Diabetes treatment satisfaction among a multi-ethnic Aotearoa New Zealand population with uncontrolled type 2 diabetes mellitus

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ABSTRACT

AIMS: To assess whether diabetes treatment satisfaction differs by ethnicity among participants with insufficient glycaemic control of type 2 diabetes mellitus in a clinical trial involving additional oral diabetes medications. Patient satisfaction is used as an indicator of healthcare quality. However, data on patients' diabetes treatment satisfaction in the context of insufficient glycaemic control is limited.

METHODS: Individuals with type 2 diabetes and an HbA_{1c} of 58–110mmol/mol (7.5–12.5%) were recruited across Aotearoa New Zealand to participate in an 8-month randomised crossover study of vildagliptin and pioglitazone as add-on therapy to metformin and/or sulfonylurea. Participants completed the Diabetes Treatment Satisfaction Questionnaire (DTSQ) at baseline pre-randomisation. Treatment satisfaction scores were compared between ethnic groups and other characteristics using the analysis of variance and linear regression. Perceived hyper- and hypoglycaemia were summarised separately.

RESULTS: Between February 2019 and March 2020, 346 participants (41% women, 32% Pacific peoples, 23% Māori, 26% European) completed the DTSQ. Mean (SD) age was 57.5 (10.9) years, diabetes duration was 9 (6.3) years and HbA_{1c} was 75 (12)mmol/mol (9.0[3.2]%). At study entry, 40% were receiving monotherapy for diabetes. Treatment satisfaction was rated highly, with a score of 29(6) (interquartile range 25–33). Pacific peoples and older people reported greater treatment satisfaction than other groups ($p < 0.001$).

CONCLUSIONS: Diabetes treatment satisfaction was high, particularly among Pacific peoples, despite suboptimal glycaemic control and insufficient glucose-lowering therapy.

Patient treatment satisfaction has been used as an indicator of healthcare quality, which is important in chronic diseases like type 2 diabetes mellitus. Several healthcare organisations measure patient satisfaction in programmes designed to improve quality of care.[1] The progressive nature of type 2 diabetes mellitus often requires treatment intensification over time to maintain glycaemic control, which is critical for preventing diabetes-related complications. However, only half the population with type 2 diabetes mellitus in Aotearoa New Zealand achieve target glycaemic control.[2] Suboptimal glycaemic control can be attributed to two factors: the patient not adhering to prescribed medications and the healthcare provider not initiating or intensifying glucose-lowering therapy when it is clinically appropriate to do so.[3] The former has complex root causes, some of which may be reflected in patients' diabetes treatment satisfaction. The latter is referred to as therapeutic inertia and is driven by a wide range of barriers at the patient, clinician and health system levels.[4]

Common patient-level causes of therapeutic inertia include unawareness of their personal level of glycaemic control, the progressive nature of type 2 diabetes mellitus,[5–7] implications for insufficient glycaemic control,[8,9] fear of or actual side effects,[10,11] concerns over the ability to manage multiple or complicated treatment regimens,[8,9] denial of disease,[12] treatment costs[13] and poor communication by and with physicians.[8,9,14] In conjunction with these patient-level causes, healthcare provider-level causes, such as concerns over patient's adherence or ability to manage more complex treatment regimens, time constraints, reactive rather than proactive care and healthcare system-level causes, such as lack of visit planning, decision support or team approach to care, also contribute to therapeutic inertia.[4] Most strategies

for addressing therapeutic inertia in diabetes use educational interventions among healthcare professionals or patients (including health literacy support), but rarely report patient diabetes treatment satisfaction in the context of insufficient glycaemic control.[4]

Generally, higher diabetes treatment satisfaction is correlated with higher medication adherence, lower HbA_{1c} and lower body weight, suggesting that higher satisfaction may be related to better glycaemic control and clinical outcomes.[15,16] Conversely, individuals (particularly women) with lower income, lower education, unemployment, difficulty accessing care and a higher number of diabetes-related complications are more likely to report lower diabetes treatment satisfaction.[16] Differences in diabetes treatment satisfaction by ethnicity, particularly in the context of insufficient glycemic control in people willing to take additional diabetes medications, have not been reported.

Insufficient glycaemic control and diabetic complications are more prevalent in people of Māori or Pacific ethnicity compared with European and other ethnic groups.[17–19] This study assessed whether diabetes treatment satisfaction among Aotearoa New Zealand adults with type 2 diabetes mellitus inadequately controlled on oral glucose-lowering medication differed by ethnicity.

Materials and methods

We report the baseline diabetes treatment satisfaction questionnaire results from a prospective randomised crossover study designed to evaluate whether people of Māori or Pacific ethnicity responded differently to vildagliptin and pioglitazone compared with non-Māori/non-Pacific peoples. This was a multi-centre trial conducted in general practices and diabetes clinic sites across Aotearoa New Zealand, including both urban and rural regions. The study protocol has been published elsewhere.[20] Participants were eligible for this study if they were aged 18–80 years, had type 2 diabetes mellitus for more than 1 year, were on stable doses of metformin and/or sulfonylurea for at least 3 months, had not used insulin in the last 3 months, had never been on dipeptidyl peptidase-4 inhibitors (DPP-4i) or thiazolidinedione and had an HbA_{1c} of 58–110mmol/mol. Self-reported ethnicity was recorded at the baseline visit. Participants were asked to tick all of the following categories that applied: Māori, Pacific peoples, NZ European, Other European, Indian, Other Asian, Other (asked to specify). Prioritised ethnicity classification as Māori or Pacific peoples was defined if either of these ethnicities were ticked or specified in "Other". If both Māori or Pacific peoples was indicated, then the prioritised ethnicity was grouped as Māori. People were grouped in four categories as Māori, Pacific peoples, European (either NZ or Other European) or Other (as all remaining ethnicities). The study was approved by the Health and Disability Ethics Committee, New Zealand (reference number: 18/STH/242) and recruitment occurred between February 2019 and March 2020. All participants provided written informed consent before data collection.

The Diabetes Treatment Satisfaction Questionnaire (DTSQ) was developed to assess peoples' satisfaction with their diabetes treatment.[21,22] It has been translated into over 100 languages and is widely used in many countries since it is internationally validated and officially approved by the World Health Organization and International Diabetes Federation. The DTSQ-status version (DTSQ-s) contains eight items, as follows: 1) overall treatment satisfaction, 2) frequency of unacceptably high blood glucose levels, 3) frequency of unacceptably low blood glucose levels, 4) treatment convenience, 5) flexibility, 6) satisfaction with understanding of diabetes, 7) willingness to continue present treatment, and 8) willingness to recommend it to others. It assesses treatment satisfaction, and two items assess patient-perceived frequency of unacceptably high and low blood glucose levels. Each item is rated on a scale from 0 to 6. Research sites undertook the DTSQ-s in person, either electronically or on paper. Visits were mainly performed in English, although a subgroup of Tongan participants enrolled in a healthcare service used only a Tongan-translated version of the questionnaire. This was done through the translation service at the Department of Internal Affairs who follow a rigorous process of translation and back translation for accuracy.

Six of the eight items (1 and 4–8) were summed to produce a total treatment satisfaction score between 0 and 36 (0–18 low; 19–36 high treatment satisfaction). Two items assessing perceived frequency of unacceptably high (item 2) and low (item 3) glucose levels were evaluated separately as a score of 0 indicated "never" while a score of 6 indicated "always". Responses of item 2 were compared by HbA_{1c}, while responses of item 3 were compared by type of diabetes medications and their incidence of hypoglycaemia. In the case of missing scores, the existing item scores were

summed and divided by the number of existing items. This was then multiplied by six to form the total treatment satisfaction score.[23]

Baseline clinical data were also collected, such as age, ethnicity, HbA_{1c}, diabetes medications and smoking status. Data are presented as number and percentage (%) or mean + standard deviation (SD). The analysis of variance (ANOVA) was used to test the differences in DTSQ total score between participants grouped by various characteristics for categorical variables, such as ethnicity, as univariate analyses. Linear regression was used to determine the association between DTSQ total scores and participants' baseline HbA_{1c}, age, duration of diabetes and body mass index (BMI). All statistical analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA). Statistical tests were two-sided at 5% significance level.

Results

Baseline characteristics

A summary of participants' baseline characteristics is presented in Table 1. A total of 346 participants were recruited into the prospective randomised crossover study (see study publication for CONSORT diagram) and all completed the DTSQ-s at baseline during clinic visits or remotely via telephone.[20] Pacific peoples made up 32% (n=111) of participants and Māori 22.5% (n=78), while Europeans were 26% (n=90) of the study population. The mean (+standard deviation [SD]) age at baseline was 57.5 (±10.9) years. There was a statistically significant difference in age across ethnicities (p <0.0001), with European participants typically older than other ethnicities: Europeans 62.7 (±9.3) vs Pacific peoples 55.5 (±11.1), Māori 57.3 (±10.5), Other 54.2 (±10.6) years, all p-values <0.001. There was no statistically significant difference between Māori and Pacific participants. Men consisted of 59% (n=205) of the study population. The average duration of diabetes was 9 (±6.3) years with a mean HbA_{1c} of 75 (±12)mmol/mol (9.0[±3.2%]). HbA_{1c} did not differ by ethnicity (p=0.07). Most participants (56.6%, n=196) were on dual oral therapy with metformin and sulfonylurea at baseline. However, almost 40% (39.6%, n=137) were on metformin monotherapy.

Satisfaction

Treatment satisfaction was rated highly (interquartile range 25–33), with a mean total score of 28.6 (±6) (Table 2 and Appendix Table 1). One participant only scored seven items; thus, their total treatment score was estimated using imputation. Participants scored their perceived frequency of unacceptably high blood glucose levels (item 2) at a mean score of 3.3 (±2.0) out of 6. Europeans had a significantly lower score than Māori (p=0.04) and Pacific peoples (p=0.0002), indicating less frequently perceived high blood glucose levels among Europeans. The perceived frequency of unacceptably low blood glucose levels (item 3) was overall rated low, with a mean score of 1.1 (±1.6). Significant differences were found in total DTSQ scores by ethnicity (Table 2), BMI and age (Table 3). Pacific peoples and older people reported greater treatment satisfaction, while those with a lower BMI were more likely to give a higher treatment satisfaction score. No association was found between baseline HbA_{1c} and total DTSQ scores (Table 2). There was also no statistically significant association between total DTSQ scores and baseline therapy, sex or smoking status (Table 2).

Participants scored their satisfaction with their understanding of diabetes as 4.9 (±1.3) from a possible score 0 to 6. Europeans scored this aspect lower than Pacific peoples (4.4±1.5 vs 5.2±1.1, p <0.0001) and Other ethnic groups (5.0±1.2, p=0.002). Māori participants also scored their satisfaction lower than Pacific participants (4.8±1.4 vs 5.2±1.1, p=0.04). There was no statistically significant correlation between participants' satisfaction with their reported understanding of diabetes and their sex, age, baseline therapy or HbA_{1c}.

Discussion

This study found that overall diabetes treatment satisfaction and understanding of diabetes was rated highly among Aotearoa New Zealand adults from multiple ethnic groups with type 2 diabetes mellitus and insufficient glycaemic control. All participants consented to a study that tested the glucose-lowering impact of an additional oral medication, with most using one or two oral hypoglycaemic agents at baseline. The reported perception of unacceptably high or low blood sugar levels among Europeans was significantly lower than Māori and Pacific peoples. Overall, European participants rated a lower satisfaction with their diabetes treatment and understanding, while Pacific participants were more likely to rate their treatment satisfaction highly compared to all other ethnic groups.

The lack of association between HbA_{1c} and overall diabetes treatment satisfaction or understanding contradicts some previously published studies.[24,25] However, these findings reinforce the contention raised by other literature[25–27] that diabetes treatment satisfaction is multifactorial and frequently unrelated to glycaemic control. Importantly, this was assessed in those willing to take part in a study investigating the glucose-lowering impact of two additional oral diabetes medications, suggesting that this subset of people with insufficiently controlled type 2 diabetes mellitus were not in disease denial and were less concerned about treatment complexity or side effects from additional diabetes medications as key reasons for not attaining optimal glycaemic control. The higher mean diabetes treatment satisfaction score among Pacific peoples compared with other ethnicities is likely to indicate higher diabetes medication adherence, given those who intend to stop diabetes medications report lower diabetes treatment satisfaction scores.[27]

It should be noted that Pacific peoples include a wide range of people with different languages, ethnicities, cultural heritage and illness beliefs, and the results from a variety of Pacific peoples in this study were grouped together. The provision of culturally appropriate healthcare may have contributed to increased satisfaction in the Pacific participants. Tongan participants received diabetes care by mostly Tongan healthcare providers, of whom a small proportion (12.6%) completed the questionnaire in Tongan. Previous research found that Tongan people believed their diabetes to be a cyclical, acute illness and attributed its cause to factors outside of their control such as poor medical care in the past, environmental pollution and God's will.[28] The aforementioned study[28] also noted that a section of their study-specific questionnaire did not translate well from English into Tongan. As we did not use a validated Tongan version of the DTSQ, this may also be a potential limitation in our present study. Other literature indicates that a doctor's high status is respected in many Pacific cultures;[29] thus, participants may be more likely to rate their treatment satisfaction highly as a reflection of their trust in their healthcare provider.

It is not surprising that the age of European participants was higher than that of other ethnicities, as this reflects the higher prevalence of type 2 diabetes at a younger age in people of Pacific, Indian and Māori ethnicities than Europeans.[31] We observed that older participants were more satisfied with their treatment compared to younger participants. This is consistent with other research that reports higher diabetes-related distress among younger people,[32] and that the progression of type 2 diabetes mellitus is typically more rapid in this group. There are several reasons for these results, such as additional stressors of family responsibilities, work and financial constraints. In this way, managing diabetes may be yet another source of stress and burden. Further research could explore key diabetes-related stressors for younger people and strategies to facilitate self-management.

It is important to recognise that people may indicate high diabetes treatment satisfaction even if they are undertreated. Almost 40% of the participants were receiving only one glucose lowering medication despite an HbA_{1c} above target, demonstrating therapeutic inertia, which is defined as the "*failure to initiate, intensify, when appropriate and clinically required*".[33] Multiple patient-level, healthcare provider-level and health system-level factors contribute to this problem. At the patient-level, given that each of the participants consented to take part in a prospective study testing the glucose-lowering impact of adding another medication (vildagliptin and pioglitazone in a randomised, crossover fashion), it is unlikely that they had concerns over their ability to manage multiple medications, had disease denial or feared side effects from additional medications. Further attention at the healthcare provider level and health system level to overcome therapeutic inertia in managing type 2 diabetes mellitus in Aotearoa New Zealand is needed.[34]

This study is strengthened by its use of a validated questionnaire in a multi-ethnic population across Aotearoa New Zealand. However, several limitations need to be considered. As this was a multi-centre trial, a range of clinicians were involved in administering the DTSQ, which may have influenced the overall scores. Given this questionnaire focussed on collecting quantitative data, these results should be interpreted with caution as there are insufficient data to draw definitive conclusions on the underlying reasons for these results. Qualitative research into influencers of treatment satisfaction is needed along with other patient reported outcomes. Finally, the results of this study are not necessarily generalisable to the general population with insufficiently controlled type 2 diabetes mellitus, given the participants were willing to take additional oral diabetes medications as part of a

randomised crossover study. Nonetheless, diabetes treatment satisfaction was high, particularly among Pacific peoples, despite insufficient control of type 2 diabetes mellitus on insufficient oral glucose-lowering therapy.

Conclusion

These findings suggest that high patient diabetes satisfaction is not a reliable proxy for optimal diabetes control or diabetes care quality in Aotearoa New Zealand, particularly in Pacific peoples.

Table 1: Baseline demographic characteristics of participants.

	Overall (n=346)	**DTSQ total score**	
		0–18 (Low) (n=27)	**19–36 (High) (n=319)**
Age (years)	57.5 (10.9)	54.2 (11.8)	57.8 (10.8)
Sex			
Female	141 (40.8%)	14 (51.9%)	127 (39.8%)
Male	205 (59.2%)	13 (48.1%)	192 (60.2%)
Ethnicity			
European	90 (26.0%)	8 (29.6%)	82 (25.7%)
Māori	78 (22.5%)	8 (29.6%)	70 (21.9%)
Pacific peoples	111 (32.1%)	5 (18.5%)	106 (33.2%)
Other	67 (19.4%)	6 (22.2%)	61 (19.1%)
BMI (kg/m^2)	35.5 (7.8)	38.1 (7.4)	35.3 (7.8)
Duration of diabetes (years)	9.0 (6.3)	7.0 (3.3)	9.1 (6.5)
Baseline HbA_{1c} level	74.9 (11.5)	78.7 (11.3)	74.5 (11.5)
59–67mmol/mol (7.5–8.3%) (Low)	114 (32.9%)	5 (18.5%)	109 (34.2%)
68–79mmol/mol (8.4–9.4%) (Medium)	120 (34.7%)	10 (37.0%)	110 (34.5%)
80–110mmol/mol (9.5–12.2%) (High)	112 (32.4%)	12 (44.4%)	100 (31.3%)
Baseline diabetes medications			
Monotherapy	137 (39.6%)	14 (51.9%)	123 (38.6%)
Dual therapy	196 (56.6%)	12 (44.4%)	184 (57.7%)
Triple therapy	13 (3.8%)	1 (3.7%)	12 (3.8%)
Smoking status			
Current smoker	49 (14.2%)	3 (11.1%)	46 (14.4%)
Ex-smoker	125 (36.1%)	9 (33.3%)	116 (36.4%)
Never smoked	164 (47.4%)	15 (55.6%)	149 (46.7%)
Missing	8 (2.3%)	0 (0%)	8 (2.5%)

Data presented as n (%) or mean (SD).

Table 2: DTSQ total score by participants' characteristics.

Characteristic	Mean (SD)	p-value*
Sex		0.3327
Female	28.9 (6.4)	
Male	28.3 (5.6)	
Prioritised ethnicity		0.0006
NZ European	27.7 (5.8)	
Māori	27.8 (6.6)	
Pacific peoples	30.5 (5.3)	
Other	27.4 (5.9)	
Baseline HbA_{1c} level		0.1533
59–67mmol/mol (7.5–8.3%) (Low)	29.4 (5.2)	
68–79mmol/mol (8.4–9.4%) (Medium)	28.4 (6.1)	
80–110mmol/mol (9.5–12.2%) (High)	27.9 (6.5)	
Baseline diabetes medication		0.0808
Monotherapy	27.8 (6.4)	
Dual therapy	29.2 (5.6)	
Triple therapy	27.1 (5.5)	
Smoking status		0.4724
Never smoked	28.3 (6.3)	
Ex-smoker	28.5 (5.6)	
Current smoker	29.5 (5.7)	

*The analysis of variance test on total score between categorical participants' characteristics as univariate analyses.

Table 3: Linear regression on association between DTSQ total score and continuous participants' characteristics.

Characteristic	Beta coefficient	95% CI	p-value
Age (years)	0.097	0.040–0.155	0.001
BMI (kg/m^2)	-0.084	-0.165–-0.003	0.041
Duration of diabetes (years)	0.066	-0.035–0.167	0.198
Baseline HbA_{1c} (mmol/mol)	-0.050	-0.104–0.005	0.076

*Confidence interval = CI.

COMPETING INTERESTS
RM has participated in industry sponsored meetings and received speaking honoraria from Sanofi, Lilly, Novonordisk, Novartis, Astra Zeneca, Boeringer Ingelheim. This study received funding from the Health Research Council of New Zealand (Grant 18-861)

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RM designed the study. RYT, AT and YJ analysed the data and RYT drafted the manuscript. RB, RY, RYT, KS, GD, RD, PC, NN, JHH, FK, TRM, BOW, RP were responsible for trial implementation and data acquisition. OD and all co-authors reviewed and edited the manuscript and approved this for submission.

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Appendix

Appendix Table 1: Summary of baseline Diabetes Treatment Satisfaction Quenstionnaire (DTSQ) scores.

DTSQ item	N	Mean (SD)	Median (Range)	Median (IQR)
1. How satisfied are you with your current treatment?	346	4.7 (1.4)	5 (0–6)	5 (4–6)
2. How often have you felt that your blood sugars have been unacceptably high recently?	346	3.3 (2.0)	3 (0–6)	3 (2–5)
3. How often have you felt that your blood sugars have been unacceptably low recently?	346	1.1 (1.6)	0 (0–6)	0 (0–2)
4. How convenient have you been finding your treatment recently?	346	4.9 (1.4)	5 (0–6)	5 (4–6)
5. How flexible have you been finding your treatment recently?	346	4.6 (1.5)	5 (0–6)	5 (4–6)
6. How satisfied are you with your understanding of diabetes?	346	4.9 (1.3)	5 (0–6)	5 (4–6)
7. Would you recommend this form of treatment to someone else with your kind of diabetes?	345	4.8 (1.7)	6 (0–6)	6 (4–6)
8. How satisfied would you be to continue with your present form of treatment?	346	4.6 (1.6)	5 (0–6)	5 (4–6)
DTSQ total score (q1, q4–q8), 1 missing data imputed	346	28.6 (6.0)	30 (9–36)	30 (25–33)

*One participant only scored 7 items (Q7 was missing) and the missing score was imputed in the calculation of total score.
Standard deviation = SD; interquartile range = IQR.