

Screening and assessment of type 2 diabetes risk factors among Pacific youth attending community health events in Auckland

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ABSTRACT

AIMS: The primary objective of this study was to explore type 2 diabetes (T2D) awareness, knowledge, attitudes and risk factors among youth in Auckland.

METHODS: We undertook convenience sampling of participants aged 16–25 years of Pacific and Māori descent recruited from South, Central and East Auckland through multiple community outreach events organised by the Tongan Health Society from 25 May to 31 July 2024. An additional three participants aged 26–31 years were assessed opportunistically to enhance our study power. Data were collected through a structured survey, an HbA_{1c} point-of-care test, body composition assessments (using the TANITA RD-545 InnerScan PRO body composition scale) and height measurements.

RESULTS: In a sample of 138 participants (aged 16–31 years; 58% female; 62% Tongan, 18% Samoan and 3% Māori), 51.9% were classified as obese, and one new case of diabetes was identified. Approximately 60.1% of participants reported awareness of T2D. Of these, 40% were made aware primarily through familial sources. High consumption of sugary drinks was common. Non-dietary risk factors included a first-degree family history of T2D (36%), smoking (39%) and alcohol consumption (45%). Most participants reportedly engaged in regular physical activity (41% males and 59% females). Participants suggested a multifaceted, youth-focussed care model, primarily lifestyle management for T2D prevention and management.

CONCLUSIONS: A significant proportion of young people aged 16–31 years were identified as obese and had a higher proportion of dietary and non-dietary risks for T2D. The results underscore the necessity for tailored prevention strategies, mainly aimed at Pacific and Māori youth, to mitigate the risk of future T2D development.

Type 2 diabetes (T2D) is a major global health issue with a steadily rising number of cases, particularly early onset in young people.¹ In Aotearoa New Zealand, over 250,000 individuals have been diagnosed with diabetes. The prevalence rates are highest among people of Māori, Pacific and South Asian descent, while the absolute numbers are highest among New Zealand Europeans.² T2D is the most common type recorded, with around 228,000 diagnosed New Zealanders.³ It is projected that by 2040 about 400,000 people in Aotearoa New Zealand, especially Māori and Pacific peoples, may be diagnosed with T2D due to the increasing rate of obesity.³

Lack of knowledge about T2D prevention and limited advocacy for accessible care contribute to this trend.³ Approximately 50% of diagnosed individuals face serious complications within 10 to 15 years.⁴ Early diagnosis and effective management are crucial, particularly for those with early-

onset T2D, to reduce the risk of chronic conditions like kidney and cardiovascular diseases.⁵ Young people with T2D often struggle to manage their blood sugar levels and are frequently undertreated for related conditions such as hypertension and dyslipidaemia.⁴ They also face increased diabetes distress and obesity stigma,⁶ and an aggravated cardiovascular disease profile,⁷ leading to poor quality of life. Research shows that those with early-onset T2D are more susceptible to microvascular complications that worsen by early adulthood.⁸ A study in Australia noted higher mortality among these individuals than those diagnosed later.⁸ The TODAY study highlighted increased T2D-related complications in minority racial and ethnic groups.⁹

There is an emerging trend of early-onset T2D among young people in Aotearoa New Zealand,¹⁰ necessitating evidence to address healthcare needs and inform health policy changes, particularly for Pacific and Māori youth. This research aimed to

explore T2D awareness, knowledge, attitudes and risk factors among youth in Auckland. We also explored participants' preferred care models for T2D.

Methods

Study design

The study employed a cross-sectional design and convenience sampling for participant assessment.

Data collection and analysis

Data collection was implemented across several community outreach events between 25 May and 31 July 2024, in collaboration with the Tongan Health Society (THS), a Pacific primary care provider. The target population consisted of all individuals aged 16–25 years old who attended the THS community outreach events. However, three participants above the upper band of the targeted age group were opportunistically assessed for the study.

We held 10 pop-up events during the THS community outreach campaigns in South, Central and East Auckland. Participants were engaged with information about the research, screening procedures, knowledge assessments, attitude, risk, and health education. All participants provided verbal and written consent before data collection, which lasted about 30 minutes and involved a self-administered, paper-based questionnaire.

HbA_{1c} testing

The A1cNow Plus analyser (professional only) by Point of Care Diagnostics NZ was used to measure HbA_{1c} from a capillary blood sample, which has shown 97.83% sensitivity and 77.42% specificity (95% confidence limit) compared with standard laboratory venous HbA_{1c}.^{9,10,11} The results were categorised as normal (HbA_{1c} <41 mmol/mol), pre-diabetes (HbA_{1c} 41–49mmol/mol) and diabetes (HbA_{1c} 50mmol/mol or higher).¹² Each participant was informed of their results after 5 minutes with the corresponding interpretation. Participants recording results that indicated pre-diabetes or diabetes were referred to a primary care service provider for further clinical investigations and management.

Body composition measurements

We conducted a body composition assessment using the TANITA RD-545 InnerScan PRO scale, which measures weight, body fat, muscle mass, muscle quality, physique rating, bone mass, visceral

fat, basal metabolic rate, metabolic age, total body water and body mass index (BMI).¹³ Each participant's weight, BMI and body fat percentage were recorded. Height measurements were taken using the Road Rod Portable Stadiometer from Hopkins Medical.¹⁴

Body composition indicators, such as body fat percentage and BMI, were classified according to established standards to assess the risk of developing T2D.^{15,16} BMI classifications followed ethnic-specific cutoffs: for overweight—Pacific/Māori $\geq 26.0\text{kg/m}^2$ to $< 32.0\text{kg/m}^2$ and European $\geq 25.0\text{kg/m}^2$ to $< 30.0\text{kg/m}^2$; for obesity—Pacific/Māori $\geq 32.0\text{kg/m}^2$ and European $\geq 30.0\text{kg/m}^2$, as recommended by a prior study.¹⁷ We compared the standard BMI thresholds¹⁸ with these ethnic-specific cutoffs and estimated their concordance with corresponding body fat percentage categories from Macek et al.¹⁹ We reclassified participants based on BMI and excess adiposity thresholds identified by Macek et al. (defined as $\geq 25\%$ for males and $\geq 35\%$ for females). A participant was considered obese if their BMI indicated obesity and their body fat percentage confirmed excess adiposity. Conversely, if the BMI indicated obesity without excess adiposity, the participant was reclassified as overweight. Participants with a BMI of 40 or above were automatically categorised as obese.²⁰

Knowledge, attitude, risk assessment and preferred care models for T2D

We administered a structured questionnaire to assess participants' knowledge of and attitude and risk for T2D. The questionnaire was adapted from prior validated tools^{21,22} and pilot-tested with 10 youth from the targeted demographic. The questionnaire aimed to gather demographic and risk information, including dietary habits (e.g., sugary drink consumption), physical activity (e.g., exercise frequency), alcohol use (e.g., current alcohol consumption), knowledge of T2D, awareness of T2D, access to care (e.g., testing history for T2D) and preferences for care models (e.g., desirable care types for T2D in Pacific and Māori communities). Knowledge of T2D was categorised as "good", "fair", or "poor": "good" if participants answered "yes" to both having heard of T2D and knowing it can cause other health complications; "fair" if they had heard of T2D but did not know about its complications; and "poor" if they had never heard of T2D. Attitudes were assessed through four questions: 1) Can anyone get T2D? 2) Am I at risk of developing T2D? 3) Should every-

one be tested for T2D (HbA_{1c})? 4) Is it essential to prevent T2D complications? Each question scored 1 point if the response was “yes”, while “no” and “don’t know” responses were scored 0. Four points indicated a “good” attitude (answering “yes” to all), 2–3 points was “fair” and 0–1 point was “poor”. Furthermore, preference for care model was assessed through predetermined options (e.g., lifestyle management programmes) and an open-ended field (other, specify) to capture information not anticipated in the predefined options.

Data entry and analysis

The completed paper-based questionnaires were entered into IBM SPSS Statistics Software (version 29.0; Chicago, Illinois, United States). The data from SPSS were imported, cleaned and stored in Microsoft Excel (Microsoft Corporation, Redmond, Washington, United States). We conducted descriptive analyses and summarised the data into frequencies and proportions using the total number of valid responses for each variable as the denominator, respectively. For example, the question about ethnicity required multiple responses, where applicable; hence the denominator was more than the total sample assessed (n=138). All statistical analyses were performed using Stata (version 16.1; Stata Corp LLC, Texas, United States).

Health education for T2D prevention

A nurse provided one-on-one in-person targeted health education for T2D prevention and management for all participants post-assessment. HbA_{1c} and body composition results were discussed with the participants, highlighting risk factors associated with developing cardiometabolic conditions. Further education was provided regarding managing these risk factors, ensuring participants were actively involved in their health journey. The health education was targeted at improving awareness of T2D, increasing understanding of the benefits of early diagnosis and treatment for T2D, enhancing knowledge of the risks of T2D and lifestyle adjustments to prevent the disease and diabetes-related health complications, and increasing advocacy for access to diabetes care services, especially weight management programmes for people classified as obese or with pre-diabetes.

Ethical considerations

The Southern Health and Disability Ethics Committee granted ethical approval (ethics reference: 2024 EXP 20214). We obtained verbal and

written informed consent from all participants before the screening and interviews. Acknowledging the significance of tikanga, we upheld Māori values, beliefs and worldviews. Our research team focussed on fostering relationships with participants while preserving mana throughout the study. We recognised the sacredness of the body (tapu) and ensured that blood samples were collected, tested and discarded with respect. Participants could request a lotu or karakia before sample disposal. Additionally, they were informed of their right to access their records to review and verify only the information they provided during the assessment.

Results

Demographics

We assessed 135 young people aged 16–25 years, and an additional three young people aged 26–31 years from several suburbs in the south, central and east of Auckland. Table 1 shows the demographic distribution of the study participants. Females represented 58% (n=80) of the study participants. The median age was 20 (16–31) years. There was an almost equal proportion of youth aged 16–19 (46.4%, n=64) and 20–24 (45.7%, n=63). Most participants identified as Tongan (62%, n=110), followed by Samoan (18%, n=31).

Knowledge of diabetes

Most participants (60.1%, n=83), reported having heard about T2D. The most common sources of information about T2D were from a family member, (40%, n=58), health promotion materials, (16%, n=24) and social media (13%, n=19). Approximately 36% (n=50) of participants reported having a first-degree relative with T2D. More than half (56.8%, n=46) of the participants who had ever heard about T2D knew about other types of diabetes. In addition, 62.0% (n=49) of participants mentioned that T2D causes other health complications. Furthermore, over a third (36.6%, n=49) of participants displayed a “good” knowledge of T2D, and participants with a “poor” knowledge of T2D represented 41.0% (n=55) of the sample (Table 2).

Attitude towards T2D

Regarding participants’ attitudes towards T2D prevention and management, 56.2% (n=77) thought anyone could develop T2D, but 32.1% (n=44) thought they were at risk of developing the condition. In addition, 75.4% (n=104) of

Table 1: Demographic distribution of participants, Auckland, 2024.

Variable	Frequency (n)	Percent (%)
Gender (n=138)		
Female	80	58.0
Male	58	42.0
Age group (n=138)		
16–19	64	46.4
20–24	63	45.7
25 and older	11	7.9
Ethnicity* (n=177)		
Tongan	110	62
Samoan	31	18
Niuean	7	4
Fijian	7	4
NZ Māori [†]	6	3
Asian	6	3
European	5	3
Tuvaluan	3	2
Cook Island Māori	2	1

*The question for ethnicity was designed for multiple responses. Hence, some participants identified with more than one ethnicity.

[†]NZ Māori = Aotearoa New Zealand Māori. The classification of NZ Māori and Cook Island Māori was adapted from the Aotearoa New Zealand National Census, Stats NZ.

Table 2: Description of participants' knowledge of T2D (including other types of diabetes), Auckland, 2024.

Variable	Frequency (n)	Percent (%)
Ever heard about T2D (n=138)		
Yes	83	60.1
No	55	39.9
Source(s) of information about T2D* (n=147)		
Family member	58	40
Health promotion materials (e.g., poster/pamphlets/banners)	24	16
Social media	19	13
Healthcare professional	15	10
Television	13	9

Table 2 (continued): Description of participants' knowledge of T2D (including other types of diabetes), Auckland, 2024.

Variable	Frequency (n)	Percent (%)
Radio	9	6
Other (e.g., school, friends)	9	6
Know other types of diabetes (n=81)		
Yes	46	56.8
No	35	43.2
Other types of diabetes (n=59)[¶]		
Type 1 diabetes	44	75
Gestational diabetes	15	25
T2D causes other health complications (n=79)		
Yes	49	62.0
No	12	15.2
Do not know	18	22.8
Scale of knowledge (n=134)		
Good	49	36.6
Fair	30	22.4
Poor	55	41.0

T2D = type 2 diabetes.

^{*}The question for the source(s) of information about T2D was designed for multiple responses. Hence, some participants identified with more than one source.

[¶]Participants responded “yes” to knowing other types of diabetes through a multiple-response question.

respondents indicated that testing for T2D should be universally accessible, whereas 76.1% (n=105) underscored the significance of preventing complications associated with T2D. Meanwhile, less than a quarter (24.6%, n=34) of participants believed a person with T2D could reverse their glucose level to normal. Regarding a scale of attitude, more than half (52.9%, n=73) of the participants recorded a “fair” attitude towards T2D, while an almost equal proportion of participants displayed “good” (23.2%, n=32) and “poor” attitude (23.9%, n=33) (Table 3).

Assessment of risk factors for T2D

Dietary factors

Most participants (91.3%, n=126) reported consuming sugary drinks like Coca-Cola, Fanta, processed fruit juices and energy drinks. Nearly equal proportions reported consuming either

1–1.5 litres (23.5%, n=24) or more than 1.5 litres (22.5%, n=23) daily, while 54.0% (n=55) consumed less than a litre. More than a third reported consuming sugary drinks several (3 or more) days a week, with 39.4% (n=49) drinking twice weekly and 31.5% (n=39) drinking once weekly before assessment (Table 4). Meanwhile, 93.4% (n=128) reported eating fruit. Among these, 22.7% (n=29) consumed two servings daily, and 17.9% (n=23) less than one serving. Most participants reported eating fruits several times a week before their assessment (Table 4). Furthermore, 89.7% (n=122) confirmed eating non-starchy vegetables. Among these, 23.8% (n=29) consumed two servings daily, while 14.8% (n=18) ate three servings. Meanwhile, 28.9% (n=35) of participants reported eating non-starchy vegetables several days a week before the assessment (Table 4).

Table 3: Description of participants' attitude towards T2D, Auckland, 2024.

Variable	Frequency (n)	Percent (%)
Anyone can get T2D (n=137)		
Yes	77	56.2
No	9	6.6
Do not know	51	37.2
Perceived personal risk of developing T2D (n=137)		
Yes	44	32.1
No	30	21.9
Do not know	63	46.0
Everyone should get tested for T2D (n=138)		
Yes	104	75.4
No	5	3.6
Do not know	29	21.0
A person with T2D can reverse glucose level to "normal" (n=138)		
Yes	34	24.6
No	16	11.6
Do not know	88	63.8
It is important to prevent T2D complications (n=138)		
Yes	105	76.1
No	2	1.5
Do not know	31	22.4
Scale of attitude (n=138)		
Good	32	23.2
Fair	73	52.9
Poor	33	23.9

T2D = type 2 diabetes.

Table 4: Description of dietary risk factors for T2D, Auckland, 2024.

Variable	Frequency (n)	Percent (%)
Drink sugary drinks* (e.g., Coca-Cola, Fanta, Just Juice, energy drinks) (n=138)		
Yes	126	91.3
No	12	8.7
Quantity of sugary drink consumed daily (n=102)		
<1 litre	55	54.0
1–1.5 litres	24	23.5
>1.5 litres	23	22.5
Frequency (average) of sugary drinks consumption 1 week before assessment (n=124)		
None	2	1.6
Once a week	12	9.7
Twice a week	39	31.5
Several days of the week, but not everyday	49	39.4
Every day of the week	11	8.9
I don't remember	11	8.9
Eat fruits (n=137)		
Yes	128	93.4
No	9	6.6
Number (average) of serving of fruits eaten in a day (n=128)		
Less than one serving	23	17.9
One serving	21	16.4
Two servings	29	22.7
Three servings	11	8.6
Four or more servings	16	12.5
Do not know	26	20.3
Do not wish to answer	2	1.6
Frequency (average) of fruits eaten 1 week before assessment (n=128)		
None	7	5.5
Once a week	19	14.8
Twice a week	27	21.1

Table 4 (continued): Description of dietary risk factors for T2D, Auckland, 2024.

Variable	Frequency (n)	Percent (%)
Several days of the week, but not everyday	42	32.8
Every day of the week	16	12.5
I don't remember	17	13.3
Eat non-starchy vegetables (n=136)		
Yes	122	89.7
No	14	10.3
Number (average) of serving of non-starchy vegetables eaten in a day (n=122)		
Less than one serving	25	20.5
One serving	20	16.4
Two servings	29	23.8
Three servings	18	14.8
Four or more servings	6	4.9
Do not know	19	15.5
Do not wish to answer	5	4.1
Frequency (average) of non-starchy vegetables eaten 1 week before assessment (n=121)		
None	5	4.1
Once a week	17	14.1
Twice a week	28	23.1
Several days of the week, but not everyday	35	28.9
Every day of the week	6	5.0
I don't remember	30	24.8

T2D = type 2 diabetes.

*Sugary drinks include any drink containing sugar or artificial sweeteners.

Nondietary factors

Table 5 summarises the non-dietary risk factors evaluated. Over one-third of participants (36.2%, n=50) reported a blood relative (e.g., parent or sibling) have been diagnosed with T2D. Regarding physical activity, 70.8% (n=97) incorporated exercise into their daily routines. Among these, 39.5% (n=51) engaged in vigorous activities (e.g., heavy weightlifting, rugby). For the 88 participants who reported their exercise duration, the majority (31.8%, n=28) lasted between 90 and 120 minutes. Additionally, 34.4% (n=33) exercised several days a week but not daily and 20.8% (n=20) were active every day before the assessment (Table 5). Furthermore, 47.1% (n=65) of participants reported ever smoking tobacco (e.g., cigarettes, pipes, cigars and vapes), with 38.5% (n=25) being current smokers. Additionally, 47.5% (n=65) reported having a current smoker in their household. Regarding alcohol use, 58.8% (n=80) indicated they had consumed alcohol, with 45.0% (n=36) of this group currently drinking alcohol (Table 5).

Preferred care model for T2D

Participants (287 response) recommended a preferred care model for individuals with T2D of a similar age. Over half (25.1%, n=72) suggested lifestyle management programmes, including diet modification and physical activity. Other recommendations included self-monitoring of blood sugar levels (15.3%, n=44), supportive community health promotion programmes (13.2%, n=38) and psychosocial support, such as stress management and emotional wellbeing counselling (10.5%, n=30). Additionally, 15.3% (n=44) did not know any recommended care model for T2D (Figure 1).

Health screening results

HbA_{1c} test

Approximately 99.3% (n=137) of participants had a “normal” HbA_{1c} result (<41 mmol/mol). One female participant tested positive for T2D with a result of 57mmol/mol, representing 0.7% (n=1). She was referred to her general practitioner for further investigation and management.

Body composition measurements

Table 6 presents the classification of body composition measurements for 120 participants of Pacific and Māori descent. Full body composition data were unavailable for 18 out of 138 participants due to physical limitations: inability to stand on the bioimpedance scale or presence of a

limb cast that interfered with scanning. Approximately 71.7% (n=86) of participants had a very high body fat percentage, followed by 16.7% (n=20) with a high body fat percentage. Utilising standard BMI thresholds, about two-thirds of participants (60.8%, n=73) were classified as obese, while 28.3% (n=34) were categorised as overweight. In contrast, the ethnicity-adjusted thresholds indicated that 53.3% (n=64) were obese and 31.7% (n=38) were overweight. Using the ethnic-specific adjusted cutoffs, 69.4% (n=59) of participants categorised as obese and 15.3% (n=13) as overweight were consistent with their body fat percentage categories. Additionally, 14.1% (n=12) of those with a BMI indicating a healthy weight were similarly aligned with normal body fat percentage.

Discussion

This study assessed 138 youth aged 16–31 years, primarily of Tongan ethnicity, across several Auckland suburbs, and it identified one previously undiagnosed diabetes case. About two-thirds of participants reported awareness of T2D, mainly from family members. Generally, knowledge of T2D was good, with females demonstrating better understanding than males. Participants’ attitudes towards T2D were predominantly positive.

Dietary risk factors revealed that many participants frequently consumed high amounts of sugary drinks. Non-dietary risk factors included about a third confirming a family history of T2D, and nearly half reported ever smoking, with a third as current smokers. Approximately two-thirds reported alcohol consumption, with most being current drinkers.

Despite regular participation in moderate and vigorous physical activities, most showed a high or very high body fat percentage, aligning with overweight and obese BMI categories. Higher BMI and body fat may increase the likelihood of developing T2D and other chronic conditions.²³ Perng et al. identified obesity as a significant factor for early-onset T2D in young people, noting that most classified as “obese” may develop T2D within 10 years.²⁴ This trend disproportionately affects First Nations and minority populations.²⁵

The number of young people categorised as overweight and obese was underestimated using ethnicity-adjusted BMI and better approximated by the standard BMI. Even though the body fat percentage threshold for obesity presented by Macek et al.¹⁹ aligns with that of Rush et al.,²⁶

Table 5: Description of non-dietary risk factors for T2D, Auckland, 2024.

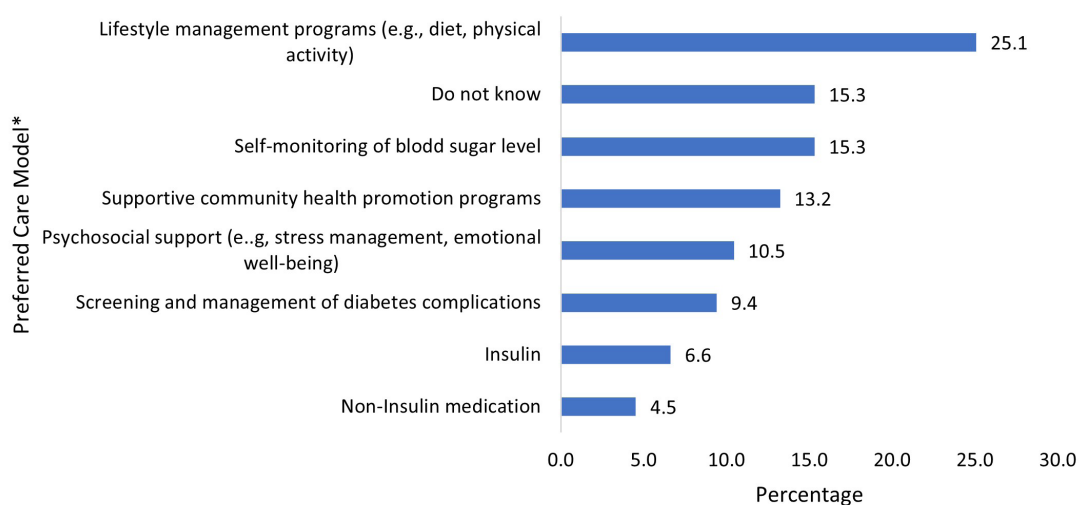
Variable	Frequency (n)	Percent (%)
Blood relative (e.g., parents, siblings) with T2D (n=138)		
Yes	50	36.2
No	44	31.9
Do not know	44	31.9
Physical activity (n=137)		
Yes	97	70.8
No	40	29.2
Duration of physical activity (in minutes) (n=88)		
30–59 minutes	10	11.5
60–89 minutes	12	13.6
90–120 minutes	28	31.8
>120 minutes	17	19.3
I don't remember	21	23.8
Method(s) of physical activity* (n=129)		
Rapid pace walking	36	27.9
Moderate exercise (e.g., bicycling, cardio)	42	32.6
Vigorous exercise (e.g., heavy weightlifting workouts, rugby)	51	39.5
Frequency of physical activity 1 week before assessment (n=96)		
None	5	5.2
Once a week	9	9.4
Twice a week	22	22.9
Several days of the week, but not everyday	33	34.4
Every day of the week	20	20.8
I don't remember	4	4.2
Do not know	3	3.1
Ever smoked cigarettes or tobacco (e.g., pipes, cigars and vape with nicotine) (n=138)		
Yes	65	47.1
No	57	41.3
I don't remember	3	2.2

Table 5 (continued): Description of non-dietary risk factors for T2D, Auckland, 2024.

Variable	Frequency (n)	Percent (%)
Do not wish to answer	13	9.4
Current smoker (n=65)		
Yes	25	38.5
No	40	61.5
Current smoker at home (not the respondent) (n=137)		
Yes	65	47.5
No	57	41.6
Do not know	6	4.3
Do not wish to answer	9	6.6
Ever drunk alcohol (n=136)		
Yes	80	58.8
No	44	32.4
Do not wish to answer	12	8.8
Currently drink alcohol (n=80)		
Yes	36	45.0
No	37	46.2
Do not wish to answer	7	8.8

T2D = type 2 diabetes.

*The question for method(s) of physical activity was designed for multiple responses.

Figure 1: Preferred care model for T2D recommended by participants, Auckland, 2024.

*The question for the preferred care model for T2D was designed for multiple responses. Hence, some participants identified with more than one care model, except when selecting "do not know".

Table 6: Classification of participants' body composition measurements, Auckland, 2024.

Classification	Pacific/Māori (n=120)	BF-concordant by standard BMI categories (n=84)	BF-concordant by ethnicity-adjusted BMI categories (n=85)
BF (%)¹⁹			
Low (<=12, male; <=19, female)	1 (0.8%)	Underweight 1 (1.2%)	1 (1.2%)
Normal (12–18.9, male; 20–29, female)	13 (10.8%)	Healthy weight 9 (10.7%)	12 (14.1%)
High (19–24, male; 30–35, female)	20 (16.7%)	Overweight 10 (11.9%)	13 (15.3%)
Very high (>=25, male; >=35, female)	86 (71.7%)	Obese 64 (76.2%)	59 (69.4%)
Standard BMI (kg/m²)¹⁸			
Underweight (<18.5)	1 (0.8%)	All concordant* with BF% category	
Healthy weight (18.5–24.9)	12 (10%)	3 discordant* with BF% category (overestimating BF% in 2 participants and underestimating in 1)	
Overweight (25–29.9)	34 (28.3%)	24 discordant with BF% category (underestimating BF% in 3 participants and overestimating BF% in 21)	
Obese (>=30)	73 (60.8%)	9 discordant with BF% category (overestimating BF% in 9 participants)	
Ethnicity-adjusted BMI (kg/m²)¹⁷			
Underweight (<18.5)	1 (0.8)	All concordant with BF% category	
Healthy weight (18.5–25.9)	17 (14.2%)	5 discordant with BF% category (underestimating BF% in 5 participants)	
Overweight (26–31.9)	38 (31.7%)	25 discordant with BF% category (underestimating BF% in 24 participants and overestimating in 1)	
Obese (>=32)	64 (53.3%)	5 discordant with BF% category (underestimating BF% in 5 participants)	

BF = body fat; BMI = body mass index.

*Discordance = total classified by BMI – concordant BF% number:

- Overestimation = body fat percentage is lower than BMI classification.
- Underestimation = body fat percentage is higher than BMI classification.

*Concordance = BMI = BF% category (e.g., normal BF% = health weight BMI).

generally non-ethnic-specific body fat percentage thresholds may explain the significant discordance. Our findings reveal the discrepancies between the two approaches and highlight the importance of ethnicity-adjusted thresholds for BMI and body fat percentage concordance, particularly for Pacific and Māori participants to accurately estimate obesity.

Participants favoured lifestyle management, blood sugar self-monitoring, community health promotion and psychosocial support for T2D care. These suggested interventions align with a randomised controlled trial by Peña et al., which demonstrated that lifestyle interventions, including nutrition and health education, can improve outcomes among young participants with T2D and prediabetes.²⁷ Furthermore, Eva et al. documented the positive impact of self-care activities and supportive networks in improving health outcomes for young people with T2D.²⁸

Though our findings indicated low T2D prevalence, various risk factors—including family history, alcohol consumption, dietary habits and high body fat—pose substantial risks for developing T2D. Individuals with high body fat and BMI are at greater risk for chronic health issues, including T2D and its complications.²³ Furthermore, increased intake of sugary beverages has also been correlated to T2D risk.^{29,30}

Our study's limitations include its cross-sectional design, which provides only a “snapshot” of the situation. Meanwhile, our sampling technique limits our ability to estimate T2D prevalence among the study population. However, these findings accurately reflect real-world T2D

conditions in the population and can guide policy for T2D prevention and management. Additionally, physical issues limited full-body measurements for all participants, though complete data were collected for HbA_{1c} and surveys.

This research demonstrates several strengths. Firstly, this research contributes to the growing scientific evidence documenting the knowledge, attitude, practice and risk for T2D among young people of Pacific and Māori descent in Auckland, Aotearoa New Zealand. Secondly, it identifies and builds an understanding of the knowledge and attitude toward T2D and its risks among the study participants by measuring their HbA_{1c} levels, BMI, body fat percentages, survey responses and preferences for T2D management. Even though the findings cannot be generalised due to the non-probabilistic nature of the sample, they can inform policies to address existing risks to prevent T2D among young people. Thirdly, through working with a Pacific primary care provider with strong ties to Pacific community groups, this research ensured that cultural considerations in the responses to the questionnaire were maintained and accurately communicated.

This study indicates a relatively high awareness about T2D among our study participants, yet significant risks exist. It underscores the necessity for regular T2D screening and targeted prevention strategies to mitigate T2D development, particularly among youth. The evidence gathered serves as a baseline for future screenings and research on risk factors, guiding T2D prevention and management policies for youth, particularly those of Pacific and Māori descent.

COMPETING INTERESTS

RM has received honoraria from Lilly, Novo Nordisk and Boeringer Ingelheim for providing educational sessions, and support from Novo Nordisk to attend a metabolic summit weekend in Melbourne in June 2025. RM participates in advisory boards for Lilly and Novo Nordisk New Zealand; is a Pharmac Diabetes Advisory Committee member; is a NZSSD monogenic diabetes guidelines group chair; is a NZSSD diabetes management guidelines group member; and is a Cardiac-Kidney-Metabolic management guidelines group member.

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