



The Prevalence and Determinants of Undiagnosed and Diagnosed Type 2 Diabetes in Middle-Aged Irish Adults

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Background and Methods

Introduction

•The prevalence of type 2 diabetes mellitus (T2DM) within the Republic of Ireland (ROI) is poorly defined, although a recent report suggested 135,000 cases in adults aged 45+ (8.9%), with approximately one-third of these undiagnosed.

•T2DM may cause serious health conditions such as cardiovascular disease (CVD) and impairment and malfunction of the renal, ophthalmic, vascular and nervous systems.

•These complications pose significant financial burdens on healthcare services; research has indicated that almost 10% of total healthcare expenditure is spent on diabetes-related care in the ROI alone.

•Thus, there is an ongoing need for effective detection strategies as subjects with undiagnosed T2DM are at high-risk of diabetic complications.

Objectives

The aim of this study was to assess the prevalence of undiagnosed and diagnosed T2DM in middle-aged Irish adults, and compare features related to either condition, in order to investigate why certain individuals remain undetected.

Study Design

The Cork and Kerry Diabetes and Heart Disease Study was a single centre, cross-sectional study conducted between 2010 and 2011, based on a population representative random sample of 2,047 men and women aged between 50-69 years (49.2% male).

Clinical Measurements

•**Body mass index (BMI):** <25, 25-29.9 and ≥ 30 kg/m².

•**High triglycerides:** ≥ 1.7 mmol/l.

•**Low high density lipoprotein cholesterol (HDL-C):** <1.03 mmol/l in males or <1.29 mmol/l in females.

•**Dyslipidaemia:** High triglyceride and low HDL-C levels.

•**Undiagnosed T2DM:** Subjects without a history of diabetes but with HbA_{1c} levels $\geq 6.5\%$ (≥ 48 mmol/mol).

•**Diagnosed T2DM:** Self-reported diagnosis or medication use.

•**Lifestyle variables:** Data on age, gender, morbidity, prescription (Rx) medication use, smoking/alcohol behaviors and health insurance status were gathered through a self-completed General Health Questionnaire (GHQ).

•**Physical activity levels:** Assessed using the validated International Physical Activity Questionnaire (IPAQ).

Statistical Analysis

Logistic regression was used to explore socio-economic, metabolic and other health-related variable associations with undiagnosed and diagnosed T2DM. The discriminatory properties of predictor variables identified in regression analyses were assessed using the receiver operating characteristic curve.

Results and Conclusions

Table 1. Odds ratios (95% CI) of having undiagnosed or diagnosed type 2 diabetes compared to no diabetes.

Feature	Odds ratio	95% CI
UNDIAGNOSED DIABETES		
Male	1.4	(0.8-2.5)
Age ≥ 60	1.0	(0.6-1.9)
On Rx for cholesterol	2.2	(1.2-3.9)
BMI category:		
<25	1	
25-29.9	4.5	(1.0-19.5)
≥ 30	6.8	(1.6-29.4)
Family history of T2DM	1.9	(1.0-3.6)
Health insurance:		
Private insurance	1	
State insurance	2.2	(1.2-4.2)
No insurance	2.3	(1.0-5.2)
Physical activity:		
High	1	
Moderate	1.9	(0.8-4.2)
No physical exercise	5.8	(2.7-12.5)
Dyslipidaemia	4.3	(2.3-8.3)
DIAGNOSED DIABETES		
Male	2.5	(1.5-4.1)
Age ≥ 60	1.4	(0.9-2.3)
On Rx for hypertension	2.7	(1.7-4.4)
On Rx for cholesterol	2.0	(1.2-3.3)
BMI category:		
<25	1	
25-29.9	8.2	(1.9-34.6)
≥ 30	9.4	(2.2-40.3)
Family history of T2DM	5.9	(3.7-9.4)
CVD	2.0	(1.1-3.5)
Alcohol use:		
Non-drinker	1	
Occasional drinker	1.3	(0.7-2.2)
Regular drinker	0.4	(0.2-0.7)
Dyslipidaemia	1.9	(1.0-3.5)

•The total prevalence of T2DM was 8.5% (95% CI: 7.4%-8.8%).

•The prevalence of undiagnosed diabetes was 3.5% (95% CI: 2.8%-4.4%), representing 41% of all T2DM cases.

•A significantly greater proportion of male subjects (11.1%) had T2DM compared to females (6.0%, $P < 0.001$).

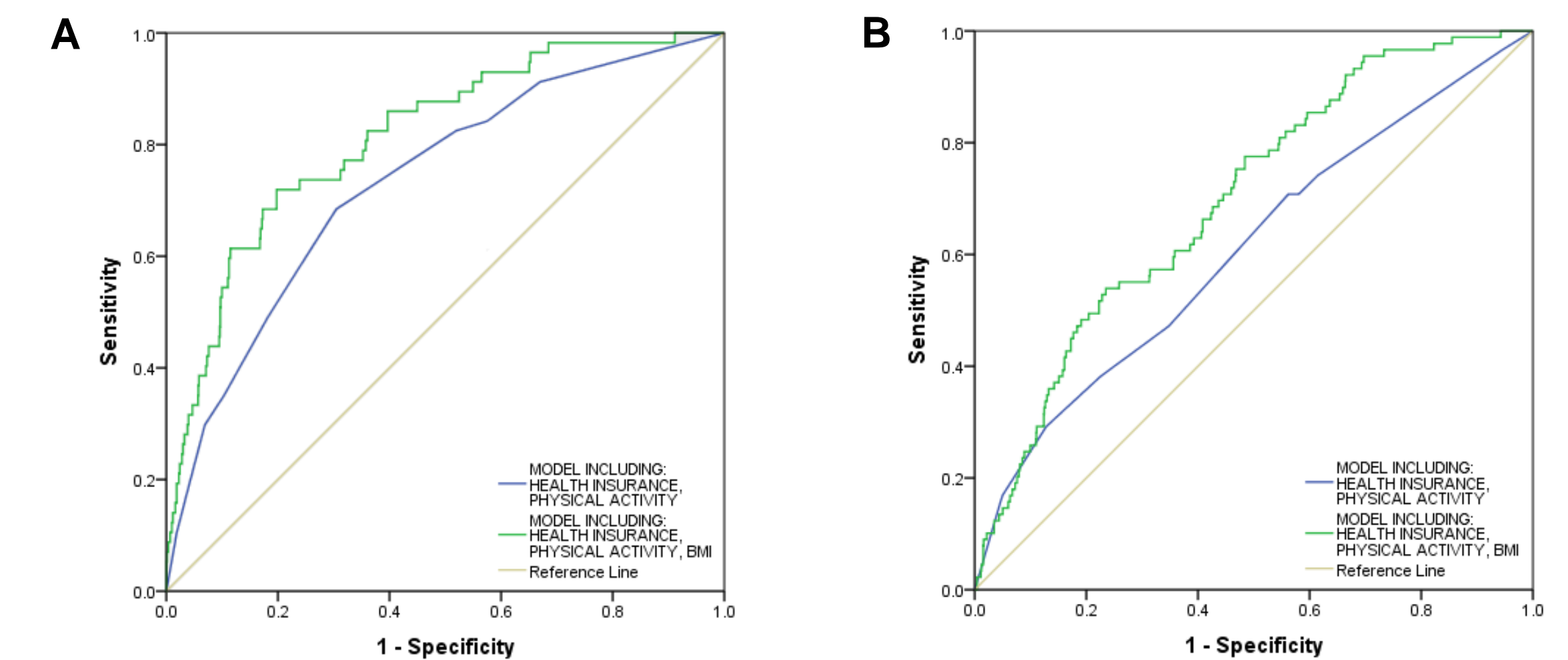
•Obesity, dyslipidaemia and having a family diabetes history were positively associated with both undiagnosed and diagnosed T2DM.

Table 2. Odds ratios (95% CI) of having undiagnosed compared to diagnosed type 2 diabetes.

Feature	Odds ratio	95% CI
Health conditions		
On Rx for hypertension	0.4	(0.2-0.8)
On Rx for cholesterol	0.5	(0.3-0.9)
BMI (kg/m ²)	1.1	(1.0-1.1)
Family history of T2DM	0.4	(0.2-0.7)
Medical cover		
Health insurance:		
Private insurance	1	
State insurance	1.2	(0.6-2.4)
No insurance	4.3	(1.6-11.8)
Health behaviors		
Physical activity:		
High	1	
Moderate	1.7	(0.7-4.2)
No physical exercise	3.8	(1.5-9.3)

•When compared to diagnosed subjects, study participants with undiagnosed T2DM were significantly more likely to have low levels of physical activity, and were less likely to be on treatment for diabetes-related conditions or to have private medical insurance.

Figure 1. Receiver operating characteristic curves for models to discriminate (A) undiagnosed and (B) diagnosed type 2 diabetes compared to no diabetes.



•Models including health insurance, physical activity and BMI displayed a higher discriminatory capacity to detect undiagnosed T2DM, suggesting that use of these variables in screening programs may help identify a subset of diabetes cases.

Conclusions

•These findings suggest that individuals from lower socio-economic backgrounds should be targeted.

•Observed low levels of physical activity, obesity assessment and recognition of untreated cardiometabolic conditions may also improve identification of T2DM cases within clinical practice.

•A strategic approach that identifies subjects without access to primary health services, and which furthers efforts to promote affordable and equitable healthcare, is also needed to prevent predictable sequelae for affected individuals.