Diabetes and Pregnancy

Preconception Care, Pregnancy Outcomes, Resource Utilization and Costs

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OBJECTIVE: To describe and compare pregnancy outcomes, resource utilization and costs among women with diabetes who receive and do not receive preconception care.

STUDY DESIGN: A multicenter, prospective, observational study of women with type 1 diabetes who received preconception care (PC), became pregnant and delivered (PC women) and women with type 1 diabetes who received prenatal care (PC) only and delivered (PN women).

RESULTS: As compared to PN women (n=74), PC women (n=24) were seen earlier in gestation and had significantly lower glycosylated hemoglobin levels. The combined number of outpatient visits for PC women was not greater than for PN women. PC women were hospitalized significantly less during pregnancy and tended to have shorter inpatient stays. The mean length of stay after delivery was significantly shorter for PC women. Intensity of care tended to be lower and length of stay shorter for infants of mothers who received PC care. The net cost saving associated with PC care was approximately $34,000 per patient.

CONCLUSION: PC achieves its major intended health benefits and is associated with reduced resource utilization and substantially reduced costs. For both health and economic reasons, clinical practice and public policy should embrace PC. (J Reprod Med® 1999;44: 33–38)

For both health and economic reasons, clinical practice and health policy should support the provision of preconception care for women with diabetes.

Keywords: pregnancy in diabetes, prenatal care,

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This work was supported by research grant 200-89-0723 from the Centers for Disease Control and Prevention, Atlanta, Georgia.

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Financial Disclosure: The authors have no connection to any of the companies or products mentioned in this article.

0024-7758/99/4401-0033/$15.00/0

Table I *Demographic Characteristics and Past Histories of PC and PN Subjects with Type I Diabetes*

Parameter	PC group (n=24)	PN group (n=74)
Sociodemographic characteristics		
Age (yr ± SEM)	27.4 ± 0.7	26.0 ± 0.8
Race, white (%)	100	72*
Education, college graduate or more (%)	67	19*
Family income, > $20,000 (%)	91	60*
Past histories		
Duration of diabetes (yr ± SE)	16.1 ± 1.7	11.2 ± 1.0*
Ever pregnant, yes (%)	56	65
For those with history of pregnancy, history of induced abortion (%)	7	48*

*$P<.05$ vs. PC group.

by the study end. Of the PN subjects, 81% had type 1 diabetes and 19%, type 2 (Figure 1). In the PN group, 94% of the women with type 1 diabetes and 83% of the women with type 2 diabetes delivered by the study end. The potential study population thus included 24 women with type 1 diabetes who received preconception care, became pregnant and delivered by the study end, 74 women with type 1 diabetes and 15 women with type 2 diabetes who received prenatal care only and delivered by the study end (Figure 1). Because there were only 15 women with type 2 diabetes, all in the PN group, and because the sociodemographic characteristics, outcomes, resource utilization and costs for women with type 2 diabetes differed substantially from those for women with type 1 diabetes, we limited our report to the 24 PC women and 74 PN women with type 1 diabetes.

PC women with type 1 diabetes were more likely to be white, were more highly educated and had a higher family income than PN women with type 1 diabetes (Table I). PC women had longer durations of diabetes than PN women (Table I) but similar rates of hypoglycemia with loss of consciousness (48% vs. 47%), nonproliferative diabetic retinopathy or worse at the first examination (55% vs. 40%) and urinary protein excretion ≥ 300 mg/24 hours at the first evaluation (17% vs. 24%). Rates of prior pregnancies did not differ between PC and PN women, but PC women were less likely to have experienced induced abortions (Table I).

PC women were significantly earlier in pregnancy than PN women: the mean difference was more than three weeks (Table II). PC women were seen significantly more likely to experience spontaneous abortions than were PN women (Table II). The mean first glycosylated hemoglobin in pregnancy (calculated as the patient's level minus the upper limits of normal for the assay) was within the normal range for PC women and was significantly lower than the mean first glycosylated hemoglobin for PN women (Table II). In addition, mean glycosylated hemoglobin in pregnancy was significantly lower among PC women than PN women (Table II). When the mean number of both preconception and prenatal care visits for PC women who became pregnant was compared with the mean number of prenatal visits for PN women, PC women made, on average, two more outpatient visits than PN women (Table II). The difference was not statistically significant.

During the preconception and prenatal periods, PC women were significantly less likely to be hospitalized for control of diabetes or other causes than were PN women (Table II). Indeed, PC women were half as likely to be hospitalized for any cause before delivery (Table II). When PC women were hospitalized, length of hospitalization tended to be shorter than for PN women (Table II). PC women who were hospitalized before delivery spent a mean of 5.6 days as inpatients as compared to PN women, who spent a mean of 18.2 days. Length of hospitalization at delivery was also significantly shorter for PC women as compared to PN women (Table II). Although rates of cesarean delivery did not differ between PC and PN women (42% vs. 41%), the mean length of hospital stay after delivery was three days for PC women and almost five for PN women (Table II). The difference in mean length of stay was almost two days.

Gestational ages at live birth were similar, but mean birth weights were significantly higher for infants of PC women than for infants of PN women (Table III). Infants of PC mothers were significantly less likely to require intravenous glucose after delivery than were infants of PN women (Table III). Major congenital anomalies affecting the central nervous system (anencephaly), the cardiovascular system (transposition of the great vessels, ventricular septal defect, coarctation of the aorta, persistent patent ductus arteriosis and pulmonic stenosis), the gastrointestinal system (duodenal atresia) and the genitourinary system (hydronephrosis) were diagnosed in 10 infants of PN women. A major anomaly (hydronephrosis) was diagnosed in only one infant

Table III *Outcomes Among Infants of PC and PN Subjects with Type 1 Diabetes*

Parameter	PC group (n=24)	PN group (n=74)
Gestational age for live births (wk)	36.6±0.5	36.0±0.3
Birth weight for live births (g)	3,584±166	3,167±102*
Intravenous infusion after delivery (%)	5	37*
Major congenital anomalies (%)	5	14
Mean days in neonatal intensive care unit	1.1±0.6	3.9±1.7
Mean days in special care	1.9±0.5	5.1±3.5
Mean days in regular nursery	2.2±0.6	2.5±0.3
Mean days of hospital stays	5.1±0.8	10.9±3.8

*$P<.05$ vs. PC group.

neous abortions in diabetic women with substantially elevated glycohemoglobin levels[1] and a significantly higher incidence of spontaneous abortions among diabetic women not receiving preconception care.[15] Our finding may reflect an ascertainment bias in that PC subjects are followed more carefully before pregnancy and are diagnosed as pregnant earlier. PN subjects might experience spontaneous abortions without seeing a health care provider or even being aware that they are pregnant.

Not surprisingly, PC subjects tend to make more outpatient visits than PN subjects, although, the differences are not statistically significant. The small difference in total outpatient visits between PC and PN women with type 1 diabetes probably relates to the fact that the outpatient preconception visits among PC women are largely offset by more frequent first-trimester outpatient visits among PN women.

The proportion of PC subjects who were hospitalized during the preconception and prenatal period was significantly lower than the proportion of PN subjects who were hospitalized during the prenatal period. This was true with respect to hospitalization during the preconception period and before delivery for all causes and especially for issues related to diabetes control. At delivery, PC women had fewer complications and significantly shorter inpatient stays. Utilization of inpatient resources also tended to be less for infants of diabetic women who received PC care as compared to those who received PN care only. Infants of PC women spent half as many days in the hospital as did infants of PN mothers. Essentially all this difference was related to reduced length of stay in the neonatal intensive care unit and special care nurseries.

These differences in outpatient and inpatient resource utilization translate into a net cost saving with PC care of approximately $34,000 per patient. In considering resource utilization, it is important to recognize the resources expended for preconception care that are not directly associated with pregnancy. In the time frame of this study, 56% of women who sought preconception care did not become pregnant. We do not know why such a large proportion of PC women did not become pregnant but speculate that it resulted from a number of causes, including delayed childbearing, the decision not to become pregnant and infertility. To the extent that these women did not become pregnant by choice, the resources used for preconception care are probably severalfold fewer than those associated with unplanned or unwanted pregnancies.

Previous studies of the economics of preconception care have suggested that the greater costs of preconception care are more than offset by the cost saved by averting adverse maternal and neonatal outcomes.[16–18] Studies by Elixhauser et al used literature review, surveys of medical care personnel and consensus development to model the cost-benefit of preconception care.[16,17] They found that with preconception care the cost saving per enrollee was approximately $1,700 (direct medical costs, undiscounted, 1989 dollars). A study by Scheffler et al estimated the costs of preconception care and analyzed hospital charges for diabetic women who were enrolled before conception in the California Diabetes and Pregnancy Program and for age-, race- and White's classification–matched pregnant diabetic women who were not enrolled.[18] Scheffler et al found that with preconception care the cost saving per enrollee was approximately $6,400 (charges, 8% discount rate, 1988 dollars). Our results suggest that the savings, measured as direct medical costs, may be severalfold greater than previously recognized. In each instance, the savings are substantial and occur in the short term. Thus, for both health and economic reasons, clinical practice and health policy should support the provision of preconception care for women with diabetes.

References

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