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Derivation and validation of diabetes risk score for urban Asian Indians

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Abstract

Objective: Simple risk scores for identifying people with undiagnosed diabetes have been developed, mostly in Caucasian groups. This may not be suitable for Asian Indians, therefore this study was undertaken to develop and validate a simple diabetes risk score in an urban Asian Indian population with a high prevalence of diabetes. We also tested whether this score was applicable to South Asian migrants living in a different cultural context.
Research design and methods: A population based Cohort of 10,003 participants aged ≥20 years was divided into two equal halves (Cohorts 1 and 2), after excluding people with known diabetes. Cohort 1 ($n = 4993$) was used to derive the risk score. Validation of the score was performed in the other half of the survey population (Cohort 2) ($n = 5010$). The validation was also done in a separate survey population in Chennai, India (Cohort 3) ($n = 2002$) (diagnosis of diabetes was based on OGTT) and in the South Asian Cohort of the 1999 Health Survey for England ($n = 676$) (fasting glucose value ≥ 7 mmol/l and HbA1c ≥ 6.5% were used for diagnosis). A logistic regression model was used to compute the β coefficients for risk factors. The risk score value was derived from a receiver operating characteristic curve.
Results: The significant risk factors included in the risk score were age, BMI, waist circumference, family history of diabetes and sedentary physical activity. A risk score value of >21 gave a sensitivity, specificity, positive predictive value and negative predictive value of 76.6%, 59.9%, 9.4% and 97.9% in Cohort 1, 72.4%, 59%, 8.3% and 97.6% in Cohort 2 and 73.7%, 61.0%, 12.2% and 96.9% in Cohort 3, respectively. The higher distribution of risk factors in the UK Cohort means that at the same cut point the score was much more sensitive but also less specific. (sensitivity 92.2%, specificity 25.7%, positive predictive value of 21.6% and negative predictive value of 93.7%).
Conclusions: A diabetes risk score involving simple non-biochemical measurements was developed and validated in a native Asian Indian population. This easily applicable simple score could play an important role as the first step in the process of identifying individuals with an increased likelihood of having prevalent but undiagnosed diabetes. The different distribution of

Abbreviations: NUDS, National Urban Diabetes Survey; ROC, receiver operating characteristic curve; CI, confidence interval; HSE, Health Survey for England; CRS, Cambridge Risk Score

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risk factors with the migrant Asian Indians living in England and the different relationship between sensitivity and specificity for the same score demonstrate that risk scores and cut-points developed and tested even within one ethnic group cannot be generalized to individuals of the same ethnic group living in a different cultural setting where the distribution of risk factors for diabetes is different.

Keywords: Type 2 diabetes; Undiagnosed diabetes; Diabetes risk score; Asian Indians; Screening for diabetes

1. Introduction

The prevalence of diabetes is increasing worldwide and is a serious public health problem in many countries. The cost of treating diabetes and, in particular, dealing with its complications, is a major concern especially in developing countries such as the Indian sub-continent where the prevalence of diabetes is high [1]. As a large proportion of the people with prevalent Type 2 diabetes are undetected and many have diabetic complications at the time of clinical diagnosis [2], it has been suggested that screening could be one approach to reduce the burden of morbidity attributable to diabetes. However universal screening of all adults in the population is not practical nor recommended [3].

One critical uncertainty in the debate about whether or not to screen for diabetes, is the most appropriate method for identifying individuals with undiagnosed diseases. A common strategy is to use simple methods to identify a population of individuals at increased risk of having undiagnosed diabetes who can then be invited to attend for more definitive testing.

A number of different groups have developed and evaluated simple risk scores for predicting prevalent but undiagnosed diabetes. Some of these have required people to complete a questionnaire, whereas others have utilized information already available to health care practitioners. The common characteristic of these questionnaires is that they all utilize non-blood based risk factors and are used to identify target groups who could be invited for biochemical measurements [4–8]. Lindstrom and Tuomilehto had used the score to predict incident cases [5]. These risk factors questionnaires have invariably been developed in Caucasian groups and may not be generalizable to other populations where the distribution of risk factors and their associations with prevalent undiagnosed diabetes differ. Only one previous study has tested the validity of a score that was originally derived and tested in a Caucasian population [4] in a different ethnic minority population in the UK [8]. However, no study has previously developed and tested a risk score specifically in a South Asian population.

Therefore the aims of this study were (1) to develop and test the validity of a simple diabetes risk score in the South Asian Indian population and (2) to assess its performance in a migrant Indian population in the UK.

2. Materials and methods

Four different Cohorts were used in this study. Cohorts 1 and 2 were two halves of the National Urban Diabetes Survey (NUDS) conducted in the year 2000 in six major cities of India [9]. Adults aged $\geq$20 years from an urban population were randomly selected for the study. Subjects from all socio-economic strata were included. The total number of subjects screened was 11,186 (men 5258, women 5928). A Cohort of 10,003 participants was divided into two equal halves (Cohorts 1 and 2), after excluding people with known diabetes. One group was used to develop the risk score (Cohort 1, $n = 4993$). The other Cohort of 5010 subjects (Cohort 2) was used to validate the risk score. In addition, the population data of the 1995 survey in Chennai, India was also used to test the validity of the risk score (Cohort 3). The number of subjects in the 1995 Chennai Survey [10] was 2002 after excluding cases of known diabetes. In both surveys, adults aged $\geq$20 years were tested for diabetes using an OGTT. The diagnosis of diabetes was based on the 2 h post-glucose value ($\geq$11.1 mmol/l) [11]. Capillary whole blood was used in Cohorts 1 and 2 and venous plasma was used in Cohort 3. These samples are considered to give an equivalent 2 h post-glucose result [11].