

# Referral to the NHS Diabetes Prevention Programme and conversion from nondiabetic hyperglycaemia to type 2 diabetes mellitus in England: a matched cohort analysis

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## Publication

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## Abstract

### Background

The NHS Diabetes Prevention Programme (NDPP) is a behaviour change programme for adults who are at risk of developing type 2 diabetes mellitus (T2DM): people with raised blood glucose levels, but not in the diabetic range, diagnosed with nondiabetic hyperglycaemia (NDH). We examined the association between referral to the programme and reducing conversion of NDH to T2DM.

### Methods and findings

Cohort study of patients attending primary care in England using clinical Practice Research Datalink data from 1 April 2016 (NDPP introduction) to 31 March 2020 was used. To minimise confounding, we matched patients referred to the programme in referring practices to patients in nonreferring practices. Patients were matched based on age ( $\geq 3$  years), sex, and  $\geq 365$  days of NDH diagnosis. Random-effects parametric survival models evaluated the intervention, controlling for numerous covariates. Our primary analysis was selected a priori: complete case analysis, 1-to-1 practice matching, up to 5 controls sampled with replacement. Various sensitivity analyses were conducted, including multiple imputation approaches. Analysis was adjusted for age (at index date), sex, time from NDH diagnosis to index date, BMI, HbA1c, total serum cholesterol, systolic blood pressure, diastolic blood pressure, prescription of metformin, smoking status, socioeconomic status, a diagnosis of depression, and comorbidities.

A total of 18,470 patients referred to NDPP were matched to 51,331 patients not referred to NDPP in the main analysis. Mean follow-up from referral was 482.0 (SD = 317.3) and 472.4 (SD = 309.1) days, for referred to NDPP and not referred to NDPP, respectively. Baseline characteristics in the 2 groups were similar, except referred to NDPP were more likely to have higher BMI and be ever-smokers. The adjusted HR for referred to NDPP, compared to not referred to NDPP, was 0.80 (95% CI: 0.73 to 0.87) ( $p < 0.001$ ). The probability of not converting to T2DM at 36 months since referral was 87.3% (95% CI: 86.5% to 88.2%) for referred to NDPP and 84.6% (95% CI: 83.9% to 85.4%) for not referred to NDPP. Associations were broadly consistent in the sensitivity analyses, but often smaller in magnitude. As this is an observational study, we cannot conclusively address causality. Other limitations include the inclusion of controls from the other 3 UK countries, data not allowing the evaluation of the association between attendance (rather than referral) and conversion.

## Conclusions

The NDPP was associated with reduced conversion rates from NDH to T2DM. Although we observed smaller associations with risk reduction, compared to what has been observed in RCTs, this is unsurprising since we examined the impact of referral, rather than attendance or completion of the intervention.

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