Original Articles

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Diabetes in hospital deliveries in public and private health system hospitals

ABSTRACT

OBJETIVE: To analyze trends of diagnoses of diabetes mellitus in hospital deliveries.

METHODS: Transversal study analyzing data on hospital deliveries for pregnant women living in Ribeirao Preto, SP, from 1998 to 2007. The data on diabetes mellitus in pregnancy were obtained from the Faculdade de Medicina de Ribeirao Preto of the Universidade de São Paulo Hospital Data Processing Center. The data analyzed were: age group, type of delivery (vaginal or cesarean), length of hospitalization and type of care: public (SUS) or private (private and supplemented health care).

RESULTS: There was a 3.9 fold increase in the proportion of deliveries with a record of diabetes in relation to the total number of births (p = 0.01). This increase was of 4.5 times in deliveries in the public health care system (p = 0.01) and 3 times in private care. An increase in the presence of diabetes was observed in all age groups, proportionally larger in lower age groups. The frequency of cesarean delivery in pregnancies which recorded diabetes fell from 64.5% in 1998/1999 to 39.8% in 2006/2007 in the public system; in the private system the frequency remained over 90%.

CONCLUSIONS: The presence of diabetes mellitus in hospital deliveries increased throughout the two year periods, despite a fall in the overall number of deliveries and an increase in the number of women of childbearing age living in Ribeirao Preto. This trend means that not only diagnosis and treatment, but also pre-pregnancy interventions which may reverse it are called for.

DESCRIPTORS: Diabetes, Gestational. Delivery, Obstetric. Cesarean Section. Hospitals, Private. Hospitals, Public.

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INTRODUCTION

At the moment, an increase in the prevalence of diabetes has been observed in almost all countries. In Brazil, a population-based study carried out in the state capitals between 1986-1988, with a population of 30-69 year olds, showed a prevalence of 7.6% for diabetes and, in the state of Sao Paulo, this was 9.7%.[12] More recent regional studies show higher rates; of 15.0% in the city of Ribeirao Preto, SP, Southeastern Brazil in 2005-2007,[14] and of 13.5%, in Sao Carlos, SP, in 2008.[4] With increased prevalence in the general population, it is possible that this increase is also occurring among pregnant women.

Various studies report the growing trend of gestational and pre-gestational diabetes mellitus (GDM),[7,8,11] which is linked to higher risk of morbidity and maternal and perinatal mortality.[2,6,18,21]

In the USA, the growing trend for the presence of GDM in hospital deliveries, in all age groups has been described for the period 1994-2004, with a marked increase in type 2 diabetes.[11]

A study which evaluated the frequency of diabetes type 1 (DM1), type 2 (DM2) and GDM in 261 diabetic pregnant women in Ribeiaão Preto, SP, between 1992 and 1999, found GDM to be the prominent condition, present in 53.2% of the women.[13]

The aim of this study was to analyze trends for diagnosing diabetes mellitus in hospital deliveries.

METHODS

Transversal study which analyzed data on hospital deliveries in Ribeirao Preto, SP, between 1998 and 2007, available from the Hospital Data Processing Center (HDPC) of the Ribeirao Preto *Faculdade de Medicina da Universidade de São Paulo,* for both public (Brazilian Unified Health System – SUS) and private health care systems in the municipality of Ribeirao Preto and municipalities in the XIII Regional Health Care Department (RHD XIII). Based on continuous records of data referring to the use of hospital beds and the characterization of the care provided (using the hospital admission form which is an instrument which collects data directly from the hospitals), the data are sent to the HDCP to be codified by specialists in codifying diseases and procedure, followed by consolidation in databases, statistical reporting and processing for research.

Diagnoses of hospital admission for giving birth were identified by principal diagnoses (reason for admission) codes O80-O84, and the presence of gestational diabetes was identified by code O24, from the 10th Revision of the International Classification of Diseases (ICD-10).[a] The types of diabetes were not analyzed, as the reliability of this information on the hospital admission form was limited or it was not included.

The following were considered independent variables: age group, how the costs of hospitalization were covered (SUS and other hospitals), type of delivery and mean duration of the hospitalization in days.

Hospitalizations classified as not covered by the SUS included private admissions, with payment made directly to the doctor or the establishment, and those which were pre-paid, such as health insurance plans, group medicine, cooperatives, partnerships or self-management. With regards to the type of delivery, they were classified according to the resolution, these being: vaginal (normal or forceps) or surgical (cesarean).

For the descriptive study of the variables, the Statistical Package for the Social Sciences (SPSS), version 17.0 was used. In the results, the data are shown grouped in two-year-periods, for less variability and better visualization.

To test the theory of variation in the rates of DM throughout the period studied, a regression model was used in which the number of women with DM mentioned in each two year period is considered to follow Poisson distribution, being the mean of the product between the total number of pregnancies in the two year period and the respective DM rate in hospital deliveries. In order to control the effects of overdispersion of data, the model included a random effect with normal distribution.[1] The rate of DM mentioned in delivery was considered to be related to the time by a logarithmic link function so that, when testing the significance of the coefficient associated with time, the null hypothesis of homogeneity of these rates over time is tested. Thus, coefficients which enabled the stratification of rates by age group were included in this function. The level of significance adopted was 0.05. SAS/STAT, version 9.2 were used for this analysis.

The research project was approved by the Ethics Committee of the *Centro de Saúde Escola* of the *Faculdade de Medicina*, Ribeirao Preto, *Universidade de São Paulo* (Protocol nº 51/2011).

RESULTS

Between 1998 and 2007, by age group, type of care, mean duration of hospitalization and type of delivery, it was observed that the total number of births tended to decrease over the two-year-periods, this was proportionally more accentuated in lower age groups. In

[a] Organização Mundial da Saúde. Classificação Estatística Internacional de doenças e problemas relacionados a saúde- CID-10. São Paulo: Centro Colaborador da Organização Mundial de Saúde para Classificação de Doenças em Português/ EDUSP;1997.

Table 1. Deliveries according to age group, care, type of delivery and mean duration of hospitalization. Ribeirao Preto, SP, Southeastern Brazil, 1998-2007.

Care	1998-1999	2000-2001	2002-2003	2004-2005	2006-2007	Total
Public						
Age group (years)						
10-14	96	98	78	62	79	413
15-24	5,807	5,594	5,295	5,002	4,327	26,025
25-34	3,646	3,594	3,434	3,410	3,250	17,334
35 e +	820	791	773	777	749	3,910
Total	10,369	10,077	9,580	9,251	8,405	47,682
Type of delivery (%)						
Vaginal	72.2	67.6	68.9	69.8	70.3	69.8
Cesarean	27.8	32.4	31.1	30.2	29.7	30.2
Mean stay in hospital (days)						
Vaginal	1.8	1.8	1.9	2.0	2.2	1.9
Cesarean	2.8	2.7	2.8	2.8	3.1	2.8
Private						
Age group (years)						
10-14	9	8	5	12	4	38
15-24	1,989	1,881	1,550	1,486	1,262	8,168
25-34	3,823	3,625	3,553	3,741	3,868	18,610
35 e +	799	900	987	1,064	1,120	4,870
Total	6,620	6,414	6,095	6,303	6,254	31,686
Type of delivery (%)						
Vaginal	18.1	14.8	12.7	10.0	9.7	13.1
Cesarean	81.9	85.2	87.3	90.0	90.3	86.9
Mean stay in hospital (days)						
Vaginal	1.2	1.2	1.2	1.3	1.4	1.2
Cesarean	1.7	1.6	1.6	1.6	1.6	1.6
Total deliveries						
Age group (years)						
10-14	105	106	83	74	83	451
15-24	7,796	7,475	6,845	6,488	5,589	34,193
25-34	7,469	7,219	6,987	7,151	7,118	35,944
35 e +	1,619	1,691	1,760	1,841	1,869	8,780
Total	16,989	16,491	15,675	15,554	14,659	79,368
Type of delivery (%)						
Vaginal	51.1	47.0	47.0	45.6	44.5	47.1
Cesarean	48.9	53.0	53.0	54.4	55.5	52.9
Mean stay in hospital (days)						
Vaginal	1.7	1.7	1.8	1.9	2.1	1.8
Cesarean	2.1	2.0	2.0	2.0	2.0	2.0

contrast, the frequency of births in the over 35 age group increased from 9.5% in the two-year-period 1998-1999 to 12.7% in the 2006-2007 period. The deliveries were predominantly financed by the SUS (605 of the total). In the period in question, the frequency of cesareans was 30.2% in the SUS and 86.9% in the other hospitals.

The mean duration of hospitalization for cesareans was 2.8 days in the SUS and 1.6 days in the other hospitals; for vaginal deliveries, the mean stays were 1.9 and 1.2 days respectively (Table 1).

With regards to the presence of diagnoses of DM in hospital deliveries (Table 2), a 3.4 fold increase was

observed in the number of deliveries over the period. This increase occurred in all age groups, being most accentuated in the lower age groups. Deliveries with the presence of DM were predominantly in public (SUS) health care in all of the two-year-periods. In the period from 1998 to 2007, the frequency of cesareans for

pregnant women with DM was 49.7% in those treated by the SUS and 93.2% in the other hospitals; a reduction was observed in the proportion of cesarean deliveries in pregnant women with diabetes treated by the SUS (64.5% in 1998/1999 to 39.8% in 2006/2007), while the proportion in the other hospitals remained above

Table 2. Deliveries for women with diabetes mellitus according to age group, care, type of delivery and mean duration of hospitalization. Ribeirao Preto, SP, Southeastern Brazil, 1998-2007.

Care	1998-1999	2000-2001	2002-2003	2004-2005	2006-2007	Total
Public						
Age group (years)						
10-14	–	–	–	–	–	–
15-24	14	26	68	67	85	260
25-34	51	67	129	145	183	575
35 e +	28	45	77	70	69	289
Total	93	138	274	282	337	1,124
Type of delivery (%)						
Vaginal	35.5	35.5	51.5	49.3	60.2	50.3
Cesarean	64.5	64.5	48.5	50.7	39.8	49.7
Mean stay in hospital (days)						
Vaginal	3.6	3.2	2.8	2.8	3.2	3.0
Cesarean	3.4	4.0	3.4	3.9	4.1	3.8
Private						
Age group (years)						
10-14	–	–	–	–	–	–
15-24	6	9	6	11	7	39
25-34	29	44	58	65	81	277
35 e +	9	24	28	28	38	127
Total	44	77	92	104	126	443
Type of delivery (%)						
Vaginal	4.5	9.1	8.7	5.8	5.6	6.8
Cesarean	95.5	90.9	91.3	94.2	94.4	93.2
Mean stay in hospital (days)						
Vaginal	2.0	1.6	1.3	1.5	2.4	1.7
Cesarean	2.2	2.0	1.8	2.3	1.8	2.0
Total deliveries						
Age group (years)						
10-14	–	–	–	–	–	–
15-24	20	35	74	78	92	299
25-34	80	111	187	210	264	852
35 e+	37	69	105	98	107	416
Total	137	215	366	386	463	1,567
Type of delivery (%)						
Vaginal	25.5	26.0	40.7	37.6	45.4	38.0
Cesarean	74.5	74.0	59.3	62.4	54.6	62.0
Mean stay in hospital (days)						
Vaginal	3.5	3.0	2.7	2.7	3.2	2.9
Cesarean	2.9	3.1	2.8	3.2	3.0	3.0

90%. The mean length of hospitalizations for deliveries with the presence of diabetes was 3.0 days in vaginal births and 3.8 days in cesarean births for those treated by the SUS and 1.7 and 2.0 days, respectively, in those treated in the other hospitals.

Table 3 shows the percentages of births with a record of diabetes according to age group and how the treatment was paid for. The proportion of diabetes was more frequent and increasing in the 35 and over age group (p = 0.01). However, even in the 15 to 24 age group, the presence of diabetes was significant, with a growing frequency (p < 0.01) in a greater proportion to that of other age groups. In both public and private health care the frequency of diabetes in deliveries was significant in all age groups (SUS: 15-24 and 24-35, p < 0.01 and 35 and over, p = 0.01; other hospitals: p = 0.01 in all age groups; 15-24 and 25-34, p < 0.01 and 35 and over, p = 0.01). Both the proportion of diabetes and the trend to increase were more accentuated in deliveries treated by the SUS than those in the other hospitals, as can be seen in Figures 1 and 2.

DISCUSSION

With regards to diagnoses of diabetes in deliveries for residents in Ribeirao Preto, it was observed that there was a 3.9 fold increase in the 1998 to 2007 period. International population studies have also shown trends of increases in the presence of diabetes in pregnancy.[2,7,8,11] These findings reinforce the theory that the increase in diabetes described in the population of Ribeirao Preto[14] may also be observed in the presence of DM in women resident in the city giving birth.

Thus, the data show an increasing tendency for the presence of DM in deliveries throughout the two-year-periods, in spite of the trend for the total number of births becoming reduced and the increase in the number of women of childbearing age living in Ribeirao Preto.

As the prevalence of DM increases with age,[11,14] the fact that there has been an increase in the number of births to women in higher age groups may contribute to the increased presence of DM in pregnant women.

More advanced maternal age, defined as aged 35 and above on the due date, has become more common.[5] According to the results obtained in Ribeirao Preto, the proportion of deliveries in this age group increased from 9.5% in the two-year-period 1998-1999 to 12.7% in the 2006-2007 period.

In this study, the frequency of DM diagnosis in hospital discharges for deliveries in Ribeirao Preto was 2.1% in the period in question, 0.8% in 1998-1999 and 3.2% in 2006-2007. In deliveries in the SUS, the frequency of diabetes was higher than in other hospitals, a difference that became even more

Table 3. Deliveries for women with diabetes mellitus according to age group and care. Ribeirao Preto, SP, Southeastern Brazil, 1998-2007.

| Care	1998-1999	2000-2001	2002-2003	2004-2005	2006-2007	Valor - p[a]
Public						
Age group (years)						
15-24	0.24	0.46	1.28	1.33	1.96	< 0.01
25-34	1.39	1.86	3.75	4.25	5.63	< 0.01
35 e +	3.41	5.68	9.96	9.00	9.21	0.01
Total	0.89	1.36	2.86	3.04	4.01	0.01
Private						
Age group (years)						
15-24	0.30	0.47	0.38	0.74	0.55	0.10
25-34	0.75	1.21	1.63	1.73	2.09	0.01
35 e +	1.12	2.66	2.83	2.63	3.39	0.01
Total	0.66	1.20	1.50	1.65	2.01	0.01
Total						
Age group (years)						
15-24	0.25	0.46	1.08	1.20	1.64	< 0.01
25-34	1.07	1.53	2.67	2.93	3.70	< 0.01
35 e +	2.28	4.08	5.96	5.32	5.72	0.01
Total	0.80	1.30	2.33	2.48	3.15	0.01

[a] According to the Poisson regression model
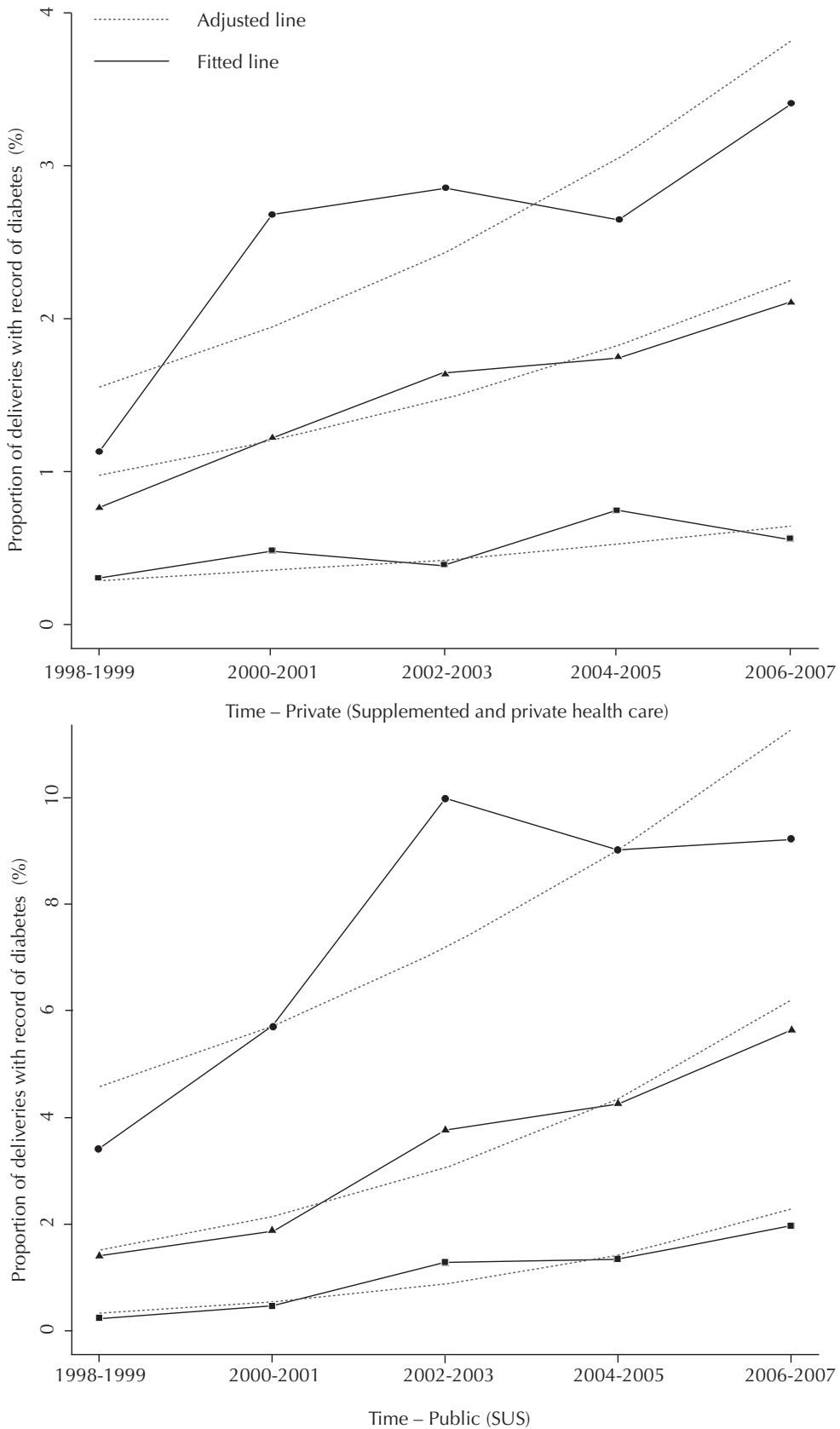
Figure 1. Proportion of hospital deliveries with record of diabetes according to age group and type of care between the two-year periods. Ribeirao Preto, SP, Southeastern Brazil, 1998-2007.
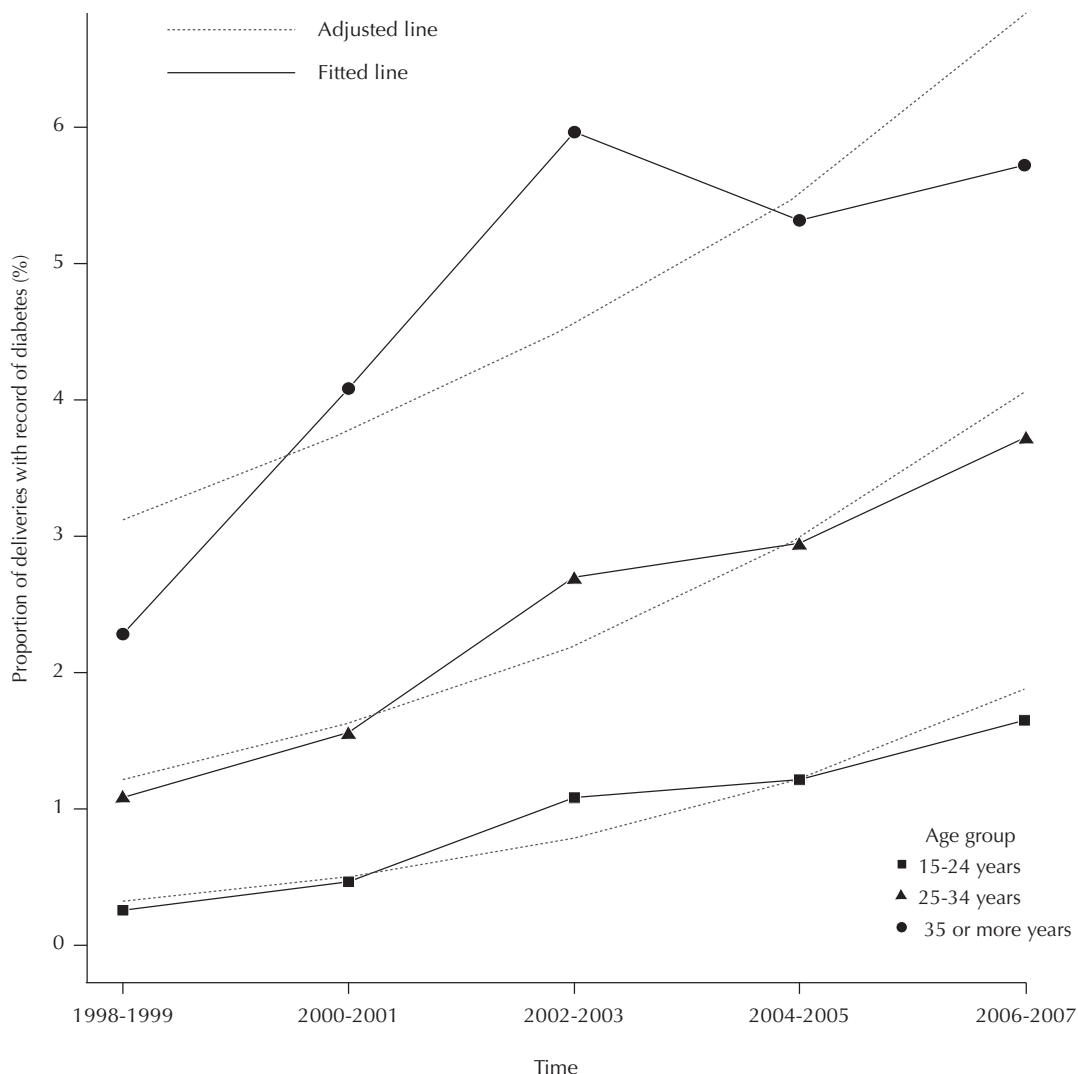
Figure 2. Proportion (%) of total hospital deliveries with record of diabetes by age group between the two-year-periods. Ribeirao Preto, SP, Southeastern Brazil, 1998-2007.

accentuated in the latter two-year-periods and was twice as high in the 2006/2007 period (4.0% *versus* 2.0%). This finding may be due to the fact that the majority of referral services for high risk pregnancies belong to the SUS.[13]

International data show that DM is diagnosed in approximately 7% of pregnancies, with a variation of 1% to 14%, depending on the population studied and the diagnostic tests used.[10,11]

It is not possible to detail the criteria used to diagnose diabetes in this study, as the data were obtained from hospital admission forms from diverse hospitals, with codes for birth and associated morbidities. It is probable that some cases of pre-diabetes, which would now be classifies as DM by the criteria currently in rigor,[17,19] were not categorized as such. Thus, the

frequency of DM in hospital deliveries in Ribeirao Preto may be underestimated.

With regards to the age group of women with DM in delivery, it was observed that there was an increase in all age groups, but more so among the youngest. Various studies have presented similar results, highlighting concerns about increasing levels of diabetes in young women, a group which was thought to be at lower risk.[9,11] In the 15-24 age group, during this period, there was a 6.4 fold increase in the proportion of records of diabetes in hospital births.

The decrease observed in the proportion of cesarean deliveries with DM attended by the SUS is noteworthy, varying from 64.5% in 1998/1999 to 49.7% in 2006/2007, in contrast with the other hospitals, where levels remained stable and above 90%. The Ministry of

Health, resolution in 1998,[b] increasing remuneration for normal delivery and establishing a maximum payment limit for cesareans per hospital, may have contributed to the drop in cesarean rates in the SUS.

With regards the mean duration of hospitalization, the mean stay during the period in question varied from 2.9 to 3.5 days for births with DM, greater than for those in which DM was not present, which varied from 1.7 to 2.1 days, irrespective of the type of delivery. The mean stay for births in the SUS is longer, whether cesarean or vaginal, with or without the presence of DM. The longer stay in the SUS may reflect diverse situations, such as; treating a higher number of women with complications in their pregnancies, the health care professional who attended the birth, in general, not being the same one as for pre-natal care, and even for questions of management. Such aspects merit more specific study and do not form part of this study's scope.

Another aspect to be considered relates to improvements in the quality of hospital records during the period studied. In Brazil, in the last two decades, there has been increasing interest in the systematic use of health care system databases as a tool in creating health care policies and in planning and managing health care services.[3]

The data of this study highlight the trend for DM to be present in increasing numbers of deliveries, especially in the younger age groups, and in deliveries carried out by both the public and private health care services. Faced with this situation, the importance of thinking about preventing diabetes mellitus before pregnancy, in all age groups, stands out.

Bearing in mind the risks of perinatal and maternal morbidity associated with diabetes, it's increasing significance in pregnancy calls not only for its identification and treatment, but also for pre-pregnancy interventions so that this trend can be reversed in pregnant women.

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[b] Ministério da Saúde. Portaria GM 2.816, de 29 e maio de 1998. Dispõe sobre aumento da remuneração do parto normal e limite máximo para pagamento de cesáreas por hospital. *Diario Oficial* 29/05/98 Seção I Pág. 9

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