Diabetes and Pregnancy

Factors associated with seeking pre-conception care

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OBJECTIVE — To define sociodemographic characteristics, medical factors, knowledge, attitudes, and health-related behaviors that distinguish women with established diabetes who seek pre-conception care from those who seek care only after conception.

RESEARCH DESIGN AND METHODS — A multicenter, case-control study of women with established diabetes making their first pre-conception visit (n = 57) or first prenatal visit without having received pre-conception care (n = 97).

RESULTS — Pre-conception subjects were significantly more likely to be married (93 vs. 51%), living with their partners (93 vs. 60%), and employed (78 vs. 41%); to have higher levels of education (73% beyond high school vs. 41%) and income (86% > $20,000 vs. 60%); and to have insulin-dependent diabetes mellitus (IDDM) (93 vs. 81%). Pre-conception subjects with IDDM were more likely to have discussed pre-conception care with their health care providers (98 vs. 51%) and to have been encouraged to get it (77 vs. 43%). In the prenatal group, only 24% of pregnancies were planned. Pre-conception patients were more knowledgeable about diabetes, perceived greater benefits of pre-conception care, and received more instrumental support.

CONCLUSIONS — Only about one-third of women with established diabetes receive pre-conception care. Interventions must address prevention of unintended pregnancy. Providers must regard every visit with a diabetic woman as a pre-conception visit. Contraception must be explicitly discussed, and pregnancies should be planned. In counseling, the benefits of pre-conception care should be stressed and the support of families and friends should be elicited.

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PC, group seeking pre-conception care; PN, group making first prenatal visit without having received pre-conception care; MDRTC, Michigan Diabetes Research and Training Center; HBM, Health Belief Model; IDDM, insulin-dependent diabetes mellitus; NIDDM, non-insulin-dependent diabetes mellitus; OR, odds ratio.

In the late 1970s, it was recognized that malformations in infants of diabetic mothers occur before the 7th gestational week (1). In the early 1980s, it was observed that elevated 1st trimester glycosylated hemoglobin is associated with fetal malformations (2). During the 1980s, prospective studies demonstrated that pre-conception counseling and treatment and early postconception care reduce the incidence of major malformations (3–7). Recommendations for such care have been developed and published (8–11). An increase in the percentage of planned pregnancies in diabetic women and a decrease in the incidence of major congenital malformations has been reported from Copenhagen, Denmark (12). Yet, in the U.S., most pregnancies complicated by diabetes are unplanned and most women have not received pre-conception care (13,14).

The purpose of this study was to identify the characteristics that distinguish women with established diabetes who seek pre-conception care from those who seek care only after conception. Identification of these characteristics will permit better targeting and delivery of pre-conception services to women with diabetes and will reduce the considerable personal and public health burden associated with adverse outcomes of pregnancy in women with established diabetes.

RESEARCH DESIGN AND METHODS

— The study was performed at five centers in southeastern Michigan that offer programs of pre-conception and prenatal care to women with established diabetes. These included three large university-affiliated teaching hospitals (two of which serve substantial minority populations) and two large private community hospitals. Since the inception of pre-conception care programs, directors have used various marketing approaches, such as continuing education programs, journal advertisements, and letters and newsletters to physician col-

leagues, to encourage the use of available services. Other strategies used to encourage patient involvement include pamphlets, posters, public service announcements, and patient education programs. Two hospitals received funding from the Michigan Department of Public Health to promote their programs. Results of these outreach efforts were generally disappointing.

Programs for pre-conception counseling used a team approach to provide comprehensive services to women with diabetes and their partners. Patients were considered to have sought pre-conception counseling when they declared their intent to become pregnant and began team care with an endocrinologist, an obstetrician or maternal-fetal medicine specialist, a nurse educator, and a dietitian. At the initial visit, diabetic, medical, gynecological, and obstetrical histories were taken. Diabetic complications were assessed with particular reference to retinopathy, nephropathy, neuropathy, including autonomic neuropathy, cardiovascular risk factors, and cardiovascular disease. Women and their partners were counseled about the risk of pregnancy to the mother and her infant. They received the education and skills necessary for intensive insulin therapy. The importance of blood glucose control was explained, and glycemic control was optimized. Patients were followed carefully until conception and throughout pregnancy, and those with difficulty conceiving were referred for evaluation and treatment of infertility.

All women with established diabetes who were making their first pre-conception visit to these sites (PC) or first prenatal visit to these sites without having received pre-conception care (PN) were eligible to participate in the study. The project director contacted participating clinics at the five sites each week to identify women seen in the clinics meeting eligibility criteria. Eligible women were then called and invited to participate within 1 week of their initial clinic visit. The study was reviewed and approved by the respective Institutional Review Boards, and all subjects gave informed consent.

Data collection for each participant included a 30-min telephone interview and a medical record review. Trained research assistants interviewed those who agreed to participate. The structured interview contained items related to knowledge, attitudes, beliefs, social support, and associated health-related behaviors hypothesized to distinguish women with established diabetes who seek pre-conception care from those who seek care after conception. Sociodemographic information and past medical and obstetrical histories were also obtained from the interview and medical record review.

Knowledge was assessed using a modified version of the Diabetes Knowledge Test for Insulin-Dependent Diabetes, developed and validated by the Michigan Diabetes Research and Training Center (MDRTC). The psychosocial and clinical needs of persons with diabetes and the impact of diabetes were assessed with the Diabetes Care Profile, developed by the MDRTC to provide a summary of diabetes-related attitudes, beliefs, and behaviors (15). Attitudes and beliefs regarding diabetes and pregnancy were assessed according to three theoretical frameworks to account for health actions: the Health Belief Model (HBM) (16–18), Social Cognitive Theory (19,20), and the Theory of Reasoned Action (21).

The items developed to measure the primary dimensions of the three theories were patterned after standard items previously published to represent the major model constructs (21–23). Face and content validity were determined by review of the items by a panel of experts (all individuals who were involved in the development or refinement of one of the three models). All suggestions for modifications were incorporated into the final measures. The entire instrument was also pilot tested to assess clarity of items and interview length.

The HBM hypothesizes that an individual is more likely to engage in a recommended health action if he/she feels susceptible, perceives the health condition or its sequelae to be serious, considers the recommended behavior(s) to be beneficial, and can manage any barriers. The HBM dimensions were assessed as follows. Perceived susceptibility was measured as the woman's assessment of her own and her unborn child's vulnerability to complications of pregnancy (two items). Perceived severity was measured as the woman's assessment of the seriousness of those complications to herself and her unborn child (two items). Perceived benefits were measured as the woman's belief that adherence to the recommendations comprising pre-conception and prenatal counseling would help prevent untoward complications for her and her unborn child (seven items). Perceived barriers were measured as the woman's perceived difficulties associated with implementing the recommendations for care, such as limited time, insufficient resources, or required lifestyle changes (10 items).

Social Cognitive Theory posits that self-efficacy, the conviction that an individual can act to produce a desired behavioral outcome, determines the amount of effort an individual will expend on a task and may account for the initiation and maintenance of behavioral change. Self-efficacy was measured as the woman's confidence in her ability to carry out standard health recommendations during pregnancy (six items).

According to the Theory of Reasoned Action, a major determinant of behavioral intention is an individual's perception of the social influence or subjective norm to perform or not perform the behavior in question. Subjective norm was measured as the woman's belief that her partner (or significant others) thinks she should or should not seek pre-conception care and her motivation to comply with the referent's desires (two items). Social support was measured as the perceived availability of four broad types of supportive behaviors or acts:

Table 1—*Sociodemographic characteristics of the PC and PN subjects*

	PC subjects	PN subjects	P
n	57	97	
Age (years)	28.2	26.0	0.059
Race (%)			
White	100.0	63.9	<0.001
African-American	0.0	35.1	
Other	0.0	1.0	
Marital status (%)			
Married	96.2	50.5	<0.001
Living with partner	96.2	59.8	<0.001
Education (%)			
Subject			
Not high school graduate	3.6	22.7	<0.001
High school graduate	16.4	30.9	
Some college	27.3	29.9	
College graduate	52.7	16.5	
Partner			
Not high school graduate	3.8	18.5	<0.001
High school graduate	22.6	40.2	
Some college	22.6	21.7	
College graduate	50.9	19.6	
Employment (%)			
Subject employed	78.2	41.2	<0.001
Partner employed	96.1	71.1	<0.001
Income (%)			
<$6,000	2.0	12.5	0.010
$6,000–$11,999	4.0	16.7	
$12,000–$20,000	8.0	11.1	
>$20,000	86.0	59.7	

emotional, appraisal, informational, and instrumental (seven items). Finally, adherence to various aspects of the diabetic treatment regimen was assessed (five items).

In addition, a thorough review of all office and clinic records, as well as maternal and infant hospital records, was conducted using standard data collection instruments. The record review was conducted either after delivery or at project end for pre-conception care patients who did not become pregnant and for subjects who were pregnant but did not deliver by study end.

Statistical analyses were performed to compare groups on individual variables and to develop statistical models to identify possible codeterminants of seeking pre-conception care. The SAS system (SAS Institute) was used for all analyses. χ^2 tests and related methods were used for across-group comparisons of categorical variables, and Student's *t* tests were used for comparisons of numerical variables. Values are given in terms of percentages/means, and differences significant at the $P < 0.05$ level are indicated in the tables.

Logistic regression modeling was used to develop two models to identify potentially important determinants of seeking pre-conception care. The dependent variable was group (PC or PN) and the independent variables included items that can be used to identify women at risk for not receiving pre-conception care. One model was developed using the complete range of potential risk factors, and the other model was developed using only those risk factors amenable to health education interventions. Models were developed using a sequential model building process. The importance of each variable was assessed relative to other variables in the model. Models were fitted using PROC LOGIST in SAS.

RESULTS — Of 196 women with established diabetes identified, 154 (79%) were enrolled in the study. Reasons for nonparticipation included refusal (7%), loss to follow-up (6%), loss or termination of the pregnancy before the interview (5%), and delivery (2%). Individual hospitals enrolled between 14 and 30% of the study participants. Of the 154 women enrolled in the study, 57 (37%) sought pre-conception care. At the individual centers, the proportion seeking pre-conception care varied from 15 to 50%.

The sociodemographic characteristics of the subjects with established diabetes who sought pre-conception care (PC subjects) and who sought care only after conception (prenatal care only or PN subjects) are shown in Table 1. PC subjects tended to be older and were significantly more likely to be white, married, and living with their partners than were PN subjects. PC subjects and their partners also were significantly more likely to have higher levels of education, to be employed, and to have higher family incomes. Of 57 PC subjects, 53 (93%) had insulin-dependent diabetes mellitus (IDDM). In contrast, only 79 of 97 PN subjects (81%) had IDDM ($P < 0.05$). The mean duration of IDDM was 14.7 years for the PC women and 11.2 years for the PN women.

Table 2 compares the past medical histories of the PC and PN groups. Because of the differences in types of diabetes among women in the PC and PN groups and the potential differences between women with IDDM and non-insulin-dependent diabetes mellitus (NIDDM), results are shown separately for PC subjects with IDDM, PN subjects with IDDM, and PN subjects with NIDDM. Because of the small number of PC subjects with

Table 2—*Past medical histories of the PC and PN subjects by type of diabetes*

	PC subjects IDDM	PN subjects IDDM	PN subjects NIDDM
n	53	79	18
Provider for diabetes care	96.2	93.7	94.1
Diabetes clinic visit in past year	77.4	79.5	70.6
Discussed PC care with diabetes care provider	97.6*	51.4	35.7
Health provider encouraged pre-conception care	77.4*	43.0	5.9
Patient perceived very good diabetes control in past 6 months	26.9*	8.9	11.8

Values are percent answering yes. *The difference between PC (IDDM) and PN (IDDM) is significant at $P \leq 0.05$.

NIDDM, data are not presented for them. Essentially all subjects were able to name a health care provider or clinic where they received diabetes care. Seventy-seven percent of PC subjects with IDDM, 79% of PN subjects with IDDM, and 71% of PN subjects with NIDDM reported having seen their diabetes care provider in the year before their first pre-conception or prenatal visit. Of PC subjects with IDDM, 98% reported that they had previously discussed issues related to diabetes and pregnancy with their diabetes health care providers, while only 51% of PN subjects with IDDM and 36% of PN subjects with NIDDM reported having done so. When asked about perceived glycemic control, three times as many PC women with IDDM as PN women with IDDM described their diabetes control as "very good" over the 6 months before their first pre-conception or prenatal visit (27 vs. 9%, respectively). Women's perceptions of their diabetes control were significantly correlated with their first trimester glycohemoglobin ($r = 0.45$, $P < 0.001$).

Table 3 compares the past obstetrical and gynecological histories across study groups. The majority of the women were able to name a provider or clinic where they received routine gynecological care. Nearly 90% of the women reported having seen their gynecological provider in the year before their first pre-conception or prenatal visit. While 80% of PC women with IDDM reported that they had previously discussed issues related to diabetes and pregnancy with their gynecological care providers, only 34% of PN women with IDDM and 39% of PN women with NIDDM reported having done so. Seventy-seven percent of PC subjects, 43% of PN subjects with IDDM, and only 6% of PN subjects with NIDDM reported that any health care provider had encouraged them to receive pre-conception care.

PC women were no more likely than PN women to have experienced prior pregnancies or prior pregnancies complicated by diabetes. About 65% of PC and PN women with IDDM and 83% of PN women with NIDDM reported prior pregnancies. Fifty-three percent of PC women with IDDM, 58% of PN women with IDDM, and 71% of PN women with NIDDM reported prior pregnancies complicated by diabetes. Among PN women with IDDM, only 26% of the pregnancies were planned, and among PN women with NIDDM, only 12% of the pregnancies were planned. Among women with histories of pregnancies, prior pregnancy outcomes were not worse among PC women. PC women with IDDM were no more likely to have experienced spontaneous abortions or neonatal deaths than PN women with IDDM, and PC women with IDDM were significantly less likely to have had induced abortions. Past histories of spontaneous abortion and neonatal death were more common in PN women with NIDDM.

Data related to group differences in knowledge, attitudes, beliefs, and behaviors are shown in Table 4. PC women

Table 3—*Past obstetrical and gynecological histories of the PC and PN subjects by type of diabetes*

	PC subjects IDDM	PN subjects IDDM	PN subjects NIDDM
n	53	79	18
Past OB/GYN histories before study			
Provider for GYN care	88.5	82.3	82.4
GYN clinic visit in past year	88.1	87.2	90.3
Discussed pre-conception care with GYN provider	79.5*	34.4	38.5
Prior pregnancy	64.1	65.3	83.3
Prior pregnancy with diabetes	52.8	57.7	70.6
Planned pregnancy	N/A	26.3	11.8
For those with prior history of pregnancy			
Induced abortion	8.7*	47.8	26.7
Spontaneous abortion	43.5	41.3	66.7
Neonatal death	0.0	4.6	7.7
Living children	56.0	55.3	93.3

Values are percent answering yes. OB, obstetrical; GYN, gynecological; N/A, not applicable for this group. *The difference between PC (IDDM) and PN (IDDM) is significant at $P \leq 0.05$.

Table 4—*Knowledge, attitudes, beliefs, and behaviors regarding diabetes and pregnancy of the PC and PN subjects*

	PC subjects	PN subjects	
	IDDM	IDDM	NIDDM
n	53	79	18
Knowledge			
Total knowledge score (0–14 correct)	11.3*	10.6	10.0
Awareness of pre-conception care (% yes)	N/A	72.7	58.8
HBM dimensions			
Susceptibility of mom (% high)	32.1	21.8	35.3
Susceptibility of baby (% high)	49.1	60.3	64.7
Severity to mom (% very)	22.5	20.8	29.4
Severity to baby (% very)	41.7	54.2	56.3
Benefits to mom (% high)	94.3*	76.6	70.6
Benefits to baby (% high)	94.3*	73.1	82.4
Barriers to self-management (1–5)	3.9	3.9	3.9
Cost barriers (1–5)	4.2	4.0	3.7
Barriers to seeking medical care (1–5)	4.2	4.0	3.9
Efficacy expectations			
Self-efficacy score (0–10)	8.9	8.8	8.5
Subjective norm			
Partner wants patient to follow MD's advice (% a lot)	86.5	90.9	92.3
Importance of partner's opinion (% very important)	92.3	88.1	84.6
Social support			
Total social support score (1–5)	1.3	1.5	1.6
Instrumental support score (1–5)	1.3*	1.6	1.7
Adherence with medical recommendation			
Adherence with clinic visits (% all/most)	93.9*	80.5	92.3
Adherence score with diet, insulin, blood glucose monitoring	1.8	2.6	3.9
Smoking in last 12 months (% yes)	18.9*	42.3	70.6

Data are % or means. For barrier scores 1 = big problem, 5 = no problem; for self-efficacy 0 = not confident, 10 = very confident; for social support 1 = a lot, 5 = no support; for adherence score 1 = all the time, 5 = none of the time. N/A, not applicable for this category. * Difference between PC (IDDM) and PN (IDDM) significant at $P \leq 0.05$.

with IDDM scored higher on the knowledge test than PN women with IDDM, although the difference between groups was small. Only 73% of PN women with IDDM and 59% of PN women with NIDDM reported that they knew that special advice and care existed for women with diabetes who were planning a pregnancy. In general, PC women with IDDM and PN women with IDDM did not differ with respect to perceived susceptibility or severity of diabetes and pregnancy risks to the mother or her unborn child. PC women with IDDM were, however, significantly more likely to perceive that preconception care conferred benefits to the mother and her unborn child. There were no significant differences in perceived barriers, subjective norm, or self-efficacy scores among groups. Although there were no reported differences in total social support scores among groups, PC women with IDDM reported significantly more instrumental social support. Instrumental support involves practical, tangible aid offered by another individual, such as assistance in giving insulin injections, preparing meals, buying equipment, performing glucose testing, or driving to medical appointments.

Compared with PN women, PC women with IDDM were significantly more likely to report past adherence with scheduled visits for diabetes care and with all aspects of their diabetes treatment plan. They were also less likely to report smoking cigarettes in the past year.

Variables entered into the logistic regression models included sociodemographic variables and items measuring knowledge, attitudes, beliefs, or behaviors. Findings from the bivariate analyses and theoretical considerations were used to select variables for the modeling procedures. These variables included education, whether a woman was living with her partner, whether a woman had made a clinic visit for diabetes care in the past year, whether she received encouragement to seek pre-conception care from a health care professional, whether she reported good diabetes control, her diabetes knowledge score, her perception of benefits from pre-conception care, her assessment of the instrumental support available, and her adherence with the diabetes regimen. Age and income were highly correlated with education, and thus education served as a proxy for sociodemographic status in general. The adjusted odds ratio (OR) and associated *P* value for each variable are shown in Table 5.

Women who sought pre-conception care were more likely to *1*) have higher levels of education, 2) be living with their partners, 3) have seen their diabetes health care provider in the preceding year, 4) have reported being encouraged by a health care provider to seek preconception care, and 5) have previously exhibited good adherence to their diabetes regimen. The *P* values reported here are for testing the significance of the relevant variable accounting for the other variables in the model. Thus, none of the other variables considered were found to be associated with seeking pre-conception care.

One of the goals of this study was to identify determinants of seeking preconception care that are amenable to

Table 5—*Logistic regression model results with significant sociodemographic variables included in the model*

	Adjusted OR	*P*
Education	4.81	0.01
Living with partner	11.25	0.01
Diabetes clinic visit in past year	8.25	0.01
Provider encouraged pre-conception care	3.39	0.02
Diabetes in good condition	0.87	0.82
Knowledge score	0.93	0.69
Benefits of pre-conception care	5.70	0.16
Instrument support	0.94	0.87
Adherence with diabetes regimen	3.03	0.01

health care interventions. Since level of education and whether a woman is living with her partner are not easily addressed by health care intervention, a logistic regression model excluding these two variables and other sociodemographic variables was fitted to identify potentially modifiable factors. The adjusted OR ratio and associated *P* values are shown in Table 6.

Again, the results suggest that women who were under routine care for their diabetes, reported being encouraged by a provider to get pre-conception care, and adhered closely to their diabetes regimen were most likely to seek pre-conception care. None of the other variables were statistically significant when sociodemographic characteristics were no longer represented in the model.

Finally, to determine which sociodemographic, knowledge, attitude, or behavioral variables were associated with seeking pre-conception care independent of planning a pregnancy, a subanalysis was performed comparing IDDM women seeking pre-conception care ($n = 53$) and IDDM women who did not seek pre-conception care but reported that their pregnancies were planned ($n = 20$). Women seeking pre-conception care were significantly more likely to be white, to have discussed pre-conception care with their diabetes health care provider, to have discussed pre-conception care with their gynecological provider, to have reported being encouraged by a health provider to seek pre-conception care, to have exhibited good adherence to their diabetes regimen, and to have refrained from smoking. Education, employment, income, and marital status did not distinguish women with IDDM who sought pre-conception care from those who did not but nevertheless reported planning their pregnancy. Compared with PN women with unplanned pregnancy, PN women who planned their pregnancy had higher incomes and were significantly more likely to be employed and married.

CONCLUSIONS — While benefits of pre-conception care for women with diabetes are well established, only about one-third of women in this study received such care. This may represent a higher percentage than seen in institutions that do not have organized programs for pre-conception care. Only 40% of those with IDDM and 14% of those with NIDDM received pre-conception care. As has been found in previous studies, preventive services are delivered less frequently to people with NIDDM than to people with IDDM. This may reflect the erroneous perception that NIDDM is less severe than IDDM (24). Sociodemographic characteristics associated with failure to receive pre-conception care included having less education, being unemployed, having a lower income, being unmarried, not living with a partner, and being nonwhite.

These sociodemographic characteristics associated with failure to receive pre-conception care are similar to the risk factors for unintended pregnancy identified in previous studies. For example, the 1988 National Survey of Family Growth found that among ever-married women, approximately 35% of births resulted from pregnancies that were unintended at the time of conception (25). In logistic regression analysis, lack of education, poverty, and black race all remained significant determinants of unwanted pregnancy (26). Another survey of reproductive-age women who had ever been pregnant conducted in 1988–1989 by the New York State Family Planning Program found that 36% of women reported that their last pregnancy had been unintended. Unintended pregnancy was more common among blacks, and the risk of unintended pregnancy varied inversely by educational level and income. In addi-

Table 6—*Logistic regression model results with sociodemographic variables not entered in the model*

	Adjusted OR	*P*
Diabetes clinic visit in past year	4.57	0.03
Provider encouraged pre-conception care	3.13	0.02
Diabetes in good condition	1.34	0.90
Knowledge score	1.20	0.24
Benefits of pre-conception care	3.90	0.19
Instrumental support	0.94	0.85
Adherence with diabetes regimen	2.61	0.01

tion, married women were substantially less likely than previously married and never married women to report their last pregnancy as unintended (27). These findings highlight the pervasive problem of unintended pregnancy and underscore the importance of family planning, especially in high-risk populations. They also reinforce the importance of developing culturally appropriate messages and delivering interventions tailored to the educational level and specific needs of hard-to-reach populations.

The finding that less than one-half of the women with established diabetes in the PN group ever recalled discussing pre-conception counseling with their physician is alarming. In addition, less than one-half (43%) of the PN women with IDDM and only about 1 in 20 (6%) with NIDDM felt they had been encouraged by their provider to seek pre-conception care. Even when the analyses were limited to women planning pregnancies, discussion and encouragement of pre-conception care by the provider was important in distinguishing those who sought such care. No data are available on the precise nature of previous visits for diabetes care. Therefore, the extent to which the reason for recent visits may have influenced the likelihood of a discussion on the merits of pre-conception counseling cannot be determined.

Health care providers cannot wait for women with diabetes to initiate discussions about pregnancy. Medical training and continuing education programs should emphasize the importance of pre-conception counseling. Brief tutorials focusing on state-of-the-art intervention strategies and techniques could be offered to physicians to improve efforts in obtaining patient cooperation with medical advice (28,29). Office-based computer prompting systems or simple inexpensive reminder checklists affixed to patient medical records could also be used to improve physician adherence to guidelines (30). In addition, providing peer-comparison feedback to physicians about their behavior may be successful in increasing attention and adherence to health promotive and disease preventive activities (31).

For the majority of women in this study, an opportunity to discuss and encourage pre-conception care did exist during routine medical follow-up. Health care providers must consider each visit with a diabetic woman of childbearing age to be a pre-conception visit. Contraception and family planning should be explicitly discussed. In any medical setting, some patients will not understand completely what is expected of them and these patients naturally will have much higher rates of noncompliance. Poor recall is part of the problem. Studies have shown that patients forget up to half of the doctor's instructions and remember best information in the first third of the presentation (32,33). Such findings emphasize the need for appropriate timing of important recommendations and the need for repetition of the message over time. Presenting information orally and with simple written instructions also results in higher levels of patient retention (34). Descriptions of the components of pre-conception counseling and endorsement of such services by the health care team could be made available in several formats (e.g., posters and written pamphlets).

It is surprising that women with previous pregnancies (and particularly those with previous adverse outcomes) were no more likely to seek pre-conception care during subsequent pregnancies. While early in the postpartum period may not be the ideal time to discuss future pregnancies, communication between obstetrical and diabetes care providers should be encouraged and periodic counseling conducted.

Assessment of compliance with the diabetes regimen during the routine medical or gynecological follow-up will assist providers in identifying women at highest risk for not taking advantage of pre-conception care. Women who do not follow their diabetes regimen closely are least likely to take advantage of pre-conception counseling and are at highest risk for negative outcomes should they become pregnant. Interventions designed to encourage closer follow-up, such as postcard or telephone reminders, should be initiated for women missing regular appointments. Regular visits provide an opportunity to stress the importance of adhering to the diabetes regimen for its own sake and to emphasize the need for good contraceptive practices particularly when one is not in good glycemic control.

Although the mean knowledge score of the PC subjects was statistically higher than that of the PN subjects, it is difficult to know whether the difference was clinically relevant. Both groups scored quite high on the knowledge test, suggesting a general awareness of the relationship between diabetes and pregnancy.

While the attitude and belief variables were no longer significant when entered into a logistic model that included sociodemographic and access to care items, these variables should not be ignored in counseling sessions. Many of the psychosocial variables were highly associated with those items that remained in the model and could provide a focus for provider-initiated discussions regarding pre-conception care. For example, emphasizing the benefits of pre-conception counseling for both mother and baby would appear to be a useful intervention strategy. The patient's family remains a largely untapped means for reminding, assisting, encouraging, and reinforcing a patient to follow medical advice. Practitioners might assess the role of the family or partner and attempt to maximize constructive contributions when they exist. For women with minimal instrumental support, efforts should be made by providers to find alternative sources, such as other patients with diabetes or other members of the health care team.

Using an approach that focuses on benefits and social support is reinforced by the findings of a recent prospective study of women with IDDM followed at the Joslin Diabetes Center in Boston, MA.

That study found that the only factors associated with consistent use of birth control included having positive attitudes about the benefits, advisability, and comfort regarding the procurement and use of contraception and receiving greater social support for use of birth control (35).

Gregory and Tattersall (36), in a viewpoint entitled, "Are diabetic pre-pregnancy clinics worthwhile?" review the literature and conclude that the availability of pre-pregnancy clinics separates diabetic women into a highly motivated, well-controlled group who attend, and the remainder, who book late. Our findings suggest that among women in the PC group, 73% did not rate their diabetes control as "very good"; in fact, 19% rated their control as "fair" or "poor." However, the issue of whether formal programs of pre-conception care are effective in preventing morbidity or simply select a group of highly motivated patients was not the subject of the study. Rather, our findings highlight the need to incorporate the message and essential components of pre-conception care into the health care system, whether through dedicated pre-conception clinics or as an integral part of primary care. These efforts are especially needed for unmarried women of lower social class and those with NIDDM.

Population-based approaches to pre-conception counseling (12,14,37) are feasible and cost-effective (38,39). Among women with diabetes, as in the general population, unintended pregnancy remains a major problem. A systematic approach to family planning, repeated emphasis by providers of the importance of pre-conception care, and the availability of pre-conception services for all women with diabetes of childbearing age are essential components of a comprehensive diabetic management program.

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