

Willingness of people with Type 2 diabetes to start insulin therapy: Evidence from the South African Tshwane Insulin Project (TIP)

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Highlights

- Study explores “willingness” to start insulin among people with Type 2 diabetes in primary care.
- One in two patients were ‘unwilling’ to start insulin therapy if recommended.
- Drivers of unwillingness included injection anxieties, fear of needles and insufficient knowledge.
- Demographic factors were not associated with insulin therapy reluctance.
- In practice, psychological insulin resistance should be investigated in reluctant patients.

Abstract:

Aims

To determine factors associated with 'hypothetical willingness' to start insulin among people with Type 2 diabetes (T2DM).

Methods

A quantitative cross-sectional study with insulin-naïve T2DM patients at 23 primary care facilities in the Tshwane Metropolitan Municipality. Data collected included demographic and clinical data, willingness to start insulin, attitudes and barriers to insulin therapy. Factors associated with unwillingness to start insulin therapy were explored using a multivariate logistic regression model.

Results

Of 468 T2DM study patients (mean age 57.2, SD = 11.3 years), more than half (51.9%) expressed unwillingness to starting insulin therapy. Unwillingness was associated with negative attitudes (OR = 1.32, 95% CI = 1.12-1.55, $p = 0.001$) and reluctance (OR = 1.41, 95% CI = 1.27-1.57, $p < 0.001$) rather than age, sex, education or diabetes duration. The strongest reasons for patient unwillingness were injection anxieties, fear of needles, insufficient knowledge of insulin, feeling unable to cope with insulin and concerns about out-of-pocket costs.

Conclusions

The prospect of insulin therapy disturbs patients' sense of self and their psychological wellbeing. The high prevalence of psychological insulin resistance among these T2DM patients needs to be addressed for effective diabetes management.

Keywords: Diabetes mellitus, Type 2; Insulin therapy; Willingness; Psychological insulin resistance; Primary care

1. Introduction

The progressive nature of Type 2 diabetes mellitus (T2DM) means that approximately half of people on oral hypoglycaemic agents will require insulin therapy five to ten years after diagnosis (1-3). Notwithstanding this need, health care practitioners (HCPs) are reluctant to prescribe, and patients are reluctant to start insulin (4, 5), causing a delay or failure to commence appropriate therapy. Chronic diagnoses such as diabetes, cancer or coronary heart disease are known to disrupt psychological wellbeing (6), increase depression, reduce self-care and negatively impact on treatment outcomes (7, 8). Psychological stress is exacerbated when there is a need to escalate therapy, especially amongst people whose diabetes self-efficacy is low (9). People with T2DM also often have strong negative attitudes towards insulin therapy (4, 10). Negative attitudes arise from doubts about the efficacy of insulin therapy in controlling diabetes, fear of injections, concerns about risks and side effects, difficulty in fitting insulin treatment around normal life and managing injections (4). People with T2DM may also associate the need for insulin therapy with a sense of failure and self-blame that they have not managed their condition effectively (1, 11, 12).

Psychological insulin resistance (PIR) is a collective term for the combination of factors that obstruct effective therapeutic insulin management (13, 14). The construct describes a “complex phenomenon associated with insulin therapy” that includes emotional, cognitive and supportive relational factors. Deconstructed, the concept of PIR comprises three categories or domains namely emotional, cognitive and supportive factors, with eight attributes and 30 indicators (15). These have been used in various qualitative and quantitative studies, either as unvalidated items or scales (11, 12, 16, 17), or more systematically, as validated tools such as the “Insulin Treatment Appraisal Scale” (18), the “Barriers to Insulin Treatment” (19) or the “Chinese Attitudes to Starting Insulin Questionnaire” (20). Of the five validated PIR questionnaires published in English-language journals, none comprehensively cover all aspects of PIR (21). These instruments focus too narrowly on insulin refusal, seldom exploring negative and positive attitudes to insulin (21). Also, the rigour and reporting of questionnaire development and psychometric validation varies considerably between measures (21). In other research, PIR was understood to measure “hypothetical willingness” to begin insulin therapy with “being hypothetically unwilling” interpreted as a proxy for insulin refusal (12, 22).

In South Africa there is little research on PIR, despite strong evidence that few patients with T2DM requiring insulin actually escalate therapy (23, 24). We found two studies, one assessed insulin aversion among a small sample of uncontrolled patients of Indian descent on maximum oral treatment (25). The other study reported the views and experiences of HCPs on patient barriers to initiating insulin, without including patients (26). This is sub-optimal, since HCPs are known to anticipate negative emotional reactions and often have pre-conceived ideas about the willingness of patients to begin insulin therapy (27, 28).

Psychological well-being, and PIR specifically, has significant implications for diabetes management (1, 13, 29-31). To effectively manage diabetes, we need to understand the specific attributes of PIR that are relevant to South African patients and clinicians. This information can be used to develop care plans that are able to overcome PIR. This study explores the extent and nature of “reluctance in the abstract” (13) to insulin therapy among insulin-naïve T2DM patients who receive diabetes care at public primary care facilities. “Reluctance in the abstract” explores the hypothetical willingness of patients to start insulin therapy, and there is no way of knowing to what extent patients will transfer this “willingness” when directly approached by their healthcare provider. We also identify attitudinal, demographic and clinical factors associated with patient reluctance to start insulin therapy.

2. Materials and methods

2.1. Study design

This quantitative cross-sectional study of patient knowledge, attitudes and practices included insulin-naïve T2DM participants using an interviewer-administered questionnaire as part of the Tshwane Insulin Project (TIP). The TIP is a 5-year translational research programme aiming to optimise the use of insulin in primary care in South Africa.

2.2. Setting and study participants

Data were collected at 23 primary health care facilities (21 clinics and 3 community health centres) in the Tshwane Metropolitan Municipality, situated in the northern part of Gauteng Province in South Africa. In South Africa, public primary healthcare services are free. The Primary Healthcare Essential Medicines List includes basic medication for the management of diabetes including insulin which is available free of charge (32).

Challenges lay with the provision of glucose meters and strips for self-glucose monitoring, however those consumables can be accessed at hospital level.

A convenience sample of participants was drawn from T2DM patients attending routine health care visits at their respective primary care facilities between February and May 2019. Patients who were at least 18 years old, non-insulin users, diagnosed with T2DM and who provided written informed consent were included in the study. Potential participants were excluded if they declined to give consent, were younger than 18 years, had Type 1 diabetes or were T2DM insulin-users.

The University of Pretoria's Faculty of Health Sciences Research Ethics Committee (Ethics Reference: 496/2018) and the Tshwane Research Committee (No: GP_201810_049) approved the study.

2.3. The survey instrument

We reviewed published literature on attitudes towards insulin therapy to guide the development of an instrument to measure PIR. We found that most tools are designed to measure PIR in Western populations (18, 33, 34). Currently, no instruments have been validated in the South African context. We decided to develop a study-specific instrument using selected items from available surveys, including surveys conducted in South Africa. The resultant questionnaire was assessed for accuracy, relevance and appropriateness by three senior academics with expertise in diabetes research and survey development. The questionnaire was tested with a dozen patients at the Steve Biko Academic Hospital to verify the appropriateness and comprehensibility of items.

The instrument had two sections. The first section covered patient demographic and clinical data (age, gender, employment status and diabetes duration). The second section assessed PIR using 19 items. The first question determined the willingness to start. Respondents were asked to indicate their willingness to take insulin if recommended by a doctor (12, 21). Hypothetical willingness was analysed as a discrete variable encompassing any degree of willingness (slightly, moderately, or very) and compared with unwillingness (12). Respondents answered a set of attitudinal and belief items to identify psychological and social barriers to insulin therapy. These included questions relating to injection-related anxieties, perceived social stigma, sense of personal failure, low self-efficacy, fear of side effects, doubt of treatment efficacy, loss of freedom and financial

constraints. Six negative items were used to identify participant attitudes to insulin therapy. Respondents were presented with statements about being on insulin therapy and asked to indicate how worried each statement made them feel (from “extremely worried” to “not worried at all”). The reliability coefficient of the six attitudinal items was 0.86 and a total “attitudinal score” was calculated by combining all the responses where respondents selected extremely, very or slightly worried. Additionally, 12 items were used to explore the reasoning behind patient reluctance to start insulin despite clinical recommendations. A total “reluctance score” of between 0 and 12 was obtained by combining all positive answers.

2.4. Statistical analysis

Ideal sample size was calculated using Epi Info version 7.2 statistical software. Assuming 50% prevalence or level of knowledge, attitudes and practices (since this is unknown), 95% confidence level, and 5% margin of error, yielded a sample size of $n=384$ which was rounded off to 400 to accommodate any missing data or non-responses. The sample size was not adjusted for clustering within and between facilities since no relevant correlation data were available.

Data were captured using Qualtrics (Qualtrics, Provo, UT) and analysed using STATA version 15.1 (Statacorp LP, College Station, TX). Data were summarised using descriptive statistics. Associations between categorical variables were explored using *chi*-square tests. Univariate logistic regression yielded unadjusted odds ratios. We used Wilcoxon-Mann-Whitney tests to compare scores between two groups. We used a multivariable logistic regression model to determine the independent effect of attitudes and reluctance on unwillingness to start insulin. Statistical significance was set at $p < 0.05$.

3. Results

3.1. Sample characteristics

We surveyed 24 out of 79 primary healthcare facilities (30.4%) in the Tshwane District. A total of 468 T2DM insulin-naïve patients took part in the study (Table 1). Respondents ranged in age between 30 and 92 years with a mean age of 57.2 (SD = 11.3). Nearly two thirds (66.5%) were female, 54.9% had a secondary school education and 42.5% were employed. The average diabetes duration was 5.0 (2.0-9.0) years, and most of the respondents (84.8%) said that they had never been advised to take insulin.

TABLE 1: Characteristics of insulin-naïve T2DM patients (n = 468) who were either willing or unwilling to start insulin. Figures are numbers (% of non-missing values) unless otherwise stated.

Patient characteristics	Total n (%) n = 468	Unwilling n (%) 243 (52%)	Willing n (%) 225 (48%)	P-value
Sex				
Female	311 (66.5)	173 (55.6)	138 (44.4)	0.024
Male	157 (33.5)	70 (44.6)	87 (55.4)	
Age groups				
30-55	209 (44.7)	95 (45.4)	114 (55.6)	0.012
Over 55	259 (55.3)	148 (57.1)	111 (42.9)	
Race				
African	425 (90.8)	227 (53.4)	198 (46.6)	0.043
Other*	43 (9.2)	16 (37.2)	27 (62.8)	
Educational attainment				
Primary school	129 (27.6)	77 (59.7)	52 (40.3)	0.138
Secondary school	257 (54.9)	129 (50.2)	128 (49.8)	
Tertiary education	37 (7.9)	15 (40.5)	22 (59.5)	
No schooling	45 (9.6)	22 (48.9)	23 (51.1)	
Employment status				
Employed	199 (42.5)	92 (46.2)	107 (53.8)	0.058
Unemployed	99 (21.2)	55 (55.6)	44 (44.4)	
Retired	160 (34.2)	93 (58.1)	67 (41.9)	
Student or disabled	10 (2.1)	3 (30.0)	7 (70.0)	
Diabetes duration				
Below 5 years	167 (46.4)	88 (52.7)	79 (47.3)	0.222
5-10 years	127 (35.3)	67 (52.8)	60 (47.2)	
Over 10 years	66 (18.3)	27 (40.9)	39 (59.1)	
Ever been advised to take insulin in the past				
Yes	71 (15.2)	30 (42.3)	41 (57.7)	0.077
No	397 (84.8)	213 (53.7)	184 (46.3)	

P-value represents the difference between the respondents' characteristics.

(*) Other = Asian/Indian, Coloured and White.

3.2. Willingness to start insulin

Of the respondents, 51.9% reported being unwilling to start insulin if recommended by their doctor, and the remainder indicated some degree of willingness (slightly willing, 13.7%; moderately willing, 13.2%; and very willing, 21.2%). Men (55.4%, $p = 0.024$) and respondents younger than 55 years (55.6%, $p = 0.012$) were more willing to start insulin than women and patients over 55 years. Most African respondents were unwilling to start insulin (53.4%, $p = 0.043$). There were no significant differences in willingness between educational attainment, employment status, diabetes duration and prior insulin advice (Table 1).

3.3. Participants' attitudes towards insulin use

Many participants held negative attitudes towards insulin therapy (Table 2). With a median attitudinal score of 4 (IQR = 2 – 5; mode = 6), the most commonly shared concerns among participants were injection related anxieties (79%), fear of needles (75%) and coping with insulin therapy (64%). More than half of the patients (54%) regarded going onto insulin as a personal failure.

TABLE 2: Attitudes of insulin-naïve T2DM patient towards insulin therapy in the Tshwane Metropolitan Municipality (n=468).

How worried does the statement make you feel?	Extremely/very/slightly worried n (%)	Not worried at all n (%)
Injections related anxieties		
I have to take injections every day.	370 (79.4)	96 (20.6)
I am afraid of needles.	348 (74.7)	118 (25.3)
Lifestyle restrictions and adaptations/Loss of freedom		
I feel like I cannot do the things I like to do.	255 (54.8)	210 (45.2)
I have to cope with the demands of insulin therapy.	298 (64.1)	167 (35.9)
Social stigma		
I can't go out with friends and family.	181 (39.2)	281 (60.8)
Feelings of personal failure (self-blame)		
Going on insulin makes me feel like a failure.	251 (54.0)	214 (46.0)

Respondents who were unwilling had higher attitudinal scores than respondents who were willing to start insulin therapy ($p < 0.001$). Further, respondents who were unwilling, had significantly more negative responses to all six attitudinal items ($p < 0.001$) (Table 3). The attitudinal items that most strongly distinguished unwilling from willing participants were injection-related anxieties including fear of needles and lifestyle restrictions (Table 3).

TABLE 3: Attitudes of insulin-naïve T2DM patients who were either willing or unwilling to start insulin therapy in the Tshwane Metropolitan Municipality.

	Unwilling n (%)	Willing n (%)	n	χ^2 - statistic (df)	P-value	OR	95% CI	P-value
Injections related anxieties								
I have to take injections every day.	224 (93.0)	146 (64.9)	370	56.00 (1)	<0.001	7.13	4.06-12.53	<0.001
I am afraid of needles.	218 (90.5)	130 (57.8)	348	65.71 (1)	<0.001	6.93	4.18-11.47	<0.001
Lifestyle restrictions and adaptations/Loss of freedom								
I feel like I cannot do the things I like to do.	179 (74.6)	76 (33.8)	255	78.08 (1)	<0.001	5.75	3.85-8.59	<0.001
I have to cope with the demands of insulin therapy.	193 (80.4)	105 (46.7)	298	57.47 (1)	<0.001	4.69	3.11-7.09	<0.001
Social stigma								
I can't go out with friends and family.	135 (56.5)	46 (20.6)	181	62.25 (1)	<0.001	4.99	3.30-7.55	<0.001
Feelings of personal failure (self-blame)								
Going on insulin makes me feel like a failure.	154 (64.2)	97 (43.1)	251	20.72 (1)	<0.001	2.36	1.63-3.43	<0.001

Data are the number and percentages of patients who indicated that the statement made them feel worried (extremely, very or slightly). P values compare differences between willing vs unwilling participants.

3.4. Barriers to insulin therapy

With a median reluctance score of 5 (IQR = 2 – 8; mode = 3), patients were reluctant to start insulin therapy because they didn't have enough information (67.0%), were scared of needles and pain (66.5%) and could not afford glucose meters and strips (62.4%) (Table

4). Half (50.3%) of respondents did not feel that they could manage with insulin therapy. Fear of side effects, namely weight gain (31.1%) and hypoglycaemia (37.4%), was significantly less common.

TABLE 4: Barriers to insulin use among insulin-naïve T2DM patients (n=468) in primary care in the Tshwane Metropolitan Municipality.

"I may be reluctant to start insulin treatment despite doctor recommendation because...?"	Yes n (%)	No n (%)
Lack of information		
I don't have enough information regarding insulin.	312 (67.0)	154 (33.0)
Doubts about the effectiveness of insulin		
I don't believe that insulin can help control my diabetes.	132 (28.4)	333 (71.6)
Financial constraints		
I don't have enough financial resources to afford glucose meter and strips.	291 (62.4)	175 (37.6)
I cannot afford to change my diet and have regular meals.	241 (51.7)	225 (48.3)
Fear of needles and injection concerns		
I am scared of needles and the pain from injections.	310 (66.5)	156 (33.5)
I am worried that I might forget to take my injections.	182 (39.1)	283 (60.9)
Fear of side effects		
I am concerned about gaining weight.	145 (31.1)	321 (68.9)
I am worried about low blood sugar (hypoglycaemia) due to insulin.	174 (37.4)	291 (62.6)
Concerns about adverse effects and myths		
I have seen people deteriorate after they started insulin.	150 (32.2)	316 (67.8)
I have heard many negative things from people about insulin.	126 (27.0)	340 (73.0)
Low self-efficacy and lack of social support		
I will not be able to manage with insulin therapy.	234 (50.3)	231 (49.7)
I don't have any support at home to help me.	127 (27.3)	338 (72.7)

When comparing reluctance scores between the willing and unwilling respondents, unwilling respondents had significantly higher reluctance scores for all questions ($p < 0.001$) (Table 5). Unwilling participants were reluctant to start insulin because of fear of needles and pain (88.0%), lack of information (84.2%), financial constraints (77.6%) and low self-efficacy (73.8%).

TABLE 5: Barriers to insulin use among insulin-naïve, T2DM patients who were either willing or unwilling to start insulin therapy in the Tshwane Metropolitan Municipality.

	Unwilling n (%)	Willing n (%)	n	χ^2 - statistic (df)	P-value	OR	95% CI	P-value
Lack of knowledge								
I don't have enough information regarding insulin.	203 (84.2)	109 (48.4)	312	67.36 (1)	<0.001	5.69	3.68-8.77	<0.001
Doubt about the effectiveness of insulin								
I don't believe that insulin can help control my diabetes.	105 (43.9)	27 (12.0)	132	58.06 (1)	<0.001	5.75	3.57-9.25	<0.001
Financial constraints								
I don't have enough financial resources to afford glucose meter and strips.	187 (77.6)	104 (46.2)	291	48.83 (1)	<0.001	4.02	2.70-6.01	<0.001
I cannot afford to change my diet and have regular meals.	161 (66.8)	80 (35.6)	241	45.51 (1)	<0.001	3.65	2.49-5.35	<0.001
Fear of needles and injection concerns								
I am scared of needles and the pain from injections.	212 (88.0)	98 (43.6)	310	103.06 (1)	<0.001	9.47	5.93-15.14	<0.001
I am worried that I might forget to take my injections.	132 (55.0)	50 (22.2)	182	52.38 (1)	<0.001	4.28	2.86-6.41	<0.001
Fear of side effects								
I am concerned about gaining weight.	93 (38.6)	52 (23.1)	145	13.01 (1)	<0.001	2.09	1.40-3.13	<0.001

I am worried about low blood sugar (hypoglycaemia) due to insulin.	120 (49.8)	54 (24.1)	174	32.71 (1)	<0.001	3.12	2.10-4.64	<0.001
Concern about adverse effects and myths								
I have seen people deteriorate after they started insulin.	115 (47.7)	35 (15.6)	150	55.14 (1)	<0.001	4.95	3.19-7.70	<0.001
I have heard many negative things from people about insulin.	90 (37.3)	36 (16.0)	126	26.87 (1)	<0.001	3.13	2.01-4.87	<0.001
Low self-efficacy and lack of social support								
I will not be able to manage with insulin therapy.	177 (73.8)	57 (25.3)	234	108.90 (1)	<0.001	8.28	5.46-12.55	<0.001
I don't have any support at home to help me.	88 (36.7)	39 (17.3)	127	21.86	<0.001	2.76	1.79-4.26	<0.001

Data are the number and percentages of patients who responded "yes" to each statement. *P* values compare differences between willing vs unwilling participants.

3.5. Multivariate analysis

After adjusting for age, race, gender, education, diabetes duration and employment status in a multivariable logistic regression, we found that negative attitudes (OR = 1.32, 95% CI = 1.12-1.55, $p = 0.001$) and reluctance (OR = 1.41, 95% CI = 1.27-1.57, $p < 0.001$) were determinants of unwillingness to start insulin therapy.

4. Discussion

In the Tshwane District, more than half of T2DM patients in primary care were unwilling to start insulin therapy, with negative attitudes and reluctance predicting resistance to treatment escalation. Willingness was not associated with age, sex, educational attainment or diabetes duration. Unwilling patients expressed concerns about injection anxieties, fear

of needles, insufficient knowledge of insulin therapy, feeling unable to cope with the demands of taking insulin, concerns about associated out-of-pocket costs and lifestyle restrictions from injecting. Worryingly, a substantial group of patients were doubtful that insulin would control their diabetes.

Our findings are consistent with the limited PIR evidence in South Africa (25, 26). Similar to patients in Tshwane (this study), other patients in South Africa have reported insecurities around diabetes self-management (25, 35), particularly in terms of their sense of self-efficacy and their knowledge of insulin(36). Although these factors seem to outweigh concerns about the side effects of insulin, which have been associated with PIR in other studies (37), the possibility exists that the lack of knowledge determines the absence of concern regarding side effects. Studies from the USA (38) and China (20) also suggest that PIR is influenced more heavily by social relations, particularly cultural expectations of family support, than by concerns about the side effects of insulin therapy.

The demographic characteristics of this sample of T2DM patients are similar to those observed in other studies conducted in the South African primary healthcare sector where T2DM patients are often predominantly women and African, with a similar mean age (39, 40). Within this sample, demographic factors did not influence willingness to start insulin therapy. When analysed on their own, older age (>55 years), female sex and African race were associated with unwillingness to start insulin, these factors were not significant in the multivariate analysis. This finding is consistent with much of the literature reviewed (17, 22, 35, 41-43), although some studies (12, 16, 44) have found evidence that socio-demographic factors significantly increase patient unwillingness to start insulin.

The level of unwillingness to initiate therapy found in our study is similar to results from low-income and poorly educated insulin-naïve patients in the Democratic Republic of Congo (42.7%) (45) and among racial minority populations with low income in the United States (48.0%) (46). It is lower than levels reported in Malaysia (74.2%) (44) and Singapore (70.6%) (16), but higher than those reported in Australia (22.6%) (22), the U.S. (28.2% - 33.0%) (12, 42), Saudi Arabia (34.6%) (17) and the Netherlands (39.0%) (41). The large variation in prevalences of unwillingness to start insulin therapy (range between 28.2% - 74.2%) may be explained by the different methods used in different studies, making it difficult to compare results. To some extent, unwillingness may be influenced by

demographic and social differences, including patient socio-economic status, education levels and patient/clinician language barriers (26).

Importantly, the link between unwillingness and PIR needs to be clearly defined. In patients unwilling to initiate insulin therapy, PIR can be used as a tool to identify important barriers to accepting treatment. Of the barriers described as PIR, the concerns about out-of-pocket costs are inherent in less resourced public health systems, particularly in sub-Saharan Africa (47). Adjustments to the structure of the healthcare systems, economic difficulties and declining public expenditures are reasons which have weakened the capacity to provide access to free therapy (48). The only insulin specific barriers highlighted as PIR are those surrounding administration and monitoring (self-injection, glucose monitoring and side effects). As important as this specificity is, it nests in rather than defines a person's state of being. In a medical setting, clinicians run the risk of using PIR as a diagnostic tool of a (non-existent) condition, rather than as "complex concept" describing hypothetical barriers of varying depth, strength and duration to diabetes insulin therapy. It is therefore unclear how PIR conceptually advances the multi-dimensional notion of psychological well-being developed by Ryff (49) and the critical role mental health plays in effective diabetes management and chronic clinical care in general. PIR does not constitute an intervention framework, although each of the elements or items can be addressed through theoretically informed and practically tested psychological and educational interventions. The interventions developed to address the unwillingness to commence insulin therapy should be tailored to address the reasons for PIR.

4.1. Limitations and strengths of the study

This study offers insight into conducting research in a developing country with limited support and medical resources available to people living with diabetes. Poor literacy levels of the respondents, and language disparities between HCPs and respondents were among the difficulties encountered during this study. Although the latter was mitigated by using trained fieldworkers who were fluent in local languages. The instrument used to measure PIR was not validated and included mostly negatively worded items, therefore did not assess positive beliefs about insulin. Further, as a study of hypothetical willingness, the findings cannot predict participants' actual insulin uptake.

Another limitation of the study is the fact that patients surveyed in this study did not necessarily require insulin, but data from previous studies demonstrate the need for

therapy intensification in T2DM patients in South Africa who are mostly poorly controlled (24, 40, 50). Considering the natural progression of T2DM and in anticipation to insulin therapy, the study assessed the willingness of patients to begin insulin if recommended by a health professional. Similar studies have been conducted in other settings (12, 17, 41, 46).

Clinical parameters such as haemoglobin A1c, blood pressure or diabetic complications were not available in this survey because the access to patient medical records was not sought. However, previous studies found that demographic and clinical characteristics did not differ significantly by willingness to initiate insulin therapy (22).

Despite these limitations, this study meaningfully investigated factors associated with hypothetical willingness to start insulin among insulin-naïve T2DM patients attending primary care facilities in Tshwane. The strengths of this study include a large sample size and the exploration of both attitudes and barriers to insulin use. The study sample is representative of the general population that accesses diabetes care in the primary healthcare sector because of the number and spread of health facilities surveyed, however the results might not be generalizable to the entire country because of the heterogeneity of the South African population.

4.2. Clinical implications and future directions

The relative weight of factors that influence hypothetical willingness to initiate insulin therapy can be used to guide patient clinician interactions. It is essential to establish the psychological well-being status of each individual T2DM patient and the elements that are disturbed by therapy escalation. In the Tshwane Insulin Project, the capability approach to learning is being used to develop diabetes competency. Clinicians work from patient experience to develop strategies with them to overcome barriers to insulin therapy and improved diabetes self-management.

The complexity of PIR has multiple clinical implications for improving insulin therapy receptiveness among poorly controlled patients. PIR should be investigated when patients are reluctant to start insulin therapy. This information can be used to overcome the patient's anxieties and fears. HCPs should begin by inquiring about patient knowledge of and attitude towards starting insulin therapy. Short, personalised interventions that address specific fears or misperceptions may thus be useful. These interventions require

that HCPs are adequately prepared to educate patients' on diabetes care and how to quell concerns and uncertainty regarding insulin therapy. The development of a therapeutic education programme on diabetes and access to insulin without placing additional financial strain on the patient is pivotal to reducing the prevalence of PIR within Tshwane and beyond.

5. Conclusion

More than half of T2DM patients in primary care in the Tshwane District express unwillingness to starting insulin therapy, with negative attitudes towards insulin and reluctance predicting resistance to insulin therapy. Reluctance to initiate insulin therapy arises because the escalation of diabetes therapy disturbs patients' sense of self and their psychological well-being. PIR is a real issue in effective diabetes management and an unmet need that should be addressed with patients, their families and carers as well as with clinicians.

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Author contributions

All authors are part of the Tshwane Insulin Project study group. PR, EMW and PNP were responsible for the conceptualisation and design of the study. PNP supervised data collection. PNP and PR analysed the data, PW contributed to the interpretation of the data. PNP, TSM, PW and PR contributed to the interpretation framework, writing and editing. All authors read, critically reviewed and approved the article.

Bibliography

1. Peyrot M, Rubin RR, Khunti K. Addressing barriers to initiation of insulin in patients with type 2 diabetes. *Primary Care Diabetes*. 2010;4:S11-S8.
2. Penforinis A, San-Galli F, Cimino L, Huet D. Current insulin therapy in patients with type 2 diabetes: Results of the ADHOC survey in France. *Diabetes and Metabolism*. 2011;37(5):440-5.
3. Hanefeld M. Use of insulin in type 2 diabetes: What we learned from recent clinical trials on the benefits of early insulin initiation. *Diabetes & Metabolism*. 2014;40(6):391-9.
4. Edelman S, Pettus J. Challenges Associated with Insulin Therapy in Type 2 Diabetes Mellitus. *The American Journal of Medicine*. 2014;127(10, Supplement):S11-S6.
5. Manski-Nankervis J-A, Furler J, O'Neal D, Ginnivan L, Thuraisingam S, Blackberry I. Overcoming clinical inertia in insulin initiation in primary care for patients with type 2 diabetes: 24-month follow-up of the Stepping Up cluster randomised controlled trial. *Primary Care Diabetes*. 2017;11(5):474-81.
6. Confederation N. Investing in emotional and psychological wellbeing for patients with long-term conditions. London: NHS Confederation Mental Health Network. 2012.
7. Kolappa K, Henderson DC, Kishoreb SP. No physical health without mental health: lessons unlearned? *Bull World Health Organ*. 2013;91:3-A.
8. Ramkisson S, Pillay BJ, Sartorius B. Psychosocial stress in South African patients with type 2 diabetes. *Journal of Insulin Resistance*. 2016;1(1):1-7.
9. Kim B, Song Y, Kim JI. Psychological Insulin Resistance and Low Self-efficacy as Barriers to Diabetes Self-care Management in Patients with Type 2 Diabetes. *Korean Journal of Adult Nursing*. 2019;31(1):61-7.
10. Benroubi M. Fear, guilt feelings and misconceptions: Barriers to effective insulin treatment in type 2 diabetes. *Diabetes Research and Clinical Practice*. 2011;93, Supplement 1:S97-S9.
11. Peyrot M, Rubin RR, Lauritzen T, Skovlund SE, Snoek FJ, Matthews DR, et al. Resistance to insulin therapy among patients and providers: results of the cross-national Diabetes Attitudes, Wishes, and Needs (DAWN) study. *Diabetes Care*. 2005;28(11):2673-9.
12. Polonsky WH, Fisher L, Guzman S, Villa-Caballero L, Edelman SV. Psychological insulin resistance in patients with type 2 diabetes: the scope of the problem. *Diabetes Care*. 2005;28(10):2543-5.
13. Polonsky WH, Jackson RA. What's so tough about taking insulin? Addressing the problem of psychological insulin resistance in type 2 diabetes. *Clinical Diabetes*. 2004;22(3):147-50.
14. El Shafei M, El Sayyah H, Hussein R. Psychological insulin resistance in patients with type 2 diabetes mellitus. *Egyptian Journal of Psychiatry*. 2015;36(1):60-.
15. Song Y. Concept analysis for psychological insulin resistance in Korean people with diabetes. *Journal of Korean Academy of Nursing*. 2016;46(3):443-53.
16. Wong S, Lee J, Ko Y, Chong M, Lam C, Tang W. Perceptions of insulin therapy amongst Asian patients with diabetes in Singapore. *Diabetic Medicine*. 2011;28(2):206-11.
17. Batais MA, Schantter P. Prevalence of unwillingness to use insulin therapy and its associated attitudes amongst patients with Type 2 diabetes in Saudi Arabia. *Primary Care Diabetes*. 2016;10(6):415-24.
18. Snoek FJ, Skovlund SE, Pouwer F. Development and validation of the insulin treatment appraisal scale (ITAS) in patients with type 2 diabetes. *Health and Quality of Life Outcomes*. 2007;5(1):69.
19. Petrak F, Stridde E, Leverkus F, Crispin AA, Forst T, Pfützner A. Development and validation of a new measure to evaluate psychological resistance to insulin treatment. *Diabetes Care*. 2007;30(9):2199-204.
20. Fu SN, Chin WY, Wong CK, Yeung VT, Yiu MP, Tsui HY, et al. Development and validation of the Chinese Attitudes to Starting Insulin Questionnaire (Ch-ASIQ) for primary care patients with type 2 diabetes. *PloS One*. 2013;8(11):e78933.
21. Holmes-Truscott E, Pouwer F, Speight J. Assessing Psychological Insulin Resistance in Type 2 Diabetes: a Critical Comparison of Measures. *Current Diabetes Reports*. 2017;17(7):46.
22. Holmes-Truscott E, Blackberry I, O'Neal DN, Furler JS, Speight J. Willingness to initiate insulin among adults with type 2 diabetes in Australian primary care: Results from the Stepping Up Study. *Diabetes Research and Clinical Practice*. 2016;114:126-35.
23. Levitt NS, Bradshaw D, Zwarenstein MF, Bawa AA, Maphumolo S. Audit of public sector primary diabetes care in Cape Town, South Africa: high prevalence of complications, uncontrolled hyperglycaemia, and hypertension. *Diabetic Medicine*. 1997;14(12):1073-7.
24. Mayet L, Naidoo SS. An evaluation of insulin therapy initiation among patients with type 2 diabetes attending a public health facility in South Africa. *South African Family Practice*. 2012;54(6):525-30.

25. Nadasen DM, Naidoo M. Patients with type 2 diabetes and difficulties associated with initiation of insulin therapy in a public health clinic in Durban. *South African Family Practice*. 2012;54(5):436-40.
26. Haque M, Navsa M, Emerson SH, Dennison CR, Levitt NS. Barriers to initiating insulin therapy in patients with type 2 diabetes mellitus in public-sector primary health care centres in Cape Town. *Journal of Endocrinology, Metabolism and Diabetes of South Africa*. 2005;10(3):94-9.
27. Furler J, Spitzer O, Young D, Best J. Insulin in General Practice: Barriers and Enablers for Timely Initiation. *Australian Family Physician*. 2011;40(8):617-21.
28. Lee YK, Lee PY, Ng CJ. A qualitative study on healthcare professionals' perceived barriers to insulin initiation in a multi-ethnic population. *BMC Family Practice*. 2012;13:28.
29. Peyrot M, Rubin RR, Lauritzen T, Snoek FJ, Matthews DR, Skovlund SE. Psychosocial problems and barriers to improved diabetes management: results of the Cross-National Diabetes Attitudes, Wishes and Needs (DAWN) Study. *Diabetic Medicine*. 2005;22(10):1379-85.
30. Peyrot M, Barnett A, Meneghini L, Schumm-Draeger PM. Insulin adherence behaviours and barriers in the multinational Global Attitudes of Patients and Physicians in Insulin Therapy study. *Diabetic Medicine*. 2012;29(5):682-9.
31. Ellis K, Mulnier H, Forbes A. Perceptions of insulin use in type 2 diabetes in primary care: a thematic synthesis. *BMC Family Practice*. 2018;19(1):70.
32. Mollentze WF. Insulin therapy in South Africa: barriers, dilemmas and paradoxes: Editorial. *South African Journal of Diabetes and Vascular Disease*. 2011;8(1):4.
33. Martinez L, Consoli SM, Monnier L, Simon D, Wong O, Yomtov B, et al. Studying the Hurdles of Insulin Prescription (SHIP©): development, scoring and initial validation of a new self-administered questionnaire. *Health and Quality of Life Outcomes*. 2007;5(1):53.
34. Petrak F, Stridde E, Leverkus F, Crispin AA, Forst T, Pfützner A. Development and Validation of a New Measure to Evaluate Psychological Resistance to Insulin Treatment. *Diabetes Care*. 2007;30(9):2199-204.
35. Moosa A, Bezuidenhout S, Meyer JC. Knowledge of type-2 diabetes among patients attending a community health centre in Pretoria, South Africa : patient centered treatment and care. *African Journal for Physical Health Education, Recreation and Dance*. 2015;21(sup-2):241-51.
36. Murphy K, Chuma T, Mathews C, Steyn K, Levitt N. A qualitative study of the experiences of care and motivation for effective self-management among diabetic and hypertensive patients attending public sector primary health care services in South Africa. *BMC Health Services Research*. 2015;15(1):303.
37. Brod M, Kongsø JH, Lessard S, Christensen TL. Psychological Insulin Resistance: Patient Beliefs and Implications for Diabetes Management. *Quality of Life Research*. 2009;18(1):23-32.
38. Song Y, Song H-J, Han H-R, Park S-Y, Nam S, Kim MT. Unmet needs for social support and effects on diabetes self-care activities in Korean Americans with type 2 diabetes. *The Diabetes Educator*. 2012;38(1):77-85.
39. Pinchevsky Y, Butkow N, Chirwa T, Raal F. Treatment Gaps Found in the Management of Type 2 Diabetes at a Community Health Centre in Johannesburg, South Africa. *Journal of Diabetes Research*. 2017;2017.
40. Webb EM, Rheeder P, Van Zyl DG. Diabetes care and complications in primary care in the Tshwane district of South Africa. *Primary Care Diabetes*. 2015;9(2):147-54.
41. Woudenberg YJ, Lucas C, Latour C, Scholte op Reimer WJ. Acceptance of insulin therapy: a long shot? Psychological insulin resistance in primary care. *Diabetic Medicine*. 2012;29(6):796-802.
42. Larkin ME, Capasso VA, Chen C-L, Mahoney EK, Hazard B, Cagliero E, et al. Measuring psychological insulin resistance. *The Diabetes Educator*. 2008;34(3):511-7.
43. Chen CC, Chang MP, Hsieh MH, Huang CY, Liao LN, Li TC. Evaluation of perception of insulin therapy among Chinese patients with type 2 diabetes mellitus. *Diabetes & Metabolism*. 2011;37(5):389-94.
44. Tan WL, Asahar SF, Harun NL. Insulin therapy refusal among type ii diabetes mellitus patients in Kubang Pasu district, Kedah, Malaysia. *Singapore Medical Journal*. 2015;56(4):224-7.
45. Rita SL, Lubaki FJ-P, Bompeka LF, Ogunbanjo GA, Ngwala LP. Prevalence and determinants of psychological insulin resistance among type 2 diabetic patients in Kinshasa, Democratic Republic of Congo. *African Journal of Primary Health Care & Family Medicine*. 2019;11(1).
46. Machinani S, Bazargan-Hejazi S, Hsia SH. Psychological insulin resistance among low-income, U.S. racial minority patients with type 2 diabetes. *Primary Care Diabetes*. 2013;7(1):51-5.
47. Schneider H, Blaauw D, Gilson L, Chabikuli N, Goudge J. Health systems and access to antiretroviral drugs for HIV in Southern Africa: service delivery and human resources challenges. *Reproductive Health Matters*. 2006;14(27):12-23.

48. Hanson K, Ranson MK, Oliveira-Cruz V, Mills A. Expanding access to priority health interventions: a framework for understanding the constraints to scaling-up. *Journal of International Development: The Journal of the Development Studies Association*. 2003;15(1):1-14.
49. Ryff CD. Psychological Well-Being Revisited: Advances in the Science and Practice of Eudaimonia. *Psychother Psychosom*. 2014;83:10-28.
50. Govender RD, Gathiram P, Panajatovic M. Poor control and management of type 2 diabetes mellitus at an under-resourced South African Hospital: is it a case of clinical inertia? *South African Family Practice*. 2017;59(5):154-9.