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Prevalence of Pre-Pregnancy and Gestational Diabetes in the Province of Trento-North Italy: Trend 2012-2019

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Abstract

Introduction: Pre-Pregnancy Diabetes (PPD) affects 03-05/100 and Gestational Diabetes (GDM) affects 7/100 pregnancies. The prevalence estimates show, for both conditions, a wide range of variability in relation to the characteristics of the populations and the diagnostic criteria used. In recent years there has been a significant increase in pregnancies in women with both type 1 and type 2 PPD. Similar increases are also reported for the GDM. The study reports the trend of the prevalence of PPD and GDM in pregnant women assisted at the maternity units of the province of Trento (North East Italy) from 2012 to 2019.

Material and Methods: The criteria for monitoring blood glucose during pregnancy are based on the recommendations by the International Association of Diabetes and Pregnancy Study Groups. The glycemic monitoring data are recorded in the province of Trento, on the personal obstetric guide of each pregnant woman, which is updated on the occasion of periodic checks and therefore in all pregnant women on the occasion of registration of data in the Birth Attendance Certificate (BAC) on a specific computer support operating at each maternity unit. The cases recorded in the BAC were compared with those collected by the provincial register of type 1 diabetes mellitus and with the hospital discharge archive. Based on the integrated data, the birth cohorts 2012-2019 were retrospectively analyzed. The temporal trend of the prevalence of PPD and GDM was calculated, considering the citizenship, the age group and the educational qualification of the pregnant women. Prevalence estimates are provided by 95% confidence intervals

Results: Between 01.01.2012 and 12.31.2019, 33,577 pregnant women received care at hospital maternity units of the province of Trento. 158 cases of PPD (20 cases per year) and 1,950 cases of GDM (244 cases per year) were recorded. 1 case of GDM and one case of PDD had escaped the BAC. The mean period prevalence for PPD in all pregnant women is 0.44/100 (95% CI 0.37-0.50), in Italian women is 0.39/100 (95% CI 0, 31-0.46) while in foreign women it is 0.57/100 (95% CI 0.42-0.72). The average period prevalence of GDM for all pregnant women is 5.5/100 (95% CI 5.27-7.73), in Italian women is 4.3/100 (95% CI 4.06- 4.54), while in foreign women it is 8.8/100 (95% CI 8.23-9.37). The prevalence of PPD overall shows a slight increase over time, this appears substantially stable in the Italians and increasing in the foreigners. In the case of the GDM, there is an increase over time in both population groups, greater in foreigners than in Italians. The prevalence of PPD and GDM in foreign women is higher than in Italian women. Women coming from African and Asian countries show the highest values. The prevalence of PPD and GDM grows linearly with age and with the reduction in the level of education of women.

Discussion: The information flow of the BAC, as organized in the province of Trento, can be considered a reliable source in the recovery and registration of the frequency of PPD and GDM. The prevalence estimates of PPD and GDM reported in the present study increase over the course of subsequent birth cohorts, in agreement with what is reported in the international literature. Overall, for both forms of diabetes, we report in the period under study a prevalence of about 6/100 pregnancies. The increase of prevalence according to the birth cohorts is evident above all in foreigners. Foreign women, especially from Asia and Africa and women with childbirth age over 35, and with low educational qualifications represent a significant share of PPD and GDM cases and therefore of subpopulations at greater risk to be considered as a priority in public health action.

Keywords: Birth attendance certificate; Gestational diabetes; Pre-pregnancy; Prevalence

Introduction

Pregnancy can be affected by two forms of diabetes mellitus. The first form, defined as overt or Pre-Pregnancy Diabetes (PPD), occurs at a young age and in most cases is type 1 or insulin-dependent diabetes. The second form, defined as Gestational Diabetes (GDM) is a condition of intolerance to carbohydrates with onset or first occurrence in pregnancy, induced by the state of pregnancy. GDM has a higher frequency than PPD, affecting on average 7% of pregnancies while the second affects 03-05% of cases [1]. However, the prevalence estimates show, for both conditions, a wide range of variability in relation to the characteristics of the populations studied and the diagnostic criteria used. An inadequacy of these criteria can also lead to possible misclassifications of the two conditions [2]. Taking this problem into account, the main guidelines of recent years recommend distinguishing the two conditions with specific diagnostic criteria for GDM, while PPD should be sought at the first visit in pregnancy using the same diagnostic criteria that apply to the general population for the diagnosis of diabetes mellitus [3]. GDM occurs when the activity of β cells is insufficient to overcome the insulin resistance induced by a series of hormones of placental origin and is especially typical of the late stages of pregnancy [4]. For this reason, GDM generally arises in the second part of pregnancy and the optimal time for screening is the 24-28th week of gestation. Both PPD and GDM, in the face of adequate glycemic control, may not have significant adverse effects for the mother or fetus. In any case, in the presence of a PPD, careful planning of the pregnancy and the inclusion of the pregnant woman in a multi-professional care pathway are essential. An approach of this type must also be activated at the time of identifying a case of GDM. However, it may not always be possible to guarantee these approaches in a systematic way, also in relation to the characteristics of women and the quality of care offered by the various health systems [5,6]. This helps to explain a greater recurrence of obstetric-fetal-neonatal adverse events in case of PPD and GDM compared to pregnant women who are not affected [7-9]. Pregnant women with GDM also have a 50-65% risk of recurrence of GDM in subsequent pregnancy compared to those not affected and a risk of developing type 2 diabetes mellitus within 5-10 years of delivery that is 7 times higher than a woman with normoglycemic pregnancy [10,11]. In recent years there has been a significant increase in pregnancies in women with both type 1 and type 2 PPD, due to the lowering of the age of onset of type 2 diabetes and the increase in pregnancies in the third decade of life [12-14]. Similar increases are also reported for the GDM, both in high and low-middle-income countries, possibly related to the increase in obesity in women of childbearing age [15-17]. This study reports the trend of the prevalence of PPD and GDM in assisted pregnant women at the maternity units of the province of Trento (North East Italy, 540,000 inhabitants as of 31.12.2019) from 2012 to 2019, using the Birth Attendance Certificate (BAC).

Materials and methods

The Italian criteria for monitoring blood glucose during pregnancy [18] are based on those recommended by the International Association of Diabetes and Pregnancy Study Groups [19] and provide for a control of fasting plasma glucose for all pregnant women on the occasion of the first visit in pregnancy. (Within 12 weeks of gestation), for the purpose of identifying women with PPD. The diagnosis is made for a confirmed value above the threshold of 125 mg/dl. Later in pregnancy, GDM screening is performed if certain defined risk factors are present and using the 75g Glucose Oral Load Test (OGTT). In detail, this test is prescribed at 16-18 weeks of gestation in case of diagnosis of GDM in a previous pregnancy, or a pregravidic BMI ≥30 kg/m^2, or plasma glycemic values between 100 and 125 mg/dl before pregnancy or early pregnancy. It is performed at 24-28 weeks if maternal age is 35 years or older, or if pregravid BMI is ≥25 kg / m^2, or if fetal macrosomia was diagnosed in a previous pregnancy, or if there is first-degree family history of diabetes, or if the pregnant mother's family of origin comes from areas with a high prevalence of diabetes, such as South Asia, the Caribbean and the Middle East. The diagnosis of GDM is made for a single value equal to or above the predetermined thresholds which are 92 mg/dL fasting, 180 mg/dl at 60 minutes and 153 mg/dl at 120 minutes. The glycemic monitoring data are recorded in the province of Trento, on the personal obstetric guide of each pregnant woman, which is updated on the occasion of periodic checks and therefore in all pregnant women on the occasion of registration of the BAC on a specific computer support that is operational at each maternity unit of the province of Trento. The BAC represents the national information document of reference for the registration of parental characteristics, the monitoring of assistance in pregnancy and childbirth and the registration of the characteristics of the newborn [20]. Its completion is mandatory by health professionals (usually midwives) assisting the birth. The provincial BAC archive is annually made available to the Clinical and Evaluation Epidemiology Service of the Provincial Health Services Agency of the Province of Trento. The cases recorded in the BAC were compared with those collected by the provincial register of type 1 diabetes mellitus which has recorded since 1998 all incident cases in the age of 0-29 years in the resident population and with the hospital discharge archive for the years 2012-2019. Based on the integrated data, the birth cohorts 2012-2019 were retrospectively analyzed. The temporal trend of the prevalence of PPD and GDM was calculated, using the Cochrane-Armitage criterion for the evaluation of statistical significance. The trend was also analyzed according to citizenship and if foreign, in relation to the geographical area of origin. The prevalence of the

two conditions was also analyzed in relation to the age group and educational qualification of the pregnant women. The significance of the differences between the categories under comparison was tested with the Chi-square test. Prevalence estimates are provided by 95% confidence intervals.

Results

Between 01.01.2012 and 12.31.2019, 33,577 pregnant women received care at hospital maternity units of the province of Trento. The average proportion of pregnant women with foreign citizenship is 25.8% (26.2% in 2012, 24.9% in 2019). The average age of all pregnant women is 32 years, 33 years in Italian pregnant women and 30 years in pregnant women of foreign citizenship. 158 cases of PPD (about 20 cases on average per year) and 1,950 cases of GDM (244 cases on average per year) were recorded. 1 case of GDM and one case of PDD had escaped the BAC but these were recovered through the provincial type 1 diabetes registry and the hospital discharge archive, respectively. GDM cases represent 92.5% of the overall cases of diabetes mellitus recorded in pregnancy. 97% of PPD cases are type 1 diabetes. 82% of the births of pregnant women with PPD take place at the Santa Chiara hospital in Trento, a hub center for provincial obstetric care. The births of pregnant women affected by GDM are more distributed among the birth points; in particular, only 67% of these take place at the Santa Chiara hospital in Trento. The difference in part concentration between PPD and GDM is statistically significant ($p<0.05$). In the cases of PPD, the prevalence of women with foreign citizenship is equal to 33.5%, while among the cases of GDM, the prevalence of foreign women is equal to 41.4%. In cases of PPD, the average age of all pregnant women is 33.8 years, 33.4 in Italians and 34.7 in foreigners. In cases of GDM, the average age of all pregnant women is 34, 35 in Italians and 32.5 in foreigners. The characteristics by age group and citizenship of the women belonging to the two conditions are shown in Table 1. The mean period prevalence for PPD in all pregnant women is 0.44/100 (95% CI 0.37-0.50), the mean prevalence in Italian women is 0.39/100 (95% CI 0, 31-0.46) while in foreign women it is 0.57/100 (95% CI 0.42-0.72). The average period prevalence of GDM for all pregnant women is 5.5/100 (95% CI 5.27-7.73), the average prevalence in Italian women is 4.3/100 (95% CI 4.06- 4.54), while in foreign women it is 8.8/100 (95% CI 8.23-9.37). The annual trend in the prevalence of PPD in all pregnant women and respectively in Italians and foreigners is shown in Figure 1. The annual trend in the prevalence of GDM in all pregnant women and respectively in Italians and foreigners is shown in Figure 2. The prevalence of PPD overall shows a slight increase over time, this appears substantially stable in the Italians and increasing in the foreigners, with even significant variations from one year to the next, given the relative consistency of the cases. In the case of the GDM, there is an increase over time in both population groups, greater in foreigners than in Italians. The prevalence of GDM in foreign women is higher than in Italian women with a statistically significant difference ($p<0.01$). Even in cases of PPD the prevalence is higher among foreigners, without however a statistically significant difference compared to Italians. Considering foreign women according to the geographical area of origin, the prevalence of PPD is higher in women from African countries (1.35/100) immediately followed by women from Asian countries (1.23/100) (Figure 3). A stratification of the prevalence according to the country of origin of foreign women also emerges in the case of GDM, where the prevalence is higher in Asians, followed by Africans (Figure 4). These two groups show, for both diabetic conditions, a statistically significant difference compared to both Italians ($p<0.0001$) and all foreigners ($p<0.001$). The prevalence of PPD and GDM grows linearly with age (Figure 5) and with the reduction in the level of education of women (Figure 6) with a statistically significant trend ($p <0.001$).

Age class	PPD				GDM			
	Italians		Foreigners		Italians		Foreigners	
	Num	%	Num.	%	Num.	%	Num.	%
<=24	3	2,9	2	3.8	27	2.4	59	7.3
25-29	17	16,2	7	13.2	148	12.9	161	20.0
30-34	41	39.0	16	30.2	336	29.4	259	32.1
35-39	34	32.4	17	32.1	419	36.7	238	29.5
40+	10	9.5	11	20.8	213	18.6	90	11.2

Table 1: Province of Trento. Distribution by age group and citizenship in cases of PPD e GDM among pregnant women assisted at maternity units. Period 2012-2019.

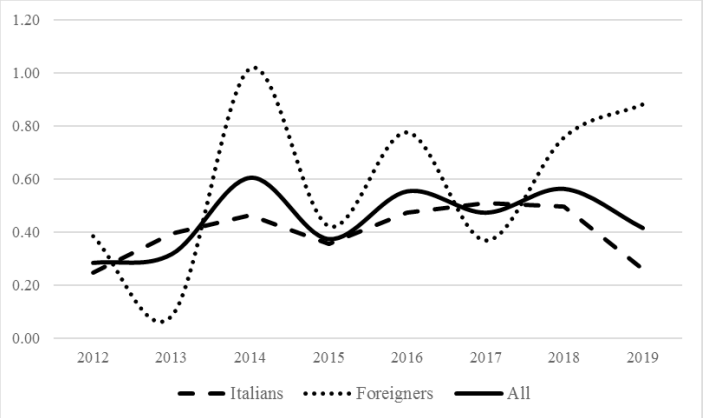

Figure 1: Province of Trento. Temporal trend of PPD prevalence. Italians, Foreigners and All pregnant women assisted at maternity units. Period 2012-2019.

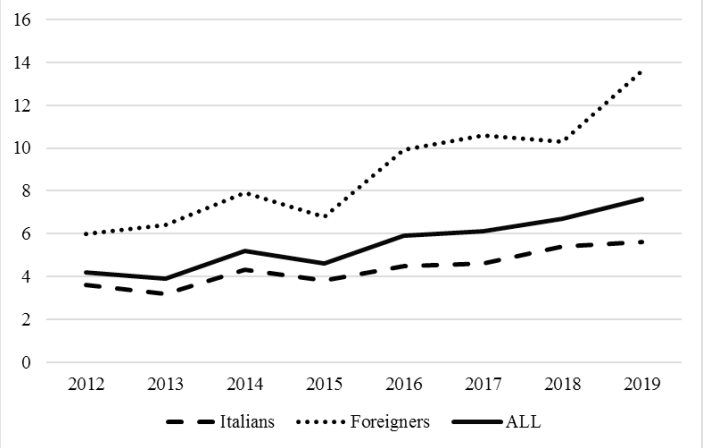

Figure 2: Province of Trento. Temporal trend of GDM prevalence. Italians, Foreigners and All pregnant women assisted at maternity units. Period 2012-2019.

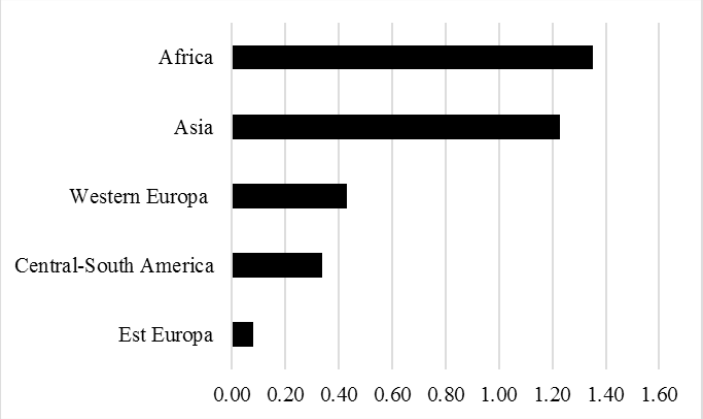

Figure 3: Province of Trento. PPD prevalence in foreign women. According to the geographical area of origin. Period 2012-2019.

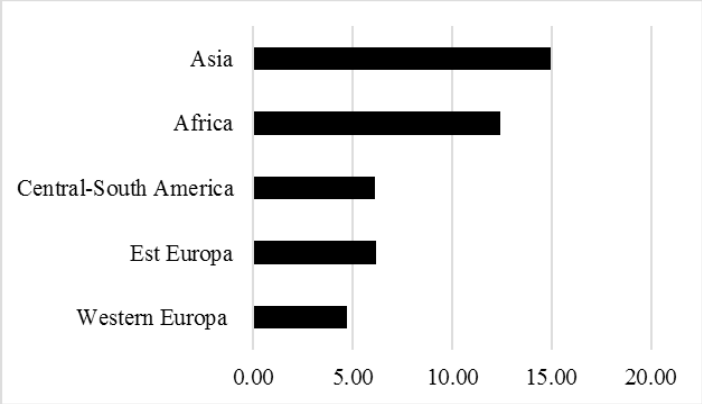

Figure 4: Province of Trento. GDM prevalence in foreign women. According to the geographical area of origin. Period 2012-2019.

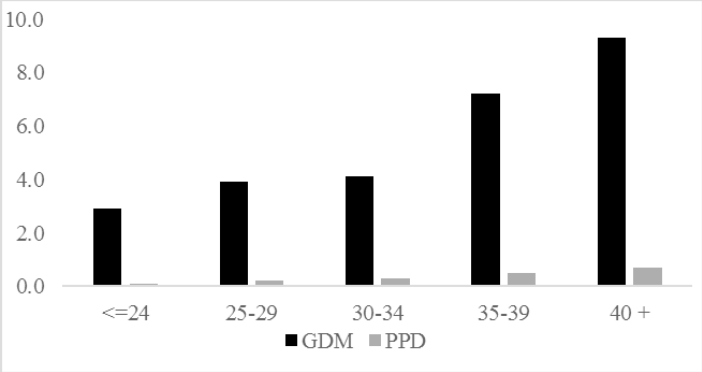

Figure 5: Province of Trento. PPD e GDM prevalence according to the age class of women. Period 2012-2019.

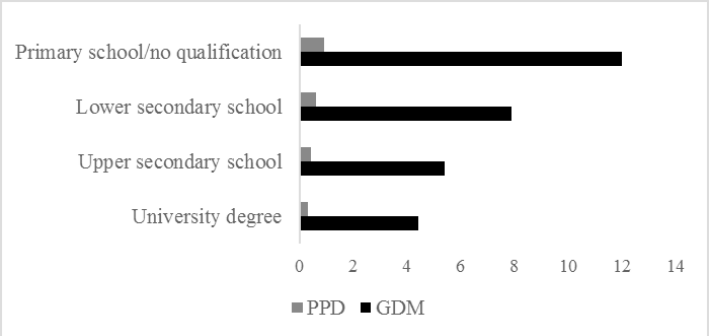

Figure 6: Province of Trento. PPD e GDM prevalence according to the education level of women. Period 2012-2019.

Conclusions

The information flow of the BAC, as organized in the province of Trento, can be considered a reliable source in the recovery and registration of the frequency of PPD and GDM, especially in relation to the fact that the midwife, present at the birth at the

maternity units, refers , in the preparation and registration of the BAC, to the obstetric guide, a personal document that collects all the information concerning the pregnancy in progress and that the pregnant woman must carry with her during the periodic checks and at the time of delivery. The prevalence estimates of PPD and GDM reported in the present study increase over the course of subsequent birth cohorts, in agreement with what is reported in the international literature. In part, this increase could be associated with an expansion in the prevalence of overweight and obesity in the population and in particular in women of childbearing age [5,15-17]. A comparison between the data relating to the province of Trento and other areas can be problematic, also taking into account the persistence of a certain heterogeneity in diagnostic tests, in the reference information sources and a possible misclassification of the two forms of diabetes [21]. The chosen study period however protects us from possible problems of local variability in the diagnosis and classification of the conditions considering that, starting from 2012, the diagnostic criteria defined by an International Consensus Conference [19] and substantially consistent with the National Guidelines on care for physiological Pregnancy [18] are in use in our province. Overall, for the two forms of diabetes, we record an average number of cases per year of about 265, for an overall average annual prevalence, in the period under study of about 6/100 pregnancies. In our study, the PPD represents about 8% of cases of diabetes mellitus affecting pregnancy, with a slightly increasing prevalence over time and substantially consistent with what was reported by previous studies [12-14,22]. The increase of prevalence according to the cohorts of birth is evident above all in foreigners, albeit in a picture of strong variability between individual years, while it appears substantially stable in the Italians. The prevalence of GDM reported in our study appears overall to be slightly lower than that reported by international studies [15-17] and by previous national studies [23-28]. The lower prevalence of GDM among pregnant women in the province of Trento, compared at least to the national level, can be explained in no small part by a lower prevalence in the general population of subjects with known risk conditions, for example overweight and obesity, as reported by the surveys of the National Institute of Statistics (ISTAT) and the Surveillance System "PASSI" [29,30]. Overall, the prevalence estimates reported by us are consistent with European data [31]. The prevalence of PPD and GDM is confirmed to be higher in older pregnant women and in those with low educational qualifications, aspects that can be correlated with the different socio-demographic stratification of known risk factors [4,5,15-17]. The age data must be taken into particular consideration given that the maternal age at birth is gradually increasing and this leads to hypothesize a further increase in the prevalence of PPD and GDM in future birth cohorts [32]. In particular, however, the prevalence of GDM is confirmed to be higher in women of foreign citizenship, especially in Asian and African ethnic groups [33]. The values found in these ethnic groups are consistent, despite the variability between individual surveys, with what is reported by studies carried out in Asian and African countries [34,35]. Foreign women, especially from Asia and Africa and women with childbirth age over 35, especially if overweight or obese, and women with low educational qualifications represent a significant share of PPD and GDM cases and therefore of subpopulations at greater risk to be considered as a priority in public health action aimed at minimizing obstetric-neonatal risks and the risk of developing GDM [36,37]. The management of individual cases according to a multi-professional and chronologically planned approach is also important [38-40]. The data provided by the BAC seem to provide us with reassurance in this sense when they indicate a greater concentration of births of women with PPD at the best equipped birth centers.

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