

Investigating Compliance with Insulin Injection Regimens among Diabetic Patients in Najran University Hospital

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Abstract

Background: Many people suffer from diabetes in Saudi Arabia and around 67.9% of diabetic patients in the country are non-compliant to treatment. Therefore, it is pertinent to explore issues on contributory factors to non-compliance. The aim of study was to investigate what factors affect patient compliance with an insulin regimen as part of self-management in Najran University Hospital.

Methodology: An exploratory descriptive study was undertaken and adopting a cross sectional survey approach. The sample consisted of 150 participants. Simple random sampling was used to select who were registered with Chronic Disease Clinics at Najran University Hospital. Self-administered questionnaires were used to collect data over 2-week period in March 2022.

Results: The sample consisted of 90 patients, of which 53.3% were male and while 46.7% were female. The results show largely positive findings regarding compliance. However, many participants exhibited poor attitudes, lacked self-management skills, and health education information. Inferential statistics confirmed statistically significant findings regarding the relationship between the poor attitude score and the poor the self-management. Knowledge of how to take insulin injections; fear of insulin injection; having a monitoring device; health conditions; diabetes type residence location education; and seeing diabetes educators were factors that contributed to attitudes.

Conclusion: The findings from this study demonstrated that compliance with self-management advice is variable among diabetic patients. It is of utmost importance for diabetic patients in Saudi Arabia to be educated and supported in all aspects of self-management to avoid diabetic complications.

Keywords: *compliance, insulin regimen, diabetes, social determinants, Najran and Saudi Arabia.*

INTRODUCTION

The International Diabetes Federation (IDF) states that the prevalence of diabetes in Saudi Arabia (SA) was 19.6% in 2011 and is predicted to reach 22.3% by 2030¹.

Comparatively, there are many more cases of diabetes in SA and it was estimated there are approximately 187 million cases that yet to be diagnosed². Healthcare services for is delivered to diabetic patients in Primary Health Care Centres (PHCC)³ in SA. Diabetic patients must

register at PHCC and monitored regularly. They must also be provided with health education and be given treatment by their general practitioner⁴. Patients are provided with oral hypoglycaemic drugs, or insulin at their PHCC⁵. They are then referred to secondary or tertiary care if there is a need to further evaluate or manage their illness. In addition, there are 20 Diabetic Clinics located around the different regions of SA, and patients are referred to these clinics on a regular basis and assessed by doctors⁶.

It is known that an increase in levels of obesity contribute to the growing number of diabetic patients. Non-compliance with prescribed medication⁷ is an additional concern. Patient non-compliance is a major health concern on a global scale and severely hinders the successful healthcare delivery⁸. Non-compliance to diabetes treatment is critical to the management of the disease and prevention of complications. Diabetes is a unique illness because treatment is self-administered via subcutaneous injection. Furthermore, diabetic patients deliver over 95% of their own care⁷. It has been found that many diabetic patients do not achieve the medication goals appropriate to optimise care⁹ even though optimal medical care can prevent diabetic complications. Health professionals may have much control over treating diabetic patients because more than 95% of the care and treatment of diabetes is carried out by the patient. More than 95% of the care and treatment of diabetes is carried out by the patient, thus making it difficult for healthcare professionals to control blood sugar levels. Therefore, non-compliance to medication is a common issue¹⁰.

Empirical studies exploring compliance with insulin therapy as part of diabetic treatment in patients in SA is lacking, indicating a dearth of studies on this population. Therefore, it is pertinent to study non-compliance with insulin injections as well as contributing factors in more depth to recommend support for patients from a public health perspective. Various factors appear to contribute to non-compliance of treatment, these include low socio-economic status and low educational attainment, ultimately leading to increased morbidity. Low

levels of health education, a lowered perception of the seriousness of the illness, and susceptibility to complications and treatment effectiveness¹¹ are psychological factors that lead to non-compliance with treatment regimens. The aim of study was to investigate what factors affect diabetic patients' compliance to insulin regimens as part of self-management Riyadh city.

MATERIALS AND METHODS:

This was a cross-sectional, quantitative study that utilized self-administered questionnaires for data gathering. We adopted this approach to gain numeric data generated through questionnaires and was then subject to statistical manipulation. The population for the study consisted of diabetic patients attending the chronic diseases clinic (CDC) in Najran University hospital, Najran city SA. Informed consent was given by patients. The chronic diseases clinic treats many diabetic patients from the city of Najran as well as surrounding areas on a daily basis. Diabetic patients undergo routine appointments in this clinic to assess their health and compliance with treatment. Simple random sampling was used to select 150 patients. Informed consent highlighted voluntary participation, and confidentiality and anonymity were established. The consent form highlighted that voluntary participation. Guidance was provided to participants regarding completing and submitting the questionnaire contained in the information pack. Demographics (e.g. gender, age, education level, marital status, residence, and employment) were collected from the participants through close-ended questions in the questionnaire. Participants were asked questions about associated variables concerning diabetes and insulin use as well as other health issues associated with clinical management. Several questions adopted a Likert-style rating scale of items to determine attitudes towards self-management of insulin. Participants were asked to respond to a 5-point scale (1=not at all, 2=slightly, 3=moderately, 4=quite a bit, 5=almost totally); similarly, in relation to self-management and health educations, which was

answered on a 3-point scale (1=never, 2=sometimes, 3=always). A third scale of items measured attitudes about assistance with insulin answered on a 4-points scale (1=daily, 2=several times, 3=sometimes, 4=never). A pilot study was carried out with 10 diabetic patients (not participating in the main study). The patients were asked to provide feedback about the clarity of the questions. After that, the questionnaire coded into SPSS and reliability was tested. The questionnaire in this study was reviewed by research with subject expertise in diabetes at the School of Health and Life Sciences at Glasgow Caledonian University. The English questionnaire was translated to Arabic and was sent to two Arabic researchers and health practitioners in the diabetic outpatient department at Najran University Hospital. They suggested some minor modifications and language issues were corrected to enable understanding by participants. It was deemed the questions were clear and non-ambiguous. Overall, the questionnaire was confirmed as comprehensive enough to explore diabetic patients' compliance with insulin therapy. Reliability/consistency were measured using Cronbach's alpha test. All questionnaires were coded and entered into SPSS (Statistical Package for Social Science 21). The data file was securely kept and was only accessible to the researchers. In addition, no names were included that can reveal the participants' identity. The data was analysed descriptively (e.g. frequencies, percentages, and averages) and inferentially (e.g. measure effects, relationships and differences). Inferential statistics are carried out to make generalisations or inferences from a small group to a large group (i.e. based on which the results can be generalised to the bigger population). Inferential statistics seek to measure causalities and relationships between variables. Inferential statistics depend on an alpha level of 5% or less ($p < 0.05$). Cronbach's alpha is used to measure the probability that the results occurred by chance. We agreed that Cronbach's alpha should be 5% at most. Thus, results below or equal this value are statistically significant. This study adhered to ethical standards regarding voluntary participation i.e. patients were not

pressured to participate. It was explained that they have the right to withdraw at any point during their participation. Consent was confirmed by completing the questionnaire, ensuring anonymity. To preserve confidentiality, data were securely saved and accessible only to the researcher. Furthermore, participants were thanked for taking part and were provided with details of the researcher and the health educator in the CDC in case they have issues or questions to raise regarding the study.

The study followed strict ethical guidelines in accordance with the ethical standards of College of Medicine in Najran University. Furthermore, this study achieved approval from the college of Medicine in Najran university no. 44-NU-0217 who approved access to the hospital patients in the outpatient clinics.

RESULTS:

The consisted of 53.3% ($n = 48$) men and 46.7% ($n = 42$) women patients undergoing insulin treatment for their diabetes. Participants' ages were recorded across 5 age categories, ranging from 25 to 55. The most common groupings were aged between 46-55 years old (36.7% $n = 33$) and the least common group comprised 12.2 % ($n = 14$) of participants between the ages of 36 and 45 years old. The outcomes were associated with variables related to responses on the type of diabetes and co-morbidities. Participants asked to specify their typology and 50% ($n = 45$) stated that they had type I diabetes while 35.6% ($n = 32$) stated that they had type II diabetes. However, 14.4% ($n = 13$) had no knowledge of their diabetic type. Also noted were participant responses to elicit other co-morbidities. Analysis showed that 50% of the cohort had other health conditions. Further analysis of patients with co-morbidities showed that 25.6% ($n = 23$) confirmed they suffer from cardiovascular problems; 17.8% ($n = 16$) had eye problems; 15.6% suffered neuropathy; 7.8% had kidney problems and 7.8% ($n = 7$) stated that they had unspecified health problems.

Patients reported on the frequency of consult CDC for blood glucose monitoring using HbA1c measurement. Overall, 62.5% (n =55) of the participants stated that they underwent HbA1c monitoring while 37.5% (n =33) stated they had not. Two thirds of the sample were tested to evaluate the average blood glucose over a 3-month period, which provides a reliable measure of diabetic state. However, 26.3% (n = 15) of sample were not tested last year. The frequency of self-monitoring responses is outlined in Figure 1.

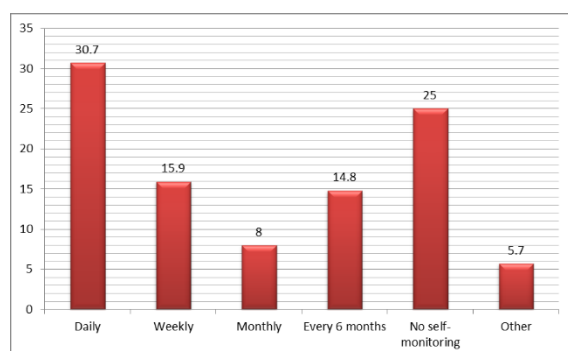


Figure 1: The frequency participants self-monitor of blood glucose

Analysis shows that the majority of participants (30.7% n =27) check their blood glucose on a daily basis, while 15.9% (n =14) do so on a weekly basis; 14.4% (n =13) test every 6 months, and 8% (n =7) do so on a monthly basis. However, 25% (n = 22) stated that they do not conduct self-monitoring at all while 5.7% (n =5) stated periods for testing. Table 1 presents a further detailed assessment of diabetes management at the hospital clinic. The frequency of attendance in the clinic was 52.2% of the participants whereas 22.2% explained that they visit the diabetic clinic every 2 months or less.

Table 1: Frequency of attendance at diabetes clinics and receiving instructions

Variable	Frequency (n)	Percent (%)
Frequency in clinic attendance		
<2 Months	20	22.2
>2 Months	47	52.2
Other	22	24.4

Consultation with a diabetes educator		
None	22	24.4
One	19	21.1
Twice	22	24.4
More	27	30.0
Instruction provided on how to manage diabetes?		
Yes	64	72.7
No	24	27.3

All participants consulted the diabetes educator at some point: 30% reporting more than two times, while 21.1% only saw the educator once. However, 24.4% of participants explained that they have never seen the educator. When asked about whether or not they were instructed about diabetic care, 72.7% explained that they received such instructions while 27.3% stated that they did not. Most participants self-administer their insulin injection (72.1%) while 20.9% explained that they need the help of a family member to assist them. A primary physician was essential for injecting insulin according to 5.8% of the participants, while 1.2% reported that an endocrinologist helps them administer the insulin injection. Furthermore, the questionnaire revealed that 73.9% understand how and when to take the insulin injection while 26.1% reported that they did not. Over a third of the participants expressed fear over taking insulin injections (33.7%). In addition, 39.3% stated that they do feel embarrassed that they take insulin, while the rest (60.7%) showed no feeling of embarrassment. Physicians were identified as the main sources of information according to (50%) of participants. This was followed by 25.6% of participants who stated that the diabetes educator is the main source to their knowledge about diabetes and insulin injections. Other sources of information include mainly family and friends (14.4%), while 10% stated that electronic sources and media is where they source information; 8.9% stated usage of booklets and brochures while only 6.7% explained that nurses provided them with the information regarding diabetes and insulin injections.

Participants were asked about their opinions and attitude towards insulin injections. Using a 5-points Likert-type scale, they were asked to rank 7 statements. For each statement participants' answers were recorded and then an overall mean (M) was calculated along with the standard deviation (SD) and the ranking of the items. Table 2 shows the details of opinion statements provided about insulin injections and their use. It was found that participants generally had negative opinions about insulin

injections. The most positive opinions were generated for an item in the questionnaire stating that participants need to plan their daily activities around their insulin injection (M = 3.33). This was followed by a statement indicating that it was hard to follow the treatment plan for insulin (M=3.21). The least mean score was generated for the item stating that the healthcare provider does not help in understanding the importance of keeping normal blood sugar level.

Table 2: Participants attitudes/opinions regarding self-management using insulin therapy

Item	Not at all	Slightly	Moderately	Quite a bit	Almost totally	Mean	SD	Rank
Taking insulin injections interferes with my regular social activities involving meeting with family, friends, neighbors, or social groups	31.1	14.4	16.7	10	27.8	2.89	1.61	4
SAdhering to the treatment plan for taking insulin as instructed is difficult to follow	14.4	20	22.2	16.7	26.7	3.21	1.41	2
I need to plan daily activities around my insulin injections	11.1	11.1	35.6	17.8	24.4	3.33	1.27	1
I do not take my insulin injections in accordance with my daily regimen and BG levels as explained by my doctor/healthcare professional*	23.3	24.4	27.8	6.7	17.8	2.71	1.37	6
Taking insulin injections interferes with my ability to perform my hobbies or recreational activities, household chores, and shopping	21.1	15.6	18.9	20	24.4	3.11	1.48	3
My healthcare provider at the clinic does not help me understand the importance of maintaining normal blood sugar levels*	33.7	16.9	25.8	7.9	15.7	2.55	1.43	7
I am not able to adjust my insulin dose in response to low or high blood glucose (sugar) readings*	21.3	23.6	30.3	7.9	16.9	2.75	1.34	5
*reversed items, from positive to negative form								

Table 3 shows that most participants maintain insulin injections (M = 2.35) and it was also found that they are using insulin injections to prevent diabetic complications (M = 2.35). High scores were revealed regarding sufficient information about the type of diabetes they have and its related symptoms (M = 2.23). It was also demonstrated that a high percentage of

participants either always or sometimes follow such instructions. Scores reflecting the importance of a healthy diet had the lowest score (M=1.72), indicating that this item/instruction is the least followed. In addition, 40.9% stated that they never follow a healthy diet while 44.4% stated that they do so on occasion. Furthermore, low scores were

elicited of physical exercise, ($M=1.93$) and 31.1% stated they never do physical exercise while 44.4% said that they do so sometimes. The table below indicates each item and the percentages and the mean scores for each. Another scale was used to inquire about assistance with insulin therapy. It was shown that there was an inverse relationship between scores and the need for assistance after computing for Mean and Standard Deviation. Assistance was commonly needed on the

estimation of their glucose results ($M=2.18$) followed by help in titrating the insulin dose ($M=2.25$). Overall, more than 50% of the patients seek help under each of the items listed above, either on a daily basis or several times per week. Although most item ask about the need for assistance, it can be seen from the table below that most patients stated that they do not require assistance or only require assistance on occasions (See Table 4).

Table 3: Self-management and healthcare education among patients

Statement	Never	Sometimes	Always	Mean	SD	Rank
Do you always remember to take your insulin injections*	16.7	48.9	34.4	2.18	.696	3
Do you regularly take insulin injections*	13.5	38.2	48.3	2.35	.709	1
Do you take insulin injection because you are afraid of the response your physician may have	36.7	32.2	31.1	1.94	.826	
Do you take insulin injections to prevent diabetes-related complications	12.8	39.5	47.7	2.35	.699	1
Do you attend appointments at the clinic	24.4	37.8	37.8	2.13	.782	5
Do you perform physical exercise	31.1	44.4	24.4	1.93	.747	10
Do you follow a healthy diet to help you manage your diabetes	40.9	46.6	12.5	1.72	.677	11
Do you attend regular medical checkups to prevent complications, e.g., eye and foot tests	29.2	44.9	25.8	1.97	.745	9
I am provided with helpful advice and information at the diabetes clinic and I am satisfied with the consultation	25.6	44.4	30	2.04	.748	7
I am provided with sufficient information about my type of diabetes and the symptoms I may have	14.4	47.8	37.8	2.23	.688	2
I am provided information about the lifestyle-related risk factors (diet, exercise, smoking, etc.), which may affect my diabetes	22.2	40	37.8	2.16	.763	4
I am provided with adequate information about diabetes-related complications	21.1	42.2	36.7	2.16	.748	4
I am provided with adequate information on self-management of my diabetes, using insulin injection	27.8	44.4	27.8	2.00	.750	8
I am provided with adequate information about how to manage hypoglycemia (low blood sugar) and hyperglycemia (high blood sugar)	21.1	46.7	32.2	2.11	.726	6
I am provided with adequate information on managing my diet	22.2	44.4	33.3	2.11	.741	6
*reversed items, from negative to positive form						

Table 4: Frequency of assistance with insulin injections among patients

Statement	Daily	Several times per week	Sometimes	Never	Average	SD	Rank
I receive help with insulin injections	36	14.6	20.2	29.2	2.43	1.251	2
I receive help with home blood glucose tests (finger prick)	29.5	25	33	12.5	2.28	1.028	3
I receive help with portioning of meals	29.2	33.7	19.1	18	2.26	1.072	4
I receive help with estimation of results	33	29.5	23.9	13.6	2.18	1.045	7
I receive help with changing the insulin dose	34.8	25.8	19.1	20.2	2.25	1.141	5
I receive help with attending clinic visits	25.8	40.4	18	15.7	2.24	1.012	6
I need assistance*	12.4	10.1	33.7	43.8	3.09	1.018	1
*reversed items, from negative to positive form							

Spearman's rho correlation coefficient indicated that there was a significant and negative correlation between the attitude scale and the self-management scale, ($\rho(90) = -0.67, p < 0.001$). An analysis of both revealed that the poor attitude towards insulin injections is positively correlated with poor self-management and health education knowledge. Furthermore, it was apparent that there is a positive correlation between insulin injection attitude and assistance with the therapy, ($\rho(90) = 0.62, p < 0.001$). This indicates that poorer their attitude towards insulin injections is correlated with a decrease in seeking assistance. A significant negative relationship was found between self-management and assistance with insulin injections ($\rho(90) = -0.61, p < 0.001$), indicating the better patients' self-management with insulin injections the more likely they are to seek assistance when needed. It was found that a significant difference existed between those who understood how to take insulin and those who did not regarding their attitude toward insulin injection using the Man-Whitney U test. Poorer attitudes were evident for those who did not understand how to take insulin (MR = 69.54) compared to those who did (MR = 35.64), {U=171.5, $p < 0.00$ }. Participants who did not know how to take insulin showed poorer self-management and health education (MR = 19.20) compared to patients who knew

how to take insulin (MR = 53.45), {U=165.5, $p < 0.001$ }. Participants who did know how to take insulin were less likely to seek assistance (MR=63.61) compared to those who did (MR = 36.95), {U=285.0, $p < 0.001$ }. It was also found that patients who feared taking insulin injections had poorer attitudes towards insulin therapy (MR = 57.70) compared to patients who did not (MR = 38.54), {U=504.0, $p < 0.01$ }. Poorer self-management and health education was found among patients who feared insulin injections (MR = 3 4.32) compared to patients who did not (MR = 50.43), {U=564.50, $p < 0.0$ }. In terms of assistance with insulin injections, participants who feared injections showed less desire for assistance (MR = 52.98) compared to patients who did not (MR = 40.33), {U=609.50, $p < 0.05$ }. Participants who had blood glucose monitoring devices demonstrated positive attitudes (MR=61.15) compared to those who haven't (MR = 36.44), {U=424.0, $p < 0.001$ }. In addition, those who had a device showed better self-management and health education scores (MR = 55.17) compared to those who did not (MR = 28.80), {U=389.50, $p < 0.001$ }. Furthermore, participants who had a device sought out more assistance (MR=34.66) compared to those who do not (MR=62.55), {U=345.0, $p < 0.001$ }. Participants who had other health conditions demonstrated a poorer attitude towards diabetes (MR = 57.74)

compared to those who did not (MR = 31.97), {U=416.50, $p < 0.001$ }. Aside from this, participants with other health issues showed poorer self-management (MR = 30.50) compared to those without (MR = 59.78), {U=339.50, $p < 0.001$ }. Less assistance was sought by those who had other health issues (MR = 59.77) compared to patients who do not (MR = 29.23), {U=296.0, $p < 0.001$ }. Poorer attitudes were found for those who had type II diabetes (MR = 47.08) as opposed to type I (MR = 33.26), {U=461.5, $p < 0.01$ }. Participants with type II diabetes had poorer self-management and health education scores (MR = 31.92) compared to those with type I diabetes (MR = 44.03), {U=493.50, $p < 0.05$ }. Those with type II diabetes seek less assistance (MR = 45.87) as opposed to those with type I diabetes (MR = 33.42), {U=469.0, $p < 0.05$ }. Patients residing in urban areas demonstrated more positive attitude scores (MR = 38.84) compared to rural patients (MR = 57.56), {U=542.00, $p < 0.001$ }. Also, urban patients had better self-management and health education scores (MR = 51.96) compared to rural patients (MR = 33.80), {U=553.50, $p < 0.001$ }. More assistance is sought by urban patients (MR=37.41) when needed compared to the rural patients (MR = 58.52), {U= 479.50, $p < 0.001$ }. A Kruskal Wallis test was performed to measure the effect of education on the three scales. It was found that education impacts attitude towards insulin injections. Lowest attitude scores were found among participants who only had primary or intermediate school education and the best attitude scores were for university graduates (primary school = 58.79; intermediate school = 57.75; high school = 40.82; university= 26.26), {X² = 5.04, $p < 0.001$ }. Similarly, education was found to have a significant effect on self-management and health education (primary school = 26.33; intermediate school = 26.06; high school = 51.45; university = 70.88), {X²=48.79, $p < 0.001$ }. Assistance was significantly affected by education level (primary school=57.44; intermediate school=58.47; high school=43.90; university=22.52) this indicates that those with university degrees more readily seek assistance, when necessary, compared to the rest {X²=30.29, $p < 0.001$ }. A significant effect

was found for attendance to diabetes education on participants' attitude towards insulin. Participants who had never consulted with an educator showed the poorest attitude scores (None=58.20; Once=41.92; Twice=45.36; More=37.78): {X²=7.94, $p < 0.05$ }. Self-management and Health education scores were better among participants who had seen the diabetes educator more than twice (None=29.45; Once=43.61; Twice=50.20; More=56.20): {X²=13.57, $p < 0.01$ }. More assistance was needed by those who attended meetings with diabetes educators more than twice ((None=58.45; Once=50.05; Twice=38.68; More=35.27): {X²=11.78, $p < 0.01$ }).

Discussion:

It was found that most participants in this study (62.5%) of participants in this study stated that they went to the clinic for blood glucose monitoring while just over one third (37.5%) stated they had not. Diabetic patients are treated in PHCC where they are monitored on a regular basis⁶. However, these findings were not reflected in the study results. A possible explanation for this finding could be that the patients who participated in this study were infrequent attendees.

It was found that most of the participants (30.7%) check their blood glucose on a daily basis, with their remainder doing so infrequently (15.9% weekly; 8% monthly; 14.4% every 6 months). However, whilst it is concerning that two thirds of insulin dependent patients demonstrate variability in checking their blood glucose levels is a concern, 25% stated that they do not do self-monitoring at all. For those who monitor their blood glucose on a regular basis (i.e., every day or every week), it can be argued that they are optimizing health outcomes by controlling their diabetes¹². However, those who only measure it once a week, or never measure it are at risk of high levels of glucose in their blood going without monitoring, which is a danger to their health. Diabetes cannot be cured, but it must be controlled for with monitoring of blood glucose, as well as exercise and dietary adaptations¹³. Furthermore, due to the fact that

diabetes gets worse over time, it is essential that patients take the correct medicine in order to reduce high blood sugar levels¹⁴. Without adequate blood glucose monitoring, healthcare practitioners will not be aware of the level of glucose in their blood and will thus not be in a position to prescribe the correct medication.

It was found that the majority (60%) experienced hypoglycaemic episodes in the last month. However, 40% did not. It was found that many of the healthcare workers were hesitant to engage in a discussion on treatment risks associated with insulin to avoid worrying patients about inducing hypoglycaemia¹⁵. Thus, it may be that the patients who had suffered hypoglycaemic episodes may have not been informed sufficiently enough about the risk of hypoglycaemic episodes, and thus had not adhered to their anti-hypoglycaemic medicine. In fact, a study done to determine how diabetics patients' opinion on the burden of self-treatment because of their medication found that all the patients in the study (n=1,653) considered all forms of medication to be a burden¹⁶. Thus, it may be that the subjects in this study how have suffered hypoglycaemic episodes may not have sufficiently adhered to their anti- hypoglycaemic medication.

When asked about which sources of information the subjects in this study used to obtain information about diabetes, it was found that 50% of the subjects stated that their physician was the main source of information, followed by 25.6% who stated that the diabetes educator was the main source of their knowledge about diabetes and insulin injections. A further 14.4% informed that their main source of information was their mainly family and friends, whilst 10% stated that electronic sources and media were the source information they consulted; 8.9% declared that it was usage of booklets and brochures whilst only 6.7% stated that nurses provided them with the information regarding diabetes and insulin injections. This agrees with the statements that in SA, diabetic patients are treated in PHCCs where they receive healthcare information about their illness⁶. However, for those who did not state that their physician was their main source of information about

diabetes, it may be that these do not visit the clinic as often as they should and therefore are not able to seek as much information about diabetes as those who attend regularly do.

The fact that very few of the participants in this study stated that their nurse was a source of information about diabetes, may reflect the statements of a study that discovered that healthcare providers were hesitant to introduce discussion on treatment risks associated with insulin to avoid worrying patients about inducing hypoglycaemia¹⁵. Thus, it may be that their nurses were cautious about providing them with information. This is an important finding, and something that needs to be improved because patients who have diabetes need a high level of support when diabetes treatment is introduced¹⁷.

This study also sought to establish what the subjects' attitudes were towards insulin injections. In general, it was found that the subjects had negative attitudes towards insulin injections. The most positive opinions were apparent for the statement "I need to plan my day around taking insulin injections" (M = 3.33). This was followed by the statement saying that sticking to the treatment plan for insulin as instructed is hard to follow (M = 3.21). The least mean score was generated for the item stating that the healthcare provider does not help in understanding the importance of keeping normal blood sugar levels. These findings again support those study findings which discovered that all the participants stated that all of their diabetic medication was a burden to them¹⁶. Moreover, the study also found that insulin injections were the most burdensome to the participants, and adherence to this form of treatment was negatively associated with the sense of burden perceived.

Most of the subjects stated that they are provided with sufficient information about the type of diabetes they have and its related symptoms (M=2.23). Therefore, it may be that even though not all of the subjects are received information about diabetes from their physician or nurse, the rest must have obtained reliable information from elsewhere, such as booklets, because the majority of the subjects stated that

they had sufficient information about the type of diabetes they have and its related symptoms. In terms of a healthy diet, the scores reflected that lowest score ($M=1.72$) indicating that this item/instruction is the least followed; 40.9% stated that they never follow a healthy diet while 44.4% stated that they do so on occasions. Therefore, it has been found that amongst the diabetic patients in this study, a healthy diet was not a top priority for many of them. Furthermore, physical exercise also received a low score ($M=1.93$) with 31.1% of patients stating they never do physical exercise while 44.4% said that they do so some sometimes. These findings are important, and something that needs to be improved on, as many researchers state that diabetes is not a curable disease, but along with insulin medication, patients need to ensure that they take regular exercise and have a healthy diet, or else their condition will worsen^{18,19,20}.

Overall, more than 50% of the patients have sought help in terms of each of the items listed above, either daily or several times per week. Although most items indicate that assistance is needed, it can be seen from Table 4.8 that most patients stated that they require no assistance or only assistance on occasions in terms of their diabetes therapy. An alarming percentage of 62% of patients do not seek help²¹. Other studies confirm the present study^{22,23}.

Inferential statistics revealed that the poorer a person's attitude towards insulin injections the more likely they have poor self-management and health education knowledge. This is synonymous with the health promotion model that was put forward by a study which states that a person needs to be educated about health if they are to be capable of efficiently looking after their own health and wellbeing²⁴. Furthermore, it also correlates with the theories put forward by two studies which state that diabetic patients need to be provided with advanced health information and trained effectively on how to medicate themselves and the need for the treatment^{23,25}. It was theorised that educational level impacts upon compliance with diabetes treatment in diabetic patients; patients need to be made aware that diabetes progresses with time and that their

treatment will have to be intensified²³. It was concluded that when diabetes patients are educated sufficiently about the vital role that insulin plays in the management of their treatment, they are more likely to adhere to the treatment²¹.

The present study confirmed that there is a strong significant difference between those who understand how to take insulin and those who do not. This study points out the poorer attitude, lack of self-management, and need for assistance on the part of patients who do not know how to take insulin compared to patients who do. This agrees with a study that pointed out that disease-related knowledge, attitudes and skills may be absent, and that this may be attributable to a lack of sufficient patient education during consultation with health care providers²⁵. However, it is essential to be aware of how this attitude could determine methods when it comes to health practice and could challenge the effective management of diabetes²⁶.

It was found statistically that a significant proportion of those who participated in the study have a poorer attitude, inferior self-management, and needed more assistance compared with patients who do not fear insulin injections. Similarly, it was found that a statistically significant proportion of patients fear insulin injection, leading to poor self-management and the progression of complications associated diabetes¹⁵. Diabetes education methods and psychological treatment approaches such as addressing a fear of insulin injections may also help to change the negative perceptions of the patient²⁷.

The study showed that impact of poorer attitude, inferior self-management and need for assistance on the part of those who have type II diabetes was significantly greater than was the case of those with type I diabetes. This finding is considerably higher than in a study which argued that there was a better attitude and superior self-management in patients with type II diabetes. Thus, there is a need to investigate this situation with further study using a larger sample²⁸.

Although, results agreed with those of the present study, they argued that patients with type I diabetes is a chronic disease, has a longer duration, and patients are more likely to have an increased awareness in terms of the progression of diabetes¹⁶.

The Kruskal Wallis test showed that that education has an impact on the attitude towards insulin injections, self-management, and assistance. The poorest scores were found among participants who had primary or intermediate school education only and the best scores were for university graduates (primary school=58.79; intermediate school=57.75; high school=40.82; university=26.26). This finding is congruent with study with a sample of 406 participants to determine the sociodemographic of diabetic patients in Abha²⁶. The study showed that that the level of educational status of the participants was a significant determinant of compliance. The findings of the current study are not however in line with those results of study conducted in a Ugandan hospital to determine the prevalence and factors associated with non-compliance to diabetes. It was found that that level of education did not have a significant effect on medication compliance²⁹. The discrepancy in findings between the two studies could be due to fact that the Ugandan hospital study was carried out in Nigeria and not in SA. It also backs up the findings of the study carried out by Khan et al. (2012) who conducted a cross sectional, quantitative study to determine the rate of non-compliance and the factors that contribute to non-compliance amongst patients with diabetes, in SA²⁵. In this study, the level of non-compliance to insulin injections was 61.60% amongst those who had primary school education, 47.16 amongst those with secondary education, and only 47.61% amongst those who were educated to high school level or higher.

A statistically significant association was found upon inferential analysis was carried out to determine if the participant's place of residence influenced their attitudes towards insulin. The participants who lived in the urban areas had more positive scores (MR=38.84) compared to rural patients (MR=57.56): {U=542.00, $p < 0.001$ }. This goes against the findings of the

study carried out by Khan, which was mentioned in the previous paragraph. The study found that the rate of non-compliance was higher amongst the participants who lived in urban areas than in rural areas (71.04% n=355 and 60.15% n=133, respectively)²⁵. However, this study was only based on one region in SA, and therefore it may be that there are variations across the country.

A significant effect was found regarding attendance to diabetes education on patients' attitude, self-management and need for assistance in terms of insulin injections. The study showed that a poor attitude, inferior self-management, and need for assistance existed for those patients who had never consulted an educator compared with patients who had met an educator more than twice. Health promotion approaches as part of an ongoing education consultation with an educator towards diabetes management had a significant impact on patients' attitudes and changed behavior³⁰.

CONCLUSION:

This study explored numerous variables associated with compliance of diabetes patients with insulin treatment and their understanding of their condition. The patients in the present study had variable self-management compliance and their attitudes towards their condition varied, e.g., approximately one-third patients did not monitor their blood glucose levels regularly. This reveals critical issues regarding education of diabetes patients in SA regarding self-management to prevent the exacerbation of their condition. Furthermore, this study has implications for healthcare in a hospital setting, which should be addressed to reverse this trend.

RECOMMENDATION:

Healthcare practitioners in diabetes clinics in SA should ensure that they optimize opportunities to educate their patients regarding regular blood glucose monitoring to prevent exacerbation of their condition; consequently, healthcare teams must ensure their availability

in clinics to provide their patients with information and advice regarding insulin treatment. This could be addressed during discussions with the physician, who could proactively refer patients on an annual basis to the healthcare teams for diabetes education. This may enable communication with patients and may promote a positive attitude towards insulin treatment and quality of life in diabetes patients. Hence, professional educators are recommended to ensure that healthcare teams for diabetes education in SA, receive adequate and specific training in communicating with diabetes patients about their condition and its treatment. This appears important, as the patients in this study did not rely on their educator as the primary source of information about their condition and its treatment.

LIMITATIONS:

It is important to determine whether the findings of the current study are generalizable to the population; hence, it is essential to determine whether sufficient information has been provided about the sample and the demographic³¹. Furthermore, participants constituting the sample need to have been selected randomly. Sufficient information has been provided about the nature of the sample in terms of the demographic characteristics, such as sex and age; however, the participants were not selected randomly, but were rather sampled consecutively in the study, thereby limiting the generalizability of the findings to other patients from the clinic. Furthermore, the sample size was not large enough (n=90) and the study was only conducted in one area of SA.

Throughout the study, every possible caution has been taken to ensure the lack of bias in the results. However, it must be noted that because the participants were asked to complete the questionnaire during a clinical consultation, they may have felt pressured to complete it within a certain time frame, as they may have had other commitments. Therefore, some of their responses may not have been completely accurate, thereby implying the potential for bias in the results. Therefore, further studies are

required using a much larger sample size including diabetes patients from different parts of the country, in both rural and urban areas, using random sampling techniques. This would allow for more reliable and valid findings to for policies and practice in diabetes care.

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The authors have no competing interests to declare.

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Main author did the proposal writing and data analysis contracting and follow up, while the co-authors did validation for the tool and administrative follow up, data collection procedure and did final manuscript writing and submission.

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