Institution: University of Leicester

Unit of Assessment: UoA2 Public Health, Health Services and Primary Care

Title of case study: Pre-diabetes and Type 2 diabetes: Risk-assessment tools for early detection and prevention

1. Summary of the impact

Around 2.5 million people in the UK have Type 2 diabetes, with many more in a pre-diabetic state, Both conditions are hard to detect and frequently remain undiagnosed and untreated for years. The cost burden to the NHS of eventual treatment is estimated at £10 billion; 80% of which is spent on complications that are, with good care, avoidable. Targeted diabetes prevention programmes could aid in prevalence reduction and associated costs. Leicester's Diabetes Research Centre has developed two risk scores, both suitable for use with an ethnically diverse UK population, to detect these conditions: a self-assessment questionnaire and a general practice database tool. Recommended by NICE, they have been used successfully in varied settings. Since July 2011, around 260,000 people have completed the self-assessment score online and more than 40,000 through other means.

2. Underpinning research

Benefits of early detection

Type 2 diabetes (T2DM) is one of the most common long-term conditions globally; it is also non-communicable and potentially preventable. In the UK around 10% of the adult population over 45 has T2DM, and diabetes prevalence is increasing steadily due to an ageing population, high obesity levels and a more ethnically diverse make-up. T2DM is preceded by a pre-diabetic state called impaired glucose regulation (IGR). Population-based screening studies have shown that around 20% of the adult population over 45 has an undiagnosed glucose disorder and this prevalence is significantly higher (up to six times) in those from black and minority ethnic groups.

Need for novel screening strategies

Leicester's Diabetes Research Centre, one of the largest of its kind in Europe, focuses on finding new ways of identifying people at high risk of diabetes as well as developing effective interventions to stop, slow and treat the condition.

In 2007, a study reported in the BMJ showed that timely treatment with medication or modifications to lifestyle can delay or prevent progression to T2DM in people with IGR, as well as the development of complications such as heart and renal disease in people with T2DM (**1**). Despite the evidence for these benefits, uptake in screening programmes is generally low, and lower still in black and minority ethnic populations. A qualitative study identified a number of barriers to uptake of screening: the time commitment involved in attending a long appointment during working hours, low self-perception of risk, difficulties with arranging general practice appointments, and dislike of oral glucose tolerance tests (**2**). The findings highlighted the need for novel screening strategies.

Two self-assessment scores for an ethnically diverse population

In 2008, the Centre offered screening within 20 general practices to 30,950 randomly selected people from Leicestershire, who had not been previously diagnosed with T2DM (**3**). Of these, 6,390 took up the offer, and a fifth were identified as either having undiagnosed T2DM or at high-risk of developing the disease. A comprehensive set of data - age, sex, BMI, waist circumference, family history of diabetes, history of high blood pressure and ethnicity – as well as oral glucose tolerance tests, was collected from all those attending.

This data was used to develop two scores to detect undiagnosed IGR or T2DM in an ethnically diverse population; the results were published in leading journals Diabetic Medicine and Diabetologia (**4,5**). The Leicester Self-Assessment (LSA) score is based on factors known to the patient and the Leicester Practice Risk (LPR) score is designed to enable general practices to identify those at highest risk in their populations, using routinely stored data (minus waist circumference). These are the first scores that have been specifically developed or validated in a

UK multi-ethnic population. Both scores were externally validated using data from a second screening study (**6**).

Clinical trials

The tools have been successfully used to identify those at risk in clinical studies led by the Centre: the Let's Prevent Diabetes trial used the LPR score to rank people by risk of IGR/T2DM within general practices, and those with the highest 10% of scores were then invited for second-stage screening and a quarter of those screened were found to have either IGR or T2DM (**7**). Similar results were seen for a study into the Walking Away from Diabetes programme, a 3-hour course which offers participants the opportunity to explore their risk of developing diabetes and to identify the changes they need to make to remain healthy. The self-assessment score is being used in two CLAHRC (Collaboration for Leadership in Applied Health Research and Care) early detection studies, ATTEND and PRISM, which have screened over 3,000 participants to date.

Key Leicester researchers: Melanie Davies, Professor of Diabetes Medicine, 2006-present; Kamlesh Khunti, Professor of Primary Care Diabetes and Vascular Medicine, 2007-present; Dr Laura Gray, Lecturer of Population and Public Health Sciences, 2008-present
Other Leicester researchers: Dr Clare Gillies, Lecturer in Medical Statistics, 2000-present; Dr Helen Eborall, Lecturer in Social Sciences, 2008-present; Dr Margaret Stone, Sen. Res. Fellow, 1999-present.

3. References to the research

1 **Gillies CL**, Abrams KR, Lambert PC, Cooper NJ, Sutton AJ, Hsu RT, **Khunti K**. Pharmacological and lifestyle interventions to prevent or delay type 2 diabetes in people with impaired glucose tolerance: systematic review and meta-analysis. BMJ. 2007 Feb 10;334(7588):299. Epub 2007 Jan 19. Review.
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3 Webb DR, **Gray L.J**, **Khunti K**, Srinivasan B, Taub N, Campbell S, Barnett J, Farooqi A, Echouffo-Tcheugui JB, Griffin SJ, Wareham NJ, **Davies MJ**. Screening for diabetes using an oral glucose tolerance test within a western multi-ethnic population identifies modifiable cardiovascular risk: the ADDITION-Leicester study. Diabetologia. 2011 Sep;54(9):2237-46
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6. **Gray L.J.,** Tringham J.R., **Davies M.J.,** Webb D.R., Jarvis, J.,Skinner T.C., Farooqi A.M., **Khunti K**. (2010). Screening for type 2 diabetes in a multi-ethnic setting using known risk factors to identify those at high risk: a cross-sectional study. Vascular Health and Risk Management, 6:837-42.
7 **Gray L.J, Khunti K**, Edwardson C, Goldby S, Henson J, Morris DH, Sheppard D, Webb D, Williams S, Yates T, **Davies MJ**. Implementation of the automated Leicester Practice Risk Score in two diabetes prevention trials provides a high yield of people with abnormal glucose tolerance. Diabetologia. 2012 Dec;55(12):3238-44.

Grants
NIHR. A community based primary prevention programme for Type 2 Diabetes integrating identification, lifestyle intervention and community services for prevention – the Let's Prevent Study. (June 2007-June 2014). £1,993,371
CLAHRC LNR. The Walking Away from Diabetes Study, The Leicester-self assessment score, PRISM, ATTEND. (June 2008-June 2013). £10,234,278
NIHR: Development of a structured screening and lifestyle intervention for prevention of Type 2 Diabetes Mellitus in a population with Learning Disabilities. (Oct 2011-Oct 2016). £1,894,340

4. Details of the impact

Around 300,000 people have completed the self-assessment tools through the Diabetes UK website, general practices, road shows, faith centres, Boots and Tesco pharmacies and PCT-organised screening events. If T2DM could be prevented in just 3% of these people as a result, this could produce a gross saving for the NHS of £40m a year over four years.

Impact on policy

Both tools are now specifically recommended by NICE for identifying those at high risk of T2DM (Khunti is Chair and Davies is a member of the NICE guidance group; **A,B**).

The impact of the work around diabetes prevention led to Khunti and Davies being invited, by the UK National Screening Committee, to lead on developing the content and structure of The Handbook of Vascular Risk Assessment, Risk Reduction and Risk Management (both the original 2008 version and updated 2012 version; **C**). Gray authored the section on risk scores. The handbook is widely used within the Department of Health and across the NHS and was also a major contributor to the development of the Department of Health Best Practice Guidance (2009; **D**).

Impact on public expenditure

Modelling work by NICE showed that utilising risk scores in a screening programme is cost-effective and is likely to be cost-saving in those from black and minority ethnic backgrounds. Work carried out by the Centre shows that the cost per case detected is lowered significantly, from £350 to around £200, by incorporating risk scores (**E**).

Impact on public health in the UK

Clinical commissioning groups: The self-assessment tool is being used by clinical commissioning groups around the country at screening events. It is also used to target people for the NHS Health Check, a programme to prevent heart disease, stroke, diabetes and kidney disease. Here it identifies those at high risk, who can then be given support and lifestyle interventions to reduce their risk and prevent onset of these conditions.

Healthy Lifestyle roadshows: Diabetes UK has used the self-assessment tool at local road shows since 2011. In 2012 (latest available figures) they carried out 20,911 risk assessments and referred 10,945 visitors, 3,700 of whom were at high risk of having or developing T2DM in the next 10 years. In a survey conducted in 2011, of those who were in these higher risk categories, 69% had been to their general practice or intend to go. Recall of the risk factors for T2DM and how to reduce risk was high among visitors two months after attending the road show (**F**).

Evaluation of the use of the self-assessment score within Diabetes UK activities showed that after being risk assessed: 41% had started to eat more healthily and a further 44% intended to; 33% had increased their physical activity levels and a further 43% intended to; and 44% of those referred to their GP had been to their GP to seek a test. Bridget Turner of Diabetes UK says: “The diabetes risk score plays an important part in encouraging more people to take greater notice of their health and their lifestyles - helping to tackle the growing public health challenge of Type 2 diabetes and working towards earlier diagnosis and prevention.” (**G**).

Community Champions: Diabetes UK has embarked on a programme of awareness-raising within black and minority ethnic communities by recruiting 'Community Champions' – volunteers who are trained to deliver healthy lifestyle and diabetes awareness messages, through information stands and talks at community centres, places of worship and at festivals and events. Over 100 champions have been trained in London, and the programme is being rolled out in four other towns across England. Some champions have been trained to undertake the risk assessments.

Faith centres: The test has been used with 200 people in three faith centres in Leicester, by interpreters using iPads. It is being adapted for use by non-English speaking Guajarati speakers.

Pharmacies: In conjunction with Diabetes UK the self-assessment test is available in Boots and Tesco pharmacies: the latter is advertising the service on buses, taxis, and London Underground

carriages; on radio stations and online; and in shopping centres and on high streets across the UK In Northern Ireland during Diabetes Week 2011, Diabetes UK ran a risk assessment event in 11 Boots stores: 140 risk assessments were carried out, with 25 people referred to their GP. The Regional Pharmacy Manager, Boots, said: "We were delighted with the success of our recent work with Diabetes UK Northern Ireland. In helping to identify patients who are at high risk of diabetes, we can work with other healthcare professionals to ensure an early diagnosis is made and help people reduce their risk." (**H**).

In Wales, the self-assessment score was used in 700 pharmacies as part of a free health check initiative; the 10-day Diabetes UK Cymru/Community Pharmacy Wales project 2011. This project involved an extensive media campaign. More than 17,500 people visited their local pharmacy for the assessment with 1,478 (8.4%) being referred to their GP for a diabetes test after being found to be at high risk of developing the condition (**I**).

Online and TV: The test has been available on the Diabetes UK website since 2011 and is now on the Boots and Tesco websites, free of charge. It has been used by over 260,000 people since July 2011. It was featured in the Embarrassing Bodies programme (Channel 4, 6 June 2011), reaching around 2 million viewers. The automated tool allows for targeted population-based screening within primary care and is available on the University's website. It will soon be available through the Royal College of General Practitioners website.

International impact
Khunti and Gray are part of the International Diabetes Federation's PREDICT 2 project which is developing a global risk score to be used in developing countries. Gray is currently developing risk scores for use in Portugal and Spain.

Awards
Davies was awarded a prestigious NIHR Senior Investigator status in 2009 and this was renewed to the maximum term in 2012. The risk scores were awarded gold at the national Quality in Care (QIC) Diabetes Awards 2011 for the best early detection/screening initiative, and Gray won the Best Presentation Prize at the World Congress for the Prevention of Diabetes 2011.

5. Sources to corroborate the impact

A. Chatterton H, Younger T, Fischer A, **Khunti K**; Programme Development Group (2012) Risk identification and interventions to prevent type 2 diabetes in adults at high risk: summary of NICE guidance. BMJ. 2012 Jul 12; 345:e4624. doi: 10.1136/bmj.e4624.
B. National Institute for Health and Clinical Excellence (2012) Preventing type 2 diabetes: risk identification and interventions for individuals at high risk. Public health guidance, PH38. http://www.nice.org.uk/PH38.
C. UK National Screening Committee. The Handbook of Vascular Risk Assessment, Risk Reduction and Risk Management (2012). www.screening.nhs.uk/getdata.php?id=14338
D. National Operations Manager, UK National Screening Committee/NHS Screening Programmes. 10 July 2013
E. **Khunti K, Gillies CL**, Taub NA, Mostafa SA, Hiles SL, Abrams KR, **Davies MJ.** A comparison of cost per case detected of screening strategies for Type 2 diabetes and impaired glucose regulation: modelling study. Diabetes Res Clin Pract. 2012 97(3):505-13. doi: 10.1016/j.diabres.2012.03.009. Epub 2012 May 2.
F. Healthy Lifestyle road shows: http://www.diabetes.org.uk/Documents/Reports/nhs-health-check-lets-get-it-right-0912.pdf
G. Director of Policy & Care Improvement, Diabetes UK. 14 June 2013
H. Diabetes UK Northern Ireland campaign: http://www.lurganmail.co.uk/news/boots-staff-help-identify-people-with-diabetes-risk-1-2911076.
I. Diabetes UK Wales campaign: http://www.diabetes.org.uk/In_Your_Area/Wales/Campaigning/Pharmacy-campaign/, http://www.cpwales.org.uk/News/September-2011/Diabetes-Risk-Campaign-(Nualu)-Final-Version--(2).aspx