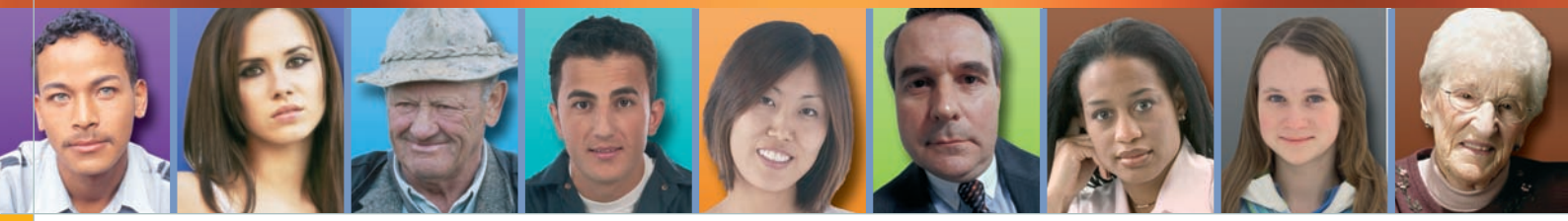
Ireland and Northern Ireland's Population Health Observatory

Making Diabetes Count



A systematic approach to estimating population prevalence on the island of Ireland in 2005

THE INSTITUTE OF PUBLIC HEALTH IN IRELAND

First report of
The Irish Diabetes Prevalence Working Group,
Ireland and Northern Ireland's Population Health Observatory (INIsPHO),
Institute of Public Health in Ireland

Making Diabetes Count
A systematic approach to estimating population prevalence on the island of Ireland in 2005

April 2006

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Republic of Ireland population data was obtained from the Information Management Unit in the Department of Health and Children.

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Abbreviations

ADA	American Diabetes Association
CREST	Clinical Resource Efficiency Support Team (Northern Ireland)
DHSSPSNI	Department of Health, Social Services and Public Safety (Northern Ireland)
DECODE	Diabetes Epidemiology: Collaborative Analysis of Diagnostic Criteria in Europe
Diabetes UK (NI)	Diabetes UK (Northern Ireland)
DoHC	Department of Health and Children (Republic of Ireland)
EHSSB	Eastern Health and Social Services Board (Northern Ireland)
FEND	Federation of European Nurses in Diabetes
FPGT	Fasting Plasma Glucose Test
HALS	Health and Lifestyle Survey (Northern Ireland)
HSE	Health Service Executive (Republic of Ireland)
HSSB	Health and Social Services Board (Northern Ireland)
HSW	Health and Social Wellbeing Survey (Northern Ireland)
IDF	International Diabetes Federation
INIsPHO	Ireland and Northern Ireland's Population Health Observatory, Institute of Public Health in Ireland
IPH	Institute of Public Health in Ireland
LHOA	Local Health Office Area (Republic of Ireland)
LHSCG	Local Health and Social Care Group (Northern Ireland)
NCASP	National Clinical Audit Support Programme (England)
NDA	National Diabetes Audit (England)
NHSSB	Northern Health and Social Services Board (Northern Ireland)
OGTT	Oral Glucose Tolerance Test
NISRA	Northern Ireland Statistics and Research Agency
PBS	PHO-Brent-ScHARR Diabetes Population Prevalence (Model)
PHO	Public Health Observatory
QOF	Quality and Outcomes Framework
ScHARR	University of Sheffield School of Health and Related Research
SHSSB	Southern Health and Social Services Board (Northern Ireland)
SLÁN	Survey of Lifestyle, Attitudes and Nutrition (Republic of Ireland)
SOA	Super Output Area (Northern Ireland)
WHO	World Health Organisation
WHSSB	Western Health and Social Services Board (Northern Ireland)
YHPHO	Yorkshire and Humber Public Health Observatory (England)

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Foreword

Diabetes mellitus is a common chronic condition that causes significant morbidity and mortality if not properly diagnosed and managed. The number of people with diabetes on the island is expected to increase because our population is growing, it is ageing and obesity rates are rising.

Accurate estimates of the population prevalence of diabetes are essential to identify need, to plan and deliver services, and to monitor performance. Until now, national estimates for the Republic of Ireland and Northern Ireland have been based on the application of international averages to resident population or counts extrapolation from local studies. Reliable detailed sub-national estimates have not been available.

For this reason, Ireland and Northern Ireland's Population Health Observatory (INIsPHO) in the Institute of Public Health in Ireland undertook a study to:

i. provide the best available estimates of the population prevalence of diabetes (diagnosed and undiagnosed) on the island at national and sub-national level
ii. promote a more systematic approach to the development of such estimates
iii. make recommendations to tackle inadequacies in existing research and data.

The study was overseen by the Irish Diabetes Prevalence Working Group. This is the first time that the charities, key professional organisations, and government agencies on the island have come together for such work. We look forward to the next phase of its work which will look at the numbers of new cases that could result from possible changes in our population profile and trends in obesity.

We would like to thank the members of the Working Group for their contributions, and the Institute for supporting the Working Group and initiating this important study which will make a significant contribution to improving the prevention and treatment of diabetes on the island.

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Executive Summary

Diabetes mellitus is a chronic condition associated with significant morbidity and mortality. It is the most common cause of retinopathy and nephropathy in the Western world, and is associated with a significantly increased risk of cardiovascular, cerebrovascular and peripheral vascular disease. Early diagnosis and appropriate management is essential to reduce the occurrence of these complications.

The number of people with diabetes on the island is expected to increase because our population is growing, it is ageing and obesity rates are rising.

Accurate estimates of the population prevalence of diabetes allow us to describe the patterns of diabetes in the population, estimate the number of undiagnosed cases, plan and deliver services in a rational way, and monitor performance. Until now, national estimates have been based on the application of international averages to resident population counts or extrapolation from local studies. Reliable detailed sub-national estimates have not been available. The absence of accurate detailed prevalence estimates has hampered planning of services for the prevention, care and monitoring of diabetes.

The main aims of this study were to:

i. provide the best available estimates of the population prevalence of diabetes (diagnosed and undiagnosed) on the island at national and sub-national levels
ii. promote a more systematic approach to the development of such estimates
iii. make recommendations to tackle inadequacies in existing research and data

i. Prevalence of diabetes

The report contains population prevalence estimates for Type 2 diabetes (adults only) and Type 1 diabetes (children and adults), disaggregated by age, sex, ethnicity and area. Adults are taken to be those aged 20 years and over; children those aged 0-19 years.

In 2005, it is estimated that 67,063 adults (aged 20 years and over) in Northern Ireland (5.4%) and 141,063 adults in the Republic of Ireland (4.7%) had diabetes (diagnosed or undiagnosed).

In both Northern Ireland and the Republic of Ireland, diabetes is more common amongst adult females than it is amongst adult males (6.3% for females and 4.5% for males in the North, and 5.4% for females and 4.0% for males in the South).

In Northern Ireland, prevalence of adult diabetes increases with age from 0.5% for 20-29 year olds to 3.1% for 30-59 year olds and 14.0% for those aged 60 years and over. In the Republic of Ireland, prevalence of adult diabetes also increases with age from 0.6% for 20-29 year olds, to 3.0% for 30-59 year olds and 13.8% for those aged 60 years and over.

The "Asian" population is the ethnic group most at-risk of developing diabetes in Northern Ireland, with 12.4% of all adults in this group estimated to have adult diabetes. The estimated population prevalence of adult diabetes in the "Black" population is 8.4% and 5.4% in the "White" population. In the Republic of Ireland prevalence estimates for ethnic minorities are not available because the size of the corresponding ethnic populations is unknown.

Chapter 4 contains detailed prevalence estimates at the sub-national level:

- Health Service Executive regions, and Local Health Office Areas in the Republic of Ireland
- Health and Social Services Boards, Local Government Districts and Health Board Localities in Northern Ireland.

The geographical variation in the prevalence of Type 2 diabetes amongst adults reflects geographical variation in the sex, age and ethnicity (Northern Ireland only) profiles and local socio-economic circumstances.

After taking into account the effects of age, sex and ethnicity (Northern Ireland only), considerable adjustment was needed to take account of local socio-economic circumstances. In some areas estimates were increased by up to one quarter because of local deprivation. In other areas, estimates were decreased by around one tenth because of local affluence.

It is estimated that, in Northern Ireland, just under a quarter (23.5%) of all of diabetes cases (Type 1 or Type 2) amongst those aged 17 years and over are undiagnosed – 15,821 persons in Northern Ireland. Estimates are not available in the Republic of Ireland because primary care data is inadequate.

ii. Development of estimates

The PBS Model (developed by Yorkshire and Humber Public Health Observatory (YHPHO), Brent NHS Primary Care Trust, and University of Sheffield School of Health and Related Research (ScHARR)) was adopted for use on the island of Ireland. The model estimates the total number of diabetes cases (diagnosed and undiagnosed combined) in resident populations.

Age-, sex- and ethnicity-specific estimates of diabetes prevalence rates are taken from a number of UK reference population studies. The reference rates for Type 2 diabetes are adjusted to take into account increases in overweight/obesity rates that have occurred since the studies were carried out. These rates are then applied to resident population counts at various geographical levels. Finally, the sub-national estimated numbers of cases are adjusted to take account of local socio-economic circumstances.

The PBS model offers several advantages over existing methods used to estimate population prevalence of diabetes on the island:

- It provides a systematic approach with a clear methodology that can be applied in both the Republic of Ireland and Northern Ireland
- The model has been rigorously tested in England
- As well as producing national estimates, the PBS Model can be used to estimate prevalence at sub-national level
- Prevalence estimates are disaggregated by age, sex and ethnicity
- The model takes account of the way in which the risk of diabetes varies with sex, age, ethnicity and local socio-economic circumstances
- It provides estimates of population prevalence without making assumptions about the percentage of cases that are undiagnosed
- If these estimates are compared with the number of cases on diabetes registers, the percentage of cases that are undiagnosed can be explicitly estimated.

Like any methodology developed elsewhere, when applied to the island of Ireland, the PBS model has limitations:

- It is based on UK reference studies
- It uses English obesity data
- Type 2 diagnoses are based on World Health Organisation (WHO) 1985 diagnostic cut-off points
- The local socio-economic deprivation variation in diabetes risk is based on UK clinical data.

iii. Research and data recommendations

The Working Group made a number of recommendations to tackle inadequacies in existing knowledge about diabetes on the island. These are:

1. Population prevalence estimation should be recognised as a key component of the information support needed for better prevention, care and monitoring of diabetes. **A systematic approach to the development and use of population prevalence estimates, at national and sub-national level, should be developed on the island. Further development of the PBS Model is recommended.**

2. Diabetes registers are key components of the information support for better prevention, care and monitoring of diabetes. The Quality Outcomes Framework data collection could form the basis of a register in Northern Ireland if it included adequate information about the residence of patients to allow area-based clinical diagnosis rates to be calculated. The recent Department of Health and Children report entitled, *Diabetes: Prevention and model for patient care*[4], recommended that a national diabetes register be established in the Republic of Ireland. **The establishment of national diabetes registers on the island, North and South, is strongly recommended.**

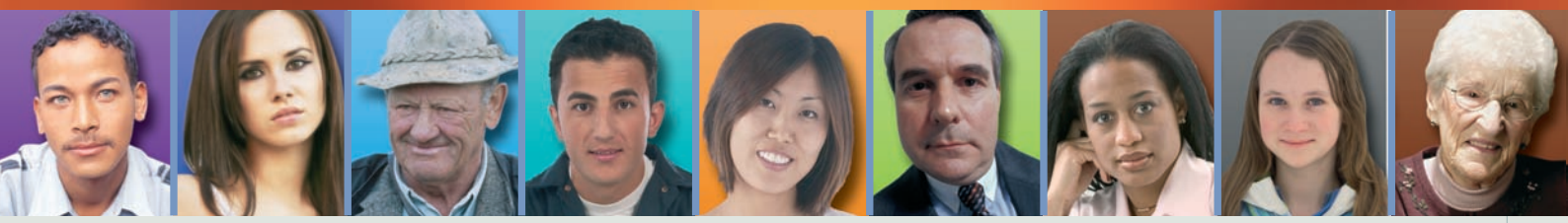
3. **Diabetes registers, in Northern Ireland and the Republic of Ireland, should contain adequate information about the residence of patients to allow socio-economic variations in occurrence, treatment and outcomes of diabetes to be assessed.**

4. **A comprehensive All-Ireland system for monitoring the prevalence of overweight/obesity, and the factors that influence it, should be established.**

5. Ethnicity must be taken into account when estimating the population prevalence of diabetes because of the higher occurrence of the condition in "Asian" and "Black" populations. **The inclusion of ethnicity in the 2006 and each subsequent census in the Republic of Ireland is strongly supported.**

6. **All-Ireland cross-sectional population studies should be undertaken to accurately estimate:**
   - **Type 2 diabetes prevalence amongst children (0-19 years)**
   - **the risk of diabetes associated with different socio-economic circumstances**
   - **the percentage of diabetes cases that are undiagnosed**
   - **diabetes prevalence amongst adults (20+ years).**

1 What is diabetes?



1. What is diabetes?

Diabetes mellitus is a group of metabolic disorders characterised by chronic hyperglycaemia (too much glucose in the blood). The body breaks down digested food into a sugar called glucose from which it derives energy. The hormone insulin produced and secreted by beta cells of the pancreas allows the body to use that sugar by helping glucose to enter the cells. In a person with diabetes, either the pancreas fails to produce enough insulin or the body cannot properly use the insulin it has. As a result there is a build up of glucose in the blood causing the cells to be starved of energy and other complications.

Diabetes is a lifelong condition and is associated with a range of serious macro and micro vascular complications such as coronary heart disease (heart attack), nephropathy (kidney disease), retinopathy (eye disease possibly leading to blindness) and neuropathy (nerve disease) (see Figure 1).

There are two main types of diabetes.

Type 1 diabetes

In Type 1 diabetes, the destruction of the beta cells in the pancreas leads to insufficient insulin production. Patients are usually younger, present acutely and often require emergency treatment for diabetic ketoacidosis (coma).

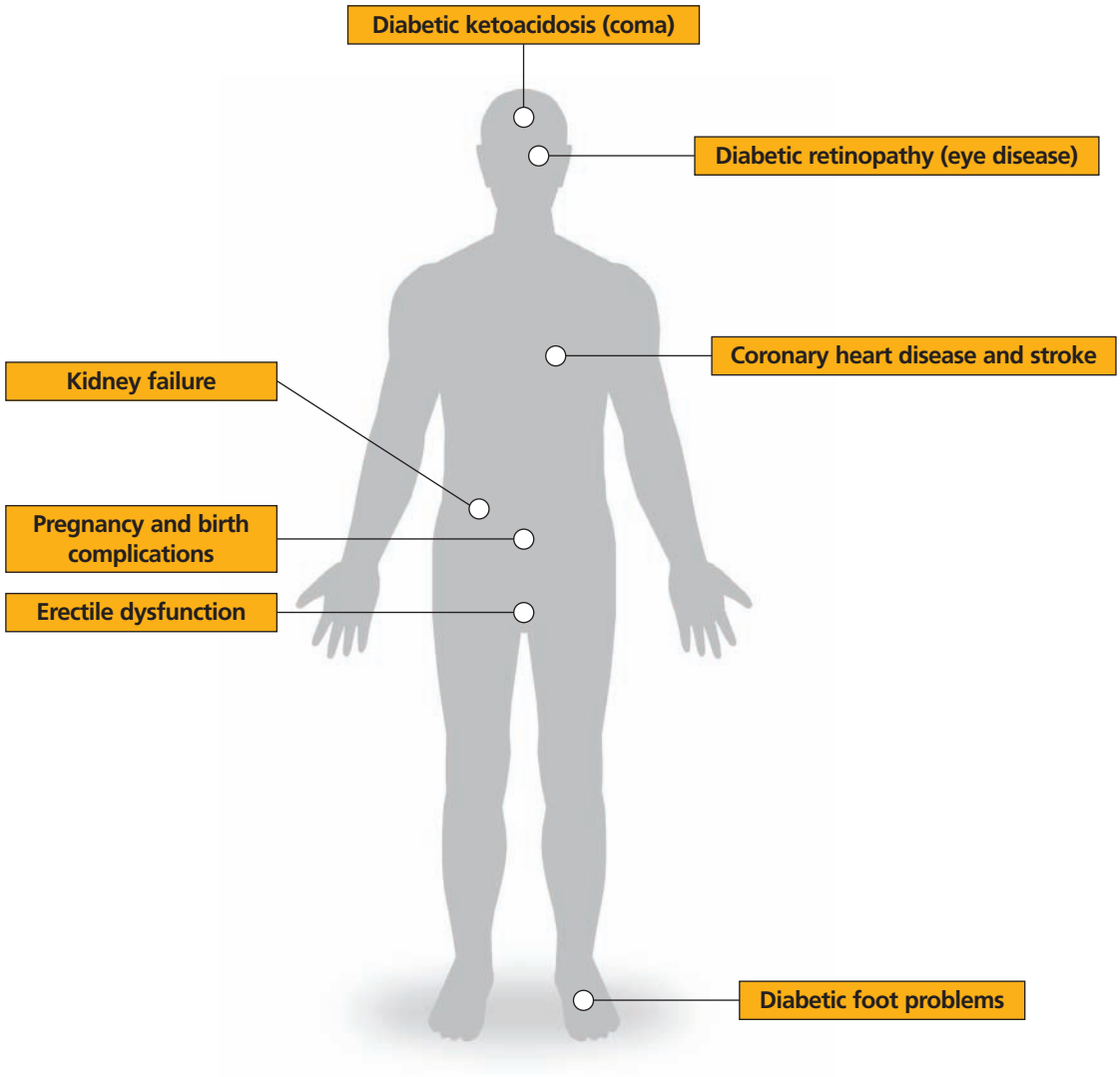
The pathogenesis of Type 1 diabetes is thought to involve environmental triggers that may activate autoimmune mechanisms in genetically susceptible individuals. It accounts for approximately 10%-15% of all cases of diabetes in European populations.[1]

Type 2 diabetes

Type 2 diabetes is the most common form of diabetes. It occurs because the body produces too little insulin and is unable to properly use the insulin that is secreted. It usually occurs in older people although it is becoming more common amongst younger people, partly due to lifestyle factors such as diet, lack of physical activity and obesity. Onset is slower than it is for Type 1 diabetes and people may display no symptoms for years, presenting only when complications occur.

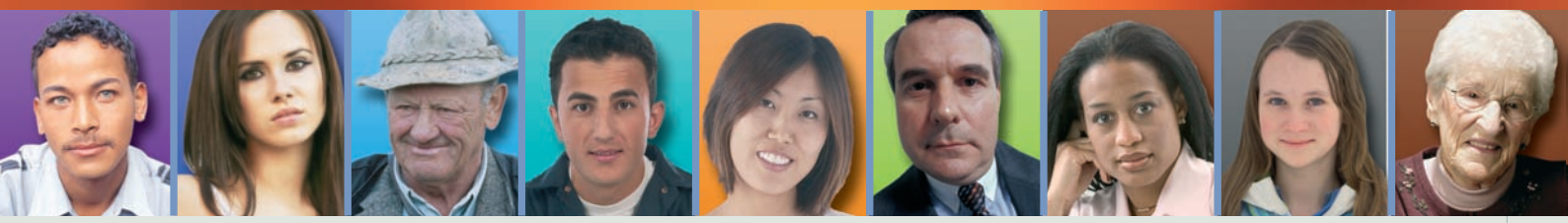
Type 2 diabetes accounts for approximately 85%-90% of all cases of diabetes in European countries.[1] There is enormous variation in the prevalence of Type 2 diabetes, with higher rates in populations with "modern" lifestyles. Prevalence varies with sex, age and ethnic background and whilst there is a genetic susceptibility to Type 2 diabetes, environmental risks such as nutritional factors, lack of physical activity, and central and overall obesity are also associated with increased risk.

Figure 1: Complications of diabetes



Source: Diagram adapted from Audit Commission Report – Testing Times – 2000.[2]

2 Policy context



2. Policy context

2.1 Northern Ireland

A joint Diabetes UK (NI)/Clinical Resource Efficiency Support Team (CREST) taskforce was set up in Northern Ireland in 2001 to review progress since the 1996 CREST report on diabetic services, and to develop a framework for diabetic services in Northern Ireland.

The taskforce reported in June 2003 and identified five areas for the development of diabetic services within Northern Ireland[3]:

- Prevention and early detection
- Care, monitoring and treatment
- Targeting vulnerable groups
- Planning and managing services
- Implementation issues

A regional implementation group, being led by the Department of Health, Social Services and Public Safety (DHSSPS), is linking the development of diabetic services to the development of ambulatory care services at Health and Social Services Board level.

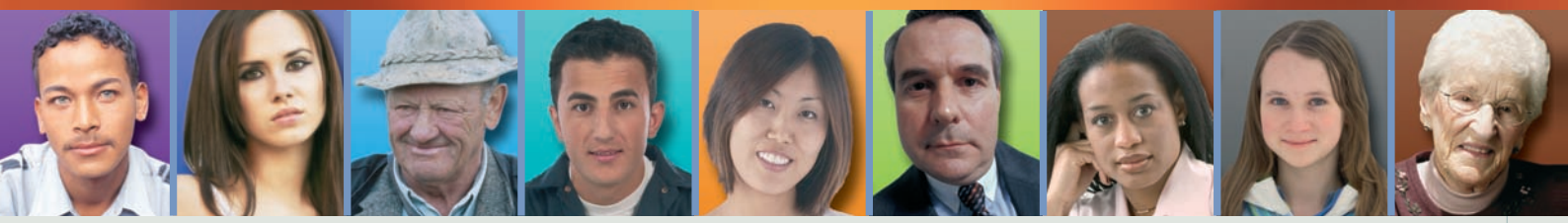
2.2 Republic of Ireland

The recent report of the National Diabetes Working Group proposed a model of diabetes care which is patient centred and includes the following elements[4]:

- Diabetes networks – local diabetes service development groups to plan diabetes services
- Shared Care – care delivered at the most appropriate level and shared between primary and secondary services/roles and responsibilities are clearly understood and underpinned by clinical protocols
- Multi-disciplinary primary care teams
- Prevention and screening – including health promotion, public education and targeted screening of high risk groups
- Hospital based specialist centres with:
  - Referral guidelines for primary care
  - Integrated care pathways
  - Links with primary care and rehabilitation services.

It is expected that the development of diabetes services will be a national priority and this will be reflected in the Health Service Executive (HSE) national service plan.

3 Estimating the prevalence of diabetes



3. Estimating the prevalence of diabetes

3.1 Why we need accurate population prevalence estimates

Accurate estimates of the population prevalence of diabetes are essential because they allow us to:

- **Describe the patterns of diabetes in the population**

  Accurate estimates of population prevalence (including both diagnosed and undiagnosed cases) allow us to describe patterns of diabetes within the population, properly assess the burden of the condition, and explore how it varies with known risk factors.

- **Estimate the number of undiagnosed cases**

  Estimates of the number of cases (diagnosed and undiagnosed) in the population can be compared to the number of diagnosed cases. This allows us to describe patterns of undiagnosed diabetes in the population, help active case finding, and support the quality information agenda. It also informs the development of awareness raising initiatives and screening.

- **Plan and deliver services in a rational way**

  Accurate estimates of the numbers of people with diabetes support rational planning and development of services, and allocation of resources at local and regional levels.

- **Monitor performance**

  Taskforces have been set up within Northern Ireland and the Republic of Ireland to tackle diabetes, and accurate estimates of prevalence will aid the implementation of their work at local and regional level. Analysing trends in prevalence (diagnosed and undiagnosed) is a critical component of systems performance assessment.

3.2 Overview of existing prevalence estimates

Table 1 below shows that existing prevalence estimates are based on different international averages, different assumptions about the percentage of cases that are undiagnosed, and apply to different age groups. Often, when figures are quoted, these details are not clearly stated.

International

The World Health Organisation (WHO) estimated that in 1985, 30 million people worldwide had diabetes. This figure rose to an estimated 135 million in 1995 and an estimated 177 million in the year 2000. These figures are expected to rise to at least 366 million by 2030.[5]

In 2003 the International Diabetes Federation (IDF) e-Atlas estimated that there were 194 million people between the ages of 20-79 years living with (either diagnosed or undiagnosed) diabetes (both Type 1 and Type 2). This equated to a global prevalence rate of 5.1%. By 2025 these figures are expected to rise to 333 million with a global prevalence rate of 6.3%.[6]

The IDF e-Atlas estimated that the population prevalence amongst those aged 20-79 years across Europe in 2003 was 7.8% (48.4 million persons). By 2025 the prevalence is expected to rise to 9.1% (58.6 million persons).[6]

Diabetes affected approximately 7.5% of the EU-25 population aged 20 years and over in 2003, according to the report by the International Diabetes Federation-European Region (IDF-Europe) and the Federation of European Nurses in Diabetes (FEND). This prevalence rate for Type 1 and Type 2 diabetes is expected to rise to 16% over the next 20 years, with the increasing prevalence of Type 2 diabetes being the main driving force behind the increase.[7]

Northern Ireland

Diabetes UK (NI)/CREST

Diabetes UK (NI) estimates that in 2001, 2.9% of all persons in Northern Ireland had been diagnosed with diabetes (Type 1 and Type 2 combined) and a further 1.5% had diabetes that had not been diagnosed.[8] The figure of 2.9% is based on an overall UK prevalence of nearly 3%, a figure reported in core textbooks such as ABC Diabetes[9] and Cardiovascular Disease: Time to Act.[10]

When applied to 2001 census population counts, these prevalence rates suggest that there are 74,000 persons living with diabetes in Northern Ireland (49,000 persons diagnosed and 25,000 persons undiagnosed).

The joint Diabetes UK (NI)/CREST taskforce in Northern Ireland accepted the Diabetes UK (NI) estimates.[3]

Health and Social Wellbeing Survey 1997

The Health and Social Wellbeing Survey 1997 (based on an interviewer-administered questionnaire) estimated that the self-reported prevalence of diabetes for both males and females was 3%. The survey also found that, for both males and females, prevalence increased with age.[11]

Republic of Ireland

WHO

The WHO estimated that in 2000 there were 86,000 cases of diabetes in the Republic of Ireland. This figure is expected to rise to 157,000 by 2030.[12]

International Diabetes Federation

In 2003 the IDF e-Atlas estimated that 3.4% of all persons aged 20-79 years in the Republic of Ireland were affected by diabetes (Type 1 and Type 2 combined, diagnosed and undiagnosed).[6]

Diabetes Federation of Ireland

Diabetes Federation of Ireland estimated that in 2003 there were 200,000 persons with diabetes (Type 1 and Type 2 combined) and a further 200,000 who had diabetes but were unaware that they had the condition. They estimated that a further 250,000 persons had impaired glucose tolerance or "pre-diabetes"; 50% of whom would develop diabetes in the next five years if lifestyle changes are not made.[13]

These diabetes prevalence estimates were obtained by applying age-specific prevalence rates to the age-specific resident population counts. Diabetes Federation of Ireland reported that the assumed age-specific prevalence rates (see table below) were based on those in the IDF e-Atlas.[14]

Detail of method used by Diabetes Federation of Ireland

Age (years)	Population size	Prevalence	
		Assumed percentage	Estimated number
0 - 25	1,492,314	0.2%	2,984
25 - 79	2,150,491	7.8%	167,731
75+	174,531	15.0%	26,175
All ages	3,817,336	5.2%	196,890

In its submission to the Joint Oireachtas Committee on Health and Children in January 2006, a delegation from Diabetes Federation of Ireland stated that approximately 250,000 people in Ireland have diabetes (approximately 100,000 of which are undiagnosed) with a further 100,000 people having pre-diabetes.[15]

Quarterly Household Survey

The Quarterly Household Survey, a questionnaire-based survey conducted by the Central Statistics Office (CSO) in the third quarter of 2001, included questions on health. The CSO estimated that the self-reported prevalence of diabetes was 1.5% amongst those aged over 18 years. The prevalence amongst males and females was reported to be 1.7% and 1.4% respectively, and the prevalence of diabetes was reported to be 4.5% amongst those aged 65 years and over.[16]

Other local studies

In the Cork and Kerry Diabetes and Heart Disease Study,[17] carried out between March and August 1998, 1,018 persons aged 50-69 years were sampled from 17 general practices in Cork and Kerry. The study revealed that the prevalence of Type 2 diabetes was 3.9%; it estimated that 30% of these cases were undiagnosed.

Table 1: Summary of existing estimates of the population prevalence of diabetes

Area	Global	Global	European Region	European Region	EU-25	Republic of Ireland	Republic of Ireland	Republic of Ireland	Republic of Ireland	Northern Ireland
Year	2003	2000	2003	2000	2003	2003	2006	2003	2000	2001
Sex	Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons	Persons
Ages (years)	20-79	_	20-79	_	20+	20-79	All ages	All ages	_	All ages
Source	IDF e-Atlas	WHO	IDF e-atlas	WHO	IDF-Europe /FEND (cited)	IDF e-Atlas	Diabetes Federation Ireland	Diabetes Federation Ireland	WHO	Diabetes UK (NI)
Type 1 Type 2	1 & 2	1 & 2	1 & 2	1 & 2	1 & 2	1 & 2	1 & 2	1 & 2	1 & 2	1 & 2
Diagnosed /Undiagnosed	D & UD	_	D & UD	_	D & UD	D & UD	D & UD	D & UD	_	D & UD
Rate (%)	5.1%	_	7.8%	_	7.5%	3.4%	_	5.2%	_	2.9% diagnosed 1.5% undiagnosed
Number	194 million	171 million	48.4 million	33.3 million	25 million	89,800	250,000 diagnosed 100,000 undiagnosed	200,000 diagnosed 200,000 undiagnosed	86,000	74,000 49,000 diagnosed 25,000 undiagnosed

3.3 The PBS Diabetes Population Prevalence Model

Introduction

The PBS Diabetes Population Prevalence Model was developed by the Yorkshire and Humber Public Health Observatory (YHPHO), Brent NHS Primary Care Trust, and the University of Sheffield's School of Health and Related Research (ScHARR).[18]

The PBS Model provides area-based estimates of the numbers of persons with Type 1 and Type 2 diabetes (diagnosed and undiagnosed). It accounts for age, sex, ethnicity and socio-economic factors, factors that are known to affect the prevalence of diabetes.

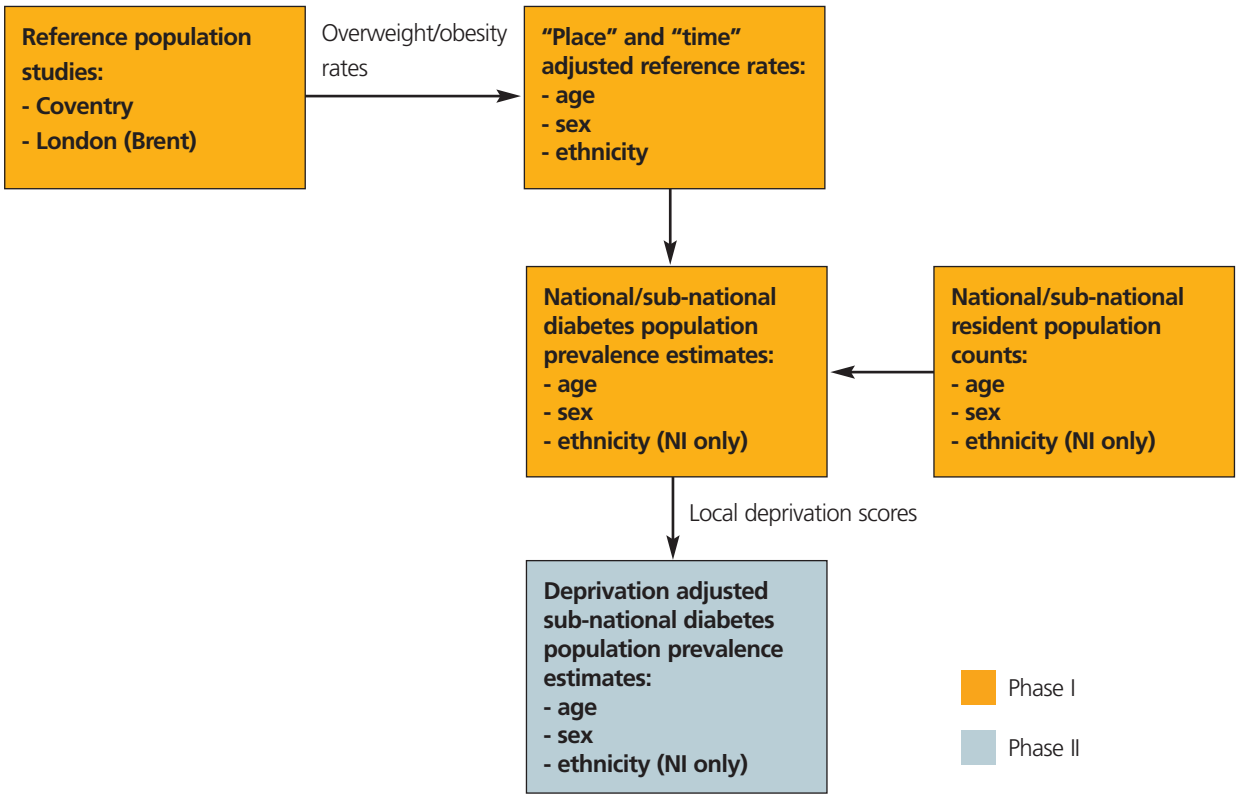
Population prevalence of Type 2 diabetes is estimated in two Phases. In Phase I, "time" and "place" adjusted prevalence rates from English reference population studies are applied to resident population counts. In Phase II the estimated total number of cases in each jurisdiction is redistributed so that sub-national variation in prevalence also reflects sub-national variation in local socio-economic circumstances.

The methodology is outlined below; further technical details are given in Appendix 1 and Appendix 2.

Type 2 diabetes: Phase I estimates

In Phase I, age-, sex- and ethnicity-specific estimates of population prevalence, taken from UK reference population studies, are adjusted for "place" and "time", and then applied to resident population counts on the island of Ireland (see Figure 2 below).

Figure 2: Application of the PBS Model to the island of Ireland (Type 2 diabetes)



English reference population studies

Several reference population studies were used because no single study provided all the necessary information for all ethnic groups. The definition of the ethnic groups used in the reference studies is given in Table 4, and more details of the reference studies are given in Appendix 1.

"Place" and "time" adjustments

The reference studies occurred in Coventry between 1986 and 1989 and in London (Brent) in the early 1990s. Consequently, findings had to be adjusted – for "place" and "time" – before they could be applied to 2005 resident population counts. These two adjustments were based on:

- differences between the overweight/obesity rates in the study locations and the rest of England ("place")
- changes in overweight/obesity rates that occured in England during the period between the conduct of the studies and the present ("time").

These adjustments, made separately for males and females, were based on data from the different waves of the National Health Survey of England. English overweight/obesity data was used because relevant data for Northern Ireland and the Republic of Ireland was not available (see Appendix 3). In the original PBS model, the "time" adjustment was made to 2001. When the model was applied to the island of Ireland, the adjustment was made to 2005.

The final adjusted population prevalence rates that were applied to resident population counts on the island are given in Table 2 below.

Table 2: Adjusted reference prevalence rates used in this study, by age, sex and ethnicity (Type 2 diabetes)

Age (years)	Male			Female		
	White/other	Black	Asian	White/Other	Black	Asian
20-24	0.0%	0.0%	1.2%	0.3%	0.0%	0.8%
25-29	0.0%	0.0%	1.2%	0.3%	0.0%	0.8%
30-39	0.0%	0.0%	5.1%	0.0%	0.0%	3.2%
40-49	3.2%	6.5%	14.3%	3.2%	11.9%	7.8%
50-59	4.6%	8.9%	23.7%	5.7%	36.6%	19.8%
60-69	11.0%	23.0%	31.5%	11.5%	25.0%	33.3%
70-79	12.0%	25.2%	43.9%	19.4%	42.3%	26.6%
80+	9.3%	19.5%	44.8%	19.2%	41.8%	21.4%

No estimates for Type 2 diabetes amongst children (aged under 20 years) are given.

Type 2 diabetes: Phase II estimates

In Phase II, the estimated total number of cases in each jurisdiction was redistributed so that sub-national variation in prevalence reflects sub-national variation in local deprivation scores. This redistribution does not affect national prevalence estimates. More details are given in Appendix 1.

Type I diabetes estimates

Age- and sex-specific reference rates for Type 1 diabetes are taken from a Welsh study carried out in 1998. No place, time or deprivation adjustment was made to these reference rates before they were applied to resident population counts. The Type 1 reference rates used in the model are given in Table 3 below; they are applied to all ethnic groups.

Table 3: Reference prevalence rates used in this study, by age and sex (Type 1 diabetes)

Age (years)	Male	Female
	White, Black, Asian, Other	White, Black, Asian, Other
0-4	0.0%	0.0%
5-9	0.1%	0.1%
10-14	0.3%	0.3%
15-19	0.3%	0.4%
20-24	0.3%	0.3%
25-29	0.5%	0.4%
30-39	0.7%	0.5%
40-49	0.6%	0.4%
50-59	0.5%	0.3%
60-69	0.3%	0.1%
70-79	0.1%	0.1%
80+	0.1%	0.1%

Estimated resident population counts

Adjusted Type 2 reference rates, and Type 1 reference rates, were applied to estimated mid-year resident population counts for 2005.

Different counts were available for Northern Ireland and the Republic of Ireland; these are summarized in Table 4 below.

In Northern Ireland, ethnicity-specific population counts for 2005 were not available, and 2001 census data were applied to 2005 age-, sex-specific population counts.

In the Republic of Ireland, population counts for 2005 were not available for Local Health Office Areas (LHOA), and 2002 census data were applied to 2005 age-, sex-specific national population counts.

Table 4: Details of the 2005 estimated mid-year population counts used in this study

	Northern Ireland	Republic of Ireland
Sex	Male Female	Male Female
Age	Type 1 diabetes: 0-29 years (5 year age bands) Type 2 diabetes: 20-29 (5 year bands) 30-79 years (10 year age bands) 80+ years	Type 1 diabetes: 0-29 years (5 year age bands) Type 2 diabetes: 20-29 (5 year bands) 30-79 years (10 year age bands) 80+ years
Ethnicity	"White": White, Irish Traveller, Mixed "Black": Black Caribbean, Black African, Other Black "Asian": Indian, Pakistani, Bangladeshi, Other Asian "Other": Chinese, Other Ethnic Group (extrapolated from 2001 census)	All people assumed "White" (no ethnicity data available)
Geography	Northern Ireland Health & Social Services Boards Local Government Districts Health Board Localities	Republic of Ireland Health Service Executive regions Local Health Office Areas (extrapolated from 2002 census)

3.4 Why the PBS Model?

On the island, the most widely quoted population prevalence estimates are those produced by Diabetes Federation of Ireland in the Republic of Ireland and Diabetes UK (NI) in Northern Ireland. Both apply international averages to population counts; both make assumptions about the percentage of cases that are undiagnosed. (See Table 5 below.)

Table 5: Summary of existing methodologies used to estimate population prevalence of diabetes on the island of Ireland

	Republic of Ireland		Northern Ireland	
	PBS Model (2005)	Diabetes Federation of Ireland (2003)	PBS Model (2005)	Diabetes UK (NI) (2001)
Sex	Male & Female	All persons	Male & Female	All persons
Age (years)	0-19 years (Type 1) 20-29 years (Type 1 & 2) 30-59 years (Type 1 & 2) 60+ years (Type 1 & 2)	0-25 25-79 75+	0-19 years (Type 1) 20-29 years (Type 1 & 2) 30-59 years (Type 1 & 2) 60+ years (Type 1 & 2)	All ages
Ethnicity	Ignored	Ignored	Taken account of	Ignored
Areas	National Health Service Executive regions Local Health Office Areas	National	National Health and Social Services Boards Local Government Districts Health Board Localities	National
Undiagnosed Cases	No assumptions	Assumed to be 100,000	Estimates obtained from comparison to estimates of clinical diagnoses	Assumed to be 1.5%

The PBS Model used in this study represents the first attempt to systematically estimate population prevalence across the island of Ireland.

Benefits and limitations

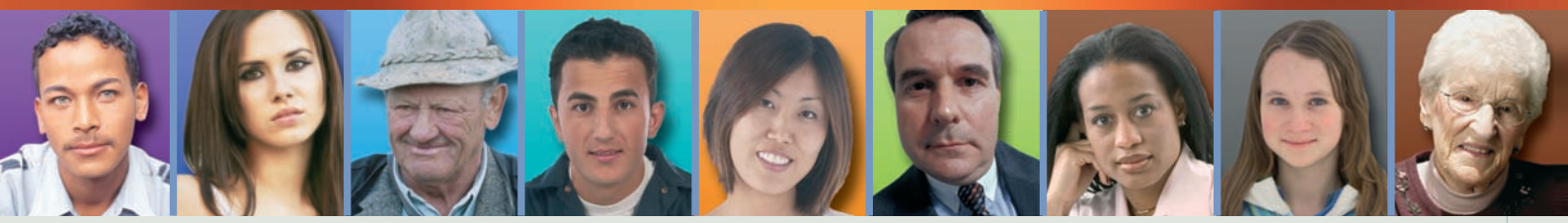
The PBS Model offers several advantages over existing methods used to estimate population prevalence of diabetes:

- It provides a systematic approach with a clear methodology based on the use of rigorous population studies and resident population counts. The model has been rigorously tested in England.
- As well as producing national estimates, the PBS Model estimates prevalence at sub-national levels.
- Prevalence estimates are disaggregated by age, sex and ethnicity.
- The model takes account of the way in which the risk of diabetes varies with sex, age, ethnicity and local socio-economic circumstances.
- It provides a single methodology that can be applied in both the Republic of Ireland and Northern Ireland.
- It provides estimates of population prevalence without making any assumptions about the percentage of cases that are undiagnosed.
- If these population estimates are compared with the number of cases on diabetes registers, the percentage of cases that are undiagnosed can be explicitly estimated.

Like any methodology developed elsewhere, when applied to the island of Ireland, the PBS Model has limitations:

- The reference prevalence rates for Type 2 diabetes are based on the WHO 1985 diagnostic cut-off points. More recently, the WHO reduced its diagnostic cut-off point, and the American Diabetes Association (ADA) proposed the use of the fasting plasma glucose test (FPGT). It appears from the Diabetes Epidemiology: Collaborative Analysis of Diagnostic Criteria in Europe (DECODE) study group[19], that the use of ADA criteria will have little effect on the national prevalence rate but will affect the phenotype of persons diagnosed with diabetes. If the new WHO diagnostic cut-off point becomes more commonly used, the PBS Model will underestimate prevalence.
- Only English overweight/obesity data were available for the "place" and "time" adjustments. There is some evidence that overweight/obesity rates in the Republic of Ireland may be lower than those in England, and that Irish men may be more obese than Irish women[20] (reverse is true in England[21] and Northern Ireland[11]). Differences in survey methodology make conclusions difficult. In these circumstances, the Working Group felt that the use of English data was appropriate. (See Appendix 3 for details).
- In the Republic of Ireland, it was necessary to assume that the whole population belonged to the "White" ethnic group because no resident population estimates for ethnic minorities were available. A sensitivity analysis suggests that this will result in slight underestimates at the national level and some minor distortion of the sub-national patterns.
- There is no "place" or "time" adjustment for Type 1 estimates. Reference rates were taken from the Welsh study conducted in 1998. From other studies the prevalence of Type 1 diabetes is known to be increasing [22, 23]; so the population prevalence estimates of Type 1 diabetes may be underestimates.
- The socio-economic variation in diabetes risk is based on UK clinical data. In particular, this means that the adjustment could only be used to redistribute the total number of cases within each jurisdiction.

4 The number of people with diabetes



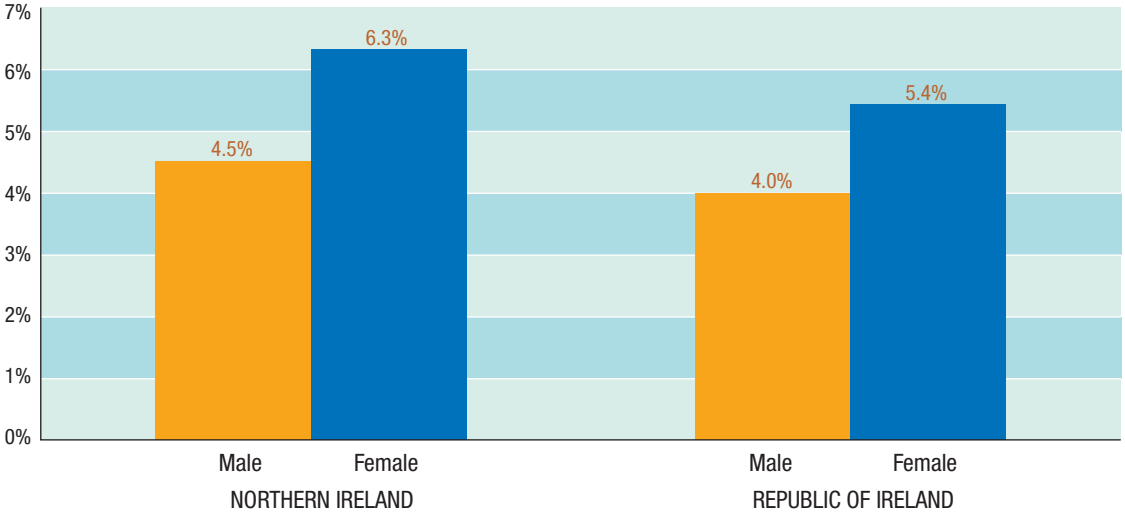
4. The number of people with diabetes

4.1 All-Ireland

The prevalence of Type 1 and Type 2 diabetes in adults (aged 20 years and over) in England is 6.1%. For both males and females, the estimated population prevalence rates in Northern Ireland and the Republic of Ireland are smaller than those in England. This is explained by the fact that residents of the island have a younger age profile than residents of England, and that a much larger percentage of English residents belong to at-risk ethnic minorities (see Appendix 4).

The PBS Model estimates that in 2005 there were 67,063 adults in Northern Ireland and 141,063 adults in the Republic of Ireland with diabetes (Type 1 and Type 2 combined). Prevalence of adult diabetes (Type 1 and Type 2 combined) was higher in Northern Ireland (5.4%) than it is in the Republic of Ireland (4.7%). This is true for both males and females (see Figure 3).

Figure 3: Estimated population prevalence of adult diabetes (Type 1 and Type 2 combined), by sex and jurisdiction



This is explained by the fact that the residents of the Republic of Ireland have a younger age profile than residents of Northern Ireland, and because all residents of the Republic of Ireland were assumed to be "White".

4.2 Northern Ireland

Summary of findings

Adult diabetes (Type 1 and Type 2 combined)

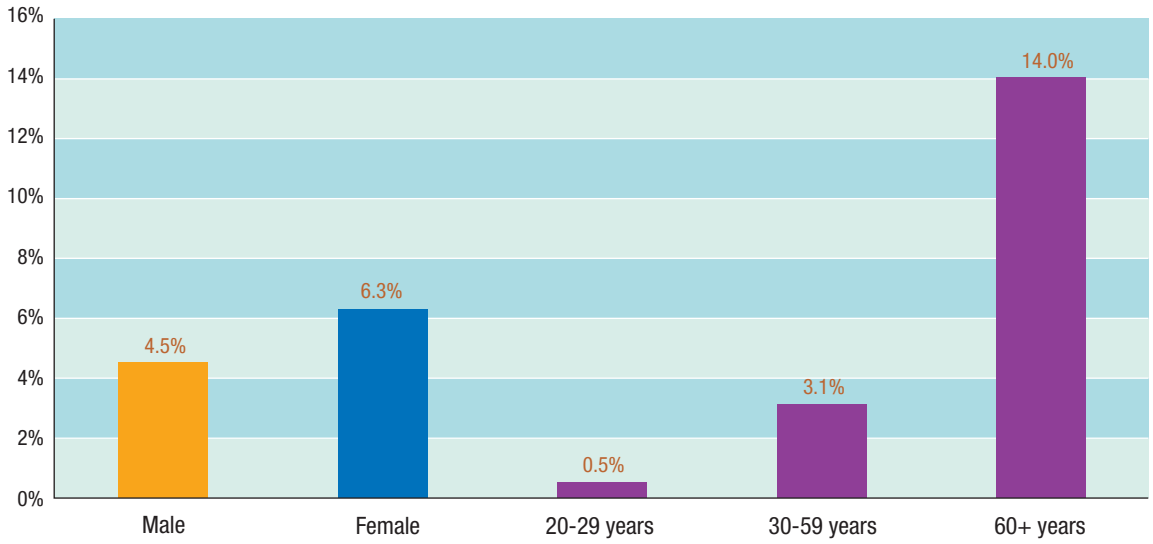
67,000 adults (aged 20 years and over) in Northern Ireland are estimated to have diabetes (Type 1 and Type 2 combined) (5.4%).

Prevalence is higher amongst adult females than it is amongst adult males: 6.3% of females are estimated to have diabetes compared to 4.5% of males. These correspond to 40,489 females and 26,573 males aged 20 years and over. This reflects the higher prevalence rates found amongst females in the reference population studies.

Prevalence increases with age from 0.5% for persons aged 20-29 years to 3.1% for persons aged 30-59 years. Those aged 60 years and over have the highest prevalence (14.0%).

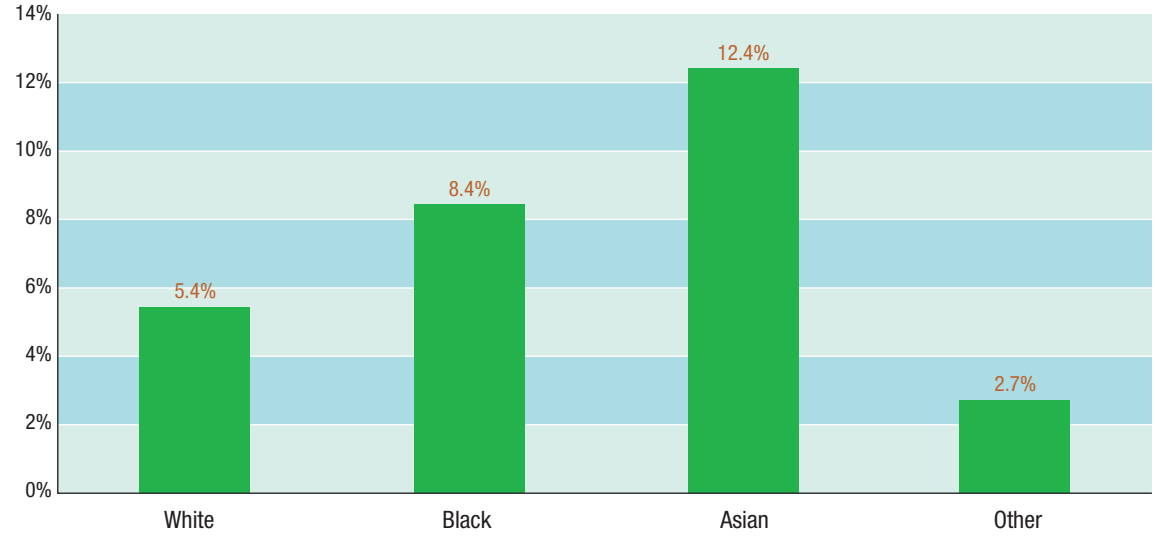
Figure 4 shows the prevalence of diabetes in adults in Northern Ireland, by sex and age.

Figure 4: Estimated population prevalence of adult diabetes (Type 1 and Type 2 combined) in Northern Ireland, by sex and age



In Northern Ireland, the estimated prevalence of adult diabetes varies with ethnicity. Prevalence is highest amongst "Asian" and "Black" ethnic groups (12.4% and 8.4% respectively). This reflects patterns in the adjusted reference rates used in the PBS Model.

Figure 5: Estimated population prevalence of adult diabetes (Type 1 and Type 2 combined) in Northern Ireland, by ethnicity



Prevalence of adult diabetes varies only slightly across the Health and Social Services Boards in Northern Ireland. Prevalence is highest in the Eastern Health and Social Services Board (5.6%) and lowest in the Northern Health and Social Services Board (5.2%). This is explained by the fact that there are relatively more people from at-risk ethnic minority groups and relatively more older people in the Eastern Board.

Type 1 diabetes
The model estimates 5,768 persons in Northern Ireland have Type 1 diabetes (0.3% of the total population). It is estimated that 3,278 males (0.4%) and 2,491 females (0.3%) have Type 1 diabetes.

Approximately 0.2% of all children (aged 0-19 years) in Northern Ireland (992 children) have Type 1 diabetes. There is no difference in prevalence amongst males and females.

Approximately 0.4% of all adults (aged 20 years and over) in Northern Ireland (4,776 adults) have Type 1 diabetes. Prevalence is higher amongst males (0.5%) than amongst females (0.3%).

Adult Type 2 diabetes
It is estimated that 62,287 persons aged 20 years and over in Northern Ireland have Type 2 diabetes (5.1% of the population in this age group). Type 2 diabetes affects 4.0% (23,790) of adult males and 6.0% (38,497) of adult females.

Detailed tables of prevalence estimates

Table 6: Estimates of the population prevalence of adult diabetes (Type 1 and Type 2 combined) in Northern Ireland, by Local Government District

Area	Type 1 + Type 2 (20+ years)												
	Estimated Number			Estimated Prevalence									
	Person	Male	Female	Person	Male	Female	20-29 yrs	30-59 yrs	60+ yrs	White	Black	Asian	Other
NORTHERN IRELAND	67,063	26,573	40,489	5.4%	4.5%	6.3%	0.5%	3.1%	14.0%	5.4%	8.4%	12.4%	2.7%
EHSSB	27,126	10,369	16,757	5.6%	4.5%	6.5%	0.5%	3.1%	14.0%	5.6%	8.2%	9.6%	2.5%
NHSSB	16,510	6,644	9,866	5.2%	4.4%	6.0%	0.5%	3.0%	13.1%	5.2%	9.7%	14.1%	2.7%
SHSSB	12,180	4,941	7,238	5.4%	4.5%	6.2%	0.5%	3.1%	14.1%	5.4%	8.8%	13.8%	2.9%
WHSSB	11,099	4,575	6,524	5.5%	4.6%	6.4%	0.6%	3.3%	15.1%	5.5%	7.9%	16.9%	3.1%
EHSSB													
ARDS	2,931	1,188	1,743	5.2%	4.4%	6.0%	0.5%	2.9%	12.3%	5.2%	7.4%	5.1%	2.1%
BELFAST	12,181	4,393	7,787	6.2%	4.9%	7.2%	0.6%	3.4%	16.1%	6.2%	9.6%	10.1%	2.5%
CASTLEREAGH	2,577	990	1,586	5.2%	4.3%	6.0%	0.5%	2.8%	12.1%	5.2%	10.7%	9.9%	2.3%
DOWN	2,409	979	1,430	5.1%	4.3%	6.0%	0.5%	3.0%	13.1%	5.1%	5.6%	13.7%	3.0%
LISBURN	3,852	1,548	2,304	4.9%	4.1%	5.6%	0.5%	2.9%	12.9%	4.9%	8.3%	9.8%	3.1%
NORTH DOWN	3,047	1,179	1,868	5.2%	4.2%	6.1%	0.5%	2.9%	11.8%	5.2%	6.0%	9.5%	3.1%
NHSSB													
ANTRIM	1,690	712	978	4.8%	4.0%	5.6%	0.5%	2.9%	13.0%	4.8%	12.8%	12.3%	3.5%
BALLYMENA	2,296	906	1,391	5.2%	4.3%	6.1%	0.5%	2.9%	12.7%	5.2%	2.0%	15.4%	3.9%
BALLYMONEY	1,108	444	664	5.4%	4.4%	6.3%	0.5%	3.0%	13.6%	5.4%	11.2%	17.1%	3.2%
CARRICKFERGUS	1,410	575	835	5.0%	4.2%	5.7%	0.5%	2.8%	12.3%	5.0%	13.4%	10.4%	2.4%
COLERAINE	2,291	896	1,396	5.6%	4.6%	6.4%	0.5%	3.1%	13.2%	5.6%	12.8%	14.5%	2.8%
COOKSTOWN	1,280	525	755	5.5%	4.6%	6.3%	0.6%	3.3%	14.6%	5.5%	0.0%	25.1%	4.1%
LARNE	1,297	524	773	5.6%	4.7%	6.5%	0.5%	3.1%	13.2%	5.6%	6.9%	12.3%	3.9%
MAGHERAFELT	1,304	543	761	4.5%	3.8%	5.3%	0.5%	2.8%	12.6%	4.5%	4.6%	17.6%	2.9%
MOYLE	730	294	436	6.2%	5.2%	7.1%	0.6%	3.4%	14.8%	6.2%	6.9%	10.3%	7.1%
NEWTOWNABBEY	3,087	1,222	1,865	5.2%	4.4%	5.9%	0.5%	2.9%	12.7%	5.2%	9.0%	12.4%	2.0%
SHSSB													
ARMAGH	2,067	837	1,230	5.3%	4.4%	6.1%	0.5%	3.1%	13.5%	5.3%	5.3%	15.0%	2.5%
BANBRIDGE	1,464	604	860	4.6%	3.9%	5.3%	0.5%	2.7%	12.1%	4.6%	2.6%	10.4%	3.9%
CRAIGAVON	3,251	1,302	1,949	5.5%	4.5%	6.4%	0.6%	3.2%	14.2%	5.5%	5.8%	12.5%	2.6%
DUNGANNON	1,852	751	1,100	5.4%	4.5%	6.3%	0.5%	3.1%	14.2%	5.4%	8.1%	17.5%	3.7%
NEWRY & MOURNE	3,525	1,440	2,085	5.7%	4.7%	6.5%	0.6%	3.4%	15.3%	5.6%	15.0%	16.8%	2.2%
WHSSB													
DERRY	4,049	1,636	2,413	5.5%	4.7%	6.2%	0.6%	3.4%	15.8%	5.5%	8.6%	17.3%	3.5%
FERMANAGH	2,354	981	1,373	5.6%	4.6%	6.5%	0.5%	3.2%	13.8%	5.6%	14.9%	14.3%	2.5%
LIMAVADY	1,142	487	655	4.8%	4.0%	5.6%	0.5%	3.0%	14.0%	4.8%	2.7%	28.3%	2.0%
OMAGH	1,802	743	1,059	5.2%	4.3%	6.1%	0.5%	3.2%	14.3%	5.2%	7.2%	16.9%	3.3%
STRABANE	1,725	715	1,010	6.4%	5.3%	7.4%	0.6%	3.6%	17.0%	6.4%	26.6%	18.9%	6.5%

Table 7: Estimates of the population prevalence of adult Type 2 diabetes in Northern Ireland, by Local Government District

Area	Type 2 (20+ years)					
	Estimated Number			Estimated Prevalence		
	Person	Male	Female	Person	Male	Female
NORTHERN IRELAND	62,287	23,790	38,497	5.1%	4.0%	6.0%
EHSSB	25,270	9,308	15,962	5.2%	4.1%	6.2%
NHSSB	15,285	5,923	9,361	4.8%	3.9%	5.7%
SHSSB	11,286	4,414	6,873	5.0%	4.0%	5.9%
WHSSB	10,298	4,101	6,196	5.1%	4.1%	6.0%
EHSSB						
ARDS	2,714	1,061	1,654	4.8%	3.9%	5.6%
BELFAST	11,439	3,983	7,456	5.8%	4.5%	6.9%
CASTLEREAGH	2,389	883	1,506	4.8%	3.8%	5.7%
DOWN	2,226	870	1,356	4.8%	3.8%	5.7%
LISBURN	3,545	1,369	2,175	4.5%	3.7%	5.3%
NORTH DOWN	2,827	1,050	1,777	4.8%	3.7%	5.8%
NHSSB						
ANTRIM	1,548	625	923	4.4%	3.5%	5.3%
BALLYMENA	2,128	807	1,321	4.8%	3.8%	5.8%
BALLYMONEY	1,028	396	632	5.0%	3.9%	6.0%
CARRICKFERGUS	1,300	510	789	4.6%	3.7%	5.4%
COLERAINE	2,137	806	1,331	5.2%	4.2%	6.1%
COOKSTOWN	1,188	470	717	5.1%	4.1%	6.0%
LARNE	1,208	471	737	5.2%	4.2%	6.2%
MAGHERAFELT	1,189	475	715	4.1%	3.3%	4.9%
MOYLE	685	267	418	5.8%	4.7%	6.8%
NEWTOWNABBEY	2,859	1,091	1,768	4.8%	3.9%	5.6%
SHSSB						
ARMAGH	1,914	747	1,168	4.9%	3.9%	5.8%
BANBRIDGE	1,338	529	809	4.2%	3.4%	5.0%
CRAIGAVON	3,018	1,165	1,854	5.1%	4.1%	6.0%
DUNGANNON	1,718	672	1,046	5.0%	4.0%	6.0%
NEWRY & MOURNE	3,277	1,294	1,983	5.3%	4.3%	6.2%
WHSSB						
DERRY	3,754	1,466	2,287	5.1%	4.2%	5.9%
FERMANAGH	2,190	882	1,308	5.2%	4.2%	6.2%
LIMAVADY	1,045	428	617	4.4%	3.5%	5.3%
OMAGH	1,664	661	1,003	4.8%	3.9%	5.7%
STRABANE	1,617	650	967	6.0%	4.9%	7.1%

Table 8: Estimates of the population prevalence of Type 1 diabetes in Northern Ireland, by Local Government District and age group

Area	Type 1 (0-19 years)						Type 1 (20+ years)					
	Estimated Number			Estimated Prevalence			Estimated Number			Estimated Prevalence		
	Person	Male	Female	Person	Male	Female	Person	Male	Female	Person	Male	Female
NORTHERN IRELAND	992	494	499	0.2%	0.2%	0.2%	4,776	2,784	1,992	0.4%	0.5%	0.3%
EHSSB	373	183	190	0.2%	0.2%	0.2%	1,856	1,061	795	0.4%	0.5%	0.3%
NHSSB	246	123	123	0.2%	0.2%	0.2%	1,225	721	505	0.4%	0.5%	0.3%
SHSSB	193	98	95	0.2%	0.2%	0.2%	893	528	365	0.4%	0.5%	0.3%
WHSSB	180	89	91	0.2%	0.2%	0.2%	801	474	327	0.4%	0.5%	0.3%
EHSSB												
ARDS	39	20	19	0.2%	0.2%	0.2%	216	127	89	0.4%	0.5%	0.3%
BELFAST	157	75	83	0.2%	0.2%	0.2%	742	410	332	0.4%	0.5%	0.3%
CASTLEREAGH	35	17	17	0.2%	0.2%	0.2%	188	108	80	0.4%	0.5%	0.3%
DOWN	40	20	20	0.2%	0.2%	0.2%	183	109	74	0.4%	0.5%	0.3%
LISBURN	64	33	32	0.2%	0.2%	0.2%	308	178	129	0.4%	0.5%	0.3%
NORTH DOWN	39	19	19	0.2%	0.2%	0.2%	220	129	91	0.4%	0.5%	0.3%
NHSSB												
ANTRIM	28	14	14	0.2%	0.2%	0.2%	143	87	56	0.4%	0.5%	0.3%
BALLYMENA	32	16	15	0.2%	0.2%	0.2%	168	99	70	0.4%	0.5%	0.3%
BALLYMONEY	16	8	8	0.2%	0.2%	0.2%	80	48	33	0.4%	0.5%	0.3%
CARRICKFERGUS	22	10	11	0.2%	0.2%	0.2%	110	65	46	0.4%	0.5%	0.3%
COLERAINE	32	16	16	0.2%	0.2%	0.2%	155	89	65	0.4%	0.5%	0.3%
COOKSTOWN	21	11	10	0.2%	0.2%	0.2%	92	54	38	0.4%	0.5%	0.3%
LARNE	17	8	8	0.2%	0.2%	0.2%	89	53	36	0.4%	0.5%	0.3%
MAGHERAFELT	25	12	13	0.2%	0.2%	0.2%	115	69	46	0.4%	0.5%	0.3%
MOYLE	10	5	5	0.2%	0.2%	0.2%	45	26	19	0.4%	0.5%	0.3%
NEWTOWNABBEY	45	22	22	0.2%	0.2%	0.2%	228	131	97	0.4%	0.5%	0.3%
SHSSB												
ARMAGH	34	17	17	0.2%	0.2%	0.2%	153	90	63	0.4%	0.5%	0.3%
BANBRIDGE	24	12	12	0.2%	0.2%	0.2%	127	75	51	0.4%	0.5%	0.3%
CRAIGAVON	48	25	23	0.2%	0.2%	0.2%	233	137	96	0.4%	0.5%	0.3%
DUNGANNON	31	15	15	0.2%	0.2%	0.2%	134	79	55	0.4%	0.5%	0.3%
NEWRY & MOURNE	57	29	28	0.2%	0.2%	0.2%	247	146	101	0.4%	0.5%	0.3%
WHSSB												
DERRY	69	34	35	0.2%	0.2%	0.2%	295	169	126	0.4%	0.5%	0.3%
FERMANAGH	35	17	18	0.2%	0.2%	0.2%	163	99	64	0.4%	0.5%	0.3%
LIMAVADY	21	11	11	0.2%	0.2%	0.2%	97	59	38	0.4%	0.5%	0.3%
OMAGH	30	15	15	0.2%	0.2%	0.2%	138	82	56	0.4%	0.5%	0.3%
STRABANE	24	12	12	0.2%	0.2%	0.2%	107	64	43	0.4%	0.5%	0.3%

Table 9: Estimates of the population prevalence of adult diabetes (Type 1 and Type 2 combined) in Northern Ireland, by Health Board Locality

Area	Type 1 + Type 2 (20+ years)												
	Estimated Number			Estimated Prevalence									
	Person	Male	Female	Person	Male	Female	20-29 yrs	30-59 yrs	60+ yrs	White	Black	Asian	Other
NORTHERN IRELAND	67,056	26,571	40,485	5.4%	4.5%	6.3%	0.5%	3.1%	14.0%	5.4%	8.4%	12.4%	2.7%
EHSSB	27,126	10,369	16,757	5.6%	4.5%	6.5%	0.5%	3.1%	14.0%	5.6%	8.2%	9.6%	2.5%
NHSSB	16,510	6,644	9,866	5.2%	4.4%	6.0%	0.5%	3.0%	13.1%	5.2%	9.7%	14.1%	2.7%
SHSSB	12,180	4,941	7,238	5.4%	4.5%	6.2%	0.5%	3.1%	14.1%	5.4%	8.8%	13.8%	2.9%
WHSSB	11,099	4,575	6,524	5.5%	4.6%	6.4%	0.6%	3.3%	15.1%	5.5%	7.9%	16.9%	3.1%
EHSSB													
ARDS	2,931	1,188	1,743	5.2%	4.4%	6.0%	0.5%	2.9%	12.3%	5.2%	7.4%	5.1%	2.1%
NORTH & WEST BELFAST	6,931	2,489	4,442	6.8%	5.4%	8.0%	0.6%	3.8%	17.9%	6.8%	10.6%	7.8%	2.5%
SOUTH & EAST BELFAST	7,853	2,909	4,944	5.4%	4.4%	6.3%	0.5%	3.0%	13.5%	5.4%	9.3%	10.0%	2.3%
NORTH DOWN	3,047	1,179	1,868	5.2%	4.2%	6.1%	0.5%	2.9%	11.8%	5.2%	6.0%	9.5%	3.1%
DOWN	2,409	979	1,430	5.1%	4.3%	6.0%	0.5%	3.0%	13.1%	5.1%	5.6%	13.7%	3.0%
LISBURN	3,852	1,548	2,304	4.9%	4.1%	5.6%	0.5%	2.9%	12.9%	4.9%	8.3%	9.8%	3.1%
NHSSB													
ANTRIM & BALLYMENA	4,037	1,637	2,401	5.1%	4.2%	5.9%	0.5%	2.9%	13.0%	5.1%	8.2%	13.9%	3.7%
CAUSEWAY	4,131	1,633	2,498	5.6%	4.7%	6.5%	0.5%	3.1%	13.6%	5.6%	11.7%	14.8%	3.2%
EAST ANTRIM	5,791	2,320	3,471	5.2%	4.4%	6.0%	0.5%	2.9%	12.7%	5.2%	9.6%	12.3%	2.2%
MID-ULSTER	2,581	1,067	1,514	5.0%	4.1%	5.7%	0.5%	3.0%	13.5%	4.9%	4.9%	19.6%	3.5%
SHSSB													
ARMAGH & DUNGANNON	3,920	1,589	2,331	5.3%	4.4%	6.2%	0.5%	3.1%	13.8%	5.3%	7.0%	16.2%	3.0%
CRAIGAVON & BANBRIDGE	4,713	1,906	2,807	5.2%	4.3%	6.0%	0.5%	3.0%	13.5%	5.2%	4.9%	11.9%	2.8%
NEWRY & MOURNE	3,525	1,440	2,085	5.7%	4.7%	6.5%	0.6%	3.4%	15.3%	5.6%	15.0%	16.8%	2.2%
WHSSB													
NORTHERN GROUP	6,290	2,580	3,710	5.5%	4.6%	6.3%	0.6%	3.4%	15.6%	5.4%	6.7%	17.8%	3.2%
STRULE/ERNE GROUP	4,784	1,984	2,800	5.5%	4.6%	6.5%	0.5%	3.2%	14.4%	5.5%	13.2%	16.2%	3.3%

Table 10: Estimates of the population prevalence of adult Type 2 diabetes in Northern Ireland, by Health Board Locality

Area	Type 2 (20+ years)					
	Estimated Number			Estimated Prevalence		
	Person	Male	Female	Person	Male	Female
NORTHERN IRELAND	62,280	23,787	38,493	5.1%	4.0%	6.0%
EHSSB	25,270	9,308	15,962	5.2%	4.1%	6.2%
NHSSB	15,285	5,923	9,361	4.8%	3.9%	5.7%
SHSSB	11,286	4,414	6,873	5.0%	4.0%	5.9%
WHSSB	10,298	4,101	6,196	5.1%	4.1%	6.0%
EHSSB						
ARDS	2,714	1,061	1,654	4.8%	3.9%	5.6%
NORTH & WEST BELFAST	6,549	2,278	4,271	6.4%	4.9%	7.7%
SOUTH & EAST BELFAST	7,305	2,602	4,703	5.0%	3.9%	6.0%
NORTH DOWN	2,827	1,050	1,777	4.8%	3.7%	5.8%
DOWN	2,226	870	1,356	4.8%	3.8%	5.7%
LISBURN	3,545	1,369	2,175	4.5%	3.7%	5.3%
NHSSB						
ANTRIM & BALLYMENA	3,726	1,451	2,275	4.7%	3.8%	5.6%
CAUSEWAY	3,852	1,470	2,382	5.2%	4.2%	6.2%
EAST ANTRIM	5,364	2,072	3,292	4.8%	3.9%	5.7%
MID-ULSTER	2,373	944	1,429	4.6%	3.7%	5.4%
SHSSB						
ARMAGH & DUNGANNON	3,634	1,419	2,214	5.0%	4.0%	5.9%
CRAIGAVON & BANBRIDGE	4,354	1,694	2,660	4.8%	3.8%	5.7%
NEWRY & MOURNE	3,277	1,294	1,983	5.3%	4.3%	6.2%
WHSSB						
NORTHERN GROUP	5,828	2,310	3,518	5.1%	4.1%	5.9%
STRULE/ERNE GROUP	4,445	1,780	2,665	5.1%	4.1%	6.2%

Table 11: Estimates of the population prevalence of Type 1 diabetes in Northern Ireland, by Health Board Locality and age group

Area	Type 1 (0-19 years)						Type 1 (20+ years)					
	Estimated Number			Estimated Prevalence			Estimated Number			Estimated Prevalence		
	Person	Male	Female	Person	Male	Female	Person	Male	Female	Person	Male	Female
NORTHERN IRELAND	992	494	499	0.2%	0.2%	0.2%	4,776	2,784	1,992	0.4%	0.5%	0.3%
EHSSB	373	183	190	0.2%	0.2%	0.2%	1,856	1,061	795	0.4%	0.5%	0.3%
NHSSB	246	123	123	0.2%	0.2%	0.2%	1,225	721	505	0.4%	0.5%	0.3%
SHSSB	193	98	95	0.2%	0.2%	0.2%	893	528	365	0.4%	0.5%	0.3%
WHSSB	180	89	91	0.2%	0.2%	0.2%	801	474	327	0.4%	0.5%	0.3%
EHSSB												
ARDS	39	20	19	0.2%	0.2%	0.2%	216	127	89	0.4%	0.5%	0.3%
NORTH & WEST BELFAST	81	38	43	0.2%	0.2%	0.2%	382	211	171	0.4%	0.5%	0.3%
SOUTH & EAST BELFAST	111	54	57	0.2%	0.2%	0.2%	548	307	241	0.4%	0.5%	0.3%
NORTH DOWN	39	19	19	0.2%	0.2%	0.2%	220	129	91	0.4%	0.5%	0.3%
DOWN	40	20	20	0.2%	0.2%	0.2%	183	109	74	0.4%	0.5%	0.3%
LISBURN	64	33	32	0.2%	0.2%	0.2%	308	178	129	0.4%	0.5%	0.3%
NHSSB												
ANTRIM & BALLYMENA	60	30	30	0.2%	0.2%	0.2%	311	185	125	0.4%	0.5%	0.3%
CAUSEWAY	57	29	29	0.2%	0.2%	0.2%	280	163	116	0.4%	0.5%	0.3%
EAST ANTRIM	83	41	42	0.2%	0.2%	0.2%	427	249	179	0.4%	0.5%	0.3%
MID-ULSTER	46	23	23	0.2%	0.2%	0.2%	208	123	84	0.4%	0.5%	0.3%
SHSSB												
ARMAGH & DUNGANNON	65	32	32	0.2%	0.2%	0.2%	287	170	117	0.4%	0.5%	0.3%
CRAIGAVON & BANBRIDGE	72	37	35	0.2%	0.2%	0.2%	359	212	147	0.4%	0.5%	0.3%
NEWRY & MOURNE	57	29	28	0.2%	0.2%	0.2%	247	146	101	0.4%	0.5%	0.3%
WHSSB												
NORTHERN GROUP	106	53	54	0.2%	0.2%	0.2%	462	270	192	0.4%	0.5%	0.3%
STRULE/ERNE GROUP	74	37	37	0.2%	0.2%	0.2%	339	204	135	0.4%	0.5%	0.3%

4.3 Republic of Ireland

Summary of findings

Adult diabetes (Type 1 and Type 2 combined)

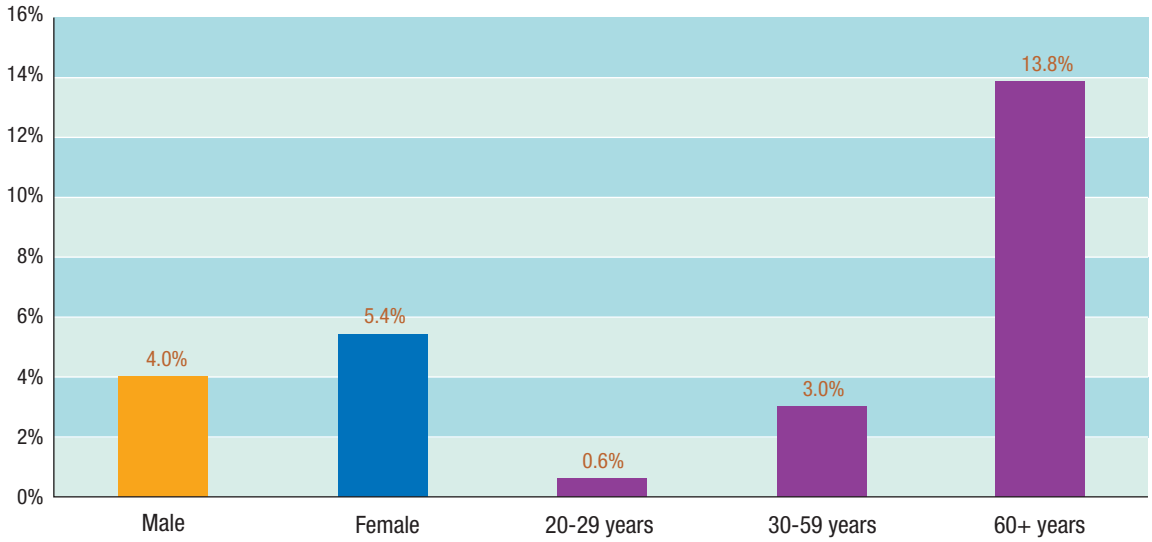
Because the 2002 Census did not record information on ethnicity, all people in the Republic of Ireland were assumed to belong to the "White" ethnic group.

With this assumption, the PBS Model estimates that in 2005, 4.7% of all adults (aged 20 years and over) had diabetes (Type 1 and Type 2 combined).

Estimated percentage rates are higher for females than males: 5.4% of adult females are estimated to have diabetes compared with 4.0% of adult males. These prevalence rates correspond to 82,256 adult females and 58,807 adult males.

Estimated prevalence increases with age from 0.6% for persons aged 20-29 years to 3.0% for persons aged 30-59 years. Those aged 60 years and over have the highest prevalence (13.8%). Figure 6 below shows the prevalence of adult diabetes in the Republic of Ireland, by sex and age.

Figure 6: Estimated population prevalence of adult diabetes (Type 1 and Type 2 combined) in the Republic of Ireland, by sex and age



Prevalence of adult diabetes varies only slightly across the Health Service Executive regions in the Republic of Ireland. Prevalence is highest in the Western region (5.2%) and lowest in the Dublin Mid-Leinster region (4.4%). This is explained by differences in the percentages of older people and differences in local socio-economic circumstances.

Type 1 diabetes

The model estimates 14,240 persons in the Republic of Ireland have Type 1 diabetes (0.3% of the total population). It is estimated that 8,193 males (0.4%) and 6,047 females (0.3%) have Type 1 diabetes.

The model estimates that 0.2% of all children (aged 0-19 years) in the Republic of Ireland (2,229 children) have Type 1 diabetes. There is no difference in prevalence amongst males and females.

The model estimates 0.4% of all adults aged 20 years and over in the Republic of Ireland (12,011 adults) have Type 1 diabetes. Prevalence is higher amongst males (0.5%) than it is amongst females (0.3%).

Adult Type 2 diabetes

The model estimates 129,052 persons in the Republic of Ireland have adult Type 2 diabetes (4.3% of the adult population). This corresponds to 3.5% (51,719) of adult males and 5.1% (77,333) of adult females.

Detailed tables of prevalence estimates

Table 12: Estimates of the population prevalence of adult diabetes (Type 1 and Type 2 combined) in the Republic of Ireland, by Local Health Office Area

Area	Type 1 + Type 2 (20+ years)								
	Estimated Number			Estimated Prevalence					
	Person	Male	Female	Person	Male	Female	20-29 yrs	30-59 yrs	60+yrs
REPUBLIC OF IRELAND	141,063	58,807	82,256	4.7%	4.0%	5.4%	0.6%	3.0%	13.8%
DUBLIN MID LEINSTER	38,235	15,594	22,641	4.4%	3.7%	5.0%	0.6%	2.9%	13.7%
DUBLIN NORTH EAST	33,147	13,775	19,372	4.5%	3.8%	5.2%	0.6%	3.0%	13.8%
SOUTHERN	33,184	13,940	19,244	5.0%	4.2%	5.7%	0.5%	3.1%	13.7%
WESTERN	36,570	15,536	21,035	5.2%	4.4%	5.9%	0.5%	3.1%	13. 9%
DUBLIN MID LEINSTER									
AREA 01	4,688	1,784	2,904	4.6%	3.8%	5.3%	0.5%	2.8%	12.2%
AREA 02	3,400	1,276	2,124	3.9%	3.2%	4.6%	0.5%	2.5%	11.7%
AREA 03	4,553	1,766	2,787	4.1%	3.3%	4.9%	0.6%	2.9%	15.0%
AREA 04	5,296	2,142	3,154	4.8%	4.0%	5.5%	0.6%	3.4%	15.0%
AREA 05	3,718	1,529	2,189	4.0%	3.3%	4.6%	0.6%	2.9%	14.6%
KILDARE	4,642	2,060	2,582	3.6%	3.1%	4.0%	0.5%	2.7%	12.4%
LAOIS/OFFALY	4,556	1,978	2,578	5.1%	4.3%	5.8%	0.6%	3.1%	14.2%
LONGFORD/WESTMEATH	3,751	1,583	2,168	4.9%	4.2%	5.7%	0.5%	3.0%	13.7%
WICKLOW	3,467	1,436	2,031	4.6%	3.9%	5.3%	0.5%	3.0%	13.7%
DUBLIN NORTH EAST									
AREA 06	5,261	2,084	3,177	4.3%	3.5%	5.0%	0.6%	2.9%	14.8%
AREA 07	5,000	1,919	3,080	4.9%	3.9%	5.7%	0.6%	3.0%	14.7%
AREA 08	6,420	2,707	3,713	4.2%	3.6%	4.7%	0.5%	2.9%	12.8%
CAVAN/MONAGHAN	4,211	1,810	2,401	5.2%	4.4%	6.1%	0.5%	3.1%	13.8%
LOUTH	3,893	1,601	2,292	5.1%	4.3%	5.9%	0.6%	3.3%	15.5%
MEATH	3,828	1,666	2,162	3.9%	3.4%	4.4%	0.5%	2.7%	12.3%
CARLOW/KILKENNY	4,602	1,992	2,609	4.9%	4.2%	5.6%	0.5%	3.1%	13.8%
SOUTHERN									
KERRY	5,683	2,409	3,274	5.5%	4.7%	6.4%	0.6%	3.3%	14.2%
NORTH CORK	2,892	1,207	1,685	5.1%	4.3%	6.1%	0.5%	3.0%	13.3%
NORTH LEE	5,116	2,168	2,948	4.5%	3.8%	5.2%	0.6%	3.0%	13.9%
SOUTH LEE	5,669	2,301	3,369	4.3%	3.6%	4.9%	0.5%	2.8%	12.7%
TIPPERARY (S.R.)	3,243	1,377	1,866	5.5%	4.6%	6.3%	0.6%	3.3%	14.6%
WATERFORD	3,950	1,663	2,287	5.1%	4.4%	5.9%	0.6%	3.2%	14.3%
WEST CORK	2,014	861	1,153	5.2%	4.4%	6.1%	0.5%	2.9%	12.3%
WEXFORD	4,564	1,943	2,621	5.3%	4.5%	6.0%	0.6%	3.2%	14.4%
WESTERN									
CLARE	3,677	1,587	2,090	4.7%	4.1%	5.4%	0.5%	2.9%	12.8%
DONEGAL	6,142	2,615	3,527	6.1%	5.2%	7.0%	0.6%	3.6%	16.2%
GALWAY	7,427	3,180	4,246	4.7%	4.0%	5.3%	0.5%	3.0%	13.6%
LIMERICK	6,198	2,602	3,596	4.6%	3.9%	5.4%	0.5%	3.1%	13.7%
MAYO	5,105	2,144	2,961	5.8%	4.8%	6.7%	0.6%	3.3%	14.2%
ROSCOMMON	2,167	931	1,236	5.3%	4.4%	6.2%	0.5%	3.0%	12.7%
SLIGO/LEITRIM	3,495	1,478	2,017	5.5%	4.6%	6.3%	0.5%	3.2%	13.8%
TIPPERARY (N.R.)	2,353	997	1,357	5.1%	4.3%	6.0%	0.5%	3.0%	13.3%

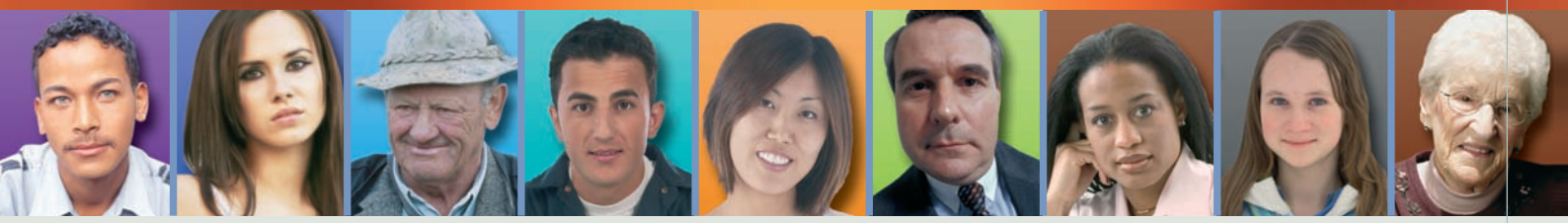
Table 13: Estimates of the population prevalence of adult Type 2 diabetes in the Republic of Ireland, by Local Health Office Area

Area	Type 2 (20+ years)					
	Estimated Number			Estimated Prevalence		
	Person	Male	Female	Person	Male	Female
REPUBLIC OF IRELAND	129,052	51,719	77,333	4.3%	3.5%	5.1%
DUBLIN MID LEINSTER	34,663	13,515	21,148	4.0%	3.2%	4.7%
DUBLIN NORTH EAST	30,177	12,029	18,148	4.1%	3.4%	4.9%
SOUTHERN	30,522	12,355	18,167	4.6%	3.7%	5.4%
WESTERN	33,765	13,859	19,906	4.8%	3.9%	5.6%
DUBLIN MID LEINSTER						
AREA 01	4,294	1,562	2,732	4.2%	3.3%	5.0%
AREA 02	3,056	1,082	1,974	3.5%	2.7%	4.2%
AREA 03	4,101	1,509	2,593	3.7%	2.9%	4.5%
AREA 04	4,850	1,887	2,963	4.4%	3.6%	5.1%
AREA 05	3,318	1,297	2,022	3.5%	2.8%	4.2%
KILDARE	4,081	1,725	2,356	3.1%	2.6%	3.6%
LAOIS/OFFALY	4,192	1,757	2,435	4.7%	3.8%	5.5%
LONGFORD/WESTMEATH	3,446	1,400	2,046	4.5%	3.7%	5.4%
WICKLOW	3,161	1,257	1,904	4.2%	3.4%	5.0%
DUBLIN NORTH EAST						
AREA 06	4,750	1,791	2,960	3.9%	3.0%	4.6%
AREA 07	4,596	1,689	2,907	4.5%	3.4%	5.4%
AREA 08	5,785	2,339	3,446	3.7%	3.1%	4.3%
CAVAN/MONAGHAN	3,892	1,615	2,277	4.8%	3.9%	5.8%
LOUTH	3,584	1,418	2,166	4.7%	3.8%	5.6%
MEATH	3,414	1,417	1,997	3.5%	2.9%	4.1%
CARLOW/KILKENNY	4,222	1,764	2,458	4.5%	3.7%	5.3%
SOUTHERN						
KERRY	5,282	2,167	3,115	5.2%	4.2%	6.1%
NORTH CORK	2,671	1,073	1,598	4.8%	3.8%	5.7%
NORTH LEE	4,651	1,891	2,759	4.1%	3.4%	4.8%
SOUTH LEE	5,133	1,991	3,142	3.9%	3.1%	4.5%
TIPPERARY (S.R.)	3,008	1,235	1,773	5.1%	4.1%	6.0%
WATERFORD	3,643	1,481	2,163	4.7%	3.9%	5.6%
WEST CORK	1,865	770	1,095	4.8%	3.9%	5.8%
WEXFORD	4,216	1,736	2,480	4.9%	4.0%	5.7%
WESTERN						
CLARE	3,364	1,399	1,965	4.3%	3.6%	5.1%
DONEGAL	5,745	2,379	3,367	5.7%	4.7%	6.7%
GALWAY	6,793	2,807	3,986	4.3%	3.6%	5.0%
LIMERICK	5,664	2,285	3,379	4.2%	3.4%	5.0%
MAYO	4,763	1,937	2,826	5.4%	4.4%	6.4%
ROSCOMMON	2,010	833	1,176	4.9%	4.0%	5.9%
SLIGO/LEITRIM	3,247	1,330	1,917	5.1%	4.2%	6.0%
TIPPERARY (N.R.)	2,172	887	1,286	4.7%	3.8%	5.7%

Table 14: Estimates of the population prevalence of Type 1 diabetes in the Republic of Ireland, by Local Health Office Area and age group

Area	Type 1 (0-19 years)						Type 1 (20+ years)					
	Estimated Number			Estimated Prevalence			Estimated Number			Estimated Prevalence		
	Person	Male	Female	Person	Male	Female	Person	Male	Female	Person	Male	Female
REPUBLIC OF IRELAND	2,229	1,105	1,124	0.2%	0.2%	0.2%	12,011	7,088	4,923	0.4%	0.5%	0.3%
DUBLIN MID LEINSTER	631	311	320	0.2%	0.2%	0.2%	3,572	2,079	1,493	0.4%	0.5%	0.3%
DUBLIN NORTH EAST	540	268	272	0.2%	0.2%	0.2%	2,970	1,746	1,224	0.4%	0.5%	0.3%
SOUTHERN	501	248	253	0.2%	0.2%	0.2%	2,663	1,586	1,077	0.4%	0.5%	0.3%
WESTERN	557	277	279	0.2%	0.2%	0.2%	2,805	1,677	1,128	0.4%	0.5%	0.3%
DUBLIN MID LEINSTER												
AREA 01	67	33	34	0.2%	0.2%	0.2%	394	222	172	0.4%	0.5%	0.3%
AREA 02	49	23	25	0.2%	0.2%	0.2%	344	193	150	0.4%	0.5%	0.3%
AREA 03	55	27	29	0.2%	0.2%	0.2%	452	258	194	0.4%	0.5%	0.3%
AREA 04	85	42	44	0.2%	0.2%	0.2%	445	255	191	0.4%	0.5%	0.3%
AREA 05	74	36	38	0.2%	0.2%	0.2%	400	233	167	0.4%	0.5%	0.3%
KILDARE	107	53	54	0.2%	0.2%	0.2%	561	335	226	0.4%	0.5%	0.3%
LAOIS/OFFALY	74	37	37	0.2%	0.2%	0.2%	364	221	143	0.4%	0.5%	0.3%
LONGFORD/WESTMEATH	62	31	31	0.2%	0.2%	0.2%	305	183	122	0.4%	0.5%	0.3%
WICKLOW	58	29	29	0.2%	0.2%	0.2%	306	179	127	0.4%	0.5%	0.3%
DUBLIN NORTH EAST												
AREA 06	84	41	42	0.2%	0.2%	0.2%	510	293	217	0.4%	0.5%	0.3%
AREA 07	57	28	29	0.2%	0.2%	0.2%	404	231	173	0.4%	0.5%	0.3%
AREA 08	116	58	58	0.2%	0.2%	0.2%	635	368	267	0.4%	0.5%	0.3%
CAVAN/MONAGHAN	67	33	34	0.2%	0.2%	0.2%	319	195	124	0.4%	0.5%	0.3%
LOUTH	59	29	30	0.2%	0.2%	0.2%	309	182	127	0.4%	0.5%	0.3%
MEATH	80	40	40	0.2%	0.2%	0.2%	414	248	165	0.4%	0.5%	0.3%
CARLOW/KILKENNY	76	38	38	0.2%	0.2%	0.2%	380	228	151	0.4%	0.5%	0.3%
SOUTHERN												
KERRY	74	36	37	0.2%	0.2%	0.2%	401	243	159	0.4%	0.5%	0.3%
NORTH CORK	42	21	21	0.2%	0.2%	0.2%	221	135	86	0.4%	0.5%	0.3%
NORTH LEE	85	42	43	0.2%	0.2%	0.2%	465	276	189	0.4%	0.5%	0.3%
SOUTH LEE	99	48	50	0.2%	0.2%	0.2%	536	310	227	0.4%	0.5%	0.3%
TIPPERARY (S.R.)	47	24	23	0.2%	0.2%	0.2%	235	142	93	0.4%	0.5%	0.3%
WATERFORD	58	29	30	0.2%	0.2%	0.2%	306	182	124	0.4%	0.5%	0.3%
WEST CORK	28	14	14	0.2%	0.2%	0.2%	149	91	58	0.4%	0.5%	0.3%
WEXFORD	68	34	34	0.2%	0.2%	0.2%	348	207	141	0.4%	0.5%	0.3%
WESTERN												
CLARE	58	29	29	0.2%	0.2%	0.2%	313	188	125	0.4%	0.5%	0.3%
DONEGAL	85	43	42	0.2%	0.2%	0.2%	396	236	160	0.4%	0.5%	0.3%
GALWAY	123	61	63	0.2%	0.2%	0.2%	633	373	260	0.4%	0.5%	0.3%
LIMERICK	103	51	52	0.2%	0.2%	0.2%	534	317	217	0.4%	0.5%	0.3%
MAYO	71	36	35	0.2%	0.2%	0.2%	342	207	135	0.4%	0.5%	0.3%
ROSCOMMON	32	16	16	0.2%	0.2%	0.2%	157	98	60	0.4%	0.5%	0.3%
SLIGO/LEITRIM	49	24	25	0.2%	0.2%	0.2%	248	148	99	0.4%	0.5%	0.3%
TIPPERARY (N.R.)	36	18	18	0.2%	0.2%	0.2%	181	110	71	0.4%	0.5%	0.3%

5 The number of people with undiagnosed diabetes



5. The number of people with undiagnosed diabetes

5.1 Northern Ireland

The Quality and Outcomes Framework (QOF) is part of the new General Medical Services (nGMS) contract introduced on 1st April 2004 in Northern Ireland. As part of the framework, general practitioners provide information on the number of patients with conditions such as coronary heart disease, hypertension, asthma and diabetes.[24]

In Northern Ireland, it is possible to estimate the number of people who have undiagnosed diabetes by comparing the population estimates from the PBS Model and QOF data. The accuracy of the estimated percentage of cases that are undiagnosed is determined by:

- The true percentage of cases that are undiagnosed
- The accuracy of the population prevalence estimates from the PBS Model
- The accuracy of the QOF data.

Table 15 suggests that nearly a quarter (23.5%) of all cases of diabetes (Type 1 and Type 2 combined) in people aged 17 years and over in Northern Ireland are undiagnosed (15, 821 persons in total). The percentage of cases that are undiagnosed varies across Health Board Localities from 13.1% to 32.1%.

Caution is required when interpreting sub-national estimates:

- The comparison of QOF data and PBS estimates could be affected by cross boundry patient flows, the effects of which are likely to be strongest in urban areas
- The denominators in QOF and PBS differ because QOF populations are the combined registered populations of the general practices located in the Local Health and Social Care Groups while PBS populations are the resident population of the Health Board Localities.
- The adjustments for local socio-economic circumstances made in Phase II of the PBS Model can also play a role.

Both these effects can distort the socio-economic variation in the percentage of cases that are undiagnosed. For example; if residents from more deprived areas are most likely to attend general practices in more affluent areas, or the socio-economic gradient in diabetes risk is steeper in Northern Ireland than it is in the English NCASP/NDA Study that has been incorporated into the PBS Model, then this would lead to an overestimation of the percentage of cases undiagnosed in more affluent areas and an underestimation in more deprived areas. This could explain the surprisingly low percentage in North & West Belfast (a relatively deprived area) and the high percentage in North Down (a relatively affluent area).

Table 15: Percentage of diabetes (Type 1 and Type 2 combined) cases in Northern Ireland that are estimated to be undiagnosed

Area	QOF (17+ years)			PBS (17+ years)			
	Estimated number	GP List size	Estimated prevalence	Estimated number	Estimated prevalence	Estimated number of cases that are undiagnosed	Estimated percentage of cases that are undiagnosed
NORTHERN IRELAND	51,541	1,385,857	3.7%	67,362	5.1%	15,821	23.5%
EHSSB	21,093	560,652	3.8%	27,243	5.3%	6,150	22.6%
NHSSB	12,366	356,302	3.5%	16,585	5.0%	4,219	25.4%
SHSSB	9,599	253,172	3.8%	12,237	5.1%	2,638	21.6%
WHSSB	8,483	215,731	3.9%	11,155	5.2%	2,672	24.0%
EHSSB							
ARDS	2,249	64,826	3.5%	2,942	5.0%	693	23.6%
NORTH & WEST BELFAST	6,028	117,854	5.1%	6,958	6.4%	930	13.4%
SOUTH & EAST BELFAST	6,224	168,431	3.7%	7,888	5.1%	1,664	21.1%
NORTH DOWN	2,083	70,386	3.0%	3,059	4.9%	976	31.9%
DOWN	1,881	52,914	3.6%	2,421	4.8%	540	22.3%
LISBURN	2,628	86,241	3.0%	3,871	4.7%	1,243	32.1%
NHSSB							
ANTRIM & BALLYMENA	3,176	88,255	3.6%	4,055	4.8%	879	21.7%
CAUSEWAY	2,951	84,899	3.5%	4,149	5.3%	1,198	28.9%
EAST ANTRIM	4,252	127,492	3.3%	5,817	5.0%	1,565	26.9%
MID-ULSTER	1,987	55,656	3.6%	2,595	4.7%	608	23.4%
SHSSB							
ARMAGH & DUNGANNON	2,927	83,198	3.5%	3,940	5.0%	1,013	25.7%
CRAIGAVON & BANBRIDGE	4,024	99,021	4.1%	4,735	4.9%	711	15.0%
NEWRY & MOURNE	2,648	70,953	3.7%	3,542	5.3%	894	25.2%
WHSSB							
NORTHERN GROUP	4,707	118,928	4.0%	6,323	5.1%	1,616	25.6%
STRULE/ERNE GROUP	3,776	96,803	3.9%	4,807	5.2%	1,031	21.4%

QOF Data Source: Payment Calculation and Analysis System (PCAS) as at 31 March 2005, taking account of locally resolved adjustments up to 30 June 2005. Disease register size and prevalence figures are as at 14 February 2005.[25]

5.2 Republic of Ireland

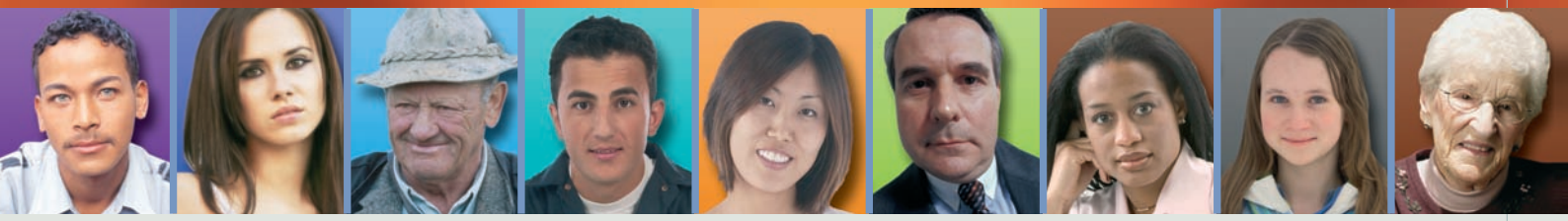
In the Republic of Ireland there are few studies of the percentage of cases that are diagnosed at either the national, regional or local level.

The Cork and Kerry Diabetes and Heart Disease Study was carried out in 1998 to estimate the prevalence of major cardiovascular risk factors, including Type 2 diabetes, amongst the general population of males and females aged 50-69 years. The research revealed that 3.9% of the sample had Type 2 diabetes and that of which 30% of these cases were undiagnosed.[17]

A study by Smith S. M. et al in 1997-98 looked at 41 general practices nationwide. The study found that the prevalence of diabetes in this general practice population, aged 40 years and over, was 9.2%. It concluded that 23.5% had been undiagnosed prior to study.[26]

Other small studies have been carried out. However, it is difficult to extrapolate the results from these studies to different areas of the Republic of Ireland.

6 Research and data



6. Research and data

6.1 The need for a systematic approach to monitoring population prevalence

Prior to this study, estimates of the population prevalence of diabetes were based on the application of international averages to resident population counts on the island, North and South, or extrapolation from local studies.

The existing estimates of population prevalence in Table 1 in Section 3.2 vary significantly because they are based on different international averages, different assumptions about the percentage of cases that are undiagnosed, and apply to different age groups. Often, when figures are quoted, these details have not been clearly stated.

6.2 The PBS Model

The PBS model provides a systematic approach with a clear methodology based on the use of rigorous population studies and resident population counts. It takes account of the way in which the risk of diabetes varies with sex, age, ethnicity and local socio-economic circumstances. As well as producing national estimates, the PBS Model can be used to estimate prevalence at sub-national level.

Recommendation 1:
Population prevalence estimation should be recognised as a key component of the information support needed for better prevention, care and monitoring of diabetes. A systematic approach to the development and use of population prevalence estimates, at the national and sub-national level, should be developed on the island. Further development of the PBS Model is recommended.

6.3 Diabetes registers

The PBS Model estimates the population prevalence of diabetes, whether it is diagnosed or not, in an area. Rather than make assumptions about the percentage of cases that are undiagnosed, these percentages are estimated by comparing PBS population estimates of the total number of cases (diagnosed and undiagnosed) to the number of cases that have been clinically diagnosed.

We were able to do this, to some extent, in Northern Ireland by using QOF data (see Section 5.1 for more details).

In the Republic of Ireland, no such data is available and while small studies have been carried out in parts of the country, it is not feasible to extrapolate their findings to the whole jurisdiction. The development of a national diabetes register has been recommended in *Diabetes: Prevention and Model for Patient Care*[4] as a key element of the information required for better diabetes care in the Republic of Ireland.

Recommendation 2:
Diabetes registers are key components of the information support needed for prevention, care and monitoring of diabetes. The Quality Outcomes Framework data collection could form the basis of a register in Northern Ireland if it included adequate information about patients to allow area-based clinical diagnosis rates to be calculated. The recent Department of Health and Children report entitled, *Diabetes: Prevention and Model for Patient Care*[4], recommended that a national diabetes register be established in the Republic of Ireland. The establishment of national diabetes registers on the island, North and South, is strongly recommended.

6.4 Socio-economic differences in diabetes prevalence

The adjustment for local socio-economic circumstances incorporated into the PBS Model is based on estimates of the risk of diabetes for each of the quintiles of the small area deprivation scores in the Republic of Ireland and Northern Ireland.

No local studies were able to provide the necessary risk estimates in the Republic of Ireland. An attempt to estimate these risks using QOF data provided by general practitioners in Northern Ireland proved unsuccessful because there was inadequate information about the residence of patients with diabetes.

Instead, the risk estimates from an NCASP/NDA study of diabetes in seven general practices in England already incorporated into Phase II of the model was used.[18]

Recommendation 3:
Diabetes registers, in Northern Ireland and the Republic of Ireland, should contain adequate information about the residence of patients to allow socio-economic variations in occurrence, treatment and outcomes of diabetes to be assessed.

6.5 Monitoring overweight/obesity

Overweight and obesity are major risk factors for Type 2 diabetes, and during this study it became apparent that existing data about overwight/obesity rates on the island of Ireland was inadequate. While English overweight/obesity data was used in the calculation of diabetes population prevalence estimates, it is unclear if it will continue to be appropriate.

Recommendation 4:
A comprehensive All-Ireland system for monitoring the prevalence of overweight/obesity, and the factors that influence it, should be established.

6.6 Ethnicity data in the Republic of Ireland

Ethnicity is one of the four characteristics used in the PBS Model to estimate the population prevalence of diabetes.

The necessary ethnicity data is available in Northern Ireland. In the Republic of Ireland, ethnicity data was not collected in any national census before 2006. We had to assume the residents of the Republic of Ireland all belonged to the "White" ethnic group.

In order to understand the impact of this assumption, a sensitivity analysis was carried out using Northern Ireland population data. The table below compares Northern Ireland population prevalence estimates (Type 1 and Type 2 combined) when ethnicity data is used and when it is ignored.

Adult diabetes prevalence estimates (Northern Ireland)

Area (LGDs)	Prevalence estimates (Type 1 and Type 2 combined)	
	Ethnicity data included	Ethnicity data ignored
Northern Ireland	5.4%	5.4%
Belfast	6.2%	6.1%
Coleraine	5.6%	5.6%
Craigavon	5.5%	5.5%
Derry	5.5%	5.5%

The table shows little impact on national prevalence estimates although there may be some minor distortion of the regional pattern in diabetes arising from the fact that people in ethnic minorities may tend to live in particular areas. The nature of the distortion may change over time as the size of the ethnic minority populations on the island of Ireland grow.

Recommendation 5:
Ethnicity must be taken into account when estimating the population prevalence of diabetes because of the higher occurrence of the condition in "Asian" and "Black" populations. The inclusion of ethnicity in the 2006 and each subsequent census in the Republic of Ireland is strongly supported.

6.7 Irish research

The limitations listed in Section 3.4 are a result of inadequacies in existing knowledge about diabetes on the island. Research is needed to address these inadequacies so that the PBS Model can be further developed and those developments properly validated.

Recommendation 6:
All-Ireland cross-sectional population studies should be undertaken to accurately estimate:

- Type 2 diabetes prevalence amongst children (0-19 years)
- Type 2 diabetes prevalence amongst adults (20+ years)
- the risks of diabetes associated with different socio-economic circumstances
- the percentage of diabetes cases that are undiagnosed.

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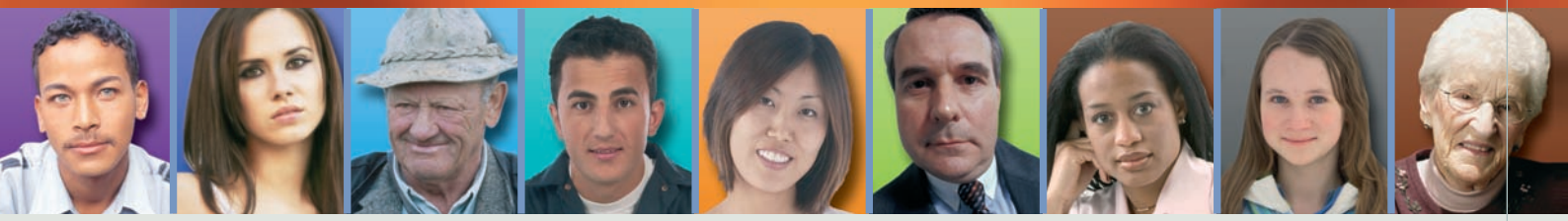

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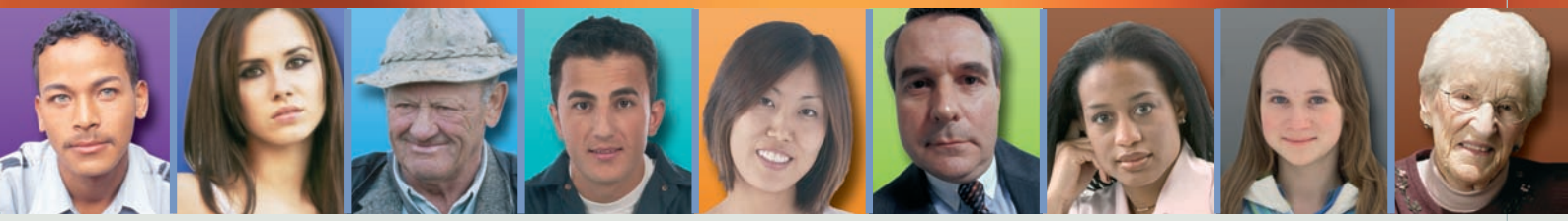
Appendices



Appendix 1:
Technical details of the PBS Model

1.1 Reference population studies used in the PBS model

Adult Type 2 diabetes

Coventry Diabetes Study ("White", "Asian" and "Other" ethnic groups) [27, 28]

The Type 2 diabetes reference population prevalence rates for "White", "Asian" and "Other" ethnic groups are based on those found in the "European White" and "South Asian" populations in the Coventry Diabetes Study. These rates include previously known cases of Type 2 diabetes, as well as new cases diagnosed using a two-stage case finding process based on OGTT and the WHO's 1985 diagnostic cut-off point. The same prevalence figures are used for Indian, Bangladeshi and Pakistani populations. More detailed ethnic groups estimates by age and sex were not available.

London-Brent Study & Coventry Diabetes Study ("Black" ethnic group) [29]

The Type 2 diabetes reference population prevalence rates for the "Black" ethnic group are those observed in the "European White" population in the Coventry Diabetes Study, multiplied by the age- and sex-specific diabetes risk ratios derived from a comparison of Black African-Caribbean and European white populations in the London (Brent) Study that was conducted in the early 1990s.

Type 1 diabetes

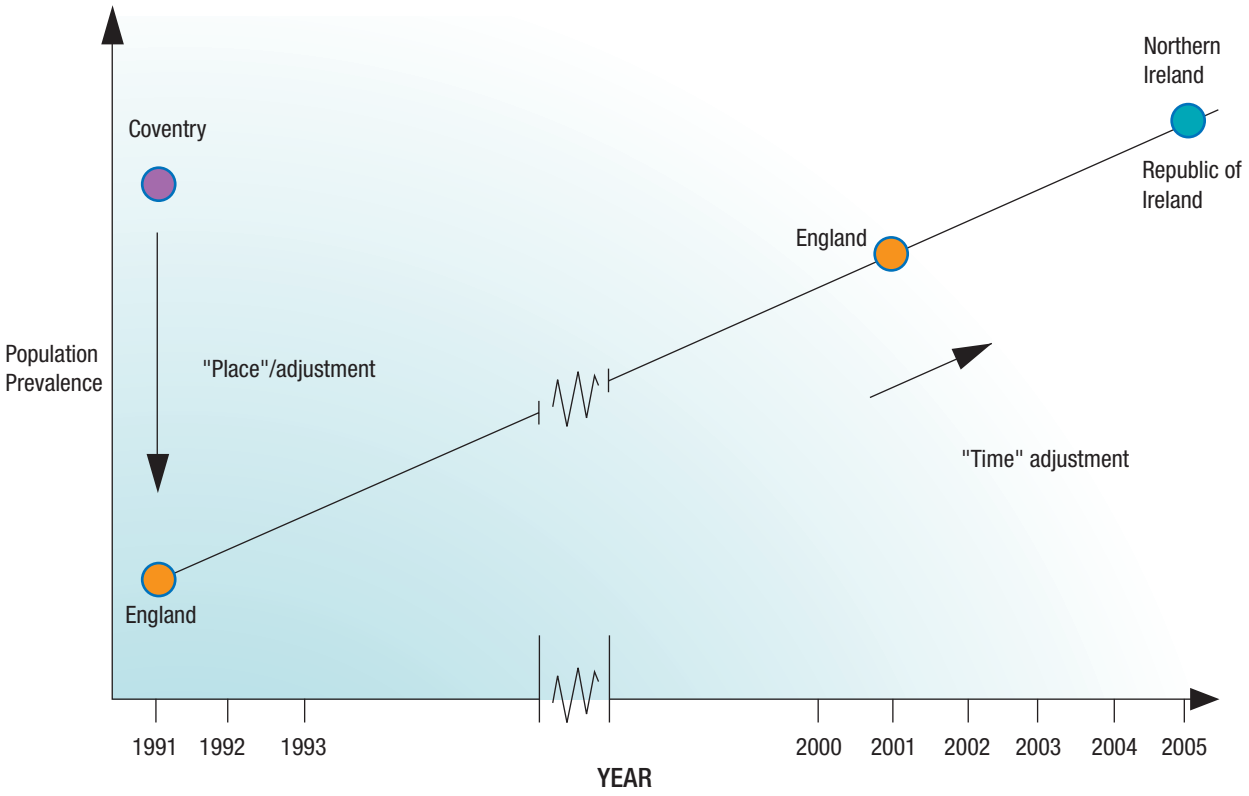
Welsh Study [30]

The Type 1 diabetes population reference prevalence rates are taken from a capture-recapture study carried out in Wales in 1998. The same age-, sex-specific reference rates are used for each ethnic group.

1.2 Adjustment for "place" and "time" (Type 2 diabetes)

To acount for differences in "place", Type 2 reference rates were downwardly adjusted because there were higher levels of obesity in Coventry than the rest of England. To adjust for changes over "time", these adjusted reference rates were then upwardly adjusted because overweight/obesity rates have increased since that study was conducted in 1986-1987. English trends in overweight/obesity were used to make both these adjustments (see Figure 7). In the original PBS Model, the "time" adjustment was made to 2001; in this study the adjustment was made to 2005 because further English obesity data were available.

Figure 7: "Place" and "Time" adjustments used in this study



1.3 Adjustment for local socio-economic circumstances (Type 2 diabetes)

In Phase II, the cases of Type 2 diabetes for each jurisdiction were redistributed so that the resultant sub-national variation in prevalence reflects sub-national variation in local socio-economic circumstances. This redistribution was achieved by applying an adjustment factor to Phase I prevalence estimates for each sub-national area used in this study – HSE regions and LHOAs in the Republic of Ireland, and HSSBs, LGDs and HBLs in Northern Ireland.

The calculation of the adjustment factors involved the following steps:

- Using census enumeration districts in the Republic of Ireland and Super Output Areas in Northern Ireland; the percentage of an area's population living in the first national deprivation quintile, the second quintile and so on were calculated
- The risks of Type 2 diabetes associated with each national deprivation quintile was taken from the English NCASP/NDA Study
- These risk estimates were applied to each area's deprivation profile to obtain the number of diabetes cases that would be expected
- The number of cases expected in an area divided by the number expected in the whole jurisdiction was taken as the adjustment factor for that area.

The NCASP/NDA Study was based on 57,853 persons with Type 2 diabetes across seven general practices in England. It was used because:

- it was one of the more recent studies (carried out in 2001) of those reviewed
- the diabetes prevalence rates are adjusted for age, sex and ethnicity
- its sample size is relatively large compared to the other studies
- the seven practices cover demographically different areas.[13]

No Northern Ireland or Republic of Ireland studies are available to estimate the risk of diabetes associated with each national deprivation quintile. The risk estimates based on the English NCASP/NDA Study may be different from those on the island of Ireland. Because there is no way of directly comparing the English and Irish risk estimates, the adjustment for local socio-economic circumstances could not be applied to national prevalence estimates.

Appendix 2: Effects of adjustments on population prevalence estimates (adult Type 2 diabetes)

The following tables show how the population prevalence estimates for adult Type 2 diabetes change as a result of the "place" and "time" adjustments, and the adjustment for local socio-economic circumstances.

Adult Type 2 diabetes population prevalence estimates, with different adjustments (Republic of Ireland – Local Health Office Areas)

Area	Prevalence estimates						
	Without any adjustments		Including place and time adjustments only		Adjustment factor for deprivation (%)	Including place, time and deprivation adjustments	
	Number	Prevalence	Number	Prevalence		Number	Prevalence
REPUBLIC OF IRELAND	109,782	3.7%	129,052	4.3%	100.0	129,052	4.3%
DUBLIN MID LEINSTER	29,935	3.4%	35,138	4.0%	98.6	34,663	4.0%
WESTERN	28,393	4.0%	33,421	4.7%	101.0	33,765	4.8%
LOUTH	2,716	3.6%	3,190	4.2%	112.3	3,584	4.7%
MEATH	3,232	3.3%	3,807	3.9%	89.7	3,414	3.5%
NORTH LEE	3,889	3.4%	4,576	4.0%	101.6	4,651	4.1%
SOUTH LEE	4,771	3.6%	5,599	4.2%	91.7	5,133	3.9%
TIPPERARY (S.R.)	2,417	4.1%	2,845	4.8%	105.7	3,008	5.1%
TIPPERARY (N.R.)	1,917	4.2%	2,256	4.9%	96.3	2,172	4.7%
CLARE	3,052	3.9%	3,595	4.6%	93.6	3,364	4.3%
DONEGAL	4,136	4.1%	4,870	4.8%	118.0	5,745	5.7%

Adult Type 2 diabetes population prevalence estimates, with different adjustments (Northern Ireland – Local Government Districts)

Area	Prevalence estimates						
	Without any adjustments		Including place and time adjustments only		Adjustment factor for deprivation (%)	Including place, time and deprivation adjustments	
	Number	Prevalence	Number	Prevalence		Number	Prevalence
NORTHERN IRELAND	53,121	4.3%	62,287	5.1%	100.0	62,287	5.1%
ARDS	2,594	4.6%	3,045	5.4%	89.2	2,714	4.8%
BELFAST	8,672	4.6%	10,122	5.1%	113.0	11,439	5.8%
COLERAINE	1,927	4.7%	2,258	5.5%	94.6	2,137	5.2%
COOKSTOWN	952	4.1%	1,118	4.8%	106.2	1,188	5.1%
BANBRIDGE	1,299	4.1%	1,526	4.8%	87.6	1,338	4.2%
NEWRY & MOURNE	2,521	4.0%	2,961	4.7%	110.7	3,277	5.3%
FERMANAGH	1,876	4.4%	2,206	5.2%	99.3	2,190	5.2%
STRABANE	1,112	4.1%	1,308	4.8%	123.7	1,617	6.0%

Adult Type 2 diabetes population prevalence estimates, with different adjustments (Northern Ireland – Health Board Localities)

Area	Prevalence estimates						
	Without any adjustments		Including place and time adjustments only		Adjustment factor for deprivation (%)	Including place, time and deprivation adjustments	
	Number	Prevalence	Number	Prevalence		Number	Prevalence
NORTHERN IRELAND	53,115	4.3%	62,280	5.1%	100.0	62,280	5.1%
NHSSB	13,837	4.4%	16,237	5.2%	94.1	15,285	4.8%
WHSSB	8,023	4.0%	9,429	4.7%	109.2	10,298	5.1%
NORTH & WEST BELFAST	4,456	4.4%	5,201	5.1%	125.9	6,549	6.4%
SOUTH & EAST BELFAST	6,603	4.5%	7,715	5.3%	94.7	7,305	5.0%
EAST ANTRIM	5,010	4.5%	5,878	5.3%	91.3	5,364	4.8%
CRAIGAVON & BANBRIDGE	3,816	4.2%	4,479	4.9%	97.2	4,354	4.8%
NEWRY & MOURNE	2,520	4.0%	2,960	4.7%	110.7	3,277	5.3%
NORTHERN GROUP	4,383	3.8%	5,149	4.5%	113.2	5,828	5.1%

After taking into account the effects of age, sex and ethnicity (Northern Ireland only), considerable adjustment was needed to account for local socio-economic circumstances. In some areas estimates were increased by up to a quarter because of local deprivation. In other areas, because of local affluence, estimates were reduced by around a tenth.

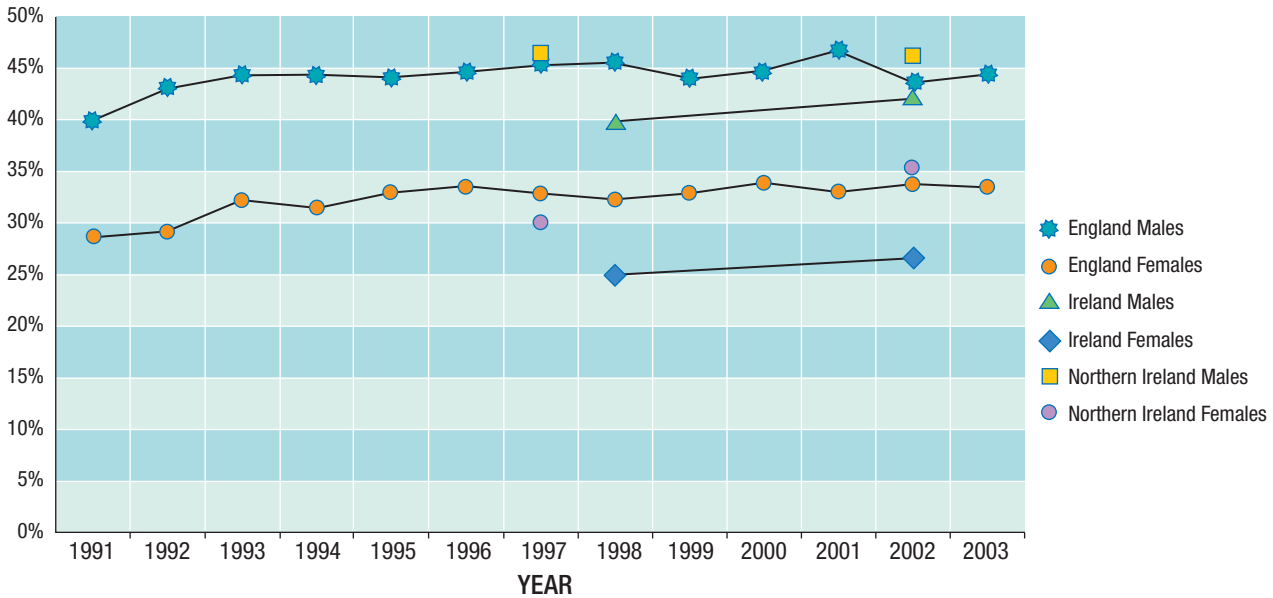
Appendix 3: Overweight/obesity rates in England, Northern Ireland and the Republic of Ireland

In England, the time adjustment accounted for the changes in diabetes between the time of the Coventry Diabetes Study (1986-89) and 2001. Obesity and overweight data from the Health Survey for England[21] from 1991 to 2001 was used to undertake this adjustment. When the PBS Model was applied to the island of Ireland, the Health Survey for England (2003) data was available and the time adjustment was extended to 2005.

Figures 8 and 9 present trends in overweight and obesity rates in England, Northern Ireland and the Republic of Ireland.

The Health Survey for England (HSE) combines personal questions and physical measurements, and has been conducted annually since 1991. The Survey of Lifestyle, Attitudes and Nutrition[20] (SLÁN) was carried out in the Republic of Ireland in 1996 and 2002. The survey comprises a self-completed questionnaire. In Northern Ireland The Health & Social Wellbeing survey[11] (HSW) was carried out in 1997 and consisted of a personal interview as well as physical appraisals by a nurse. The survey was again carried out in 2005 but these results are not yet available. The second survey in Northern Ireland is the Health and Lifestyle Survey[31] (HALS) carried out in 2002 by the Health Promotion Agency for Northern Ireland (HPA). The methodology of the HALS is very similar to the SLÁN survey in the Republic of Ireland.

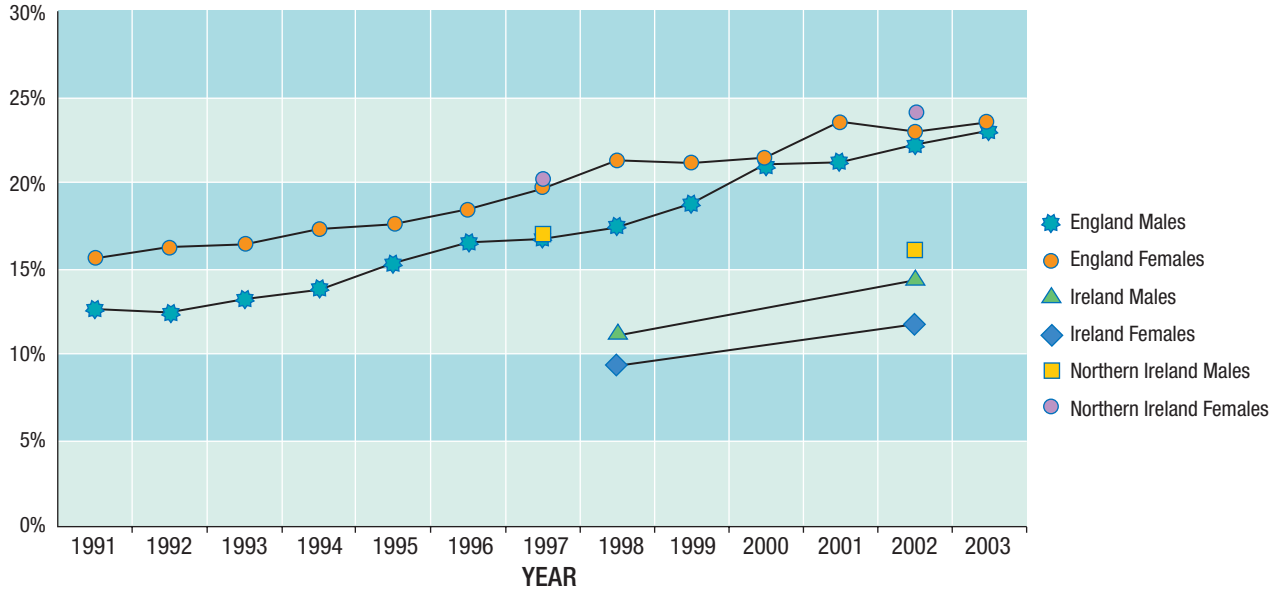
Figure 8: Overweight rates in England, Northern Ireland and the Republic of Ireland*



* Note that 1997 and 2002 data for Northern Ireland are based on different survey methodologies.

Figure 8 shows that, in all three jurisdictions, more males are reported as being more overweight than females. For both males and females, overweight rates in the Republic of Ireland are less than those in England or Northern Ireland.

Figure 9: Obesity rates in England, Northern Ireland and the Republic of Ireland*



* Note that 1997 and 2002 data for Northern Ireland are based on different survey methodologies.

In England and Northern Ireland, more females are reported to be more obese than males; the opposite is reported in the Republic of Ireland. For both males and females, obesity rates in the Republic of Ireland are less than those in England or Northern Ireland.

Care is needed when comparing and interpreting overweight/obesity rates from these surveys since the HSE and HSW are based on personal interviews, while HALS and SLÁN are based on self-completed postal questionnaires.

Since SLÁN and HALS have very similar methodologies, a comparison can be made between the two sets of data for 2002. More males in Northern Ireland are reported to be more obese than males in the Republic of Ireland (16% and 14% respectively). More Northern Ireland females are reported to be more obese than females in the Republic of Ireland (24% and 12% respectively).

The North/South Ireland Food Consumption survey, carried out between 1997-99, investigated such things as lifestyle, food and health attitudes in a representative sample of 1379 persons aged between 18 and 64 years from across the island. The survey found that more males on the island were more obese than females (20% and 16% respectively), and more males on the island were overweight than females (46% and 33% respectively).[32]

Appendix 4: Demographic Comparison of England, Northern Ireland and the Republic Of Ireland.

In Northern Ireland and England, 51.3% of the population is female. The percentage in the Republic of Ireland is slightly lower at 50.3%.

Figure 10 below shows that England has the oldest population with 20.8% aged 60 years and over, and 37.7% aged 0-29 years. The Republic of Ireland has the youngest population with 15.1% aged 60 years and over, and 45.5% aged 0-29 years. In a sense, Northern Ireland lies between these two.

Figure 10: Comparison of the age profiles of England, Northern Ireland and the Republic of Ireland

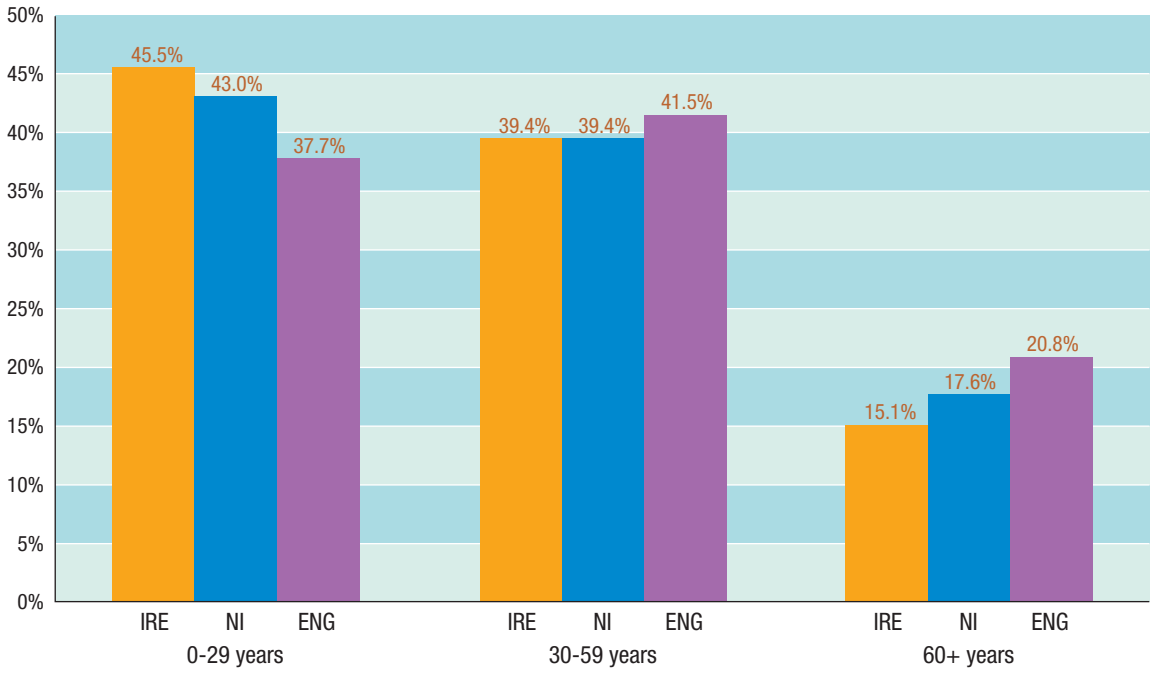
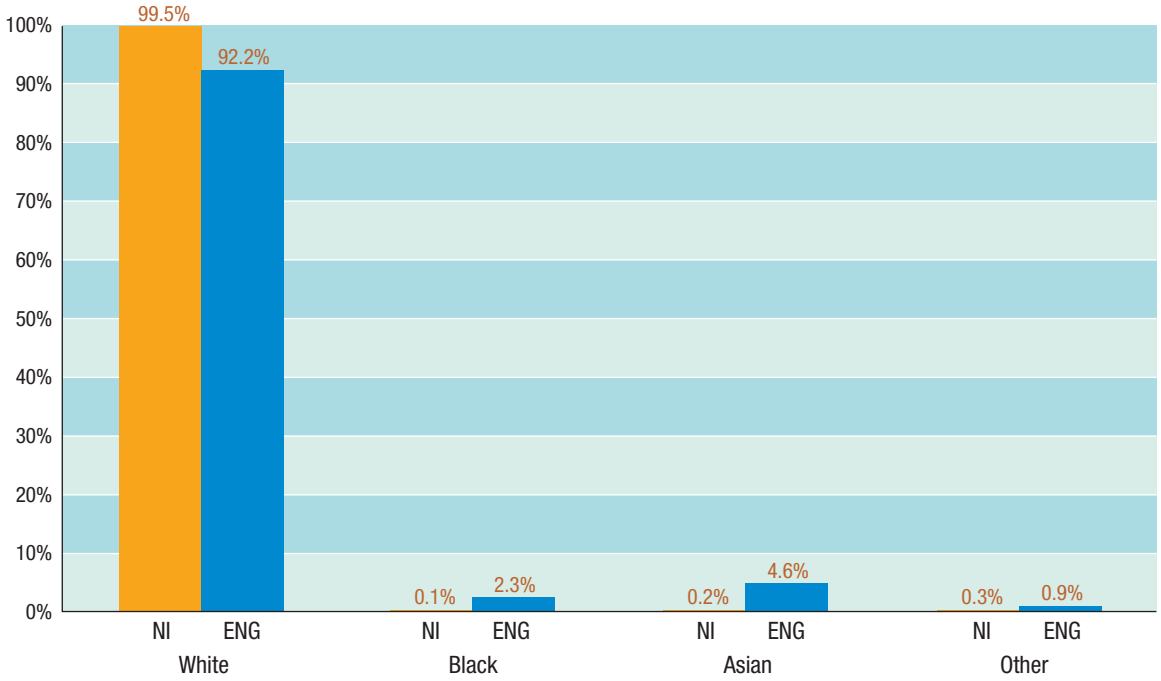


Figure 11 below shows that there are relatively more persons from "Asian" and "Black" ethnic backgrounds in England than there are in Northern Ireland. The definitions of the ethnic groups are given in Table 4 of Section 3.3.

No ethnic data was collected in the census carried out in the Republic of Ireland in 2002.

Figure 11: Comparison of the ethnicity profiles of Northern Ireland and England



The three main groups at highest risk of developing diabetes are females, those over 60 years of age, and those of "Asian" ethnic background. England has the oldest population and the Republic of Ireland has the youngest population. Therefore one would expect a higher estimated population prevalence of diabetes in England.

England has a greater percentage of persons with non-white ethnic backgrounds than does Northern Ireland. Therefore one would expect a higher estimated population prevalence of diabetes in England than in Northern Ireland.

Appendix 5: Diagnostic Criteria for Diabetes

5.1 Diabetes

The Coventry Diabetes Study used the 1985 WHO criteria for the diagnosis of diabetes based on a fasting glucose value more than 7.8 mmol/l, a 75g OGTT and a two hour glucose value more than 11.1 mmol/l.

In 1999 the WHO updated its diagnostic criteria so that diabetes can be diagnosed if a person meets any of the following criteria:

- Random glucose more than 11.1 mmol/l with osmotic symptoms (polyuria, polydipsia, etc)
- Fasting plasma glucose more than 7.0mmol/l on two consecutive occasions
- Two hour glucose value on a 75g OGTT more than 11.1 mmol/l

As a result a wider range of patients with differing degrees of insulin resistance and insulin secretion can be diagnosed with diabetes.

The American Diabetes Association in 1997 stated that the diagnosis of diabetes should be based on a fasting glucose more than 7.0mmol/l.

5.2 Pre-diabetes

There is now a term used called pre-diabetes. This term encompasses both impaired fasting glucose (IFG) and impaired glucose tolerance (IGT). These patients are at risk of developing Type 2 diabetes: approximately 50% will develop diabetes within 5 years.[13]

IFG is defined as raised fasting levels of glucose. A result more than 7.8 mmol/l and less than 11.1 mmol/l indicates that a person does not have diabetes but does have IGT. The definition of IFG has been challenged recently. Up to 2004 it was a fasting glucose of between 6.1-6.9 mmol/l and a two hour glucose value of less than 7.8 mmol/l. Recently the ADA has changed the diagnostic criteria by lowering the fasting level to a fasting glucose of between 5.6-6.9 mmol/l.

IGT is defined as higher than normal blood glucose levels yet below the level of a person with diabetes two hours after a 75g oral glucose load.

Both IFG and IGT would appear to carry the same risk for developing diabetes but IGT is more closely associated with cardiovascular disease than IFG.

Appendix 6: Membership of the Irish Diabetes Prevalence Working Group

Name	Organisation
Brew Atkinson	Northern Ireland Consultant Group in Endocrinology and Diabetes
Naresh Chada	Department of Health, Social Services and Public Safety
Anna Clarke	Diabetes Federation of Ireland
John Devlin	Department of Health and Children
Jayne Hillis	Diabetes UK (Northern Ireland)
Angela Jordan	Eastern Health and Social Services Board
Eleanor McArdle	HSE North Western Area
David Merrick	Yorkshire and Humber Public Health Observatory
Tom O'Dowd	Trinity College Dublin
Ivan Perry	University College Cork
Ann Shannon	HSE North Western Area
Diarmuid Smith	Irish Endocrine Society
David Stewart	Eastern Health and Social Services Board
Kevin P. Balanda (Chair)	Institute of Public Health in Ireland
Lorraine Fahy	Institute of Public Health in Ireland
Cynthia McMahon (Secretary)	Institute of Public Health in Ireland