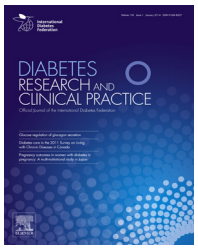
Contents available at ScienceDirect

Diabetes Research and Clinical Practice

journal homepage: www.elsevier.com/locate/diabres

International Diabetes Federation



External validation of two diabetes risk scores in a young UK South Asian population

L.J. Gray [a,*], K. Khunti [b], E.G. Wilmot [b], T. Yates [b], M.J. Davies [b]

[a] University of Leicester, Department of Health Sciences, Leicester, UK
[b] University of Leicester, Diabetes Research Centre, Leicester Diabetes Centre, Leicester, UK

ARTICLE INFO

Article history:
Received 2 July 2013
Received in revised form
17 March 2014
Accepted 22 March 2014
Available online 2 April 2014

Keywords:
Screening
Type 2 diabetes
Risk scores
Early detection

ABSTRACT

Aims: To externally validate the Leicester Practice Risk Score (LPRS) and the Leicester Risk Assessment score (LRAS) in a young South Asian population.

Methods: South Asian participants aged 25–39 years inclusive from a population based screening study were included. The risk scores were calculated and compared to the diagnosis of type 2 diabetes mellitus (T2DM) or T2DM and Impaired Glucose Regulation (IGR, including IFG and IGT) using either an oral glucose tolerance test (OGTT) or a HbA1c (≤48 mmol/mol/6.5% and ≤42 mmol/mol/6.0% respectively). Measures of discrimination and calibration were calculated.

Results: Of the 331 participants 8 (2.4%) had undiagnosed T2DM and 30 (9.1%) had IGR using an OGTT, 11 (3.4%) and 39 (12.1%) were found using HbA1c. Using the LPRS to detect T2DM on an OGTT gives an area under the ROC curve of 0.91 (95% CI 0.86, 0.97), including those with IGR gives an ROC of 0.72 (0.62–0.81), these values are 0.93 (0.88, 0.98) and 0.68 (0.60, 0.77) when using an HbA1c to define outcome. Acceptable levels of calibration were seen. Similar results are found for the LRAS.

Conclusions: These scores can be used to identify those with undiagnosed T2DM and/or IGR in a young South Asian population. This is the first study to externally validate scores developed for prevalent undiagnosed disease in this age group using both OGTT and HbA1c.

1. Introduction

382 million people have Type 2 Diabetes Mellitus (T2DM) world-wide [1]. In the UK this figure is estimated to be 3 million increasing to 5 million by 2025 [2]. This prevalence is increasing across all age groups, including children, adolescents and young adults. A retrospective cohort study found an eight fold increase in prescriptions for oral anti-diabetic therapy between 1998 and 2005 in those aged less than 18 years [3]. In this same age group prevalence ranging from 1.9 per 100,000 up to 3 per 100,000 have been reported [4,5]. Prevalence estimates for T2DM in young adults are limited; a retrospective review of a secondary care diabetes service found that 14% of the diabetes clinic who were 35 years old or less had T2DM [6]. T2DM is usually preceded by the 'pre-diabetic' state called impaired glucose regulation (IGR) where there is a high risk of developing T2DM, which includes Impaired Fasting Glucose (IFG) and Impaired Glucose Tolerance (IGT). Progression from IGR to T2DM is likely but not inevitable, people with IGR are between 5 and 15 times more likely to develop T2DM than those with normal glucose levels

* *Corresponding author at*: University of Leicester, Department of Health Sciences, Leicester Diabetes Centre (Broadleaf), Leicester General Hospital, Gwendolen Road, Leicester LE5 4PW, UK. Tel.: +44 0116 2584043; fax: +44 0116 258 5344.
E-mail address: lg48@le.ac.uk (L.J. Gray).

http://dx.doi.org/10.1016/j.diabres.2014.03.018

[7]. T2DM can be prevented in those with IGR through lifestyle modification or pharmacology [8]. There are little data regarding the prevalence of IGR in those less than 40 years old. A cross-sectional survey of New Zealanders aged 15 years and above using HbA1c between 5.7% and 6.4% inclusive to categorise IGR found a prevalence of 8.4% (95% CI 5.6%, 11.2%) in those aged 15–24 years and 15.8% (95% CI 11.2%, 20.4%) in those aged 25–34 years [9].

Clinical risk scores can be used to identify those at high risk of developing diabetes who would benefit from further screening. Using a risk score to pre-screen has been shown to increase the pick-up rate compared to a population based approach [10]. The National Institute for Health and Clinical Excellence (NICE) in the UK has recommended the use of clinical risk scores for identifying those at high risk of T2DM so that interventions aimed at prevention can be commenced [11]. The Leicester Risk Assessment Score and the Leicester Practice Risk Score were developed for use in the UK and detect undiagnosed IGR and T2DM [12,13]. The Leicester Risk Assessment score is a self-assessment score completed by members of the public without intervention from a heath care professional or the results of medical tests. The score includes age, sex, ethnicity, body mass index (BMI), waist circumference, family history of diabetes and hypertension. The Leicester Practice Risk Score is similar but for use within primary care databases to rank those listed by risk. Both of these scores were developed and validated in those aged between 40 and 75 years. To date there is no data regarding the performance of these risk scores in those less than 40 years old. This is of particular importance as NICE has recommended the use of validated risk scores in high risk groups, which includes those aged 25–39 from black and minority ethnic groups and have shown that this could be cost saving [11]. This specific recommendation is based on data which shows that in the UK T2DM is more prevalent in people of South Asian, Chinese, African-Caribbean, and black African descent, with twice the rate of T2DM compared to white Europeans [14,15].

The aim of this paper is to externally validate the Leicester Practice Risk Score and the Leicester Risk Assessment score in a young (25–39 years inclusive) South Asian population using data from the ADDITION-Leicester screening study [16].

2. Methods

2.1. Data set

A subset of data from the ADDITION-Leicester population based screening study was used to externally validate the risk scores. This study has been described in detail elsewhere [16]. In summary, ADDITION-Leicester invited a randomly selected 30,950 people without diagnosed diabetes aged 40–75 years old (25–75 years old if of Black or Minority Ethnic (BME) groups) from Leicester and Leicestershire, UK for screening between 2004 and 2008.

In ADDITION-Leicester, participants were classified IFG, IGT and T2DM based on an Oral Glucose Tolerance Test (OGTT) according to WHO 1999 criteria [17]. For this study IGR refers to the composite of IGT and/or IFG. HbA1c was collected on all participants at baseline. A HbA1c ≥48 mmol/mol/6.5% [18] was used to define T2DM, those with a HbA1c between 42 mmol/mol/6.0% and 46 mmol/mol/6.4% were deemed at high risk of T2DM [19].

Both the Leicester Practice Risk Score and the Leicester Risk Assessment score were developed using data from the ADDITION-Leicester study; in both cases those of South Asian ethnicity who were aged less than 40 years were excluded from the analysis [12,13]. Therefore the cohort of individuals used in this current analysis can be thought of as an external data set.

In this data set the term South Asian relates to people who identified themselves as being 'Indian', 'Pakistani', 'Bangladeshi', or 'Any other Asian background'.

2.2. Risk scores

The derivation of the Leicester Practice Risk Score and the Leicester Risk Assessment score are shown in Table 1. The scores are similar in terms of the covariates included, although how the covariates are included differs. The Leicester Practice Risk Score includes all measured risk factors as continuous variables (age and BMI); in contrast these are collapsed into categories for the Leicester Risk Assessment score. Additionally the Leicester Practice Risk Score does not contain waist circumference as this is not well recorded in primary care. The two scores are used in slightly different ways in practice. The Leicester Practice Risk Score is used within a GP practice computer database; the score can be used to rank the practice population from the lowest to the highest risk. Those at the highest risk can subsequently be invited for screening. NICE recommends inviting the top 50% for screening [20]; others have used the top 10% [10]. This can be changed depending on the available resources. When using

Table 1 – Leicester Practice Risk Score and the Leicester Risk Assessment score.

Risk factor	Leicester Practice Risk Score	Leicester Risk Assessment score
Age	0.0408359 * age (years)	40–49 years: 0[†] 50–59 years: 5 60–69 years: 9 70–75 years: 13
Sex	0.1839942 if male	1 if male
Ethnicity	0.7565977 if not White European	6 if not White European
BMI	0.0820698 * BMI (kg/m^2)	<25 kg/m^2: 0 25–29 kg/m^2: 3 30–34 kg/m^2: 5 ≥35 kg/m^2: 8
Waist circumference	Not included	<90 cm: 0 90–99 cm: 4 100–109 cm: 6 ≥110 cm: 9
Family history of diabetes	0.4770517 if yes	5 if yes
Antihypertensive therapy	0.5498978 if prescribed	5 if prescribed or known high BP

[†] All those less than <40 will receive a score of zero.