG) en las mujeres embarazadas recibiendo servicios en el Hospital Universitario de Puerto Rico durante el período de 1997 a 1998. El diseño del estudio fue transversal, en donde se utilizaron los expedientes médicos disponibles de las mujeres diagnosticadas con DMG. En el análisis estadístico se utilizaron medidas

descriptivas como frecuencias así como medidas de resumen como la media y la desviación estándar. Se calculó la prevalencia anual y la prevalencia del periodo completo (18 meses). La prueba exacta de Fisher se utilizó para comparar las proporciones de interés. Los expedientes disponibles (78) comprendían un período de 18 meses (julio de 1997 a diciembre de 1998). La prevalencia de DMG tanto para el periodo completo como para el año 1998 fue de 2%. La mayor proporción de casos de DMG se encontraba en el grupo de edad ≤ 30 años (52.3%). El 48.5% obtuvo un índice de masa corporal antes del embarazo ≥ 30 m/kg². El peso ganado durante el último embarazo fue mayor de 15 libras (57%). El 64% reportaron un historial familiar de diabetes, mientras el 34.7% tuvo un historial de DMG en embarazos previos. En la primera visita prenatal, el 80.5% reflejó niveles de glucosa mayores de 110 mg/dl. La preeclampsia (6.3%) y la macrosomía (14%) fueron responsables del mayor número de complicaciones de la madre y el feto, respectivamente. Se necesitan realizar otros estudios epidemiológicos acerca de DMG en Puerto Rico para obtener una mejor descripción de la condición en la isla.

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