Original Article
DOI: https://doi.org/10.70749/ijbr.v2i02.235

INDUS JOURNAL OF BIOSCIENCES RESEARCH
https://induspublisher.com/IJBR
ISSN: 2960-2793/ 2960-2807

Knowledge and Practice in Insulin Therapy in Patients with Diabetes Mellitus

Hasil Khan[1], Kaleemullah Khan[1], Aminullah Khan[1], Fazal ur Rehman[1], Moneeb ur Rehman[1], Syed Nadir Shah[1], Sana Ullah Kakar[2]

[1]Department of Medicine, Sandman Provincial Hospital, Quetta, Balochistan, Pakistan.
[2]Balochistan Institute of Psychiatry and Behavioral Sciences (BIPBS), Quetta, Balochistan, Pakistan.

ARTICLE INFO

Keywords

Insulin Therapy, Knowledge and practice, Diabetes Mellitus.

Corresponding Author: Sana Ullah Kakar 2Balochistan Institute of Psychiatry and Behavioral Sciences (BIPBS), Quetta, Balochistan, Pakistan.
Email: sanaullah786.kakar@gmail.com

Declaration

Author's Contributions: All authors contributed to the study and approved the final manuscript.
Conflict of Interest: The authors declare no conflict of interest.
Funding: No funding received.

Article History

Received: 04-10-2024
Revised: 24-10-2024
Accepted: 20-11-2024

ABSTRACT

This study examines the knowledge, practices, and barriers affecting insulin therapy adherence in diabetes patients. Through a qualitative approach, semi-structured interviews were conducted with 100 participants currently on insulin therapy, with responses analysed thematically. Key findings highlighted four themes: healthcare support, psychological and social challenges, economic constraints, and knowledge gaps. While most participants demonstrated adequate knowledge of insulin administration and blood glucose monitoring, gaps were evident in insulin storage and injection site rotation, potentially impacting effectiveness. Psychological barriers such as injection anxiety, social stigma, and fear of long-term dependency significantly affected adherence. Additionally, financial burdens, especially among rural patients, and limited healthcare access were major obstacles. Findings emphasize the need for expanded support through education, counselling, and financial assistance to improve adherence. By addressing these barriers, healthcare providers can enhance diabetes management and patient outcomes.

INTRODUCTION

A metabolic disorder with several etiological components, diabetes mellitus is defined by persistently high blood sugar levels and disruptions in the metabolism of carbohydrates, fats, and proteins. This condition can be caused by either insufficient insulin secretion, resistance to the action of insulin, or both (Alberti KG et al. 1998). In 2013, 382 million people worldwide had diabetes, and by 2035, that number is expected to rise to 592 million, according to a report by the International Diabetes Federation. Over 1.8 million people in Ethiopia have diabetes, with an estimated national prevalence of 4.36% among the adult population, according to the same survey (Sicree R et al. 2001).

Type I diabetes mellitus, which requires daily insulin treatment due to an insulin shortage, is one of three types of diabetes mellitus. Type II diabetes mellitus is another. While hyperglycemia with beginning or initial detection during pregnancy is known as gestational diabetes, type II diabetes mellitus is caused by the body's inefficient use of insulin. A key component of type I diabetes treatment and, in many situations, a crucial

component of type II diabetes management, insulin therapy is also a vital component of diabetic care. Nevertheless, 20% of individuals purposefully miss their insulin doses, and at least one-third of diabetic patients do not take their medication as directed (Siminerio L et al. 2011).

Since drugs alone are insufficient to control diabetes mellitus without various non-pharmacological measures adopted, patient participation is extremely important (Clifford RM et al. 2005).

This means that they should inevitably get involved in their management hence the critical aspects of diabetes mellitus include insulin therapy, diet and exercise. It is crucial to adhere to the insulin therapy directions mainly because deviations might lead to poor glucose regulation the intensified risk of side effects that may include cardiovascular disease, neuropathy, retinopathy, or early death (American Diabetes Association, 2022). Interestingly, despite the central role of insulin in the management of diabetes, several barriers are known to prevent people from using insulin properly including injection fear, shame, financial problems and lack of understanding of how insulin works (Peyrot et al., 2012). Such challenges demonstrate that it is hard to adhere to insulin therapy and evidence the need for a broader approach to the disease.

Education of the patient has emerged as a powerful tool toward enhancing the SELF efficacy and treatment compliance of diabetes patients. The literature review shows that multicomponent diabetes education schemes enhance patients' knowledge of insulin significantly, reduce the level of concern and confusion, and equip them with the practical means for handling the disease more effectively (Powers et al., 2018). About insulin therapy patients should know how to safely handle insulin, how to choose the injection sites to prevent lipodystrophy, how to properly inject insulin, and when to test blood glucose levels (Funnell et al., 2017). Outpatients with type I diabetes with good prognosis benefited greatly from such educational programmes for patients; however, those with type II diabetes also needed insulin as part of their management and would also benefit from the programmes.

Two, aside from education, there must also be an enabling healthcare environment that will promote the practice of adhering to said practices. As a result, when focusing on the medical and psychosocial aspects of diabetes and to ensure that current interventions correspond the needs of different individual, healthcare practitioners, diabetes educators and patient can collaborate. The insulin-using patients, who receive continuous support and follow-up, consultative visits and counseling, can overcome modifiable barriers to insulin therapy, enhance treatment compliance, metabolic outcomes, and perceived health status. This broad approach to diabetes care highlights the importance of insulin therapy and of therapy as a part of a lifetime of healthful living.

LITERATURE REVIEW

Importance of Insulin Therapy in Diabetes Management

In the management of diabetes, one must still use insulin; this is for Type 1 diabetes where the body produces little or no insulin, and for many steroid onsets type 2 diabetes where insulin might be necessary to get the best blood glucose levels (Alberti et al., 1998). In the first analysis, more favourable glycemic control has been associated with decreased likelihood of prolonged outcomes including cardiovascular disease, neuropathy and retinopathy; these studies confirmed the efficacy of insulin in managing diabetes along with blood glucose concentrations and reversing difficulties associated with the disease (Nathan, 1993). Insulin has been said to be an effective intervention in recent years given that the International Diabetes Federation estimates that 592 million people globally would have diabetes by 2035 (Sicree et al., 2001). This is especially so because there is evidence of an upward trend on the use of insulin by patients with established Type 2 diabetes (American Diabetes Association, 2022).

Barriers Imparting to Insulin Compliance

The problem of patients sticking to the correct management of insulin remains quite challenging, despite the acknowledged importance of insulin. This review shows that adherence rates for diabetes self- management with insulin range from 30% to 50% meaning that a significant population does not follow the regimen as prescribed (Siminerio et al., 2011). These include anxiety related to injections, perceived stigma, and costs, which creates barriers that often threaten the effectiveness of the

treatment (Peyrot et al., 2012). These challenges are further evidenced by current literature suggesting that other factors continued to hinder self-monitoring and normal insulin administration, majorly due to financial constraints and limited health care access in LMICs (Polonsky & Fisher, 2020). These barriers demonstrate that adherence involves a wide range of issues and requires individual-specific strategies for sustained compliance that are far in excess of the prescription.

Patient Education and Knowledge as a Concept Play a Very Important Role

Due to this it is necessary for diabetic patients to be educated to be able to understand and adhere to their insulin therapy schedule. Investigated in detail, intensified structure and meticulous diabetes educative schemes significantly enhance patients' understanding of insulin application techniques, usage, and other forms of self-regulation essential for adherence (Clifford et al., 2005). These programs are often centred on telling patients about blood glucose testing, on how to store insulin, on the process of switching sites of injection, and on the appropriate time for injections – all of which are known to be a very crucial part of every patient who is taking insulin, Funnell et al. (2017). Cited by Powers et al., 2018, systematic education may increase the level of adherence by 20 percent; there is potential of education to deal with some of the most common barriers to insulin in patients. Most significantly, diabetes education tends to apply as a concept to individuals on insulin—both Type 1 diabetics who require insulin in addition to regular non-insulin injections and Type 2 who occasionally rely on insulin as a component of their versatile treatment protocol.

Physician Aid in Compliance

Insulin therapy is supported and improved by healthcare professionals for the patients. In dealing with diabetes, peer input in addition to that from doctors and and diabetes educators is often required. This enables development of a more patient centered care that is more patient centred and supportive as per their needs (Polonsky et al., 2020). Follow ups and additional support depend on patients' old history and have always been associated with improved adherence because patients continuously receive reinforcement to follow the prescribed regimen (Davidson, 2004). In the last three studies done, pupils conducted a persistent supportive role for MDs which helped to decrease insulin therapy dropout rates, enhance glycemic regulation, and patient well-being (Balhara et al., 2021). These findings therefore underscore the importance of touch points for patients and healthcare providers if long term compliance is to be achieved.

Psychological Barrier and Emotion Related to Adherence of Insulin

Other psychological factors of diabetic patients regarding insulin are gradually being identified as significant factors of patients' compliance with their treatment regimen. There are patients' concerns on injections, stigmatization and perceived idea that insulin administration is anti-social or last resort (Peyrot et al., 2012). Fisher and Polonsky observe, Sample, patients who view insulin therapy as a message that their diabetes is not well managed, are likely to be deterrent to starting or sustaining the therapy, and hence, below par glycemia. Insulin adherence among patients depends on a number of psychological barriers; counseling, peer support and reassurance to patients has however been shown to modify this aspect thus making the patients agree to take their insulin as required as they have been assured that all is well (Gonzalez et al., 2016). This means that emphasising on psychological support is important for enhancing patient compliance to recommended and prescribed drugs and for managing diabetes in its entirety.

Socioeconomic and Cultural Influences on Insulin Use

Cultural beliefs and SES influence insulin compliance and general efficacy of diabetes treatment as well. Examined research suggests that several barriers including costly medications and limited availability of treatment have negative effects compliance; these are related to low SES (Hu et al., 2014). Additionally, patients are sometimes afraid to start or even continue the insulin therapy because of culture and some myths regarding this; For them it will mean that they can manage diabetes only by the diet, not by the tablets and injections (Karter et al., 2010). Unfortunately, these concerns limit patient acceptability and accessibility of therapy, and recent studies underscore the need for culturally competent interventions concerning such beliefs and

challenges (Rosal et al., 2021). It will be important through community level interventions and teaching to address these sociocultural concerns related to insulin adherence.

METHODOLOGY

In order to gather information on the patients' understanding of insulin therapy and management of diabetes mellitus, this study has adopted a qualitative research design. This study sought to establish the variables involved, the challenges faced by patients and the importance of health care support and education in the management of diabetes in accordance to insulin compliance. This study targeted one hundred respondents from among those with diabetes who are currently taking insulin during their treatment.

They were selected from a nearby medical center providing care for diabetic patients to ensure that the study sample is obtained from the diabetic care habitat. To ensure that participants are individuals that have been diagnosed with diabetes mellitus, and are currently taking insulin, either for type 1 or type 2 diabetes, purposeful sampling is conducted. Incluision criteria are patients with type 1 diabetes, age 18 and older, who administer insulin injections or insulin pump. The patients who receive insulin therapy are still eligible, however those who are pregnant, have severe learning disabilities, or took insulin in the prior 28 days are excluded.

Structured interviews which will allow an evaluation of participants' experiences and their attitudes toward insulin therapy will be employed to collect the data. Concepts such as insulin therapy understanding, barriers to adherence, perceived challenges, and resources (familiar, professional, informative) have featured in the interview guide. As valuable evidence, interviews with the participants were audio-taped with the participants' consent and transcriptions were used for analysis.

Descriptive analysis was done on the data and utilization of thematic analysis made it easy to identify frequent trends and themes in the answers given. This method has provided detailed data about the factors that affect compliance with recommended treatments and is ideal for understanding multiple factors that affect patients' experiences with insulin administration.

Data Analysis

Participant replies were analyzed for this qualitative study by employing thematic analysis because of its capacity to identify themes and patterns in responses. It can be argued that through the help of this method, it is possible to analyze interview data in relation to practices, knowledge, challenges and resources concerning insulin therapy. Themes were identified and recurring patterns offered an extended understanding of the factors influencing nonadherence by diabetes patients to insulin.

The first procedure of the analysis process was data familiarization, which included a word-by-word conversion of the audio tape recordings of the interviews. To ensure in-depth focus on the given data the transcriptions were reviewed several times and initial notes were taken to indicate any emerging themes or possible topics. The last process was undergone coding in which the researcher systematically labeled brief captions to unique segments of the text, using codes, as injection anxiety, lack of knowledge, or healthcare support.

Once coding was complete, sets of codes that belonged together were combined to generate the first set of themes. The following themes summarized the participants' concerns. Efficacy and Feeling Towards Insulin Administration; Challenges Encountered in Adherence; Impact of Patient Education on Diabetes Management. After then, the themes were refined to ensure the data had a precise, distinct and correct representation of them. To ensure that the themes identified were grounded on the experiences of the participants, the original transcript during the process of refining was also consulted.

To bring the work done into line with the body of knowledge existing in the field of diabetes care and insulin adherence, the finished themes were assessed with respect to the literature already produced. Psychological, social, and healthcare predictors influencing insulin usage were revealed by the study, including those in environmental context like socioeconomic status and access to healthcare services and emotional barriers like injection fear and perceived stigma. Further, a concern of this study was the purpose of health care support and patient education regarding the improvement of insulin therapy compliance.

The conclusions were made alongside participant quotes that provided examples, so the concerns of those involved in the process reflected the findings. Recommending a pathway to enhancing patient compliance with insulin, policymakers and all healthcare groups will find this analysis comprehensive and exhaustive in capturing the dynamics and challenges of insulin utilization in diabetes care.

RESULTS

Diabetes patients' knowledge, behavior, and challenges to insulin therapy practice were investigated in this research. This sample consisted of one hundred participants who provided qualitative information with regards to their experiences of insulin therapy. Four major topics surfaced from the thematic analysis: Healthcare support, still, psychological and social factors, issues of cost and affordability and awareness and understanding of insulin therapy.

Table 1

Participants' Knowledge and Awareness of Insulin Therapy

Knowledge Areas	Adequate Knowledge (%)	Limited Knowledge (%)	No Knowledge (%)
Insulin Administration Technique	65	25	10
Blood Glucose Monitoring	70	20	10
Insulin Storage Requirements	40	35	25
Rotation of Injection Sites	55	30	15
Long-Term Benefits of Insulin Therapy	50	30	20

The content of this table is a description of patient literacy regarding the principles of insulin use, expressed in the extent of their understanding. The knowledge level of patients regarding insulin administration was reasonably satisfactory to ensure compliance with medication in that 65% of the patients appeared to have adequate knowledge regarding medication administration. The encouraging result however is that as many (70%) acknowledged that they understood self-monitored blood glucose testing; this would explain that the basics of insulin administration have worked in some of the cases The overall insight of the right way of storing insulin only 40% of respondents got right, 35% of respondents lacked a little information and knowledge about the correct way and the remaining 25% did not know anything at all. This could result in lack of proper storage, and decreased effectiveness of insulin as the hormone that is required to regulate high blood sugar levels.

For this reason, only 55% of patients had enough awareness on the options of the rotating the injection site reported and this is a good figure. This ignorance may increase the tendency to lipodystrophy, which is a situation in which the body is unable to transport insulin. Finally, less than half of the patients interviewed had the slightest understanding concerning the long-term gains of insulin, and even fewer, only twenty percent, had no clue about it all. Lack of knowledge of the defensive effects of insulin from issues will compel patients to cut down on their diet or withdraw from the management of diabetes since they have no clear understanding of future implications.

Table 2

Psychological and Social Barriers to Adherence

Barrier	High Impact (%)	Moderate Impact (%)	Low Impact (%)
Injection Anxiety	60	25	15
Perceived Social Stigma	55	30	15
Fear of Long-Term Insulin Dependency	50	30	20
Financial Concerns about Insulin Cost	70	20	10
Misconceptions about Insulin Side Effects	45	35	20

The table shows the most significant and essential social/psychological barriers to adherence. Many participants experience injection anxiety, and further evidence indicates that it may be an important factor that could prevent patients from taking insulin as prescribed. The other highly cited issue was social discrimination which patients reported to have affected majority of them (55%). This means that a considerable number of patients may feel embarrassed or uncomfortably conscious whilst taking insulin, which may lead to noncompliance.

More than half of the participants expressed a high perceived severity of long-term insulin

dependency, and this means that there are patients who are afraid of insulin, and this can hinder even the beginning of the proper treatment. Financial issues were the main problem, which expressly impacted 70% of respondents. This suggests that the ability of the patient to sustain insulin administration, insulin, and other products, is slightly constrained by the cost of insulin. Last, the last statement, with 45% of participants, indicated that a lack of understanding of side effects as well as concerns about the adverse effects that might occur from medication were of high impact when it comes to therapeutic adherence problems.

Table 3

Socioeconomic Constraints and Insulin Adherence

Socioeconomic Factor	High Constraint (%)	Moderate Constraint (%)	No Constraint (%)
Cost of Insulin and Supplies	80	15	5
Access to Insulin in Rural Areas	50	30	20
Availability of Regular Healthcare Support	40	35	25
Health Insurance Coverage	30	40	30

A synopsis of the socioeconomic factors affecting insulin compliance is presented in this table. Of confirmed response, 80% stated that the cost of insulin and ancillary products were the main barrier; this is in concordance with the budgetary constraints in Table 2. Patients residing in rural areas were particularly disadvantaged when it came to access; half (50%) of them said that it was a major barrier. It can be burdensome for the rural patient population to maintain steady therapy because of limited pharmacy choices or even access to insulin in those areas.

Another problem was that of stable and constant medical support, of which the respondents stated that there was a highly significant limitation in, as many as 40 per cent. They may not receive the needed constant counseling or therapy changes that will help them manage their diabetes optimally if they cannot see their physicians often. Last, only a few 30% of the respondents rated absence of health insurance as a serious issue. A moderate constraint level has been achieved for 40% of participants which implies that although insurance may be available for reimbursement, it may not be fully receptive to cover insulin and their associated costs hence presenting policy bear patients.

Table 4

Role of Healthcare Provider Support

Support Type	Frequent Interaction (%)	Occasional Interaction (%)	Rare/No Interaction (%)
Education on Insulin Usage	60	30	10
Regular Check-ups	55	35	10
Psychological Counseling	20	40	40
Assistance with Cost Management	25	45	30

This table proves the importance of support from healthcare professionals regarding the improvement of insulin adherence. Many of the patients (60%) indicated that they communicate relatively frequently, regarding instructions related to insulin use, thus implying that educational assistance is reasonably accessible and effective. Further, a majority of 55% of patients received follow-ups and thus majority patients receive follow up regularly, which is important for glycemic management and insulin compliance.

Yet, 40 % of participants had little or no experience in the area of reception of psychological counseling, which confirmed the severe deficiency of this service. Again, as shown in Table 2, there is a high level of injection anxiety, and fear of relying on any help relating to psychological assistance, and therefore, may find it hard to adhere if they cannot access the same. Moreover, only one quarter of participants reported receiving assistance with cost control on an often basis. This absence of financial counsel accords with what is provided in Table 3 which states development of money as one of the main impediments or constraints. Furnishing more support on the cost could decrease some of the financial pressures and likely enhance the compliance levels.

These annotated examples all suggest major socioeconomic and psychological barriers to insulin compliance, even though typically educational support is given. Improve adherence, and, ultimately, the outcome of diabetes treatment may be achieved by increasing the availability of

financial assistance, psychotherapy, and ongoing health care services for patients, particularly those living in rural areas.

CONCLUSION

For this reason, this research paints a picture of many factors that can affect patient compliance to insulin therapy by diabetic patients. Concerning the research, the crucial conclusion reveals that even though the great percentage of participants knows how to, for instance, administer insulin and check the blood sugar, there are serious gaps in a number of other essential knowledge, such as the storage procedures, the way of switching the injection sites, and the long-term benefits of insulin. These issues suggest that more focused means should be used to advance educational processes that might enhance the compliance level due to the lack of knowledge.

A lot of people faced dramatic psychological barriers that included social discrimination and fear of injection, hence the importance of psychology. Lack of compliance was also a result of concerns regarding long-term use of insulin and financial considerations as a large number of respondents said that they thought that the high cost of insulin acted as a major barrier. These results suggest that there might be a benefit to making resources for cost control and counseling part of diabetes care programs.

He found out that insulin adherence was greatly influenced by socioeconomic factors especially among people in the rural areas. This is because understanding of the disease and its management is lacking due to the lack of finances and of health facilities in the less privileged region as well as the need for policies that improve insulin access and health cover. Lastly, studies have revealed that professional care from a healthcare provider is a considerable method, if not when used alongside several educational meetings and periodic assessment and physical examinations. But what was largely missing was financial and psychological advice.

With all the foregoing said, let this study stress the need for comprehensive care systems that address the economic, psychological and learning barriers to insulin therapy. Enhancing these areas would markedly enhance compliance which in turn would enhance diabetes management and the lives of patients, especially the rural and low-income populace.

REFERENCE

1. Alberti, K. G. M. M., & Zimmet, P. Z. (1998). Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus. Provisional report of a WHO Consultation. *Diabetic Medicine*, *15*(7), 539–553. https://doi.org/10.1002/(sici)1096-9136(199807)15:7%3C539::aid-dia668%3E3.0.co;2-s
2. Alberti, K. G. M. M., & Zimmet, P. Z. (1998). Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus. Provisional report of a WHO Consultation. *Diabetic Medicine*, *15*(7), 539–553. https://doi.org/10.1002/(sici)1096-9136(199807)15:7%3C539::aid-dia668%3E3.0.co;2-s
3. American Diabetes Association. (2021). Standards of medical care in diabetes—2022. *Diabetes Care*, *45*(Supplement_1), S1–S2. https://doi.org/10.2337/dc22-sint
4. Balhara Y., P., S., Verma, R. & Jain, R. (2021). A Review of the Impact of Patient-Provider Communication on Medication Adherence in Type 2 Diabetes Mellitus. *Journal of Diabetes Research*, 2021, 1–8.
5. Clifford, R., M, Davis, W, A, & Davis, T., M. (2005). A Pilot Study of the Use of Pharmaceutical Care in an Australian Community Pharmacy as Part of an Integrated Model for Patients with Type 2

Diabetes. *Pharmacy World & Science, 27*(1), 14–19.

6. Clifford, R. M., Davis, W. A., Batty, K. T., & Davis, T. M. E. (2005). Effect of a Pharmaceutical Care Program on Vascular Risk Factors in Type 2 Diabetes: The Fremantle Diabetes Study. *Diabetes Care*, *28*(4), 771–776. https://doi.org/10.2337/diacare.28.4.771
7. Davidson, M. B. (2004). Improving Glucose Control in Patients with Insulin-Dependent and Non-Insulin-Dependent Diabetes: A Meta-Analysis of Randomized Controlled Trials. *American Journal of Medicine, 116*(10), 682–689.
8. Funnell, M., M., Anderson, R., M, & Arnold, M. S. (2017). Empowerment and Diabetes Self-Management Education. *Diabetes Spectrum*, 30(2), 91–94.
9. Funnell, M., M., Anderson, R., M, & Arnold, M. S. (2017). Empowerment and self-management education for people with diabetes. *Diabetes Spectrum*, 11(5), 1076-1085.
10. Gonzalez, J. S., Peyrot, M., McCarl, L. A., Collins, E. M., Serpa, L., Mimiaga, M. J., & Safren, S. A. (2008). Depression and Diabetes Treatment Nonadherence: A Meta-Analysis. *Diabetes Care*, *31*(12), 2398–2403. https://doi.org/10.2337/dc08-1341
11. Hu J, Wallace DC, and Tesh AS. (2014). Physical Activity, Obesity, and Mental Health among African American and White Women. *American Journal of Health Behavior*, 38(5), 644–652.
12. Istockphoto.com. (2013). *IDF DIABETES ATLAS Sixth edition*. http://www.idf.org/sites/default/files/EN_6E_Atlas_Full_0.pdf
13. Nathan, D. M. (1993). Long-Term Complications of Diabetes Mellitus. *New England Journal of Medicine*, *328*(23), 1676–1685. https://doi.org/10.1056/nejm199306103282306
14. Peyrot, M., Barnett, A. H., Meneghini, L. F., & Schumm-Draeger, P.-M. . (2012). Insulin adherence behaviours and barriers in the multinational Global Attitudes of Patients and Physicians in Insulin Therapy study. *Diabetic Medicine*, *29*(5), 682–689. https://doi.org/10.1111/j.1464-5491.2012.03605.x
15. Peyrot, M., Barnett, A. H., Meneghini, L. F., & Schumm-Draeger, P.-M. . (2012). Insulin adherence behaviours and barriers in the multinational Global Attitudes of Patients and Physicians in Insulin Therapy study. *Diabetic Medicine*, *29*(5), 682–689. https://doi.org/10.1111/j.1464-5491.2012.03605.x
16. Polonsky, W., H. & Fisher, L. (2020). Enhancing Diabetes Self-Management: The Role of a Structured Behavioral Intervention. *Diabetes Care*, 43(1), 81–87.
17. Polonsky, W. H., Fisher, L., Hessler, D., & Edelman, S. V. (2013). What is so tough about self-monitoring of blood glucose? Perceived obstacles among patients with Type 2 diabetes. *Diabetic Medicine*, *31*(1), 40–46. https://doi.org/10.1111/dme.12275
18. Powers, M. A., Bardsley, J., Cypress, M., Duker, P., Funnell, M. M., Hess Fischl, A., Maryniuk, M. D., Siminerio, L., & Vivian, E. (2015). Diabetes self-management education and support in type 2 diabetes: A joint position statement of the american diabetes association, the american association of diabetes educators, and the academy of nutrition and dietetics. *Journal of the Academy of Nutrition and Dietetics*, *115*(8), 1323–1334.
19. Powers, M. A., Bardsley, J., Cypress, M., Duker, P., Funnell, M. M., Fischl, A. H., Maryniuk, M. D., Siminerio, L., & Vivian, E. (2017). Diabetes Self-management Education and Support in Type 2

Diabetes. *The Diabetes Educator*, *43*(1), 40–53. https://doi.org/10.1177/0145721716689694

20. Rosal, M., C., White, M., J, & Borg, A. (2021). Strategies to Promote Culturally Competent Diabetes Education for Latinos. *Diabetes Care*, 44(Supplement_1), S73–S79.
21. Sicree, R., Shaw, J., Zimmet, P., & Heart, B. I. (2010). The global burden. *Diabetes and impaired glucose tolerance Baker IDI Heart and Diabetes Institute*. https://blogimages.bloggen.be/diabetescheck/attach/35593.pdf
22. Richard Sicree, J. S. P. Z. (2013). The global burden of diabetes and impaired glucose tolerance. *International Diabetes Federation*.
23. Siminerio, L., Kulkarni, K., Meece, J., & Cypresse, M. *Strategies for insulin injection therapy in diabetes self management. American Association of Diabetes Educators. 2011*.
24. Siminerio, L. M., Piatt, G., & Zgibor, J. C. (2005). Implementing the Chronic Care Model for Improvements in Diabetes Care and Education in a Rural Primary Care Practice. *The Diabetes Educator*, *31*(2), 225–234. https://doi.org/10.1177/0145721705275325
25. World Health Organization. *Diabetes Fact sheet 2013; No. 312.[cited 2014 Mar 13]*. http://www.who.int/mediacentre/factsheets/fs312/en/