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# A model for diabetes prediction five years after gestational diabetes

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## Conclusions

- BMI is an important and modifiable risk factor of diabetes after gestational diabetes (GDM).
- The prediction model rendered 86 % correct classifications of diabetes 5 years after GDM.
- As a concept to be used in counselling, a function sheet with a line diagram is proposed to illustrate the effects of weight on individual diabetes risk after GDM (Figure 2).

## Introduction

Gestational diabetes mellitus (GDM) is a major risk factor for subsequent diabetes. A five-year follow up after GDM was performed to elucidate factors associated with diabetes and to explore the possibility of constructing a model for diabetes prediction postpartum.

## Subjects and Methods

Five years after GDM a 75-g oral glucose tolerance test (OGTT) was performed in 362 women, excluding women already diagnosed with diabetes at a 1–2 year follow-up visit or later ( $n=45$ ). All but 21 women had results from follow-up at 1–2 years, while 84 women were lost from that point. WHO criteria from 1999 were used.

## Results

Five years after GDM, 28/362 (8 %) women were diagnosed with diabetes and 187/362 (52 %) had normal glucose tolerance (NGT). Among the latter, 139/187 (74 %) also had NGT at 1–2 year follow-up.

In univariate regression analysis, using NGT at 1–2 and 5 years as the reference, diabetes at 1–2 year follow-up or later ( $n=73$ ) was clearly associated with easily assessable clinical variables, such as BMI at 1–2 year follow-up, OGTT 2-h glucose concentration during pregnancy and non-European ethnicity ( $p<10^{-4}$ ), see Table 1.

A prediction model based on these variables resulted in 86 % correct classifications. The ROC curve with results are given in Figure 1.

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## Table 1

Results of univariate regression analysis of women with NGT at 1–2 and 5-years vs women diagnosed with diabetes at 1–2 year follow-up or later.

	R <sup>2</sup>	OR (95% CI)	p
Non-European ethnicity (y/n)	0.21	7.09 (3.52-14.46)	<10 <sup>-7</sup>
First grade DM heredity (y/n)	0.09	3.14 (1.69-5.84)	<0.001
Age at delivery (years)	0.06	1.10 (1.03-1.17)	0.005
<b>Pregnancy</b>			
Glucose (mmol/L), OGTT 2-h	0.16	1.91 (1.41-2.58)	<10 <sup>-4</sup>
Diagnosis early gestation (y/n)	0.10	5.24 (2.10-13.10)	<0.001
Insulin treatment (y/n)	0.15	8.25 (3.30-20.64)	<10 <sup>-5</sup>
<b>1-2 years after pregnancy</b>			
Deliveries >3 (y/n)	0.06	5.08 (1.69-15.29)	0.004
BMI (kg/m <sup>2</sup> )	0.40	1.28 (1.19-1.37)	<10 <sup>-10</sup>

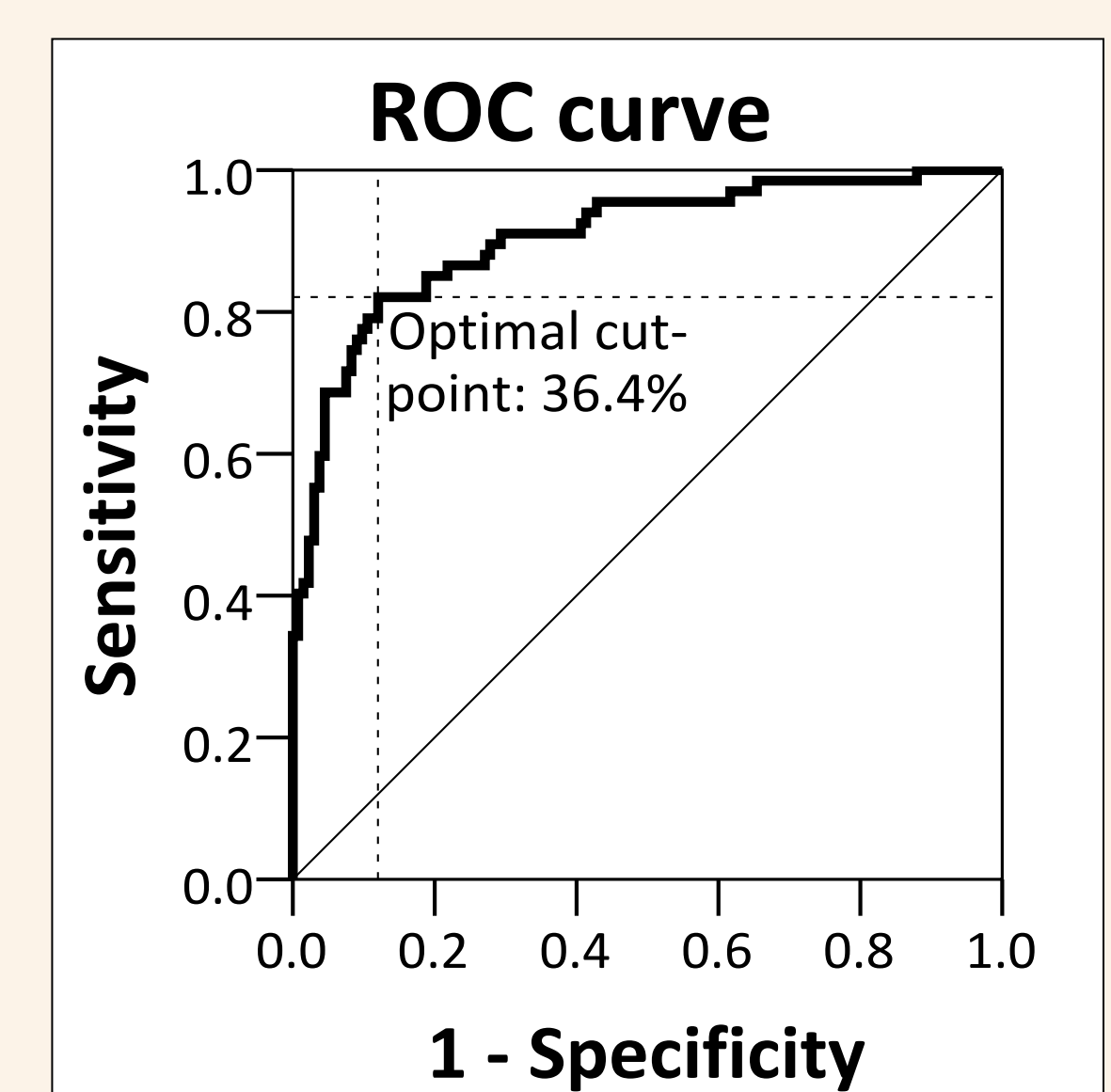
CI, confidence interval; NGT, normal glucose tolerance; OR, odds ratio, R<sup>2</sup>, pseudo R-square by Nagelkerke

## Figure 1

ROC curve of the prediction model of diabetes 5 years after GDM.

Area under the curve was 0.91 (95 % confidence interval 0.86–0.95).

A calculated optimal cut-off of 36.4 % yielded a sensitivity of 82.1 % and a specificity of 88.0 % in this population.



## Figure 2

Individually predicted risk of diabetes 5 years after GDM versus weight of a European woman with a height of 1.75 meters, a OGTT 2-h plasma glucose concentration of 10 mmol/L in pregnancy, and a weight of 90 kg resulting in: 60 % risk of diabetes with a constant weight, declining to a 24 % risk with a weight loss of 20 kg.

To confirm understanding and enforce active engagement, an appeal of interaction with the diagram was added (brown).

