# Provision of care for diabetic retinopathy in New Zealand: are there ethnic disparities?

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## ABSTRACT

**AIMS:** Ethnic disparities have been observed in treatment at first specialist appointments across various specialties within New Zealand. This study aimed to examine documentation and treatment decisions for diabetic retinopathy by ethnicity.

**METHODS:** Retrospective audit of first specialist diabetic retinopathy clinic appointments for 388 patients at the Department of Ophthalmology, Te Whatu Ora Te Toka Tumai Auckland. Multiple domains of care were assessed, including comprehensiveness of history taking, examination, investigations and treatment decisions.

**RESULTS:** Europeans comprised 42%, Māori only 9.5%, Pacific peoples 13.19%, Asian 32.7% and Middle Eastern/Latin American/African in 2%. Māori patients were eligible for a significantly greater number of treatments (p=0.001). The comprehensiveness of history taking (p=0.809), examination (p=0.513), investigations (p=0.623) and proportion of eligible treatments provided (p=0.788) was similar but did not reach the gold standard of care across all ethnicities.

**CONCLUSIONS:** The standard of care provided in first specialist appointments for diabetic retinopathy appear to be similar across all ethnic groups, although Māori were underrepresented and had a higher disease burden at presentation. Our data highlights the need to reduce barriers faced by Māori in accessing GP, optometry and retinopathy screening referrals in Auckland, and improving local consultation and treatment guidelines.


Diabetic retinopathy is a common microvascular complication of diabetes mellitus that results in ischaemic damage to the retina.[1] It is a leading cause of blindness among the working-age population in developed countries, including New Zealand.[2–4]

Māori and Pacific populations are disproportionately affected by diabetes and its complications.[5] In New Zealand, the prevalence of diabetes among Māori is twice that of Pākehā, and in Pacific peoples it is three times as prevalent.[5] Māori and Pacific peoples are more likely to develop sight-threatening diabetic retinopathy, have greater rates of progression of retinopathy and are less likely to attend diabetic retinopathy screening than Pākehā.[6–8] Māori also have higher rates of other diabetic complications, including reduced time to first major cardiovascular event, increased hospitalisation due to end stage renal disease, higher rates of lower limb amputation and cardiovascular and cancer mortality compared to other ethnic groups.[9–11]

Significant inequities exist in the provision of healthcare to Māori and Pacific patients. This has been documented across various specialty services, including reduced cardiac revascularisation and timely cancer surgery provision.[12,13] These disparities may contribute to the poorer health outcomes experienced by Māori and Pacific peoples, including those related to diabetes.

Although the prevalence of diabetic retinopathy is increasing and disproportionately affects Māori and Pacific peoples, the extent of inequity in the standards of diabetic retinopathy care provided by ethnicity is largely unknown.[2–4] This retrospective study aimed to evaluate the documentation and treatment decisions in first specialist appointments for diabetic retinopathy by ethnicity at Greenlane Clinical Centre, Auckland.

## Methods

### Subject selection

This study received ethics approval from the Auckland Health Research Ethics Committee (AHREC) AH25370. We analysed data from all patients referred to the ophthalmology department at the Department of Ophthalmology, Te Whatu Ora Te Toka Tumai Auckland, from the diabetic retinopathy screening service between 1 January 2021 and 4 August 2022. Patients for this study were identified from the electronic Auckland

District Health Board referrals database. Both physical notes and electronic clinic letters were used for data collection.

## Data collection

### *Ethnicity*

The ethnicity of patients was extracted from the National Health Index (NHI) database. NHI ethnicity data is collected as per the Ministry of Health – Manatū Hauora Ethnicity Data Protocols, whereby hospital clerical staff provide patients with the same ethnicity question as the Statistics New Zealand 2018 Census.[14] Patient ethnicity is therefore self-identified, and patients can identify with more than one ethnicity.[14] Only one ethnicity per patient was available on the current NHI database for all patients included in this study; therefore, each patient was allocated to a single ethnicity group. The ethnicities were classified into the Statistics New Zealand Level 1 ethnicity codes for analysis: Māori, Pacific peoples, Asian, European, Middle Eastern/Latin American/African, Other Ethnicity and Residual Categories.[14,15] Other and Residual Categories patients were excluded from analysis given lack of numbers and insufficient ethnicity data in these groups.

### *History taking*

Documentation of the type of diabetes, duration of diabetes and the latest $HbA_{1c}$ was assessed.

### *Examination*

The documentation of five different examination findings was reviewed. Visual acuity was recorded as the best corrected visual acuity written on the clinical notes and converted to LogMAR. The remaining four findings assessed were intraocular pressure, lens status, grade of diabetic retinopathy and presence of diabetic macular oedema (DMO).

### *Investigations*

Documentation of performing ocular coherence tomography (OCT) and widefield retinal imaging was assessed.

### *Treatment decisions*

Documentation of treatment decisions based on history and examination findings were evaluated. These included a discussion of better diabetic control when $HbA_{1c}$ was greater than 58mmol/mol, urgent diabetes nurse referral when $HbA_{1c}$ was greater than 100mmol/mol and a discussion of pregnancy plans with female patients aged 20–40 years. Other treatment decisions assessed were the completion of a CPAC score when a grade 3+ cataract was identified, the commencement of anti-VEGF treatment if visual acuity was 6/9 or worse with fovea-involving DMO, same day laser for proliferative diabetic retinopathy (PDR) and laser for non-foveal clinically significant macula oedema (CSMO). Finally, evidence of clinic letters being copied to patients was assessed.

## Statistical analysis

All data was entered into an Excel spreadsheet and analysed in STATA volume 15. Categorical data are reported as n (%) and continuous data as mean ± standard deviation (SD). Analysis of variance (ANOVA) was used to compare values between groups. A p-value of ≤0.05 was considered statistically significant.

## Indigenous health statement

The research team members have backgrounds and expertise that demonstrate a commitment to improving health research of Indigenous populations. The team has three non-training ophthalmology registrars, one of whom is Māori, and another of Indo-Fijian ethnicity. The research was initiated by Dr Sarah Welch, the Clinical Director of Ophthalmology at Greenlane Clinical Centre, with the aim to improve outcomes for Māori and Pacific patients. Another member, Dr Rachael Niederer, is a Royal Australian and New Zealand College of Ophthalmologists (RANZCO) ophthalmologist who is actively involved with Kāpō Māori in developing the Te Tiriti Action Plan to address Māori eye health inequities. She has been involved in previous research exploring ethnic disparities in eye health in New Zealand.

# Results

Notes were reviewed for all 483 patients referred for diabetic first specialist appointments. We included 397 patients seen in clinic (82.1%) and excluded 86 who did not receive clinical review. There were eight patients in the Residual Category group and one patient in the Other group who were excluded from further analysis. Reasons for the lack of review by ethnicity are reported in Table 1.

The mean time to clinic review was 248 days ± 542. No significant difference was observed by ethnicity in the likelihood of clinic attendance (p=0.241) or in time to review (p=0.906). Patients were recorded as having missed appointments when they did not attend both their initial and

all rescheduled appointments. There was no difference in missed appointment rates by ethnicity, although numbers for this were small (p=0.219). Patients who missed their first appointment but attended subsequent appointments were not included in the missed appointment group but would have contributed to increasing the mean waiting time for all groups.

For the patients seen in clinic, mean age was 57.1 years ± 15.4 and 238 (60.3%) were male. Self-identified ethnicity was European in 162 (41.8%) patients, Māori in 37 (9.5%) patients, Pacific peoples in 54 (13.9%) patients, Asian in 127 (32.7%) patients and Middle Eastern/Latin American/African in 8 (2.1%) patients. Demographics by ethnicity are reported in Table 2.

The comprehensiveness of history taking was assessed using a history score. One point was allocated for documenting each of the following to give a maximum history score of three: type of diabetes (type 1 or type 2), duration of diabetes and $HbA_{1c}$. Type of diabetes was recorded in 279 patients (71.0%), duration of diabetes in 118 patients (30.2%) and $HbA_{1c}$ in 233 patients (59.4%). The mean history score was 1.6 ± 1.0. No significant difference was observed in the mean history score by ethnicity (p=0.809), although there was a trend for a slightly lower score in European patients compared to other ethnicities. Values are reported by ethnicity in Table 3.

The quality of examination was assessed using an examination score. One point was allocated for documenting each of the following to give a maximum examination score of five: visual acuity, intraocular pressure, lens status, grade of diabetic retinopathy and presence of DMO. Visual acuity was recorded in 382 patients (96.7%), intraocular pressure in 360 patients (91.1%), lens status in 211 patients (53.4%), grade of diabetic retinopathy in 352 patients (89.1%) and the presence of DMO in 283 patients (71.6%). The mean examination score was 4.0 ± 0.9, and no difference was observed between ethnicities (p=0.513) (Table 3).

The comprehensiveness of investigations was assessed using an investigation score. The maximum score was two, with one point each for performing ocular coherence tomography and widefield retinal imaging. Ocular coherence tomography (OCT) was performed in 358 patients (90.6%) and widefield retinal imaging in 218

**Table 1:** Clinic attendance by prioritised ethnicity.

| | **European n=199 (41.8%)** | **Māori n=46 (9.5%)** | **Pacific peoples n=73 (13.9%)** | **Asian n=147 (32.7%)** | **Middle Eastern/Latin American/ African n=9 (2.1%)** |
|---|---|---|---|---|---|
| Clinic attended—no./total no. (%) | 162/199 (81.4) | 37/46 (80.4) | 54/73 (74.0) | 127/147 (86.4) | 8/9 (88.9) |
| Time to review—mean days +/- SD | 266 ± 396 | 282 ± 494 | 275 ± 399 | 211 ± 760 | 217 ± 179 |
| **Reason for clinic non-attendance—no./total no. (%)** | | | | | |
| Deceased | 6/199 (3.0) | 1/46 (2.2) | 2/73 (2.7) | 2/147 (1.4) | 0/9 (0) |
| Missed appointments | 18/199 (9.0) | 7/46 (15.2) | 11/73 (15.1) | 11/147 (7.5) | 0/9 (0) |
| Direct to cataract surgery | 2/199 (1.0) | 0/46 (0) | 1/73 (1.4) | 0/147 (0) | 0/9 (0) |
| Direct to laser | 0/199 (0) | 1/46 (2.2) | 1/73 (1.4) | 0/147 (0) | 0/9 (0) |
| Virtual clinic | 1/199 (0.5) | 0/46 (0) | 0/73 (0) | 1/147 (0.7) | 0/9 (0) |
| No clinic booked | 10/199 (5.0) | 0/46 (0) | 4/73 (5.5) | 6/147 (4.1) | 1/9 (11.1) |

**Table 2:** Patient demographics at presentation to clinic.

| | **European n=162 (42%)** | **Māori n=37 (9.5%)** | **Pacific peoples n=54 (13.9%)** | **Asian n=127 (32.7%)** | **Middle Eastern/ Latin American/ African n=8 (2%)** | **P-value** |
|---|---|---|---|---|---|---|
| Male—no./total no. (%) | 98/162 (60.5) | 24/37 (64.9) | 27/54 (50.0) | 78/127 (61.4) | 6/8 (75.0) | 0.480 |
| Age—years +/- SD | 57.7 ± 18.1 | 54.5 ± 12.2 | 53.5 ± 14.8 | 58.5 ± 13.0 | 58.9 ± 6.5 | 0.260 |
| Type 2 diabetes mellitus—no./total no. recorded (%) | 59/108 (54.6) | 23/26 (88.5) | 33/39 (84.6) | 92/97 (94.8) | 5/5 (100) | <0.001 |
| Duration of diabetes—mean years ± SD | 16.7 ± 10.9 | 11.2 ± 6.9 | 11.8 ± 6.5 | 12.1 ± 8.4 | 7.3 ± 2.5 | 0.063 |
| $HbA_{1c}$ (mmol/mol)—mean ± SD | 65.1 ± 18.6 | 74.1 ± 17.8 | 80.3 ± 20.2 | 65.9 ± 20.1 | 63.5 ± 12.2 | 0.001 |
| Vision (LogMAR)—mean ± SD | 0.17 ± 0.29 | 0.24 ± 0.41 | 0.20 ± 0.27 | 0.20 ± 0.37 | 0.08 ± 0.12 | 0.720 |
| Proliferative DR—no./total no. (%) | 10/162 (6.2) | 6/37 (16.2) | 5/54 (9.3) | 9/127 (7.1) | 1/8 (12.5) | 0.329 |
| DMO—no./total no. recorded (%) | 40/133 (30.1) | 12/25 (48.0) | 12/43 (27.9) | 30/106 (28.3) | 1/7 (14.3) | 0.264 |

**Table 3:** Documentation of history, examination and investigations by prioritised ethnicity.

| | **European (n=162)** | **Māori (n=37)** | **Pacific peoples (n=54)** | **Asian (n=127)** | **Middle Eastern/ Latin American/ African (n=8)** | **P-value** |
|---|---|---|---|---|---|---|
| History score—mean +/- SD | 1.4 ± 1.1 | 1.7 ± 1.0 | 1.8 ± 1.0 | 1.8 ± 1.1 | 1.8 ± 1.0 | 0.809 |
| Examination score—mean +/- SD | 4.2 ± 0.7 | 4.2 ± 0.7 | 4.4 ± 0.7 | 4.3 ± 0.8 | 4.2 ± 0.7 | 0.513 |
| Investigation score—mean +/- SD | 1.4 ± 0.6 | 1.5 ± 0.6 | 1.7 ± 0.6 | 1.4 ± 0.7 | 1.5 ± 0.6 | 0.623 |
| Total score out of 10—mean +/- SD | 7.0 ± 1.7 | 7.2 ± 1.4 | 7.4 ± 1.6 | 7.1 ± 1.9 | 7.5 ± 0.9 | 0.701 |

**Table 4:** Treatment decisions by prioritised ethnicity.

| Treatments provided | European (n=162) | Māori (n=37) | Pacific peoples (n=54) | Asian (n=127) | Middle Eastern/ Latin American/ African (n=8) | P-value |
|---|---|---|---|---|---|---|
| If female aged 20–40 discussed pregnancy plans—no./no. eligible (%) | 1/14 (7.1) | 1/4 (25.0) | 1/4 (25.0) | 0/0 | 0/1 (0) | 0.662 |
| If significant cataract CPAC performed—no./no. eligible (%) | 4/10 (40.0) | 2/4 (50.0) | 3/7 (60.0) | 4/5 (42.9) | 0/0 (0) | 0.759 |
| If DMO with vision 6/9 or worse anti-VEGF started—no./no. eligible (%) | 9/19 (47.4) | 2/10 (20.0) | 3/6 (50.0) | 5/14 (35.7) | 0/1 (0) | 0.542 |
| Same day laser for PDR—no./no. eligible (%) | 9/10 (90.0) | 5/6 (83.3) | 6/7 (85.7) | 10/10 (100.0) | 0/0 (0) | 0.647 |
| Urgent diabetic nurse referral if $HbA_{1c}$ >100mmol/mol—no./no. eligible (%) | 3/6 (33.3) | 1/3 (33.3) | 1/6 (16.7) | 0/5 (0) | 0/0 (0) | 0.514 |
| Discussed improving diabetic control if $HbA_{1c}$ >58mmol/mol—no./no. eligible (%) | 7/49 (14.3) | 5/20 (25.0) | 8/29 (27.6) | 7/44 (15.9) | 1/3 (33.3) | 0.527 |
| Laser for non-foveal CSMO—no./no. eligible (%) | 6/19 (31.6) | 4/7 (57.1) | 2/4 (50.0) | 7/13 (53.8) | 0/0 | 0.523 |
| Letter copied to patient—no./total no. (%) | 116/162 (71.6) | 25/37 (67.6) | 33/54 (61.1) | 91/127 (71.7) | 7/8 (87.5) | 0.285 |
| Total treatment score—mean +/- SD | 1.0 ± 0.7 | 1.3 ± 1.1 | 1.1 ± 1.1 | 1.0 ± 0.7 | 1.0 ± 0.5 | 0.169 |
| Treatment denominator—mean +/- SD | 1.8 ± 0.9 | 2.6 ± 1.3 | 2.2 ± 1.2 | 1.8 ± 1.0 | 1.5 ± 0.8 | 0.001 |
| Treatment percentage—mean +/- SD | 49.2 ± 40.3 | 42.8 ± 25.2 | 50.4 ± 41.2 | 54.4 ± 38.4 | 58.3 ± 50.0 | 0.788 |

patients (55.2%). The mean score for investigations was 1.5 ± 0.7. No significant difference was observed between ethnicities (p=0.623), although there was a trend towards slightly more investigations in Pacific patients (Table 3).

The total score out of ten was 7.1 ± 1.7. No difference was observed between ethnicities (p=0.701), although there was a slight trend towards better scores in Pacific patients and lower scores in European patients (Table 3).

Clinic letters were copied to 275 patients (69.6%). No significant difference was observed by ethnicity (p=0.285), although the likelihood of a letter being copied to a patient was slightly lower for both Māori and Pacific patients.

There were a wide range of interventions that patients were eligible for depending on their $HbA_{1c}$, childbearing status, stage of diabetic retinopathy, presence of visually significant cataract and presence of diabetic macula oedema. The treatments given and the number of patients eligible for these treatments in each ethnic group are reported in Table 4.

A treatment percentage score for each patient was calculated by dividing the number of interventions provided (treatment score) by the number of interventions the patient was eligible for (treatment denominator). There was no difference in the percentage of eligible treatments provided by ethnicity (p=0.788) (Table 4). Māori patients had a significantly higher number of treatments they were eligible for, reflecting a greater disease burden at presentation (p=0.001) (Table 4).

## Discussion

This study observed no significant difference in the comprehensiveness of history taking, clinical examination and investigations documented for patients by ethnicity. This is unlike previous literature, which has described that less time is spent on history taking and fewer investigations are arranged for Māori patients in primary health consultations.[14] Several factors may be contributory, including more time available and fewer health issues that need addressing at ophthalmology appointments than primary care. Furthermore, our study found no difference in the proportion of eligible treatments provided to patients by ethnicity. This unique finding reflects well on the Greenlane Clinical Centre eye department—studies of cardiac revascularisation and primary care consultations have found fewer treatments being prescribed to Māori patients despite the same eligibility for treatment.[12,13,16]

Māori patients were under-represented and had a significantly higher number of treatments they were eligible for compared to other groups. This represents a greater severity of disease and later presentation of Māori patients to diabetic retinopathy services. Māori account for 8.4% of patients in the Te Whatu Ora Te Toka Tumai Auckland catchment area and comprised 9.5% of the patients referred to Greenlane Clinical Centre in this study.[17] Given that Māori have more than twice the prevalence of diabetes (7.1% as opposed to 3.1%) and thrice the levels of moderate to severe diabetic retinopathy (12.9% as opposed to 4%) than Europeans, this is a significant underrepresentation of Māori.[5,6] This suggests Māori patients face increased barriers to accessing diabetic retinopathy screening and ophthalmology referral. Previous studies have also identified that Māori patients face increased barriers to accessing diabetic retinopathy screening.[18,19] Barriers include physical distance, difficulty taking time off work, fewer GP referrals to screening services, non-community based services and personal costs of care.[18,19] Previous experiences of culturally insensitive comments and mistrust in the healthcare system have also been identified as barriers to attending diabetic retinopathy screening in Māori population surveys.[19,20]

Culturally appropriate clinical practice is essential to improve participation in health services.[19] Such practices involve demonstrating an understanding of cultural beliefs, engaging whānau in health initiatives, promoting community or marae-based clinics and patient education.[8,19,21,22] The marae is the centre of everyday life and community for Māori, even in urban settings.[21] A recent qualitative study found that Māori women feel more comfortable participating in marae-based cervical screening services due to the familiarity and accessibility of the marae compared to a hospital.[21] A pilot marae-based diabetes education and health promotion programme in South Auckland also increased interest in exercise and health screening among Māori.[22] The diabetic retinopathy screening service in Auckland is not marae-based. It is also unknown what level of education is provided to Māori patients in Auckland regarding diabetic retinopathy. A survey of Māori patients in Northland demonstrated that only half were educated about and referred to diabetic screening services by their general practitioner.[19] Promoting greater education in primary

care and starting mobile marae-based retinopathy screening services may improve Māori participation in retinopathy screening and increase referrals to specialist appointments. The costs and effects of implementing these have not yet been published and are areas of future research opportunity.

Although Māori are underrepresented in referrals to ophthalmology specialist clinics, once they are referred, their overall rates of attendance to initial and rescheduled appointments are comparable to Europeans in this study. Previous research has shown that the non-attendance rates to ophthalmology specialist appointments among Māori is initially high, but improves for follow-up appointments.[19] Higher initial rates of non-attendance are due to various factors, including not receiving appointments, difficulty contacting clinic schedulers to reschedule or cancel appointments and previous negative staff interactions.[20,23] Our study highlights that with significant effort by clinic schedulers and with culturally sensitive care, we are able to achieve equivalent eventual clinic attendance for Māori patients. Greenlane Clinical Centre staff must be commended for these efforts, and this work should be continued.

Medical record keeping ensures an accurate account of patient disease and treatment requirements.[24] The overall documentation rate of a complete history, examination and investigations was suboptimal across all ethnicities in this study. Incomplete assessment is associated with under-treatment.[25] This has been reflected in the substandard treatment scores in all groups, with no ethnic group receiving the gold standard of care for their diabetic retinopathy. These findings highlight the need for standardised diabetic retinopathy consultation and treatment guidelines at tertiary centres in New Zealand.

This study has a few limitations. It is a study of small numbers and is retrospective. We were unable to measure time spent with patients and the development of rapport. Clinician judgement, patient preferences and interventions discussed that were not documented would have been missed in our data collection. Furthermore, ethnicity data is limited to the available NHI data, which had one mandatory ethnicity per patient available on the NHI database.[14,26] Using a single ethnicity per patient rather than total output ethnicity is advantageous because it allows ethnic minorities such as Māori to not be outnumbered by Europeans, while allowing clean data comparisons between groups. Disadvantages of this method include that the ethnicity selected for a patient in the NHI database may not be the ethnicity a patient identifies with most strongly, it may miss some ethnic minorities and it does not allow for patients to fall into multiple ethnic groups.

Overall, this study found no significant differences in documentation of history taking, examination, investigations and proportion of eligible treatments offered across all ethnicities in first diabetic retinopathy consultations. Māori patients had a greater disease burden and were underrepresented in those referred to clinic, highlighting the need for culturally appropriate and accessible GP, optometry and diabetic retinopathy screening clinics for this demographic. Once referred to ophthalmology clinic, overall attendance rates were similar between all ethnicities. No ethnic group received the gold standard of care for diabetic retinopathy. Future directions of study include analysing the effects of increasing diabetic retinopathy education in primary care, starting marae-based retinopathy screening clinics and creating clear consultation guidelines for first diabetic retinopathy specialist appointments. Further qualitative studies to understand the barriers that Māori patients face in accessing GP and optometry referrals to diabetic retinopathy screening clinics will also highlight other interventions that can address these barriers.

**COMPETING INTERESTS**
None to declare.

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