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## Characteristics of men classified at high-risk for type 2 diabetes mellitus using the AUSDRISK screening tool

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### ABSTRACT

**Aims:** The primary aim was to describe characteristics of men identified at high-risk for Type 2 diabetes mellitus (T2DM) using the Australian diabetes risk assessment (AUSDRISK) tool. Secondary aims were to determine the prevalence of pre-diabetes and metabolic syndrome in these men.

**Methods:** Men ( $n = 209$ ) completed the AUSDRISK tool, with 165 identified as high-risk for T2DM (score  $\geq 12$ , maximum 38). Demographic, anthropometric, physiological and behavioural outcomes were assessed for 101 men. Comparisons (one-way ANOVA) among three AUSDRISK score groups (12–15, 16–19,  $\geq 20$ ) were performed (significance level,  $P < 0.05$ ).

**Results:** Common risk factors (percentages) among high-risk men were waist circumference ( $> 90$  cm; 93%), age ( $> 44$  years; 79%), physical activity level ( $< 150$  min  $\text{wk}^{-1}$ ; 59%), family history of diabetes (39%) and previously high blood glucose levels (32%). Men with AUSDRISK scores  $\geq 20$  had higher (mean  $\pm$  SD) HbA<sub>1c</sub> ( $6.0 \pm 0.4\%$  [ $42 \pm 4.4$  mmol.mol<sup>-1</sup>],  $P < 0.001$ ), FPG ( $5.3 \pm 0.6$  mmol.L<sup>-1</sup>,  $P = 0.001$ ) and waist circumference ( $113.2 \pm 9.8$  cm,  $P = 0.026$ ) than men with scores of 12–15. Mean FPG for the sample was  $5.0 \pm 0.6$  mmol.L<sup>-1</sup>, whereas mean HbA<sub>1c</sub> was  $5.8 \pm 0.5\%$  [ $40 \pm 5.5$  mmol.mol<sup>-1</sup>]. Pre-diabetes prevalence was 70% and metabolic syndrome prevalence was 62%.

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**Abbreviations:** ADA, American Diabetes Association; AES, Australian Eating Survey; ANZCTR, Australian New Zealand Clinical Trials Registry; ARFS, Australian Recommended Food Score; AUSDRISK, Australian Diabetes Risk tool; BMI, body mass index; cm, centimetre; FPG, fasting plasma glucose; HbA<sub>1c</sub>, glycosylated haemoglobin; HOMA-IR, homeostatic model assessment-insulin resistance; IDF, International Diabetes Federation; kg, kilograms; kJ, kilojoule; L, litre; min, minute; mIU, milli-international units; mL, millilitre; mmol, millimoles; MVPA, moderate-vigorous physical activity; n, sample size; OGTT, Oral Glucose Tolerance Test; PULSE, prevention using lifestyle education; QUICKI, quantitative insulin sensitivity check index; SD, standard deviation; T2DM, Type 2 diabetes mellitus.

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**Conclusions:** The AUSDRISK tool identified men who were mostly older than 44, and had large waist circumferences and elevated HbA<sub>1c</sub>. These findings provide evidence supporting the usefulness of the AUSDRISK screening tool for T2DM screening in clinical and research settings.

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## 1. Introduction

### 1.1. Background

Diabetes is one of the most prevalent non-communicable diseases worldwide and is estimated to reach 592 million cases (10.1%) by 2035 [1]. Type 2 diabetes mellitus (T2DM) represents approximately 90% of all diabetes cases [2]. The early identification of individuals at high-risk for T2DM allows for targeted lifestyle intervention and/or drug treatment, which may prevent or delay disease progression. This is complicated however, as T2DM, and its precursor condition pre-diabetes [3], are often asymptomatic at early stages [4], making it difficult to identify individuals who would benefit from preventive approaches. Furthermore, diagnostic tests such as fasting plasma glucose (FPG), glycosylated haemoglobin (HbA<sub>1c</sub>) and an oral glucose tolerance test (OGTT) are invasive and not justified for screening purposes in terms of cost and/or time [5–7]. Consequently, many individuals with T2DM and pre-diabetes remain untreated for several years prior to clinical diagnosis [3,4].

The use of screening tools for early detection of T2DM risk is strongly supported in the literature [8–10]. Ideal screening tools require good sensitivity (i.e., probability that the test is positive for individuals that will develop T2DM in the future) and specificity (i.e., probability that the test is negative for individuals who will not develop T2DM in the future) [9]. A number of screening tools have been validated for T2DM risk assessment, including the Finnish diabetes risk score (FINDRISC) [7] and the Australian diabetes risk assessment (AUSDRISK) tool [6,11]. AUSDRISK, released in 2008, was developed using data from the large population-based AUSDIAB study [12,13]. The tool is comprised of 10-items, assessing six modifiable and four non-modifiable risk factors. The AUSDRISK validation study [6] demonstrated good sensitivity (74%) and specificity (67.7%), with a positive T2DM predictive value of 12.7%, which is similar to the FINDRISC tool [7].

Despite the strong rationale for use, AUSDRISK is poorly used in clinical practice, predominantly due to lack of awareness of the tool [14] and of its potential usefulness.

A small number of Australian studies have reported using it to assess T2DM risk in study cohorts [14–16] or as an eligibility criterion for T2DM prevention trials [17,18]. However, no studies have reported the anthropometric and biomarker characteristics of participants identified as at high-risk for T2DM using AUSDRISK or its ability to identify individuals with elevated glycaemic markers. In addition, given the strong association between T2DM, cardiovascular disease, and several metabolic comorbidities, it is of interest to investigate the prevalence of metabolic syndrome (MetS) in individuals

identified at high-risk for T2DM using AUSDRISK screening. Collectively, this information may provide further confidence in the usefulness of AUSDRISK screening to positively identify individuals with pre-diabetes and multiple risk factors for T2DM.

### 1.2. Aims

The primary aim is to profile the characteristics of a sample of Australian men identified as being at high-risk for T2DM using AUSDRISK screening (score  $\geq 12$  points). Secondary aims are to determine the ability of the AUSDRISK tool to: (a) identify existing pre-diabetes based on FPG and HbA<sub>1c</sub> values; and (b) identify the prevalence and associated characteristics of MetS in a population of men at high-risk for T2DM.

## 2. Subjects, materials and methods

### 2.1. Study design

This study is a cross-sectional investigation reporting the characteristics of Australian men ( $n=101$ ) identified with high-risk for T2DM using the AUSDRISK tool. These men were enrolled in the T2DM PULSE (Prevention Using LifeStyle Education) trial, a randomised controlled trial of a 6-month self-administered and gender-tailored lifestyle behavior change intervention (weight loss, diet modification, exercise) for men. The rationale and design of the trial are comprehensively described elsewhere [19]. AUSDRISK score was used as the primary eligibility criterion for the trial. At the baseline time point (study entry), a wide range of demographic, anthropometric, physiological and behavioural outcomes were collected. The characteristics of these men including the prevalence of pre-diabetes based on FPG and HbA<sub>1c</sub> criteria [20], and the prevalence of MetS [21] were examined. Comparisons of the sample characteristics across three AUSDRISK score groups (12–15, 16–19 and  $\geq 20$  points) were investigated. This study was conducted at the *The University of Newcastle*, Australia and was approved by the institutions Human Research Ethics Committee. The trial is registered with the Australian New Zealand Clinical Trials Registry (ANZCTR): ACTRN12612000721808.

### 2.2. Participants: Recruitment, eligibility and screening

To be eligible for the T2DM PULSE trial, men were required to: be aged 18–65, have a BMI 25–40 kg.m<sup>-2</sup> and be at high-risk for T2DM (AUSDRISK score  $\geq 12$  points; maximum score 38). Individuals were not required to have diagnosed pre-diabetes

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