

Evaluating the Effectiveness of Physician and Clinical Pharmacist Patient Education and Disease Management in Diabetes Mellitus

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Abstract

Diabetes mellitus is the leading cause for blindness, kidney failures, and non-traumatic lower limb amputations. However, if properly managed, most of the disease's complications can be avoided or delayed. Patient education and counseling empower patients with knowledge to better manage and control their disease. This project evaluates the effectiveness of diabetes education and counseling by a clinical pharmacist in reducing hemoglobin A1c levels and increasing diabetes knowledge and patient satisfaction. The HbA1c record of the patients before and after receiving the additional diabetes education were retrieved from the EHR. Surveys were conducted to measure patient knowledge and satisfaction on patients who received the extra diabetes education and on patients who did not. HgA1c levels dropped by a mean of 0.69% for patients who had received the diabetes education. Patients with diabetes education had higher satisfaction (4.6 out of 5) than patient without (4.2 out of 5). Patients with diabetes education scored only slightly higher on diabetes knowledge survey than patient without (81.2% vs. 78.7%). Therefore, glycemic control improved after receiving diabetes education and counseling by the pharmacist, but diabetes knowledge gained from the pharmacist was not the only factor that improved HbA1c outcome.

Keywords: diabetes mellitus, patient education and counseling, clinical pharmacist, diabetes knowledge, patient satisfaction; hemoglobin A1c

Introduction

The Centers for Disease Control reported a total of 25.8 million, or 8.3 %, of the U.S. population having either diagnosed or undiagnosed diabetes (2014). Nationally, diabetes is the leading cause of vision loss, kidney failure, and non-traumatic limb amputations (CDC, 2014). Diabetes treatment and related costs was 10% of national health care spending in 2010 and totaled \$245 billion in 2012 (DFM, 2014; Mississippi State Department of Health, 2012). However, when diabetes is properly managed, disease sequelae can be prevented. With primary care physicians nationally overburdened with patients and limited in visit time, patient educators can fill in the gap for diabetes education and counseling. The American Diabetes Association recommends the annual assessment of patient self-management skills and knowledge while making diabetes education resources available to the patients (American Diabetes Association Standards, 2002). Patient education and counseling empowers patients with knowledge to better manage their disease (de Weerd, Visser, & van der Veen, 1989). The objective of the project is to evaluate the effectiveness of diabetes education and counseling provided by a clinical pharmacist in controlling diabetes by measuring the A1c outcome before and after the diabetes education. The second objective is to evaluate the effectiveness of diabetes education and counseling by comparing the diabetes knowledge and patient satisfaction of diabetic patients who received diabetes education and counseling from the pharmacist with those who did not receive the service and only saw their primary care physician for diabetes treatment.

Background

The purpose of patient education is to improve glycemic control, delay or avoid complications, increase quality of life, and keep treatment cost effective (de Weerd, Visser, & van der Veen, 1989). Studies have shown that self-management education for adults with type 2

diabetes had improved glycemic control for the period within the first several months of the intervention; however, the effects diminished after the completion of the intervention (Norris, Lau, Smith, Schmid, & Engelgau, 2002; Cranor, Bunting, & Christensen, 2003).

The clinical pharmacist serving as the diabetes educator in this project offers a myriad of services to his diabetic patients over several visits as they are needed for each patient's current disease condition. He educates in layman's term the disease process of diabetes, counsels them about appropriate nutrition and exercise, works with his patients to set realistic goals and keep them accountable, and helps them to understand their medications and how to properly take them. The diabetes educator gives ample time for patients to ask questions and collaborates with the patients to make individualized treatment plans. The diabetes educator spends anywhere from 15-30 minutes with established patients and 45-60 minutes with new patients in each visit.

The frequency of the visits for each patient depends how well controlled the patient's blood glucose is. Duration of contact time with the diabetes educator and patient is an important indicator of the effectiveness of the diabetes services (Norris et al., 2002). I hypothesize that diabetic patients who received diabetes education and counseling from the clinical pharmacist have greater improvement of their A1c levels than before receiving the service. For my second hypothesis, I hypothesize that diabetic patients who received diabetes education and counseling have higher satisfaction and more diabetes knowledge than patients who did not receive the service.

Methodology

The setting of this project was in Jackson, Mississippi, in the Adult Medicine Departments at the Main and South clinics of Jackson-Hinds Comprehensive Health Center

(JHCHC). The subjects were diabetic patients of either South or Main clinic who had or had not received diabetes education and counseling from the clinical pharmacist.

A1c Data Collection

The project is a retrospective cohort study for the part of the hemoglobin A1c outcome. The list of patients who received diabetes education and counseling from the clinical pharmacist was obtained and the A1c record of the patients were retrieved from JHCHC's electronic health record (EHR) system. The subjects must be 18 years or older, have three A1c records, and have at least two encounters with the diabetes educators.

To calculate the change in A1c of the diabetic patients before and after receiving the diabetes education and counseling, a baseline, before, and after A1c's were chosen. The baseline A1c is the closest A1c recorded before the date of the first encounter with the diabetes educator. The before A1c is the A1c recorded anytime between one to 24 months before the first encounter with the diabetes educator. The A1c of the patient that is dated closest to six months before the first diabetes education encounter is chosen as the Before A1c. The after A1c is the most current A1c recorded after the first encounter with the diabetes educator and must be at least a month after the first diabetes encounter. To calculate the change in A1c before the patient received any diabetes education, the before A1c was subtracted from the baseline A1c. To calculate the change in A1c after the patient received the diabetes education, the baseline A1c was subtracted from the after A1c. The mean of the change in the A1c before and after receiving the diabetes education and counseling was calculated. To take into account the elapsed time between the recorded before, baseline, and after A1c, the change in A1c was divided by the months that had elapsed between the recorded A1c dates, and the mean was taken to determine the change in A1c per month before and after receiving the diabetes services from the diabetes educator.

Patient Satisfaction and Knowledge Survey

A 14-question survey was designed to measure patient satisfaction and knowledge and learn about obstacles the patients face in trying to control their blood glucose. Five survey questions were on patient satisfaction using the Likert scale. Another five questions assess patient knowledge of diabetes using multiple choice questions. The last four questions asked about challenges patient face with controlling their diabetes. The surveys were conducted either at the beginning or the end of the patient visit at the clinic based on convenience. I surveyed diabetic patients who did and did not receive extra diabetes education and counseling. Patient must have been diagnosed with diabetes for at least three months. Patients were told that the survey was anonymous, and the surveys were read to them. The average score for the knowledge survey questions and the values of patient satisfaction survey questions were compared between the group that received that diabetes education and the group that did not received the service.

Results

A1c Outcome

A total of 15 diabetic patients matched the A1c criteria and their A1c records were used to determine the change in A1c before and after receiving the diabetes education from the diabetes educator. The mean change in A1c before the first encounter with the diabetes educator is 0.97% over an average of 8.3 months, or an increase of 0.16% per month. The mean change in A1c after the first encounter is -0.69 DCCT % over an average of 5.6 months, or a decrease of 0.26% per month. The mean before A1c is 9.55%; the mean baseline A1c is 10.52%; and the mean after A1c is 9.83%. The mode of baseline A1c levels fell within 10.0-10.9% range. The mode of after A1c levels fell within the 8.0-8.9% and 9.0-9.9% ranges (refer to figure 1 in appendix 1). Before the first diabetes education encounter, 33% of the patients had decreasing

A1c levels. After the receiving some diabetes education and counseling, 67% of the patients had decrease A1c levels.

Patient Satisfaction and Knowledge

Seventeen surveys were collected from the group that had diabetes education and counseling with the diabetes educator, and 15 surveys were collected from the group of patients with no extra diabetes education and only saw the physician for diabetes treatment. On average, the patient satisfaction is higher for diabetic patient who had diabetes education and counseling compared to diabetic patients who did not use the diabetes service. The mean patient satisfaction score of patients with extra diabetes education is 4.6 out of 5 on the Likert scale compared to 4.2 of patients without extra diabetes education. How well the patients felt they understood their diabetes drugs was the largest difference seen in the patient satisfaction survey questions between the two groups. Question five, which was about how in control the patients felt about their diabetes, scaled the lowest among the five questions by both groups (refer to figure 2 in appendix).

Patient knowledge is slightly higher with diabetic patients who received diabetes education and knowledge than patients who did not by 2.5%. The average patient knowledge score is 81.2% for diabetes education patient and 78.7% for patients without the extra diabetes education. Both groups scored lowest in their knowledge of normal A1c and normal fasting blood glucose range (refer to figure 3 in appendix).

For the challenges of controlling blood glucose section of the survey, 60% of the group with no extra diabetes education answered that eating the wrong foods is usually the reason why their blood sugar is too low or too high, and 73% said that eating right was the hardest thing about controlling their diabetes. The top answers for what this group would like to learn more

about during their diabetes visits are diabetes medicine and eating healthy. For the group with diabetes education and counseling, the top answers for the reason why their blood sugar is out of normal range are forgetting to take their medication or eating the wrong foods, and 53% answered that eating right was the hardest thing about controlling their diabetes. Both groups had over 50% answering yes when asked whether they had a support system for their diabetes outside of the clinic. For the percentage of people who answered no, the majority in both groups would like to have some sort of emotional or mental support.

Discussion

On average, diabetic patients who received diabetes education and counseling by the clinical pharmacist had improved A1c outcome though the results is not statistically significant. The mean decrease in A1c of the patients after receiving diabetes education is -0.69%, which is comparable to the effectiveness of the ~0.75% reduction seen in certain oral antidiabetic drugs such as DPP-4 inhibitors and Meglitinides (Sherifalis et al, 2010). The observed A1c decrease is also consistent with a meta-analysis study that shows self-management diabetes education led to a 0.75% reduction in A1c. The study has shown that 24.3 hours of contact time with the educator and patient was needed to reduce A1c by an absolute 1% (Norris et al., 2002). The group with diabetes education also had higher patient satisfaction and scored slightly higher on the patient knowledge survey questions compared to the group without extra diabetes education. Unfortunately, the sample sizes of these results are small and are not statistically significant; thus the data cannot be extrapolated to Jackson-Hinds Comprehensive Health Center's diabetic patient population.

Although the data is not statistically significant, there are a few reasons that may explain why double the diabetic patients had decreasing A1c's after they had diabetes education and

counseling. Not only did the clinical pharmacist educate the patient about diabetes and ways to control blood glucose, the pharmacist also kept the patients accountable and took extra care to make sure that the patients had their medicine and diabetes-related items to properly manage their diabetes. If the patients needed financial assistance with their prescription, he referred them to the social worker and often reminded them to see the social worker before their medicine ran out. Another factor that may have contributed to improvement in A1c outcome is that patients had a better understanding of their drugs and how to properly use them because good control of blood glucose requires precise administration of oral antidiabetic drugs and/or insulin. More patients with extra diabetes education said they had a good understanding of their diabetes drugs as compared to patients who did not have extra diabetes education. Emphasis to patients on drug knowledge is one of the advantages of having a clinical pharmacist as a diabetes educator.

Interestingly enough, there was no large difference between the group with extra diabetes education and the group without it. This result could mean that the survey questions were not relevant to what was taught in the diabetes visit or that diabetes knowledge is not as important a factor in determining the health outcome. No questions tested how well the diabetes patients know about their diabetes drugs although more patients with extra diabetes education from the pharmacist said they had good understanding of their diabetes drugs compared to patients without the extra diabetes education. Many patients asked the diabetes educator very specific diabetes questions that apply to their personal lives, which made it harder to assess their knowledge. From observation, barriers to well controlled diabetes may have negated the effects of diabetes knowledge. These barriers include inability to afford medicine, lack of time to exercise, and lack of resources to obtain a healthy diet.

There are several limitations to this project aside from the sample size. A handful of the patients that did not receive extra diabetes education were new patients of JHCHC; thus, they did not make a good representation of the patient population who regularly goes to JHCHC. Numerous variables were uncontrolled and unknown in the project. Patients could have run out of medication for a period of time, causing them to have uncontrolled blood glucose and to be referred to the diabetes educator. Therefore, the A1c outcome of some cases cannot be determined as to whether it was the result of the extra diabetes services or just the result of being on diabetes medication again. Another limitation is the lack A1c records, which is one of the main reasons the sample size is small. A1c levels was also not consistently tested for reasons such as lack of financial means or the patients would stop coming to the clinic for a period of time. As a result, it was difficult to obtain evenly spaced A1c record or track the change in A1c levels over time. The frequency of patient visits with the diabetes educator was not taken into account in the effectiveness on A1c outcome. The other limitation is that there was only one clinical pharmacist acting as the diabetes educator. Most of the patients referred for diabetes education were difficult cases with high A1c levels (average A1c of 10.5%) when they had their first encounters with the diabetes educator. Therefore, the level of compliancy for the group with extra diabetes education could have been lower overall.

This project has raised more questions than answers, such as what are the A1c outcomes of patients who did not received diabetes education and counseling from the diabetes educator and is it cost effective to use clinical pharmacists as diabetes educators. According to the Ashville Project, which use clinical pharmacist as diabetes educator for medically underserved communities in Ashville, North Carolina, patient education by clinical pharmacist was found to be cost effective (Cranor, Bunting, & Christensen, 2003). In addition to increasing the size of the

project, further research possibilities could be to evaluate the effectiveness of social workers, certified diabetes educators, and nutritionists on controlling diabetes. Case studies could also be done on the patients who have well controlled diabetes. More data (e. g., demographics and patient history) can be gathered on the patients with diabetes education so that different factors influencing diabetes can be studied in detail. A possible immediate result of the project is that some patients who answered incorrectly in the knowledge section were given the right answer and now know correct facts about diabetes. Patients who did not have extra diabetes education were told of the availability of diabetes education during the survey. Another tangible result is that now there is an organized A1c record of the fifteen patients of the diabetes educator, which can be used for future studies.

Recommendations

Some recommendations that I would suggest is to increase awareness and availability of diabetes education and counseling to all diabetic patients and physicians at JHCHC. The diabetes education provided by the clinical pharmacist is a free service to the clinic and patients because the pharmacist is employed by the University of Mississippi.

Also, I would recommend all clinics to hold diabetes classes that are provided free of charge by pharmaceutical companies. The diabetes classes are taught by certified diabetes educators, and the preparation for the classes is done by the company's representative. The classes are unbranded, meaning that it will not be an advertisement for the drugs of the company.

About 50% of the diabetic people surveyed in both groups said they did not have a support system for their diabetes outside of the clinic, and of that 50%, over 70% of either group said they would like to have mental and emotional support such as a diabetes support group. Peer support group is low in cost and has been shown to improve health outcomes of participants

(Heisler, 2007). Thus, I would suggest that the diabetes educator, social worker, nutritionist, and physicians identify patients who are interested in leading or participating in diabetes support group and connect these patients.

Emphasizing the normal sugar range to diabetic patients could help increase patient monitor of blood sugar. Forty percent of the group with no extra diabetes education did not know the normal fasting sugar range nor did about 30 % of the group with extra diabetes education. Making patients more aware of their blood sugar ranges could help them know what causes their blood sugar to be out of range and learn to avoid unhealthy behaviors. According to the Standard of Care in Diabetes, the American Diabetes Association recommends that type 2 diabetics with stable blood glucose should have A1c testing done twice a year while those with uncontrolled blood glucose should have A1c tests every three months (2014). This recommendation can be financially burdensome for patients with low income and no health insurance, which is why it is not followed by all clinics. I would suggest that clinics find a way to make the A1c test free for those patients.

Conclusion

My hypotheses were supported; however, the results were not statistically significant. Numerous other studies have shown that diabetes education is effective in decreasing HbA1c, which will prevent severe complications of diabetes in the future. The U.K. Prospective Diabetes Study revealed that with each 1% decrease in Hba1c over 10 years, there is reduction by 21% of diabetes related deaths, 14% for myocardial infarction, 37% for microvascular complications, and 21% in end-point diabetes complications (Sratton et al., 2000). By increasing the awareness of the availability of diabetes education provided by the clinical pharmacist as well as free diabetes education classes provided by pharmaceutical companies, the diabetic patient

population of Jackson-Hinds Comprehensive Health Center would benefit by seeing more satisfied patients with better control of their diabetes.

References

- American Diabetes Association (2002). Standards of medical care for patients with diabetes mellitus (Position Statement). *Diabetes Care*, 26, S33–S43.
- American Diabetes Association (2014). Standards of Medical Care in Diabetes—2014. *Diabetes Care*, 37, S14-S80
- Center for Disease Control (2014). *National diabetes statistics report, 2014*. Retrieved from <http://www.cdc.gov//diabetes/pubs/statsreport14/national-diabetes-report-web.pdf>
- Cranor, C. W., Bunting, B. A., & Christensen, D. B. (2003). The Asheville project: Long-term clinical and economic outcomes of a community pharmacy diabetes care program. *Journal of the American Pharmacists Association*, 43, 174-84
- de Weerd, I., Visser, A., & van der Veen, E. (1989). Attitude behavior theories and diabetes education programmes. *Patient Education and Counseling*, 14, 3–19.
- Diabetes Foundation of Mississippi (2014). *The burden of diabetes on Mississippi*. Retrieved from <https://www.msdiabetes.org/statistics-and-burden-diabetes-mississippi>
- Heisler, M. (2007). Overview of peer support models to improve diabetes self-management and clinical outcomes. *Diabetes Spectrum*, 20, 214-221.
- Mississippi State Department of Health (2012, Sept. 6). *Diabetes in Mississippi*. Retrieved from http://msdh.ms.gov/msdhsite/_static/43,0,296.html
- Norris, S. L., Lau, J., Smith, J., Schmid, C. H., & Engelgau, M. M. (2002). Self-management education for adults with type 2 diabetes: A meta-analysis of the effect on glycemic control. *Diabetes Care*, 25: 1159-1171.
- Sherifalis, D., Nerenberg, K., Pullenayegum, E., Cheng, J. E., & Gerstein, H. C. (2010). The effect of oral antidiabetic agents on A1C levels: A systemic review and meta-analysis. *Diabetes Care*, 33, 1859-1864.
- Sratton, I. M., Adler, A. I., Neil, H. A., Matthews, D. R., Manley, S. E., Cull, C.A.,... Holman, R. R. (2000). Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes. *BMJ*, 321, 405–412.

Appendix

Appendix 1: A1c Results Graph

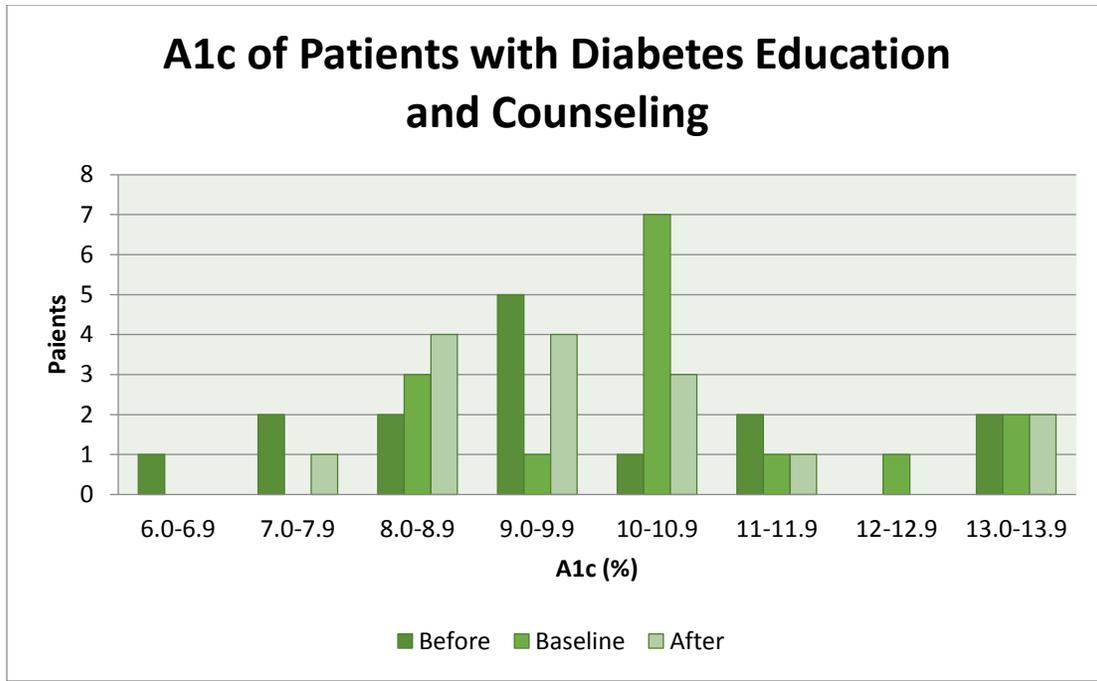


Figure 1: Histogram of the A1c levels of patient with diabetes education and counseling.

Appendix 2: Patient Satisfaction and Knowledge Survey Results Graphs

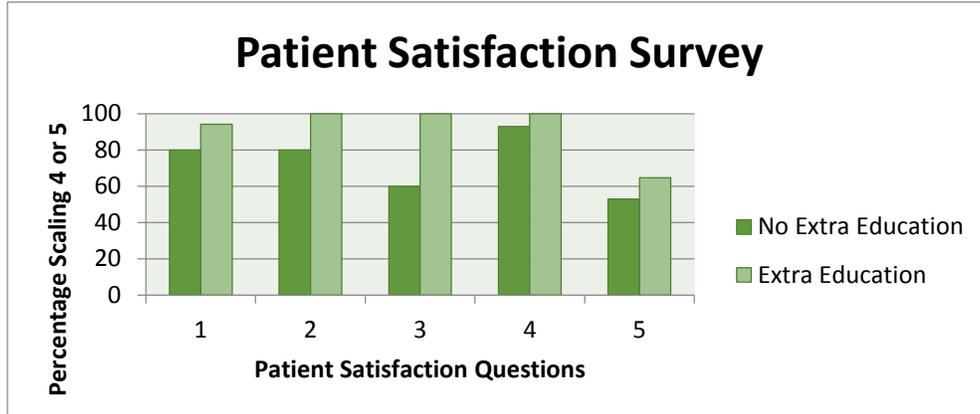


Figure 2: The percentage of people who scaled 4 or 5 on each statement in the patient satisfaction survey. Refer to appendix 3 to see the five statements in the survey.

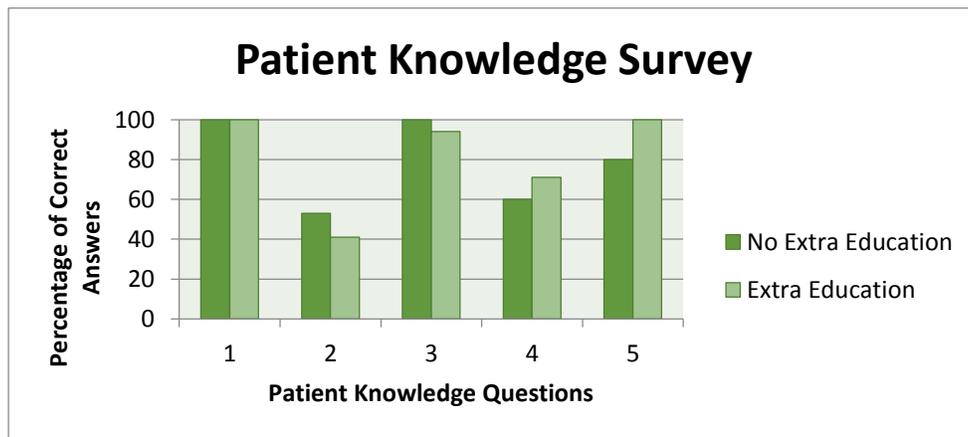


Figure 3: The percentage of people who answered correctly for each question in the patient knowledge survey.

- a. 10 – 60 mg/dl
- b. 70 – 130 mg/dl
- c. 140 – 200 mg/dl
- d. 200 – 300 mg/dl

5. Uncontrolled diabetes can result in which of the following?
- a. Blindness
 - b. Nerve damage and amputations
 - c. Kidney failure
 - d. All of above
-

1. When your blood sugar is too low or too high, what is usually the reason?
- a. Forgetting to take my medicine
 - b. Running out of my medicine
 - c. Working too hard
 - d. Eating the wrong foods
 - e. Other: _____

2. What would you like to learn more about during your diabetes visits?
- a. My medicines (side effects)
 - b. Diet (eating healthy)
 - c. Exercise options
 - d. How to get financial help for medicines and supplies
 - e. Other: _____

3. What is hardest about controlling your diabetes?
- a. Eating right
 - b. Exercising
 - c. Remembering to take my medicine
 - d. Affording my medicine
 - e. Stress
 - f. Other: _____

4. Do you have a support system for your diabetes outside of the clinic?
- a. No.
 - i. If no, would you like to have emotional and mental support? Yes or no
 - b. Yes.
 - i. If yes, where you get it from (friends, family, diabetes support group, church, etc.)? _____