

Effects of Self-Efficacy and Locus of Control on Future Preconception Counseling Plans of Adult Women With Type 1 Diabetes

Caroline M. Grady and Pamela A. Geller

■ ABSTRACT

Objective. The American Diabetes Association (ADA) recommends that women with diabetes attend preconception counseling and improve blood glucose levels before pregnancy to decrease risks of adverse outcomes. However, two-thirds of women with diabetes do not plan their pregnancies. Research has examined views regarding preconception counseling of pregnant women with diabetes, but perceptions of women with diabetes who have never been pregnant have not been explored. The purpose of this study was to examine the relationship between women's locus of control, self-efficacy, and outcome expectations of preconception counseling.

Design and Methods. A sample of 147 nulligravid women with type 1 diabetes (mean age 25.9 years) was recruited online to complete a self-report survey. Measures included a sociodemographics form, a study-specific questionnaire regarding diabetes management and education, the Reproductive Health Attitudes and Behaviors instrument, and the Diabetes-Specific Locus of Control measure.

Results. A standard multiple linear regression analysis indicated that self-efficacy was positively associated with expectations of preconception counseling ($P < 0.001$), whereas self-blame was negatively associated ($P = 0.001$). Three-fourths of the women reported not receiving preconception counseling from health care providers.

Conclusion. Self-efficacy was positively associated with women's expectation of preconception counseling usefulness, whereas self-blame for poor disease management was inversely related. The low reported rates of preconception counseling demonstrate that ADA recommendations for starting preconception counseling at puberty have not been followed uniformly. Women with diabetes should be provided education to increase their belief that they have control over their disease, which may lead to positive perceptions of preconception counseling and healthier pregnancies.

Drexel University, Philadelphia, PA

Corresponding author: Caroline M. Grady,
cmg349@drexel.edu

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Type 1 diabetes is a chronic medical condition in which insulin production ceases (1). The number of women with type 1 diabetes who are of childbearing age is increasing each year (2). Between 0.1 and 0.2% of all pregnancies occur in women with type 1 diabetes, and trends show that this percentage is on the rise (2). Women with type 1

diabetes experience additional health risks during pregnancy, the majority of which are caused by hyperglycemia. During pregnancy, hyperglycemia can lead to increased risks of adverse outcomes for both the pregnant woman and the fetus. These include preeclampsia, worsened diabetes complications, infection, spontaneous abortion, premature delivery,

stillbirth, macrosomia, the need for cesarean delivery, congenital malformations, and neonatal death (3–7). Congenital malformations occur early in pregnancy, necessitating intensive blood glucose control before conception or at least in the first trimester to decrease complications to levels that resemble the risks of women without diabetes (8,9). Despite research showing the adverse effects of poor blood glucose control before conception, about two-thirds of women with diabetes do not plan their pregnancies (1,10), which is a greater proportion than in the general population, in which half of all pregnancies are unplanned (11).

The American Diabetes Association (ADA) has published recommendations for decreasing women's risks of adverse pregnancy outcomes. Specifically, the ADA calls for preconception counseling to begin at puberty for girls with diabetes. Preconception counseling is defined as "the education of, and the discussion with, women of reproductive age about pregnancy and contraception," and "should be delivered annually in primary and/or specialist care to all women of reproductive age" (12).

Previous studies have examined preconception counseling and outcomes in women with diabetes. A number of sociodemographic characteristics were found to be associated with not attending preconception counseling or care, including being less educated, unemployed, a lower-income worker, unmarried, in a separate residence from the partner, and nonwhite (13).

Earlier studies primarily have used qualitative data to gain insight about pregnancy experiences. However, views about pregnancy from women with diabetes who have never been pregnant have not been fully explored. This study assesses quantitatively how women with diabetes understand their ability to experience a healthy pregnancy and reduce their risks of adverse outcomes. It was hypothesized that a woman's

locus of control and self-efficacy would be significantly related to her outcome expectations of preconception counseling, specifically that a positive relationship would be found between self-efficacy and expectations of the perceived utility of preconception counseling. Rosenstock et al. (14) theorized that combinations of internal/external locus of control and high/low self-efficacy could influence adherence, and researchers have found diabetes self-care behaviors to be positively correlated with outcome expectancy (15). Adherence is a self-care behavior. Therefore, locus of control and self-efficacy should affect outcome expectations.

Design and Methods

Nulligravid women between the ages of 18 and 44 years with type 1 diabetes who resided in the United States were eligible for inclusion in the study. Women who were pregnant or had ever been pregnant were excluded from the study because their previous experience could affect their perceptions of becoming pregnant in the future. Women who planned to become pregnant through fertility treatment or were exclusively having sex with women were excluded because they were considered unable to become pregnant unexpectedly, which would alter their perceptions of pregnancy planning.

Participants were recruited through the Internet via advertising on websites with a target audience of women with type 1 diabetes, such as online support communities/forums, blogs, and social networking websites (e.g., Facebook and Twitter) with information relating to type 1 diabetes. An online method of recruitment allowed for a wide range of participants with differing backgrounds and experiences. Participants electronically reviewed and agreed to a waiver of informed consent.

The Reproductive Health Attitudes and Behavior (RHAB) instrument (16) was administered to assess preconception planning. The instrument is a 48-item scale with 10 subscales:

Susceptibility, Severity, Benefit, Barrier, Cues to Action, Attitude, Subjective Norm, Intention, Self-Efficacy, and Outcome Expectation. The subscales are Likert scales and 10-point confidence scales, and all have a continuous total score. The measure has demonstrated internal consistency of 0.60–0.83 and has been shown to have good validity and reliability. Self-efficacy—the belief in one's ability to complete a task—has been shown to improve disease management (17,18).

The Diabetes-Specific Locus of Control (DLC) measure (19) was administered to assess beliefs of internal, chance, and powerful others' loci of control regarding management of diabetes. Locus of control has been examined in people with diabetes, including women with unplanned pregnancies (10,20,21). The DLC is an 18-item scale with 5 subscales: Internal-Autonomy, Internal-Blame, Chance, Powerful Other–Health Professionals, and Powerful Other–Non-Medical. The items were assessed on a 6-point scale ranging from 1 ("strongly agree") to 6 ("strongly disagree"). Each of the subscales has a continuous total score. The measure has demonstrated internal consistency of 0.65–0.75. The scale was created to be appropriate for older children, adolescents, and adults with type 1 diabetes (19).

Sociodemographic data and information regarding the participants' course of diabetes, education about pregnancy, and knowledge of how diabetes complicates pregnancy were gathered with a 22-item questionnaire created specifically for this study. From these items, participants' knowledge of hyperglycemia risks and frequency of education sessions from health care professionals (HCPs) were assessed. Before initiating the study, the questionnaire was examined for clarity and administered to colleagues. After suggested improvements were implemented, the measure was administered to other colleagues, and additional clarifica-

tions were made. The final version was reviewed by experts for accuracy.

Data collection was completed online from January 2014 through March 2014. Data were analyzed using the SPSS Statistics 20.0 statistical package (IBM Corp., Armonk, N.Y.). Descriptive statistics were analyzed and reported for all demographic variables, including participant age, racial/ethnic identity, relationship status, employment status, and highest level of education. Descriptive statistics were calculated and reported for the relevant RHAB and DLC subscales. A power analysis (24) determined that 98 participants were necessary to achieve a power of 0.80 with a medium effect size (0.15) and an alpha of 0.05.

All of the total scores of the DLC subscales and the RHAB Self-Efficacy and Outcome Expectation subscales were examined for normal distribution. The Outcome Expectation variable was not normally distributed, with a negative skew (skewness = -0.93 , standard error [SE] of skewness = 0.20). A square root transformation correction was performed. The Chance variable was not normally distributed, with a negative skew (skewness = -0.46 , SE of skewness = 0.20). No transformation improved the skewness of the variable, so the original variable was maintained. The Self-Efficacy variable was not normally distributed, with a negative skew (skewness = -1.44 , SE of skewness = 0.20). A log-transformation correction was performed. The multicollinearity, linearity, outliers, normality, and homoscedasticity assumptions were met.

Results

A total of 147 individuals completed the survey. The mean age of the sample was 25.88 years (SD 4.70 years, range 18–41 years). The majority of the sample identified as being white/Caucasian (89.1%, $n = 131$), reported being in a relationship (36.7%, $n = 54$), were employed full-time (44.9%, $n = 66$), had completed a bachelor's

degree (42.9%, $n = 63$), reported that they would like to become pregnant in the future (76.9%, $n = 113$), and had health insurance (97.3%, $n = 143$). The average duration of type 1 diabetes was 14.13 years (SD 8.68

TABLE 1. Sociodemographic Characteristics

	<i>n</i> = 147	<i>n</i>	%	
Ethnicity	White/Caucasian	131	89.1	
	Mixed race	10	6.8	
	Black or African American	1	0.7	
	Asian	0	0.0	
	Hispanic	3	2.0	
	Other	2	1.4	
Relationship status	Single	38	25.8	
	In a relationship	54	36.7	
	Married	51	34.7	
	Divorced	2	1.4	
Employment status	Employed, part-time	22	15.0	
	Employed, full-time	66	44.9	
	Unemployed	11	7.5	
	Student	45	30.6	
	No response	3	2.0	
Highest level of education	High school diploma/GED	7	4.7	
	Some college	37	25.2	
	Associate's degree	13	8.8	
	Bachelor's degree	63	42.9	
	Master's degree	22	15.0	
	Professional degree	5	3.4	
		Mean	SD	Range
Age (years)		25.88	4.70	18–41
Duration of type 1 diabetes (years)		14.13	8.68	0–31
	<i>n</i> = 210	<i>n</i>	%	
Average A1C	≥7%	115	78.2	
	<7%	30	20.4	
	No response	2	1.4	
Actively tried to lower A1C?	Yes, I was successful	113	76.9	
	Yes, but I was not successful	29	19.7	
	No	5	3.4	
Current method of treatment, management, and glucose monitoring	Multiple daily injections		23.1	
	Insulin pump		76.9	
	Blood glucose meter		87.1	
	Continuous glucose monitor		38.1	
	Oral medications		2.7	
	Low-carbohydrate diet		20.4	
	Other		1.4	

years, range <1–31 years). Regarding average A1C over the course of the disease, 78.2% (*n* = 115) reported ≥7.0%, and 20.4% (*n* = 30) reported <7%. Additional information regarding demographics, diabetes management, and beliefs about pregnancy can be found in Tables 1–3.

The majority of participants (76.9%, *n* = 113) reported that they would like to become pregnant in the future, whereas 11.6% (*n* = 17) reported not wanting to become pregnant because of their diabetes. Participants were asked what they believed was the ideal A1C at conception, and 98% (*n* = 144) provided a number between 5 and 7%, the correct range. Only 44.9% (*n* = 66) of participants correctly listed at least three specific health risks for the pregnant woman and fetus if blood glucose levels are not controlled. A large majority of participants (76.2%, *n* = 112) had not received any formal preconception counseling from an HCP, whereas 34% (*n* = 50) had requested the information. Regarding past delivery of preconception counseling, 56.5% (*n* = 83) of participants reported that they had already received information about pregnancy from their endocrinologist, whereas 20.4% (*n* = 30) had received information from their primary care doctor or from a diabetes educator (21.1%, *n* = 31) or nurse (8.2%, *n* = 12). Additionally, 17% (*n* = 25) reported that they had gotten information from another source, with obstetrician/gynecologist and social media as the most common responses. However, 25.2% (*n* = 37) of participants reported that no one had given them information. The majority of participants (60.5%, *n* = 89) reported knowing at least one woman with type 1 diabetes who had been pregnant.

To test the hypothesis that beliefs about disease control and self-efficacy would be associated with outcome expectations of preconception counseling, a multiple regression analysis was conducted.

The analysis regressed outcome expectations of preconception counsel-

TABLE 2. Diabetes and Pregnancy Characteristics

	<i>n</i>	%	
Wish to become pregnant in future	Yes	113	76.9
	No, because of diabetes	17	11.6
	No, somewhat because of diabetes	11	7.4
	No, but not because of diabetes	5	3.4
	No response	1	0.7
Currently have health insurance/universal health coverage (Y)	143	97.3	
Coexisting chronic conditions (Y)	61	41.5	
Any diabetes complications (Y)	21	14.3	
Believe the best A1C level at conception is...	Between 5 and 7%	144	98.0
	>7%	3	2.0
Three correct specific health risks* (Y)	66	44.9	
Received formal preconception counseling from an HCP (N)	112	76.2	
Asked an HCP about information related to pregnancy (Y)	50	34.0	
Been told should not become pregnant (Y)	42	28.6	
Been told it will be difficult to become pregnant (Y)	56	38.1	
Know women with same type of diabetes who have been pregnant (Y)	89	60.5	

*Correct responses included a possible risk to fetus or mother with hyperglycemia during pregnancy; list included in introduction of current article. N, no; Y, yes.

TABLE 3. Main Results: Regression Analysis of the Relationship Among Locus of Control, Self-Efficacy, and Outcome Expectations of Preconception Counseling

Independent Variable	<i>B</i>	<i>SE_B</i>	β	<i>T</i>	<i>P</i>
Constant	3.27	0.44		7.37	0.000
Self-efficacy*	0.26	0.06	0.36	4.75	0.000
Internal–autonomy	–0.00	0.03	–0.01	–0.11	0.914
Internal–blame	–0.07	0.02	–0.27	–3.41	0.001
Chance	0.01	0.01	0.06	0.73	0.465
Powerful other–health professionals	–0.04	0.02	–0.17	–1.88	0.062
Powerful other–non-medical	–0.02	0.03	–0.05	–0.56	0.574

*Variable with log transformation.

ing on loci of control and self-efficacy. Results indicated that the model was significant ($r^2 = 0.27$, $F[6, 140] = 8.63$, $P < 0.001$). Self-efficacy for planning a healthy pregnancy was a significant predictor of outcome expectations of preconception counseling ($b = 0.26$, $SE_b = 0.06$, $\beta = 0.36$, $t[140] = 4.75$, $P < 0.001$). Internal, but blaming, belief of control was a significant pre-

dictor of outcome expectations ($b = -0.07$, $SE_b = 0.02$, $\beta = -0.27$, $t[140] = -3.41$, $P = 0.001$).

Discussion and Conclusions

The findings of this study add to the literature regarding the perceptions and attitudes of women with diabetes toward pregnancy prevention and planning. Much of the previous re-

search has focused on women during or after pregnancy, rather than at a time point before they were planning to conceive. The results of this investigation show that women's self-efficacy was positively associated with their perceived usefulness of preconception counseling and birth control use, whereas self-blame about disease management negatively correlated with these views.

The majority of the study's sample was Caucasian, had a mean age of 26 years, was in a relationship, was employed full-time, had completed at least a bachelor's degree, and had health insurance. These characteristics indicate an advantaged sociodemographic sample, which in part may be explained by the online sampling method. The generalizability of the current findings to women with diverse sociodemographic characteristics remains unknown.

The average duration of the participants' diabetes was 14.1 years, which indicates that the sample is well established in their disease management. The majority (78%) reported an average A1C $\geq 7\%$, which is similar to the most recent report of A1C results among adults with type 1 diabetes (22). Seventy-seven percent of the participants reported that they wished to become pregnant in the future.

Similar to previous research (23–26), 55% of the women were not able to correctly identify the risks of having improperly controlled blood glucose levels during pregnancy. Thirty-seven percent reported not receiving any information about pregnancy, and just over half reported having education from an endocrinologist. This result indicates that, despite the advantaged sample, the ADA recommendation of providing counseling starting at puberty is not being followed. This seems particularly notable given that the current sample is highly educated and has an Internet presence, yet is still relatively unaware of the guidelines set by the ADA and of the risks of uncontrolled blood glucose during pregnancy.

Despite having less knowledge of risks, an overwhelming majority (98%) of the participants correctly reported the target A1C level at conception.

As mentioned previously, the use of social media for people with diabetes allows for information to be shared about living with the disease. Fifty-seven percent of the participants reported knowing at least one woman with the same type of diabetes who had been pregnant, with some stating that the person was a friend met online. As the diabetes online community continues to grow, information that is not fully provided by HCPs may be supplemented by people who have lived a similar experience (27,28). Through social media, women with diabetes can obtain suggestions from other women, which could increase their confidence in their ability to have a healthy pregnancy. A future direction for diabetes care could include HCPs' utilization of social media to provide accurate information to a larger number of women.

Results from the analysis showed that self-efficacy was significantly and positively associated with the expectation of helpfulness of preconception counseling, whereas self-blame had a negative association with expectations. Janz et al. (13) and Komiti et al. (29) independently examined the relationship between self-efficacy and attendance at preconception counseling, but neither study found significant results. Komiti et al. (29) also did not find a significant relationship with outcome expectations. However, neither study examined locus of control. The current study used outcome expectations of preconception counseling as the dependent variable, so this could also account for the discrepancy between results. AbuSabha and Achterberg (30) reviewed studies that measured self-efficacy, locus of control, and outcome expectancy and found that self-efficacy is a good predictor of general health behavior

and can account for $>50\%$ of variability. Taken together, the results from the AbuSabha and Achterberg (30) literature review and the current study indicate that self-efficacy could be an important factor for improving outcomes. However, Janz et al. (13) and Komiti et al. (29) did not find a significant relationship between self-efficacy and behavior. A consensus is needed to develop interventions that will put the appropriate amount of effort into enhancing the self-efficacy of women with diabetes.

This study had a number of strengths. The design of the survey included two validated measures, the Rhab instrument (16) and the DLC questionnaire (19). This increases the validity of the data given that subscales from the measures were components of the hypotheses and were examined using statistical analyses. The survey was conducted as an online study, which allowed for recruitment of a large number of potential participants. The use of the Internet also aided in rapid distribution of the survey. Finally, because the study instruments could be accessed confidentially and at participants' convenience, women were able to complete the measures without feeling rushed or self-conscious because of the presence of a researcher or other participants.

In an attempt to achieve a diverse national sample, in-person recruitment was not utilized. One limitation that must be noted is that women who do not have regular access to the Internet may not have had an equal opportunity to participate. Therefore, results are generalizable only to women who regularly use the Internet and the targeted online recruitment sites. However, as of 2011, 71.7% of households in the United States use the Internet (31). Of adults who use the Internet, 73% access social networking sites, and 71% belong to Facebook (32). With this majority, utilizing the Internet to recruit participants was reasonable. Two-thirds of the participants

(63.9%) learned about the study through Facebook. Greene et al. (33) found that Facebook, specifically, is a form of media that allows users with diabetes to reach others, ask questions, and receive information from people living with the disease. With these findings, it can be concluded that a large portion of the targeted population had the opportunity to take part in the research (32).

Furthermore, all aspects of the survey were self-reported. As with all self-report studies, some degree of social desirability bias may be present. However, questions related to the criteria were presented before the waiver of informed consent form to eliminate ineligible participants before introducing the study. The advantages noted above for utilizing the Internet as a venue for study recruitment outweigh the disadvantages.

Another limitation is the cross-sectional nature of the study. Some survey items required participants to anticipate a behavior in planning a future pregnancy, but the study timeframe does not allow for a record of the actual behavior. Therefore, causality and directionality cannot be inferred from any statistically significant results, and it also should be considered that expectations of preconception counseling might influence locus of control and self-efficacy. Further research designs should examine actual behavior within this topic and population.

These results suggest that future research should work to develop interventions for women with diabetes that reduce their belief in self-blame while also improving their self-efficacy. Outcomes may measure perceptions of preconception counseling and the behavior of attending sessions with HCPs.

The number of women diagnosed with diabetes is increasing, as is the number of pregnancies in women with diabetes (34). Women with diabetes are experiencing more unintended pregnancies than the general population (10,11,35). The ADA pro-

vides guidelines for preconception counseling, what information should be covered, and when the education should begin (1).

Results from this study demonstrate that this information is not being delivered as recommended to a socio-demographically advantaged group of women. For those demographic groups not represented in the current sample, whether this information is being provided remains unknown. Seeking out preconception counseling then becomes the responsibility of women with type 1 diabetes to achieve the healthiest pregnancy possible.

Self-efficacy was positively and significantly associated with women's expectations of the usefulness of preconception counseling, whereas self-blame for poor disease management was negatively related to this expectation. Therefore, future research and interventions should focus on improving self-efficacy and empowering women with diabetes to confidently control their disease.

The success of reaching women with type 1 diabetes with online recruitment demonstrates that the Internet may also provide a forum for preconception counseling itself, as well as for psychoeducational intervention.

In summary, women with diabetes should be provided education to increase their belief in their ability to control their disease because this can lead them to have more positive perceptions of preconception counseling, which in turn may result in better management of diabetes during pregnancy and more positive pregnancy outcomes.

Duality of Interest

No potential conflicts of interest relevant to this article were reported.

Acknowledgments

C.M.G. conceptualized the study, collected the data, designed and conducted the analysis, and wrote the manuscript. P.A.G. collaborated on study development and design, oversaw the study, reviewed the analysis, and edited the manuscript. C.M.G. is the guarantor of this work, had full access to all data in the study, and takes responsi-

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