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Article type : Research Article

Diabetic Medicine

Article type: Research Article

Article number: 2019-00111

Accepted Date: 02 August 2019

Copy editor: Maria Hale

Proofs to: laimab@unimelb.edu.au

Copyright: Diabetes UK

Figures: 2; Tables: 5; Equations: 0; References: 30

Author running head: D. Xu *et al.*

Short title running head: Health Behaviours of Indigenous Australians with Diabetes

## Research Article Epidemiology

This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the [Version of Record](#). Please cite this article as [doi: 10.1111/DME.14099](https://doi.org/10.1111/DME.14099)

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# Health-related behaviours in a remote Indigenous population with Type 2 diabetes: a Central Australian primary care survey in the Telehealth Eye and Associated Medical Services Network [TEAMSnet] project

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## What's new?

- Health behaviours of Indigenous Australians with diabetes are not recorded methodically.
- We systematically documented the self-reported health behaviours of Indigenous Australians with Type 2 diabetes using a novel survey tool [Smoking, Nutrition, Alcohol consumption, Physical Activity, Emotional well-being (SNAPE)].
- In a remote setting, we found low fruit and vegetable intake, and high rates of depressive symptoms, smoking among men and risky alcohol consumption among drinkers.
- We recommend systematic health behaviour monitoring of Indigenous Australians with diabetes using SNAPE or similar survey tools in appropriate clinical settings to

support targeted interventions to improve health behaviours associated with diabetes and its complications.

## Abstract

**Aim** There is a wealth of data concerning the health behaviours of Indigenous Australians, but the health behaviours of Indigenous Australians with diabetes are not systematically documented. At the clinical level, understanding a person's health behaviours can help identify and address barriers to diabetes care and promote good clinical outcomes.

**Methods** We used a novel survey tool to systematically collect health behaviour data on Smoking, Nutrition, Alcohol consumption, Physical activity and Emotional well-being (SNAPE) from Indigenous Australians with Type 2 diabetes in a remote primary care setting in Alice Springs.

**Results** At least one of the five surveys in the SNAPE tool was completed by 210 participants: 30% male, mean age 52.6 years (range 22.9 – 87.4). Fifty per cent of men and 23% of women were current smokers ( $P < 0.001$ ). None of the participants reported an adequate intake of vegetables. Only 9.6% reported an adequate fruit intake. Some 49% of men and 32% of women consumed alcohol in the past year ( $P = 0.022$ ), and 46% of drinkers were considered high-risk or likely-dependent drinkers. On average, participants walked 10 min or more at a time 6.0 days a week and spent 4.8 h sitting on a weekday. Mean adapted Patient Health Questionnaire 9 score was 4.61, with 34% of participants having mild depressive symptoms and 11% having moderate-severe depressive symptoms.

**Conclusions** Our SNAPE survey tool results present a high-risk, disadvantaged Indigenous population with Type 2 diabetes. More resources will be needed to sustainably implement interventions with the goal of improving health behaviours and subsequent long-term health.

## <H1>Introduction

Type 2 diabetes challenges public health systems globally, and Indigenous populations are disproportionately burdened [1]. Compared with non-Indigenous Australians, Indigenous Australians are 3.5 times more likely to have diabetes and four times more likely to be

hospitalized or die from diabetes complications [2]. Diabetes is a significant contributor to the gap between Indigenous and non-Indigenous health [3].

Self-management behaviours, such as maintaining a healthy diet and exercise influence clinical outcomes. Relative to the non-Indigenous population, Indigenous Australians have poorer health behaviours—including greater prevalence of smoking, poorer nutrition, risky alcohol consumption, physical inactivity and poor emotional well-being [4]. Understanding a patient's health behaviours can help identify barriers to diabetes care and facilitate good health outcomes.

There is a wealth of data concerning health behaviours of Indigenous Australians in general [2,4]. The Australian Aboriginal and Torres Strait Islander health survey collects self-reported health data from ~ 13 000 nationally representative Indigenous Australians every 2 years [5]. Health behaviours of Indigenous Australians with diabetes are not collected systematically. A PubMed search identified 13 publications reporting any of five behaviours [smoking, nutrition, alcohol consumption, physical activity and emotional well-being (SNAPE)] for Indigenous Australians with diabetes (Fig. 1). Results are summarized in Table S1. Only smoking prevalence was recorded regularly and systematically (12 studies). There was scant literature on nutrition (two studies), alcohol consumption (four studies), physical activity (four studies) or emotional well-being (five studies), exacerbated by lack of consistency in recording metrics, limiting study comparisons.

Therefore, we aimed to describe health behaviours of Indigenous Australians with diabetes attending a primary care clinic.

## <H1>Methods

We used a novel survey tool comprised of five questionnaires to systematically collect health behaviour data from Indigenous Australians with Type 2 diabetes in Alice Springs during 2015 as part of the TEAMSnet project, described elsewhere [6]. Briefly, for context, the telehealth project aimed to facilitate the management of diabetes and cardiovascular disease (CVD) in under-resourced settings by developing and implementing software applications for culturally appropriate tele-retinal screening (baseline visit), CVD and SNAPE risk assessment (6-month follow-up) and electronic decision support for clinicians. The project was approved by the Central Australian Aboriginal Congress (CAAC) and the Central Australian and Menzies School of Health Research Human Research Ethics Committees.

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For manuscripts reporting medical studies involving human participants, we require a statement confirming that approved the study, and that the study conforms to recognized standards, for example: [Declaration of Helsinki](#); [US Federal Policy for the Protection of Human Subjects](#); or [European Medicines Agency Guidelines for Good Clinical Practice](#). Please also include the ethics approval reference number issued by the relevant ethics committee.

Each participant provided written informed consent. A local translator assisted participants for whom English was not their first language.

## **<H2>Participants**

Indigenous adults with Type 2 diabetes were recruited from the remote CAAC primary care clinic in Alice Springs and two very remote Top End clinics in Katherine and Nhulunbuy in the Northern Territory using community-based and direct recruitment strategies, including flyers in waiting and consulting rooms, and referrals from clinical and allied health staff. Potential participants were not excluded from baseline recruitment on the basis of treated retinopathy, as proposed initially, because treatment status could not be reliably ascertained by self-report or from electronic health records prior to recruitment.

CAAC study staff phoned, texted and/or sent letters to schedule participant follow-up appointments for face-to-face administration of the SNAPE survey tool. Participants were considered uncontactable if contact could not be established after at least two attempts over a period of 2 months. Clinical staffing shortages at both very remote Top End sites limited data collection to diabetic eye screening at those sites, hence only the more comprehensive data from Alice Springs are presented herein.

## **<H2>SNAPE lifestyle survey tool**

The SNAPE survey tool of five lifestyle-related questionnaires was based on Central Australian Rural Practitioners Association (CARPA) recommendations in the Standard Treatment Manual (sixth edition) and the Clinical Procedures Manual (fourth edition) [7], and was developed in consultation with CAAC health service and study staff and CARPA support over a 12-month period. The SNAPE survey tool was administered by one experienced and culturally aware study staff member. Initially, responses were recorded on printouts with subsequent entry by study staff into a database during development of the electronic tool, after which responses could be entered directly using radio buttons on our tablet application. Survey questions are detailed in Fig. 2.

## **<H3>Smoking**

Participants were asked their smoking status. For current smokers, a short form of the Fagerström Test for Nicotine Dependence was administered.

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### **<H3>Nutrition**

A relevant validated survey was not available, so a questionnaire was adapted from Indigenous health studies (A. Brown, personal communication, 2014). Participants reported the frequency with which they consumed everyday foods and liquids (Fig. 2). Where dietary guidelines were available, the percentage of participants who met/exceeded the guideline was calculated.

### **<H3>Alcohol**

The AUDIT-C (Alcohol Use Disorders Identification Test—Consumption) questionnaire, which reliably identifies hazardous drinkers or active alcohol use disorders, was administered.

### **<H3>Physical activity**

Two questions addressed active and sedentary behaviour: Number of days spent walking  $\geq 10$  min, and hours spent sitting on a weekday, respectively.

### **<H3>BMI**

Clinical staff measured height and weight using standard procedures. BMI, calculated as weight (kg)/height (m)<sup>2</sup>, was obtained from each participant's health record. Overweight was defined as BMI 25–29.9 kg/m<sup>2</sup> and obesity was defined as BMI  $\geq 30$  kg/m<sup>2</sup>.

### **<H3>Emotional well-being**

The Patient Health Questionnaire 9 adapted for Indigenous Australians (aPHQ-9) [8] was administered. We also included additional features of depressive symptoms (identified previously by AB in Indigenous men): anger, weakened spirit, homesickness, irritability, excessive worry, rumination, and drug/alcohol use [9]. Treating clinicians were immediately notified of people with aPHQ-9 scores  $> 20$  and clinically assessed all participants with scores  $> 9$ . A diabetes educator reviewed all others.

### **<H2>Statistics**

Data were managed in Excel® (Microsoft, Redmond, WA, USA). Analyses were performed using Excel and SPSS (IBM, Armonk, NY, USA) v25, with statistical significance taken at

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$P < 0.05$ . Descriptive data were reported as frequencies (%) and count (number). Differences between groups for continuous variables were compared using a two-sample  $t$ -test, differences between proportions were compared using the chi-square test, and Spearman correlation was used to evaluate relationships between ordinal variables. No account was made for multiplicity of statistical tests.

## <H1>Results

Of 278 individuals approached to participate in the SNAPE survey visit, 210 (76%) completed at least one survey ('participants'). Sixty-eight ('survey non-participants') were uncontactable after two or more attempts; reasons could not be ascertained for six non-participants. The majority had left Alice Springs either temporarily or permanently, two were ill, two were deceased and one was incarcerated.

Baseline HbA<sub>1c</sub> levels and diabetes duration were similar in participants and non-participants ( $P = 0.378$  and  $P = 0.189$ , respectively). Survey participation was higher among women than men: 68% of men and 81% of women undertook at least one of the five questionnaires in the SNAPE survey tool ( $P = 0.014$ ). Non-participants were younger than participants (45.8 vs. 50.9 years;  $P = 0.005$ ). Participant age [mean (SD)] and range were 52.6 (12.3) years and 22.9–87.4 years, respectively (Table 1).

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## <H2>Smoking

Smoking status differed by sex, with 50% of men and 23% of women currently smoking (Table 2).

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## <H2>Nutrition

Based on Australian Dietary Guidelines [10], none of the 209 responders consumed adequate vegetables daily and 9.6% consumed adequate fruit daily. Only 4.3% met the CARPA guideline for fish intake and 17% consumed the recommended amount of milk/milk products daily (Table 3).

## <H2>Alcohol

In the previous year 49% of men vs. 32% of women reported consuming alcohol ( $P = 0.022$ ) (Table 1). For alcohol consumers, mean (SD) AUDIT-C score was 5.06 (2.40). Using

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Aboriginal-specific AUDIT-C cut-off scores [11], 46% of alcohol consumers were low-risk (score  $\leq 4$ ), 7.7% were at-risk (score 5), 36% were high-risk (score 6–8), and 10% were likely dependent drinkers (score  $\geq 9$ ) (Table 4).

## <H2>Physical activity and BMI

Men and women averaged 6.0 days a week during which they walked  $\geq 10$  min at a time. Most (78%) walked  $> 10$  min 7 days a week. Men and women spent on average 4.8 h sitting on a weekday.

Men had a lower BMI than women (29.6 vs. 32.4 kg/m<sup>2</sup>;  $P = 0.011$ ), with 29% of men and 26% of women being overweight (BMI 25–29.9 kg/m<sup>2</sup>), and 46% of men and 61% of women being obese (BMI  $\geq 30$  kg/m<sup>2</sup>).

## <H2>Emotional well-being

Mean aPHQ-9 score was 4.61 and similar between women and men ( $P = 0.092$ ) and smokers and non-smokers ( $P = 0.742$ ). Almost one in two participants had depressive symptoms, as assessed by PHQ-9 [12]. While 34% of participants had mild depressive symptoms (score 5–9) another 11% had moderate–severe depressive symptoms (score  $> 9$ ). Table 5 summarizes responses to aPHQ-9 and additional culturally specific questions.

## <H1>Discussion

We report health behaviours of Indigenous Australians with Type 2 diabetes based on a novel survey tool comprised of Smoking, Nutrition, Alcohol, Physical activity, and Emotional well-being (SNAPE) surveys. This tool, deliverable via paper or electronically, is suitable for monitoring self-management and assessment of lifestyle interventions. Encouragingly, many participants volunteered additional information, such as pituri use (described below), indicating the acceptability of our holistic approach to capturing behavioural data.

Unfortunately, high rates of adverse lifestyle-related factors in all SNAPE surveys were evident, as in the general Indigenous Australian population (where evaluated). Lifestyle risk factors are potentially modifiable, but improvements can be difficult to sustain.

Improvements in nutrition, weight and exercise can improve outcomes, such as HbA<sub>1c</sub>, blood pressure and lipid levels, which are strongly related to chronic diabetes complications risk.

However, in remote and/or disadvantaged Indigenous communities, additional challenges at



individual, community, socio-economic and environmental (e.g. overcrowding and water quality) levels hinder positive health behaviours, and many of these challenges require more effective government policies and initiatives.

Systematically collecting health behaviour data can facilitate self-management and better-targeted lifestyle interventions. Electronic records of health behaviours can facilitate integration of health promotion, clinical assessments and disease management to improve health behaviours and outcomes [13]. Importantly, risk of diabetes-related hospitalization or length of hospitalization is positively predicted by smoking and eating processed meat, and negatively predicted by exercise and lower alcohol intake [14].

## <H2>Smoking and tobacco

Contrary to previous observations [15], smoking was not associated with depressive symptom score ( $P = 0.742$ ), and this may, in part, be attributable to local smoking cessation initiatives. Smoking increases risk of diabetes onset, and once diabetes is present, poorer glycaemic control and complications, including cardiovascular mortality [16]. Consistent with previous studies [17], smoking prevalence in this remote setting was lower than among Indigenous Australians nationally (31% vs. 41%) [5], driven by the lower smoking prevalence among women (23% vs. 39% nationally), but still higher than desirable. Compared with the entire Aboriginal adult patient population in this health service, tobacco use in the diabetes group was low (48% in all adults vs. 31% in Type 2 diabetes), suggesting that the study participants may be more responsive to key health messages in light of their diabetes and higher level of care (J. Boffa, personal communication). Nevertheless, smoking prevalence was higher than the estimated 8–15% prevalence among non-Indigenous Australians with diabetes [18].

Pituri use was volunteered occasionally, with 44 (21%) participants being current and 16 (8%) being previous users. Pituri, a mixture of tobacco leaves and wood ash traditionally used by Aboriginal Australians, is held behind the lower lip or cheek for long periods and chewed episodically [19]. Our survey tool did not specifically screen for pituri or e-cigarette use.

## <H2>Diet and nutrition

Self-reported vegetable and fruit intake was very low; no participant reported adequate daily vegetable intake and only 10% reported adequate fruit intake. If representative of diet quality

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in Indigenous Australians with diabetes, this is poorer than that of the Indigenous population nationally, in which a greater proportion reported adequate vegetable and fruit intake (5% and 43%, respectively), and poorer than that reported for remote communities in the 2015 Health and Welfare of Australia's Aboriginal and Torres Strait Islander peoples report [5].

Approximately one in five Indigenous Australians live in remote or very remote areas where fresh food is not always readily available. A community store may be the only food-source, which may only be replenished weekly or less. For transport and storage, less nutritious, ready-made, pre-packaged or canned food is commercially preferable to fresh ingredients, which can be more easily damaged or deteriorate and have a shorter shelf-life. Issues of food insecurity and affordability of fresh foods may be applicable to our study population despite fresh food availability. Our participants live in and around Alice Springs, which has large national supermarket chains, suggesting availability was not an issue. Potential problems may be lack of transport, inadequate funds to purchase fresh food, low health literacy or lack of food preparation knowledge or facilities. Consistent with Indigenous data, poor diet quality is also prevalent among non-Indigenous Australians. According to the 2014–15 National Health Survey [20], 50% and 7% of Australian adults consumed the recommended daily fruit and vegetable intakes, respectively. Only 5.1% of adults in the national survey met both guidelines. Both groups are suboptimal, and ongoing endeavours to improve nutrition are warranted.

Diabetes Australia recommends limiting high-energy foods such as 'take-away' foods, sweet and savoury snacks, sugar-sweetened drinks and fruit juice. We found that one in six reported consuming takeaways and 30% reported snacking at least twice weekly. This is slightly better than in the DRUID study of urban Indigenous Australians, 29% of whom reported consuming take-away foods and 37% consumed snacks at least twice weekly [21]. This is encouraging given that some Indigenous Australians consider fast foods a status symbol implying economic prosperity, accessible and easier to prepare than healthier alternatives [22]. Reported fruit juice consumption was also low: the majority (69%) reported drinking fruit juice no more than once weekly and only 13% reported daily juice intake. Although preferable to soft drinks, fruit juice is not an equivalent of fresh fruit. It has a high glycaemic index. Low health literacy can lead to people believing juice is 'healthy'. It is also encouraging that participants preferred diet drinks (median drinking frequency, fewer than one per week) over regular soft drinks (median drinking frequency, never or rarely), and neither were reported as being consumed regularly.

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There was low fish intake—only 4.3% meeting the CARPA guideline of two to three times per week. This is unsurprising as fish are not a traditional part of the inland Aboriginal diet. However, homemade meals, promoted as healthy, were self-reported as being consumed by most participants (91%) at least daily. Home food preparation is generally associated with higher diet quality, lower intake of highly processed foods and lower rates of obesity, and is an interesting area for future Indigenous nutrition research.

## <H2>Alcohol

The alcohol consumption–diabetes relationship is complex: The Diabetes Prevention Program found that moderate daily alcohol intake was associated with decreased diabetes incidence. However, excessive alcohol increases risk of diabetes complications, such as neuropathy and retinopathy.

NHMRC alcohol guidelines recommend no more than two drinks daily and drinking no more than four drinks on a single occasion. Consistent with McCulloch’s 2003 report [17], we found relatively low rates of alcohol consumption in our diabetes survey compared with the national Indigenous population (men 49% vs. 83%; women 32% vs. 72%) [5]. However, there were high rates of risky drinking among those who did drink. Although not frequent drinkers, 81% of drinkers drank less than once a week, and over half of drinkers consumed more than four drinks on drinking days.

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## <H2>Physical activity

Decreasing sedentary time improves metabolic health. Sedentary behaviour in our study population was similar to the 5.3 sedentary hours self-reported by non-remote Indigenous Australians in 2012–2013 [5]. Globally, self-reported sitting time is ~ 5 h/day [23]. Results should be treated cautiously as objectively measured sitting time may be double that of self-reported [24].

Over a quarter of participants were overweight, similar to Indigenous Australians nationally (32% men, 27% women) [5]. Our diabetic population was also more likely to be obese than the national Indigenous population (46% vs. 36% men, 61% vs. 43% women) [5].

## <H2>Emotional well-being

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Depressive symptoms are not uncommon in people with diabetes and in Indigenous Australians. There are very little data relating to depressive symptoms in Indigenous Australians at all, much less gender differences. We have utilized research done by Dr Alex Brown related to mental health in Indigenous men to identify depressive symptoms in male and female participants. The mean aPHQ-9 score in our study was similar to that in the aPHQ-9 pilot study (our participants, 4.61 vs. 4.65 in 189 Aboriginal men in Central Australia) [8]. Similar proportions of our participants had mild (score 5–9) and moderate–severe (score > 9) depressive symptoms as in the pilot study (34% vs. 27% and 11% vs. 13%, respectively). In a 2013 audit of 44 Aboriginal and Torres Strait Islander primary care centres, only 9% (four) of health centres and 5% of adults with Type 2 diabetes were screened for depressive symptoms using a formal tool [25]. This represents a very low assessment rate relative to the proportion of participants who had their smoking status (68%) and alcohol consumption (47%) recorded. Given that we identified high levels of depressive symptoms, culturally appropriate screening for and management of depressive symptoms in Indigenous people with diabetes, based on an aPHQ-9 validated for use in both men and women, should be a high priority.

## <H2>Health gap

Diabetes and other endocrine diseases cause five times the premature mortality and poor health among Indigenous Australians compared with non-Indigenous Australians. These conditions are responsible for 7% of the gap that sees Indigenous Australians dying or living with poor health at 2.3 times the rate of non-Indigenous Australians [3]. Our results reveal health behaviours in a remote Indigenous primary care population with diabetes that are largely reflective of the Indigenous Australian population as a whole. Behaviours that contribute to the health gap include smoking, physical inactivity, alcohol, a diet high in processed meat and sweetened beverages and low in fruit and vegetables [3]. Tobacco use is the single biggest contributor to the health gap. Relative to non-Indigenous Australians, Indigenous adults are 2.6 times more likely to smoke daily, and 0.9 and 0.8 times as likely to consume adequate fruit and vegetables daily, 1.1 times as likely to exceed alcohol consumption guidelines, and 1.1 times as likely not to have undertaken recommended physical activity [5]. Encouragingly, our Indigenous participants with diabetes had lower smoking and alcohol consumption rates and similar physical activity and emotional well-being compared with the broader Indigenous Australian population. However, key measures of overall diet quality (fruit, vegetable, fish intakes) were well below Australia's suboptimal

national rates reported for both Indigenous and non-Indigenous populations. Dietary interventions are a clinically effective therapeutic target for diabetes, including metabolic control [26], retinopathy [27] and depressive symptoms [28]. Culturally appropriate dietary interventions at individual and community levels may improve diet quality and health outcomes.

## **<H2>Implications of culture and socio-economic status**

Indigenous Australians have a unique culture and history, including a hunter–gatherer lifestyle. Prior to the second half of the 20th century, Indigenous Australians were generally lean and infrequently developed chronic diseases common to Western populations. Increasing diabetes prevalence arose with adverse changes in physical activity and nutrition as Indigenous Australians adopted a ‘westernized’ lifestyle. A landmark 1980s’ study found that reverting Indigenous Australians to their traditional hunter–gatherer lifestyle (characterized by weight loss, low-fat diet and increased physical activity) markedly improved diabetes biochemical markers [29]. Indigenous Australians often experience socio-economic disadvantage in education, employment and income. Low socio-economic status is associated with poor health and adverse health risk factors and behaviours [30]. Programmes to improve health behaviours must consider the unique cultural and economic circumstances of Indigenous Australians, including nutrition programmes that are social, flexible and focus on available affordable ingredients and simple techniques.

## **<H2>Study limitations and strengths**

This is a descriptive, cross-sectional study—a snapshot of health behaviours. The self-reporting nature of surveys is a limitation that can lead to misreporting of actual behaviours, such as dietary intake. Nutrition surveys, including the survey in this study, generally use intake frequency as the measure of habitual intake over time. A standard conversion from frequency/week to serves/week is based on the assumption of a standard serving size in grams, as specified in the national guidelines. However, if ‘actual’ serving sizes consumed are larger than ‘standard’, intake will be underestimated and this may in part explain the very low fruit and vegetables intakes of participants. In addition, study participant behaviour may differ from that of non-participants locally and elsewhere in Australia. Although comprehensive comparator data for the total clinic population with diabetes were not available, the most relevant diabetes-related key performance indicator (HbA<sub>1c</sub>

< 153mmol/mol; 7%) was similar over the study period in the total clinical population with diabetes (CAAC Annual Report 2017–18) and the survey sample (31% vs. 29%, respectively). Furthermore, our non-responder analyses and comparisons with data in the review table of prior studies on the health-related behaviours of Indigenous adults with and without diabetes support the generalizability of our findings to the broader Indigenous population with diabetes. Other strengths include the use of validated smoking, alcohol and semi-validated depressive symptom surveys and the comprehensive nature of our behavioural data, largely consistent with the few comparable studies that shed light on an under-researched high-priority area—the health behaviour risk profile of Indigenous Australians with diabetes.

## **<H1>Conclusions**

This study both complements and extends prior research in Indigenous Australians with diabetes, with an example of extension being use of the SNAPE suite of surveys. Self-reported health behaviours of Indigenous Australians with diabetes revealed adverse health behaviours broadly in line with the scant Indigenous literature on health behaviours in diabetes. This remote, high-risk, disadvantaged population with diabetes attending an Indigenous primary care service will need to be better resourced if health-improving interventions are to be successfully implemented and sustained. Future research could include development and use of a validated gender-specific aPHQ-9 survey and a culturally appropriate nutrition survey to generate a robust diet quality score to better target dietary interventions. As interventions promoting health behaviours occur at clinic and government levels, a standard, validated methodology to assess their effectiveness should be promoted, ideally as part of the Medicare Health Assessment for Aboriginal and Torres Strait Islander People. We recommend systematic use of this SNAPE or similar validated health behaviour assessment tools in assessing a patient's physical, psychological and social well-being [as per MBS item 715 (adult health check)]. We also support initiatives that target the multifactorial individual, community, societal and national issues that contribute to the psychosocial disadvantage and health gap between Indigenous and non-Indigenous Australians.

## **Funding sources**

This research was funded by NHMRC Partnership / Fred Hollows Foundation [Global] Partnership Grants and a NHMRC CRE Grant. DX was supported by a NHMRC Clinical

Trials Centre Scholarship from a NHMRC Program Grant. AJJ was supported by a NHMRC Practitioner Fellowship and is a Sydney Medical Foundation Fellow. There was no involvement by funders in study design, data collection, data analysis, and manuscript preparation or publication decisions.

### **Competing interests**

None declared.

### **Acknowledgements**

The authors thank the TEAMSnet Study Group and partner organizations and funding agencies.

*TEAMSnet Study Group.* Chief investigators: Professor Sven-Erik Bursell, Professor Alex Brown, Professor Alicia Jenkins, Professor David O'Neal, Professor Danny Liew; Associate Investigators: Professor Tien Wong, Professor Hugh Taylor, Professor Anthony Keech, Professor Ecosse Lamoureux, Dr Mark Horton; TEAMSnet Programme Director: Dr Laima Brazionis; TEAMSnet Project Manager: Christopher Ryan.

*Partners and collaborators.* Central Australian Aboriginal Congress (Alice Springs); Aboriginal Medical Services Alliance (NT); CERA (Melbourne); Estenda Solutions (USA); the Fred Hollows Foundation (global); The University of Melbourne; NHMRC Clinical Trials Centre (University of Sydney); and the Central Australian Rural Practitioners Association (CARPA). We also thank the dedicated study and clinic staff (Aboriginal Health Practitioners, administrators, drivers, doctors and the chronic care team particularly Sharon Atkinson-Briggs and Renate Millonig) and CARPA for their work in developing and updating the manuals for primary healthcare practitioners in remote and rural communities in Central and Northern Australia. We wholeheartedly thank study participants and acknowledge the traditional custodians of the land on which this study was conducted.

We also thank Dr Justin Tse and his staff at the St. Vincent's Hospital Clinical School Melbourne for hosting Daniel Xu during his medical school elective.

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**FIGURE 1** Literature search strategy to identify publications that reported any of five health behaviours—smoking, nutrition, alcohol consumption, physical activity and emotional well-being—for Indigenous Australians with diabetes.

**FIGURE 2** SNAPE lifestyle survey.

### Supporting Information

Additional Supporting Information is available in the online version of this article:

**Table S1** Summary of publications reporting the health behaviours of Indigenous Australians with diabetes, and where possible compared with their Indigenous peers without diabetes or their non-Indigenous counterparts with diabetes.

**Table 1** Summary of participant characteristics, alongside the equivalent characteristics of Indigenous Australians nationally where available

Participant characteristics	All	Men	Women	P <sub>sex</sub>	National Indigenous data (%)		
					All	Men	Women
No. completed $\geq 1$ questionnaire	210	64	146				
Age, years	52.6 $\pm$ 12.3	54.2 $\pm$ 12.4	51.8 $\pm$ 12.2	0.193			
Smoking, %				< 0.001			
Current	31	50	23		41‡	43‡	39‡
Previous	11	11	11		20‡		
Never	58	39	66		36‡		
Drink alcohol*, %	38	49	32	0.022	77‡	83‡	72‡
Physical activity							
Days walked > 10 min at a time	6.0 $\pm$ 2.0	5.9 $\pm$ 2.2	6.1 $\pm$ 1.9	0.404			
Hours sitting on a weekday	4.8 $\pm$ 2.4	4.8 $\pm$ 2.5	4.8 $\pm$ 2.3	0.998	5.3‡ §		
BMI <sup>2</sup> , kg/m <sup>2</sup>	31.5 $\pm$ 7.2	29.6 $\pm$ 6.3	32.4 $\pm$ 7.5	0.011			
% overweight (BMI 25.0–29.9)	27	28	26	0.056	29‡	32‡	27‡
% obese (BMI $\geq$ 30.0)	57	46	61		40‡	36‡	43‡
aPHQ-9 depression score†	4.61 $\pm$ 4.06	3.89 $\pm$ 3.29	4.92 $\pm$ 4.33	0.092	4.65		¶
% with mild (score 5–9)	34	38	32		27¶		
% with moderate-severe (score >9)	11	6	13	0.359	13¶		

Data are given as mean  $\pm$  SD.

aPHQ9, Patient Health Questionnaire 9 adapted for Indigenous Australians.

\*n = 208

†n = 207

‡Australian Bureau of Statistics [5].

§Non-remote only.

¶Brown et al. [8].

**Table 2** Participant responses to the Fagerstrom Test (short form) for nicotine dependence

Fagerstrom Test (short form)	
Current smoker, n (%)	65 of 210 (31)
How soon after waking do you smoke your first cigarette?	
More than 60 min	31
31 to 60 min	31
6 to 30 min	23
Within 5 min	15%
Do you find it hard to stay in a place where you aren't allowed to smoke?	
% Yes	32
Which cigarette would be hardest to give up?	
% first of the day	49
How many cigarettes do you smoke a day?	
< 10	52
11 to 20	28
21 to 30	19
$\geq$ 31	1.5

Values are given as percentages unless stated otherwise.

**Table 3** Consumption frequency of everyday and occasional foodstuffs

	% with nominated frequency of intake										% who meet threshold	Indigenous Australians nationally
	Never or rarely	< 1/week	1/week	2–3/week	4–6/week	1/day	2/day	3/day	4–5/day	> 6/day		
All participants (n = 209)												
Everyday foods												
Vegetables; cooked/raw	2.4	4.3	16	24	<b>6.7</b>	37	8.1	1.4	0.0	0.0	0.0*	5††
Fruit; fresh/dried	4.8	6.2	18	<b>26</b>	6.2	29	6.7	1.9	1.0	0.0	9.6†	43††
Fish (not takeaway)	<b>56</b>	21	20	3.3	1.0	0.0	0.0	0.0	0.0	0.0	4.3‡	
Home-prepared meals	0.5	0.0	1.4	2.9	3.8	<b>60</b>	21	7.7	1.0	1.9		
Liquids												
Water	0.5	0.5	0.5	0.5	1.9	7.2	8.1	15	<b>26</b>	39		
Milk and milk products	28	101	<b>13</b>	9.1	1.9	20	7.7	4.8	3.3	1.4	17§	
Coffee/tea	2.4	0.5	0.0	1.9	2.4	25	<b>23</b>	20	17	7.2		
Juice; fruit/vegetable	24	20	<b>24</b>	15	2.4	9.6	2.4	1.0	0.5	0.0	13¶	16‡‡
Diet soft drinks and cordials	39	<b>14</b>	19	12	1.9	12	1.4	1.4	0.0	0.5		
Regular soft drinks and cordials	<b>59</b>	14	13	7.2	1.9	3.8	1.0	0.0	0.0	0.0		
Occasional foods												
Takeaway	27	<b>27</b>	29	12	1.0	2.9	0.0	0.5	0.0	1.0	17**	29‡‡
Snacks	35	<b>22</b>	13	14	5.7	8.1	1.4	0.5	0.0	0.5	30**	37‡‡
Men (n = 63)												
Everyday foods												

Vegetables; cooked/raw	1.6	3.2	21	16	7.9	<b>43</b>	6.3	1.6	0.0	0.0	0.0*
Fruit; fresh/dried	6.3	9.5	19	<b>21</b>	3.2	35	4.8	1.6	0.0	0.0	6.3†
Fish (not takeaway)	<b>52</b>	21	21	4.8	1.6	0.0	0.0	0.0	0.0	0.0	6.3‡
Home-prepared meals	1.6	0.0	1.6	3.2	1.6	<b>56</b>	27	4.8	3.2	1.6	
Liquids											
Water	1.6	0	0	0	0	9.5	13	18	<b>19</b>	40	
Milk and milk products	30	6.3	<b>16</b>	7.9	1.6	21	7.9	4.8	3.2	1.6	18§
Coffee/tea	3.2	1.6	0.0	1.6	1.6	24	<b>22</b>	21	19	6.3	
Juice; fruit/vegetable	37	<b>18</b>	18	14.	1.6	7.9	3.2	1.6	0.0	0.0	4.8¶
Diet soft drinks and cordials	37	<b>14</b>	9.5	16	3.2	13	3.2	4.8	0.0	0.5	
Regular soft drinks and cordials	<b>67</b>	7.9	9.5	7.9	1.6	4.8	1.6	0.0	0.0	0.0	
Occasional foods											
Takeaway	24	<b>30</b>	24	14	1.6	4.8	0.0	0.0	0.0	1.6	22**
Snacks	44	<b>21</b>	13	14	1.6	6.3	0.0	0.0	0.0	0.0	22**
Women (n = 146)											
Everyday foods											
Vegetables;	2.7	4.8	14	28	<b>6.2</b>	34	8.9	1.4	0.0	0.0	0.0*

cooked/raw											
Fruit; fresh/dried	4.1	4.8	17	<b>29</b>	7.5	27	7.5	2.1	1.4	0.0	11†
Fish (not takeaway)	<b>57</b>	21	19	2.7	0.7	0.0	0.0	0.0	0.0	0.0	3.4‡
Home- prepared meals	0.0	0.0	1.4	2.7	4.8	<b>62</b>	19	8.9	0.0	2.1	
Liquids											
Water	0.0	0.7	0.7	0.7	2.7	6.2	6.2	14	<b>30</b>	39	
Milk and milk products	27	12	<b>12</b>	9.6	2.1	20	7.5	4.8	3.4	1.4	17§
Coffee/tea	2.1	0.0	0.0	2.1	2.7	26	<b>24</b>	19	16	7.5	
Juice; fruit/vegetable	19	21	<b>27</b>	16	2.7	10	2.1	0.7	0.7	0.0	3.4¶
Diet soft drinks and cordials	37	<b>14</b>	9.5	16	3.2	13	3.2	4.8	0.0	0.5	
Regular soft drinks and cordials	<b>67</b>	7.9	9.5	7.9	1.6	4.8	1.6	0.0	0.0	0.0	
Occasional foods											
Takeaway	29	<b>26</b>	31	10	0.7	2.1	0.0	0.7	0.0	0.7	14**
Snacks	31	<b>23</b>	13	14	7.5	8.9	2.1	0.7	0.0	0.7	34**

Median consumption frequency is shown in bold. When national guidelines are available for a foodstuff, we calculated the percentage of participants who met or exceeded this guideline. Data are shown for all participants, men only and women only.



\*Adequate vegetable intake five or more servings daily for adult females and men over 50 years, and six or more servings for adult males under 50 years [10].

†Adequate fruit intake two or more servings daily [10].

‡Recommended fish intake two to three per week [7].

§Recommended milk/milk products two or more servings daily [10].

¶One or more per day [21].

\*\*Two or more per week [21].

††From AATSIHS [5].

‡‡From Hodge et al. [21].

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**Table 4** Participant responses to the Audit C.

Audit C alcohol	
Drink alcohol, n (%)	78 of 208 (38)
How often did you have a drink containing alcohol in the past year?	
Monthly or less	41
2 to 4 times a month	40
2 to 3 times per week	14
4 or more times per week	5
How many drinks did you have on a day you were drinking in the past year?	
1 or 2	22
3 or 4	24
5 or 6	30
7 to 9	13
≥ 10	12
How often did you have 6 or more drinks on one occasion in the past year?	
Never	15
Monthly or less	41
Monthly	19
Weekly	22
Daily or almost daily	2
Mean (SD) Audit C score	5.06 (2.40)
Risk level among drinkers (%)	
Low-risk (score ≤ 4)	46
At-risk (score = 5)	8
High-risk (score 6–8)	36
Likely-dependent (score ≥ 9)	10

Values are given as percentages unless stated otherwise.

**Table 5** Participant responses to the aPHQ9 and additional culturally-specific questions\*

aPHQ9	Proportion (%)			
	No	A little bit	Most of the time	All of the time

---

In the last two weeks, have you...

been feeling slack not wanted to do anything?	50	36	12	2.9
been feeling unhappy, depressed, really no good, that your spirit was sad?	56	34	8.7	1.4
found it hard to sleep at night or had other problems with sleeping?	62	24	8.7	5.3
felt tired or week, that you have no energy?	49	34	12	5.3
not felt like eating much even when there was food around?	65	29	4.3	1.9
been eating too much food?	67	30	3.4	0.5
been feeling bad about yourself, that you are useless, no good, that you have let your family down?	75	20	3.9	1.4
felt like you can't think straight or clearly, it's hard to learn new things or concentrate?	69	27	2.4	1.9
been talking slowly or moving around really slow?	69	23	6.3	1.9
felt like you can't sit still, you keep moving around too much?	74	19	6.3	0.5
been thinking about hurting yourself or killing yourself?	93	5.3	1.0	0.5
Culturally specific questions				
felt that your spirit was weak?	72	24	3.9	
been drinking more grog or smoking more ganja than you usually do?	96	3.9	0.5	
been feeling homesick, lonely for family or home?	64	32	4.3	
felt your anger building up inside you ready to explode?	80	18	1.4	
think you have too much worry?	54	40	5.8	
felt that you can't stop thinking about the things that cause you worry?	63	30	7.2	
felt cranky, irritable or always in a bad mood?	72	27	1.4	

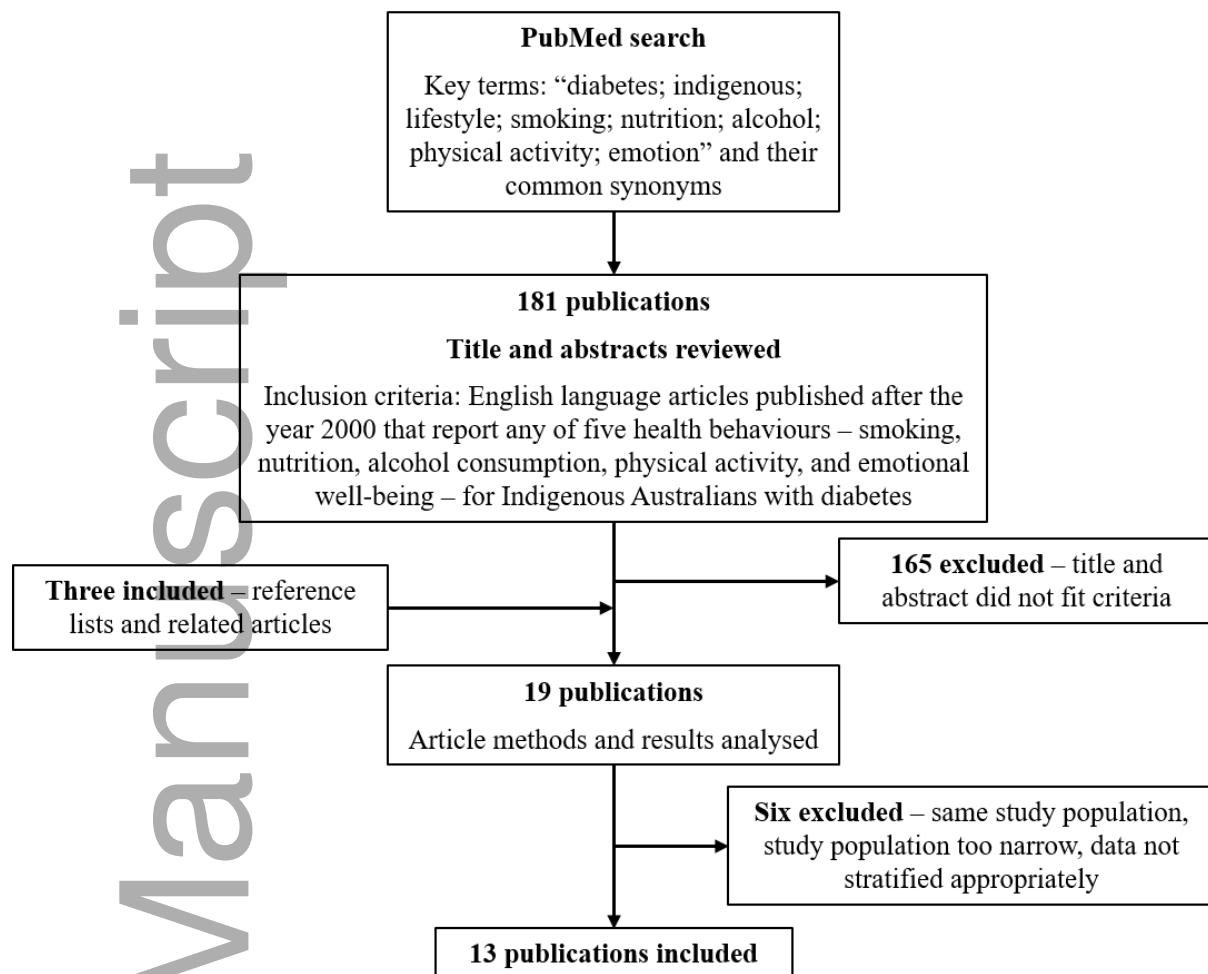
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Values are percentages.

\* No. completed questionnaires (n = 207).

aPHQ9, Patient Health Questionnaire 9 adapted for Indigenous Australians.

Figure 1



Survey	Questions	
Smoking	How soon after waking do you smoke your first cigarette?	
	Do you find it hard to stay in a place where you aren't allowed to smoke?	
	Which cigarette would be hardest to give up?	
	How many cigarettes do you smoke in a day?	
Alcohol	How often did you have a drink containing alcohol in the past year?	
	How many drinks did you have on a typical day when you were drinking in the past year?	
	How often did you have six or more drinks on one occasion in the past year?	
Depression	Have you been feeling slack, not wanted to do anything?	
	Have you been feeling unhappy, depressed, really no good, that your spirit was sad?	
	Have you found it hard to sleep at night, or had other problems with sleeping?	
	Have you felt tired or weak, that you have no energy?	
	Have you not felt like eating much, even when there was food around?	
	Have you been eating too much food?	
	Have you been feeling bad about yourself, that you are useless, no good, that you have let your family down?	
	Have you felt like you can't think straight or clearly, that it's hard to learn new things or concentrate?	
	Have you been talking or moving around really slow?	
Have you felt that you can't sit still, that you move around too much?		
	Have you been thinking about hurting yourself or killing yourself?	

Depression: Additional culture-based questions	In the last two weeks have you felt that your spirit was weak?										
	Have you been drinking more grog or smoking more ganja than you usually do?										
	Have you been feeling homesick, lonely for family or home?										
	Have you felt your anger building up inside you, ready to explode?										
	Do you think you have too much worry?										
	Have you felt that you can't stop thinking about the things that cause you worry?										
	Have you felt cranky, irritable or always in a bad mood?										
<b>Diet quality survey</b>											
	Never or rarely	<1/week	1/week	2-3/week	4-6/week	1/day	2/day	3/day	4-5/day	>6/day	>1/day
Vegetables											
Fruit											
Fresh fish											
Milk-based drinks											
Juice											
Coffee or tea											
Water											
Homemade meals											

Takeaway											
Snacks											
Diet soft drinks/cordials											
Regular soft drinks/cordials											
<b>Physical activity questions</b>											
During the last 7 days, how much time did you spend sitting on a week day (h)											
During the last week, on how many days did you walk at least 10 min at a time?											



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**Title:**

Health-related behaviours in a remote Indigenous population with Type 2 diabetes: a Central Australian primary care survey in the Telehealth Eye and Associated Medical Services Network [TEAMSnet] project

**Date:**

2019-09-09

**Citation:**

Xu, D., Jenkins, A., Ryan, C., Keech, A., Brown, A., Boffa, J., O'Dea, K., Bursell, S. E., Brazionis, L., O'Neal, D., Liew, D., Wong, T., Taylor, H., Keech, A., Lamoureux, E., Horton, M., Brazionis, L., Ryan, C. & Tse, J. (2019). Health-related behaviours in a remote Indigenous population with Type 2 diabetes: a Central Australian primary care survey in the Telehealth Eye and Associated Medical Services Network [TEAMSnet] project. *DIABETIC MEDICINE*, 36 (12), pp.1659-1670. <https://doi.org/10.1111/dme.14099>.

**Persistent Link:**

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