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Examination of the Prevalence and Mediating Factors of Diabetes Diagnoses in Kentucky Women with a History of Gestational Diabetes

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CAPSTONE PROJECT PAPER

A paper submitted in partial fulfillment of the
requirements for the degree of
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By
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Diabetes mellitus (DM) is an overwhelming health issue in the United States affecting 25.8 million people, which is equivalent to 8.3% of the population.[1] It is the seventh leading cause of death and a major cause of serious complications such as heart disease, stroke, kidney failure, nontraumatic lower limb amputations, and new causes of blindness among adults in the U.S.[1] Paralleling the obesity epidemic, the rates of DM incidence and prevalence continue to rise each year.[2] One particularly troubling public health issue related to DM is that over a quarter of the people who have this disease are unaware, even though research has shown that preventative care can delay the onset of DM and its complications.[1,3] In order to try to combat this problem, a Healthy People 2020 objective was established to increase the proportion of persons with diabetes whose condition had been diagnosed by 10%.[4] Improving primary prevention among those at risk of developing DM and increasing early diagnosis could lead to significant savings in human and financial costs associated with this disease.

While it is commonly understood that screening which enables early diagnosis of diabetes can allow for more effective management and appropriate treatment of the disease, low screening rates still remain a major public health issue.[5] The American Diabetes Association (ADA) has issued guidelines about what patient populations should be screened and when, and have provided support for testing to be carried out within the health care setting; however, there remains a need for improvement in terms of effective methods to enhance the proportion of people who are actually being screened.[6] As research studies continue to report the evidence for improving screening practices and the patients' improved outcomes, specific populations for whom screening is particularly important have been identified.

Women with a history of gestational diabetes are a unique target population with critical diabetes screening needs. Previous research has shown that women who have had gestational diabetes have a 35% to 60% chance of developing diabetes in the next 10-20 years.[1] Since these women are considered at high risk for developing diabetes, the ADA recommends that screening for the development of diabetes be performed every one to two years. However, at least one study showed that only 37% of women underwent the postpartum diabetes screening tests recommended by the ADA.[7] Gestational diabetes is diagnosed when women who have never had diabetes before develop high glucose levels during pregnancy, which can lead to poor outcomes for the baby such as a high birth weight, delivery injuries, and increased risk of diabetes later in life for both the baby and the mother.[8] Perceptions about health beliefs and lifestyle behaviors may be an important part of the equation for care for women with gestational diabetes. These perceptions include not only a women's belief about their risk factors, but their experiences within the health care system itself. In ambulatory care settings, a comprehensive health care review includes a range of interactions with different providers including physicians, pharmacists, nutritionists, and nursing staff. Compliance with the directives of their healthcare providers, such as medication adherence, physical activity, and proper eating may be dependent upon women's positive or negative experiences with care. [9,10] It is important that research be conducted to determine specific strategies to improve rates of screenings among people at high risk of developing diabetes, like women who have had gestational diabetes, so that they are able to receive quality care and prevent significant costs associated with the disease.

In this study, we sought to determine if women with a history of gestational diabetes were more likely to be screened and diagnosed with diabetes depending on their level of medical care and satisfaction with their patient/provider relationship. Previous research has shown that patient trust in his or her physician may positively influence patient adherence to diabetes management recommendations.[11] However, one study found that while longer continuity of care was associated with greater patient satisfaction and confidence in one's physician, it was not associated with a greater likelihood of receiving recommended preventive services.[12] Therefore, in order to make evidence-based recommendations about improving diabetes screening, more information is needed about whether satisfaction with the patient/provider relationship makes a difference in screening practices of patients and the prevalence of diabetes. The results of this study could emphasize the importance of preventative practices and expand the amount of evidence available to healthcare providers about increasing the amount of time invested in their patients in order to improve their patients' satisfaction with their relationship and overall health outcomes.

Methods

Participants

This study analyzed data from the Kentucky Women's Health Registry (KWHR), which is an observational, sequential cohort study surveying women ages 18 and older living in Kentucky about their health behaviors, preventative practices, access to healthcare, and health outcomes. The primary goal of the KWHR is to improve understanding of diseases affecting women in Kentucky. The KWHR uses convenience

and snowball sampling to attempt to recruit at least 1500 new participants to the study each year by three primary methods: through KWHR partners, attendance at health events, and referrals from current participants. After women have completed an initial questionnaire, they are then asked to complete follow-up surveys annually. Between the years 2006 and 2010, the KWHR was able to enroll 13,328 women, with at least 7,646 completing follow-up after one year, and 4,113 having at least three years of follow-up. The KWHR granted approval for use of the registry data from 2006 to 2011 for this study. The Institutional Review Board at the University of Kentucky considered this study to be exempt from review, due to the use of secondary, de-identified data.

Study Design

This observational study was conducted using a cross-sectional research design. We specifically reviewed KWHR questionnaires taken between 2007-2011, from 776 women who reported that they had experienced gestational diabetes during pregnancy; questionnaires from 2006 were excluded because the survey did not evaluate the participants' satisfaction with their healthcare provider. We then classified the women who reported they had experienced gestational diabetes into three groups: those who developed diabetes, those who developed pre-diabetes, or those who did not develop diabetes after pregnancy. Specific measures surveying the women's level of medical care and satisfaction in their relationship with their healthcare providers were analyzed to determine the differences in prevalence of diabetes between the three groups.

Measures

Participants experience with gestational diabetes was used as this study's eligibility criterion and predictor variable. The outcome of primary interest in this study was participants' diabetes status after pregnancy. Participant characteristics, such as level of medical care, patient/provider relationship satisfaction, and demographics were used to describe the sample and as potential mediators in statistical analysis.

Experience with Gestational Diabetes. Whether or not the patient experienced gestational diabetes was measure with the following question: " During your pregnancies did you experience any of the following: Gestational diabetes?" Response items were the following: *yes* and *no*.

Diabetes Status After Pregnancy. Diabetes status, whether or not the patient self-identifies as having diabetes, was measured with the following question: "Do you have any form of diabetes?" Response items were the following: *insulin resistance, glucose intolerance, or pre-diabetes; Type I diabetes; Type II diabetes, diet controlled only; Type II diabetes, taking pills; Type II diabetes, on insulin; Type II diabetes, taking both pills and insulin; yes, but don't know what type;* and *no*. For statistical analysis, participants who responded with *insulin resistance, glucose intolerance, or pre-diabetes* were classified as pre-diabetics, those who responded with *Type I diabetes; Type II diabetes, diet controlled only; Type II diabetes, taking pills; Type II diabetes, on insulin; Type II diabetes, taking both pills and insulin; yes, but don't know what type* were classified as diabetics, and those who responded *no* were classified as non-diabetics.

Level of Medical Care. The participants' level of medical care was measured with two questions. The first question was: "In the past 12 months, how many times have you been to the doctor?" Response items were the following: *0, 1-4, 5-10,* and *more than 10.* The second question was: "Have you ever had any of the following screening tests? Diabetes testing." Response items were the following: *yearly, less often,* and *never.* For statistical analysis, each response item was coded and analyzed individually.

Patient/Provider Relationship Satisfaction. The participants' level of satisfaction in their relationship with their primary healthcare provider was measured using four questions: "Were you satisfied with: The amount of time you had to wait after you arrived?," "Were you satisfied with: The amount of time your provider spent with you?," "Were you satisfied with: The advice you got to take care of yourself?," and "Were you satisfied with: The understanding and respect the staff showed toward you as a person?" Response items were the following: *yes* and *no.* For statistical analysis, each response item was coded and analyzed individually.

Demographics. The KWHR questionnaire included items to assess age, race, education, marital status, employment, and county of residence.

Statistical Analysis

In order to examine the relationships between women's experience with gestational diabetes and their diabetes status after pregnancy, depending on their level of medical care, patient/provider relationship satisfaction, participation in the diabetes educational service, and demographics, we performed an analysis of questionnaire data from the KWHR using SPSS Version 20. To examine the effect that the mediating

variables (level of medical care and patient/provider relationship satisfaction) had on diabetes status, our primary outcome of interest, we performed multiple chi-square tests, which independently analyzed the relationships between the variables. Chi-square tests are appropriate for this study because they are commonly used to compare observed frequencies of categorical data to expected frequencies. All table frequencies, chi-square values, and p values are reported.

Results

The mean age of the 776 women who were included in this study was 48.3 years, with almost half (46.9%) reporting that they were between 45-64 years old (Table 1). They were predominantly white (96.1%) and married (74.9%), but were almost equally split between rural (43.3%) and urban (56.7%) residencies. Slightly more than half (52%) of the women reported that they had earned a bachelor or graduate degree, and 74% considered themselves to be employed.

Among this sample of women who had a history of gestational diabetes during pregnancy, 185 (24%) were self-reported diabetics, 58 (7.5%) had pre-diabetes, and 529 (68.5%) did not have diabetes at the time of their survey. Over half of the women visited their doctor between 1-4 times in the previous 12 months (56.8%) and participated in a yearly diabetes screening (58.8%). A large majority of the women responded positively to the survey questions related to their satisfaction with their primary care provider.

When we conducted chi-square tests with diabetes status and the level of medical care mediating variables, both results were statistically significant (Number of visits to the doctor: X^2=40.333, p<0.000 and Participation in diabetes screening test: X^2=155.723,

p<0.000) (Table 2.1). Although, when we conducted chi-square tests with diabetes status and patient/provider relationship satisfaction variables, none of the results were significant (Table 2.2). However, our results were statistically significant when we conducted chi-square tests with diabetes screening and three of the four patient/provider relationship variables (Wait time: X^2=12.356, p=0.002, Time spent: X^2=8.276, p=0.016, Advice given: X^2=13.066, p=0.001, Respect given: X^2=3.221, p=0.200) (Table 2.3).

Discussion

This study found that among the women who reported that they had experienced gestational diabetes during pregnancy, 31.5% of them considered themselves to be diabetic or pre-diabetic at the time they took the KWHR survey; this finding is consistent with national statistics which report that women who have had gestational diabetes have a 35 to 60 percent chance of developing diabetes in the next 10–20 years and supports that these women could greatly benefit from public health services related to the prevention of diabetes and early diagnosis.[1] The need for a greater emphasis on follow-up for these women is also evidenced by the finding that 9.9% of the women had never participated in a post-natal diabetes screening test; almost all of these women indicated that they were not diabetic at the time of the survey, so it is possible that they could be in the large percentage of people who have diabetes without knowing. Studies have identified many barriers to follow-up such as tiredness, maternal attachment, childcare demands, work schedules, child and family development, and poor communication between obstetric and gynecology care providers and primary care providers.[13,14] There is a definite public health need for interventions to be developed which take into account these barriers and

make post-partum and longitudinal diabetic screenings more of a priority to women and their health care providers.

This study also showed that there were statistically significant differences in the amount of medical care the women received depending on their diabetes status after delivery. Those who considered themselves to pre-diabetic or diabetic more often visited their doctor more than 5 times in the last year and received yearly diabetic screenings, compared to those who were not diabetic who most frequently visited their doctor between 1-4 times in the last year and were more likely to have diabetic screenings less often. These results likely do not signify that women with a history of gestational diabetes were more likely to be screened and diagnosed with diabetes depending on their level of medical care as hypothesized, but rather that once they had developed signs and symptoms of the disease and were diagnosed, they required a higher level of medical care to manage their diabetes. Appropriate care from healthcare providers is vital for controlling symptoms, reducing complications, and the reducing the cost associated with diabetes; in 2009, 19% of all hospitalizations (114,977) were related to diabetes and the American Diabetes Association calculated the direct and indirect cost of living with diabetes to be $2,043,000,000 in Kentucky alone.[15] Living with diabetes can be a huge physical, mental, and economical burden, which is why it is so important to make screening more of a public health priority, especially in high risk populations like women with a history of gestational diabetes.

This study did not completely support our hypothesis that women with a history of gestational diabetes were more likely to be screened and diagnosed with diabetes depending on their satisfaction with their patient/provider relationship since there were

no statistically significant differences in the participants' patient/provider relationship satisfaction depending on their diabetes status after delivery. Almost everyone who participated in the study indicated that they were satisfied with their wait time, time spent with their provider, the advice they were given, and the understanding and respect their were shown, and even those who were not satisfied were evenly distributed among the diabetes status classification groups. This result could possibly be explained by the fact that the sample of women used for this study was primarily made up of white, middle aged, well-educated women, while most studies that support that patients' trust and satisfaction with their provider are important are usually in vulnerable populations, such as the elderly, less educated, and those who rely on Medicaid or Medicare insurance.[16] However, the study did show that women with gestational diabetes were more likely to be appropriately screened for diabetes when they were satisfied with their patient/ provider relationship. Those who considered themselves to be satisfied were more likely to get yearly screenings and less likely to have never been screened after delivery than those who were not satisfied. While this study may not show that patient/provider relationship satisfaction makes a statistical difference between the diabetes status groups in this particular population, it is important to remember that patient satisfaction could still be making clinically significant differences by increasing yearly screenings and improving the patients' health outcomes.

The minor amount of variation in the demographic characteristics of the sample used for this study is one of its primary limitations, and likely a result of the KWHR's use of convenience and snowball sampling; this limitation greatly reduces this study's external validity. Another major limitation due to the method of surveying is that the data

is cross-sectional; due to this limitation, there is no way to follow the progression of the participants after their experience with gestational diabetes to the present time. Furthermore, since this data was collected by surveys, there is always a chance that self-report bias could have had an impact on the results and there was no way to validate the participants' responses. The study's design to analyze secondary data from the KWHR also acted as a limitation because the questions used were not specifically designed for this purpose and only generally surveyed the participants about their level of satisfaction with their provider.

Although our findings did not completely statistically support our hypothesis, the prevalence of diabetes in this population alone should prompt all healthcare providers to put more emphasis on the importance of practicing preventative services and screenings and inspire more research about how to increase the number of people who are being screened for diabetes. Since some of the main barriers listed as reasons why women with gestational diabetes do not receive proper post-natal screenings revolve around lack of time, research should be conducted to identify healthcare settings that allow for quick and convenient screenings practices. One possible avenue to pursue would be to research the effect pharmacists could have on diabetes screening practices among high risk populations since pharmacists are already involved in healthcare screenings, knowledgeable about diabetes management, and offer convenient hours and locations.[17] Pharmacists could also be valued in terms of improving continuity of care, if the patients use the same pharmacy consistently from the time they are diagnosed with gestational diabetes under the care of their obstetrician until they have completed the transition back to the care of their primary care physician. Also, as electronic medical records become

more prevalent and are able to be shared between healthcare providers and patients, more effort should be made into researching how to best communicate issues that require follow-up at transitions of care and ways to remind providers and patients of the follow-up that is required.

While our society often thinks it is up to the individual to make sure that they are keeping themselves healthy, public health research continues to show through the ecological model that overcoming health issues requires evaluating all possible factors that may be contributing to the problem in order to find the best solution. If we truly intend to meet the Healthy People 2020 objective of increasing the proportion of persons with diabetes whose condition had been diagnosed by 10%, it will be important for patients, healthcare providers, and researchers to work together and make it a priority to develop ways to increase screenings. Focusing on high-risk populations, like women with a history of gestational diabetes, may be one effective strategy to begin to improve the proportion of people who are actually being screened and diagnosed.

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Table 1. Characteristics of Women in Kentucky Women's Health Registry who have Experienced Gestational Diabetes, N=776

Characteristic	N (%)
Diabetes status at time of survey	
Pre-diabetes	58 (7.5)
Diabetes	185 (24)
No diabetes	529 (68.5)
Level of medical care	
Number of visits to the doctor (in the past 12 months)	
0	34 (4.4)
1-4	439 (56.8)
5-10	193 (25)
More than 10	107 (13.8)
Participation in diabetes screening test	
Yearly	450 (58.8)
Less often	239 (31.2)
Never	76 (9.9)
Patient/provider relationship satisfaction	
Satisfied with the amount of wait time after arrival	567 (74.5)
Satisfied with the amount of time spent with provider	641 (84.3)
Satisfied with the advice given to take care of yourself	646 (85.1)
Satisfied with the understanding and respect the staff showed	677 (89.3)
Demographics	
Age (years)	
Mean (SD)	48.3 (11.1)
18-44	298 (38.4)
45-64	364 (46.9)
65 or older	114 (14.7)
Race	
White	743 (96.1)
Other	30 (3.9)
Education	
High school or less	86 (11.1)
Some college or associate	277 (35.8)
Bachelor or graduate	402 (52)
Other	9 (1.2)
Marital status	
Married	579 (74.9)
Divorced/separated	146 (18.9)
Widowed	32 (4.1)
Never married	16 (2.1)
Employment	
Employed	571 (74)
Unemployed	18 (2.3)
Not in labor force	173 (22.4)
Other	10 (1.3)
Rural/Urban residence	
Rural	326 (43.3)
Urban	427 (56.7)

Table 2.1 Diabetes Status Percentages by Level of Medical Care

Diabetes Status	Number of Visits to the Doctor				X^2	p value	Participation in Diabetes Screening Test			X^2	p value
	0	1-4	5-10	>10			Yearly	Less Often	Never		
Pre-diabetics	0 (0)	27 (46.6)	20 (34.5)	11 (19)	40.333[a]	0.000	46 (79.3)	12 (20.7)	0 (0)	155.723[b]	0.000
Diabetics	2 (1.1)	83 (44.9)	62 (33.5)	38 (20.5)			172 (94.5)	9 (4.9)	1 (0.5)		
Non-diabetics	31 (5.9)	62 (62.4)	111 (21.1)	56 (10.6)			229 (44)	217 (41.7)	75 (14.4)		

[a] One cell (8.3%) has an expected count less than 5. The minimum expected count is 2.49.
[b] Zero cells (0.0%) have an expected count less than 5. The minimum expected count is 5.79.

Table 2.2 Diabetes Status Percentages by Patient/Provider Relationship Satisfaction

Diabetes Status	Amount of Wait Time After Arrival		X^2	p value	Amount of Time Spent with Provider		X^2	p value	Advice Given to Take Care of Yourself		X^2	p value	Understanding and Respect the Staff Showed		X^2	p value
	Yes	No			Yes	No			Yes	No			Yes	No		
Pre-diabetics	43 (74.1)	15 (25.9)	0.047[a]	0.977	49 (84.5)	9 (15.5)	0.085[b]	0.958	50 (86.2)	8 (13.8)	0.092[c]	0.955	51 (87.9)	7 (12.1)	0.833[d]	0.659
Diabetics	136 (75.1)	45 (24.9)			154 (85.1)	27 (14.9)			154 (85.6)	26 (14.4)			165 (91.2)	16 (8.8)		
Non-diabetics	386 (74.4)	133 (25.6)			436 (84.2)	82 (15.8)			440 (84.9)	78 (15.1)			459 (89)	57 (11)		

[a] Zero cells (0.0%) have an expected count less than 5. The minimum expected count is 14.77.
[b] Zero cells (0.0%) have an expected count less than 5. The minimum expected count is 9.04.
[c] Zero cells (0.0%) have an expected count less than 5. The minimum expected count is 8.59.
[d] Zero cells (0.0%) have an expected count less than 5. The minimum expected count is 6.15.

Table 2.3 Percentages of Patient/Provider Relationship Satisfaction by Diabetes Screening

Diabetes Screening	Amount of Wait Time After Arrival		X^2	p value	Amount of Time Spent with Provider		X^2	p value	Advice Given to Take Care of Yourself		X^2	p value	Understanding and Respect the Staff Showed		X^2	p value
	Yes	No			Yes	No			Yes	No			Yes	No		
Yearly	348 (61.6)	100 (52.1)	12.356[a]	0.002	386 (60.5)	61 (51.7)	8.276[b]	0.016	392 (61.0)	55 (49.1)	13.066[c]	0.001	405 (60.1)	42 (52.5)	3.221[d]	0.200
Less Often	173 (30.6)	61 (31.8)			197 (30.9)	37 (31.4)			198 (30.8)	36 (32.1)			207 (30.7)	26 (32.5)		
Never	44 (7.8)	31 (16.1)			55 (8.6)	20 (16.9)			53 (8.2)	21 (18.8)			62 (9.2)	12 (15.0)		

[a] Zero cells (0.0%) have an expected count less than 5. The minimum expected count is 19.02.
[b] Zero cells (0.0%) have an expected count less than 5. The minimum expected count is 11.71.
[c] Zero cells (0.0%) have an expected count less than 5. The minimum expected count is 10.98.
[d] Zero cells (0.0%) have an expected count less than 5. The minimum expected count is 7.85.

Biographical Sketch:

Courtney Danielle Ryan graduated from the University of Kentucky in 2010, with a B.S. in Biology, and then went on to pursue a PharmD/MPH dual degree with an anticipated graduation in May 2014. After graduation, Courtney will be taking a pharmacist position with Meijer Pharmacy.

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