Pre-diabetes progression risk can help prioritise prevention support

People with pre-diabetes or non-diabetic hyperglycaemia (NDH) are known to be at high risk of progressing to type 2 diabetes. However, which groups are most at risk of progression when HbA_{1c} is used for diagnosis of pre-diabetes and type 2 diabetes is less clear, as the original diabetes prevention studies used fasting and oral glucose tolerance criteria for diagnosis. This retrospective cohort study of nearly 400 000 people with pre-diabetes (HbA_{1c} 42 to <48 mmol/mol), published in *Diabetic Medicine*, identified that South Asian and mixed-race people had increased risk of progression compared to people of white European ethnicity. Those with the highest levels of socioeconomic deprivation had higher progression rates than those with the lowest deprivation, but on further analysis this was only significant in the white group. People with pre-diabetes aged 40 to <65 years had higher rates of progression compared to those in younger or older groups. If we are to reduce the escalating numbers developing type 2 diabetes, then reducing progression of pre-diabetes is an important place to start. As well as offering referral to the NHS Diabetes Prevention Programme in England or similar programmes in the devolved UK nations, the authors remind us to be aware of these differing progression risks if time or financial resources are scarce, so we can ensure we prioritise the highest-risk groups.

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Although everyone diagnosed with pre-diabetes should be offered referral to the *Healthier You: NHS Diabetes Prevention Programme* or our local intensive lifestyle change programme, being aware of progression risk amongst different groups allows us, if needed, to target our limited resources to where we can hope to make the biggest impact on preventing new diagnoses of type 2 diabetes. The risk information may also be helpful in motivating people to make lifestyle changes to reduce their risk of progression and to stay diabetes-free.

Although those of South Asian and South-East Asian ethnicity are known to be at greater risk of developing type 2 diabetes at an earlier age, and of more rapid progression of complications, compared with white Europeans, little is known on how ethnicity influences progression from pre-diabetes to type 2 diabetes. Likewise, people living with the most socioeconomic deprivation are at greater risk of developing type 2 diabetes than those in less deprived groups, but again it is not clear how deprivation influences progression from pre-diabetes to type 2 diabetes.

This retrospective cohort study, published in *Diabetic Medicine*, explored the risk of progression to type 2 diabetes amongst nearly 400 000 people with pre-diabetes diagnosed between January 2005 and December 2017, who were captured in The Health Improvement Network (THIN) UK primary care database. The progression data were explored by ethnicity, (white European, South Asian, mixed-race, Black and other), deprivation index (quintiles based on the Townsend score), age (18 to <30, 30 to <40, 40 to <65 and ≥65 years) and weight (normal/underweight, overweight and obese).

Results

Overall, progression rates from pre-diabetes to type 2 diabetes were low, even in groups with the highest risk of type 2 diabetes. People from South Asia and those of mixed race, but not Black people, had higher progression risk than those of white European ethnicity. Surprisingly,

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Table 1. Risk of progression from pre-diabetes to type 2 diabetes according to demographic variables.

Demographic variable	Type 2 diabetes incidence rates (per 1000 person-years)	Adjusted hazard ratio
Age (years)		
18 to <30	36.1	0.63
30 to <40	53.7	0.89
40 to <65	59.3	Reference
≥65	47.6	0.85
Ethnicity		
White	53.3	Reference
South Asian	63.9	1.31
Mixed race	58.7	1.22
Black	56.6	0.98 (not significantly different)
Other	51.2	0.96 (not significantly different)
Townsend quintiles		
Least deprived	49.0	Reference
Most deprived	62.4	1.17 (1.16 in White group; not significantly different in other ethnicities)
BMI		
Underweight/normal	28.8	Reference
Overweight	46.3	1.58
Obese	74.8	2.49

both younger age groups (<40 years) and older people (≥65 years) had lower adjusted hazard ratios (HRs) than those aged 40 to <65 years (the reference group). Those in the higher quintiles of deprivation had higher adjusted HRs than those in the least deprived group but, when explored by ethnicity, social deprivation was only associated with increased progression in white Europeans and not other ethnicities. Weight is known to be a risk factor for progression, and in this study the adjusted HRs were very significantly increased for those with overweight and obesity compared with normal/underweight people. This trend was observed across all the ethnicities studied. Additional detail on the incident rates and adjusted HRs are shown in *Table 1*.

The authors propose that the increased risk observed in South Asians could be associated with the increased biological susceptibility to developing type 2 diabetes at an earlier age in this group, increased insulin resistance and more rapid decline of beta-cell function, as well as increased visceral and abdominal fat deposition compared with white European people at the same BMI (Iliodromiti et al, 2023). Lifestyle factors may also contribute, as South Asian people overall have been identified to be less physically active and to eat diets higher in carbohydrates and saturated fats than white Europeans (Gujral et al, 2013). The authors also postulate that behavioural factors, poor living conditions, poor availability of healthy foods and, particularly, unemployment contributing to chronic stress, anxiety and unhealthy food choices may all play a role in the increasing progression rates associated with deprivation in the white European group observed in this study.

Strengths of the study are that it was performed on a UK database, using UK parameters for pre-diabetes (HbA_{1c} between 42 and 48 mmol/mol) and including a large population with different ethnicities represented. The THIN database captures around 6% of the UK population, is generalisable to the UK population and has the same age structure as the population as a whole. Limitations include that ethnicity was only recorded for 51% of the study cohort. However, BMI and deprivation data were consistent when examined in cohorts with and without recorded ethnicities.

Implications for practice

It is important that those developing and running prevention programmes try to ensure they are meeting the needs of these groups at the highest risk of progression. Early data from the NHS Diabetes Prevention Programme showed it was effective, with a mean weight reduction of 2.3 kg and an HbA_{1c} reduction of 1.26 mmol/mol overall, and mean reductions of 3.3 kg and 2.04 mmol/mol among those who completed the programme (Valabhji et al, 2020). Although these numbers seem small, they are likely to make an impact on progression. In response to lower attendance and completer rates in some high-risk groups, including certain ethnicities, the NHS piloted a digital diabetes prevention programme in nine areas of England. Early outcomes

confirmed a mean weight loss of 3.1 kg and a 1.6 mmol/mol reduction in HbA_{1c} at 12 months (Ross et al, 2022).

As well as offering referral to the NHS Diabetes Prevention Programme in England or similar programmes in the devolved UK nations, the authors remind us to be aware of these differing progression risks, so that we can ensure we prioritise the highest-risk groups. It is hoped this study will help to inform our practice and prioritise prevention of progression from pre-diabetes to type 2 diabetes even when workload is high and resources are tight. ■

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RESEARCH: EPIDEMIOLOGY

DIABETIC MEDICINE

Risk of progression from pre-diabetes to type 2 diabetes in a large UK adult cohort

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Abstract

Aims: People with pre-diabetes are at high risk of progressing to type 2 diabetes. This progression is not well characterised by ethnicity, deprivation and age, which we describe in a large cohort of individuals with pre-diabetes.

Methods: A retrospective cohort study with The Health Improvement Network (THIN) database was conducted. Patients aged 18 years and over and diagnosed with pre-diabetes [HbA1c 42 mmol/mol (6.0%) to 48 mmol/mol (6.5%) were included]. Cox proportional hazards regression was used to calculate adjusted hazard rate ratios (aHR) for the risk of progression from pre-diabetes to type 2 diabetes for each of the exposure categories [ethnicity, deprivation (Townsend), age and body mass index (BMI)] separately.

Results: Of the baseline population with pre-diabetes ($n = 397{,}853$), South Asian (aHR 1.31; 95% CI 1.26–1.37) or Mixed-Race individuals (aHR 1.22; 95% CI 1.11–1.33) had an increased risk of progression to type 2 diabetes compared with those of white European ethnicity. Likewise, deprivation (aHR 1.17; 95% CI 1.14–1.20; most vs. least deprived) was associated with an increased risk of progression. Both younger (aHR 0.63; 95% CI 0.58–0.69; 18 to <30 years) and older individuals (aHR 0.85; 95% CI 0.84–0.87; ≥65 years) had a slower risk of progression from pre-diabetes to type 2 diabetes, than middle-aged (40 to <65 years) individuals.

Conclusions: South Asian or Mixed-Race individuals and people with social deprivation had an increased risk of progression from pre-diabetes to type 2 diabetes. Clinicians need to recognise the differing risk across their patient populations to implement appropriate prevention strategies.

KEYWORDS
epidemiology, incidence, pre-diabetes, progression, type 2 diabetes

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