Public Health Module

Venue

Duration - Date

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Unit: Public Health Aspects of Diabetes

Workbook

NAME: .....

ORGANISATION: .....

Written by Jessica Sherringham

Edited by Lorraine Williams and Fiona Sim

Public Health Aspects of Diabetes

CONTENTS

UNIT AIMS AND OBJECTIVES

Welcome to the unit on public health aspects of diabetes**.** Diabetes mellitus is a chronic disease resulting from inability to produce or reduced sensitivity to insulin. It can have serious health consequences, particularly due to cardiovascular diseases. This unit will focus on adults but will provide links to further reading about issues for children.

Aims:

This unit will:

- Explore how common diabetes is, including both the primary condition and related ill-health and the evidence of its impact on quality and length of life
- Familiarise students with the genetic, psycho-social, environmental and ethnic determinants/risk factors of diabetes
- Explore the efficacy of physical, clinical, psychological and social interventions for the prevention and management of diabetes

Objectives:

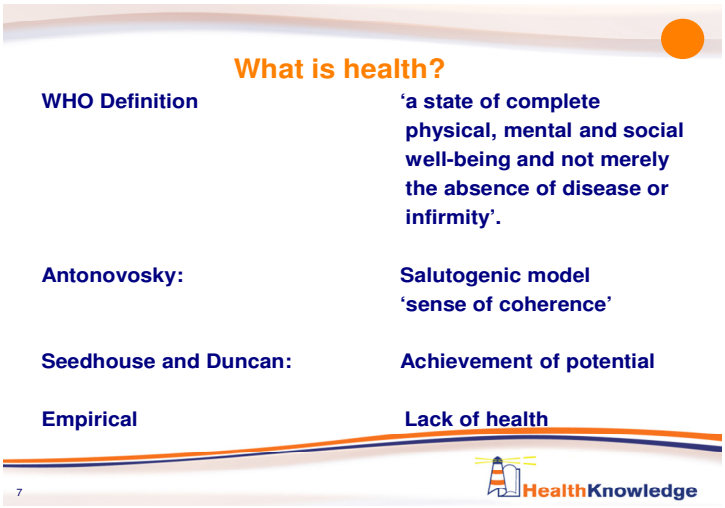
By the end of this unit participants will be:

- Aware of the WHO classification of diabetes and prevalence of different types (in different populations) including how data are collected and its limitations
- Aware of the impact of diabetes and its effect on quality of life
- Familiar with risk factors and symptoms of diabetes (e.g. waist/weight, ethnicity)
- Able to find, interpret and challenge the evidence for efficacy and ethical basis for (prevention) interventions at a population, community and individual level
- Able to find, interpret and challenge the evidence for interventions for effective management of diabetes

Note: If you already have substantial clinical knowledge of diabetes, you may want to take less time on Part 1, stopping to do the Exercise on page 30, and then focus on Part 2 of this Workbook. An introduction to what is public health is presented at the beginning of the unit. This introduction is common to all four units in the public health module (Child Health, Stroke, Coronary Heart Disease and Diabetes) and therefore can be skipped if required.

INTRODUCTION TO PUBLIC HEALTH

To understand public health it is worthwhile taking some time to consider the concept of health and its determinants[1].



What is health?

This is a difficult question and one that should be frequently pondered not least because there is no definitive answer, but we each have a way of defining it. From a biomedical perspective, health is defined as the absence of disease - the health of a society can be measured by the incidence and prevalence of disease. However the World Health Organisation (WHO) takes a more social perspective, defining health as a dynamic "state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"[2]. Each have their strengths and limitations.

The question of 'what is health' has been a challenge for contemporary philosophers[3] [4] [5]. Perhaps it is Antonovsky's Salutogenic model of health that poses the key questions

[1] The section is common to all units in the public health module and can be skipped if needed

[2] Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) and entered into force on 7 April 1948.

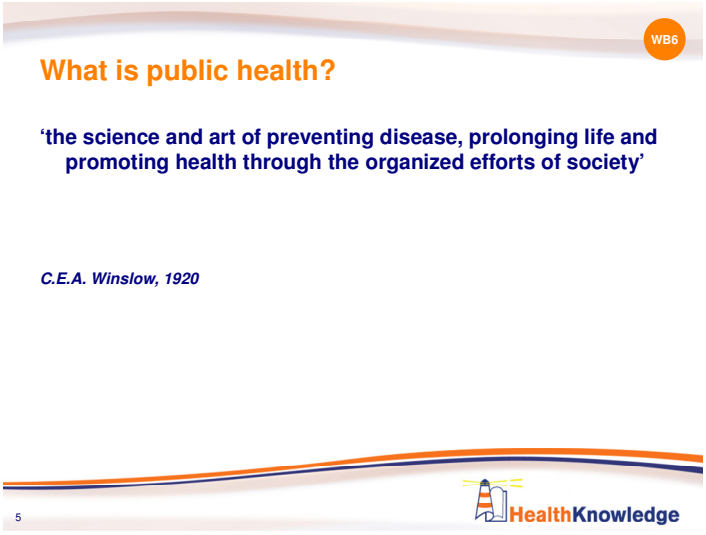
[3] Antonovsky A. The Salutogenic Model as a Theory to Guide Health Promotion. Health Promot Int 1996;11(1):11-8

and tries to explain using "the sense of coherence" framework. But Seedhouse and Duncan also suggest health is a value and concept, enabling us to achieve our potential. More empirical and objective ways of addressing what is health is associated with lack of health, being ill. For further information on issues around defining health see the sociological perspective of health and illness chapter in the Health Knowledge Textbook.

Subjective measures of health

Census data in 2001 asked those to respond if they were not in good health. About 9% of UK defined themselves as not in good health but this was as high as 18% of the population in one of the most deprived areas of UK and only 4% in one of the most affluent. Though subjective, this type of data informs planning and needs and ties in well with other epidemiological data demonstrating how life expectancy at birth varies within nations and between nations, with the poor, more deprived populations usually having a shorter life expectancy[6].

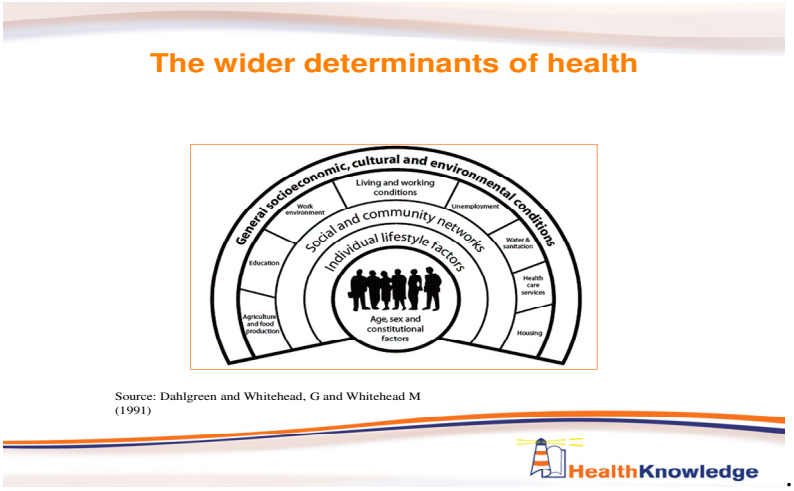
What is public health?



[4] Seedhouse D. Health Promotion: Philosophy, Prejudice and Practice. Chichester: Wiley; 1997
[5] Duncan Peter. Critical Perspectives on Health. Basingstoke: Pagrave Macmillan; 2007

[6] http://www.statistics.gov.uk/census2001/profiles/commentaries/health.asp.

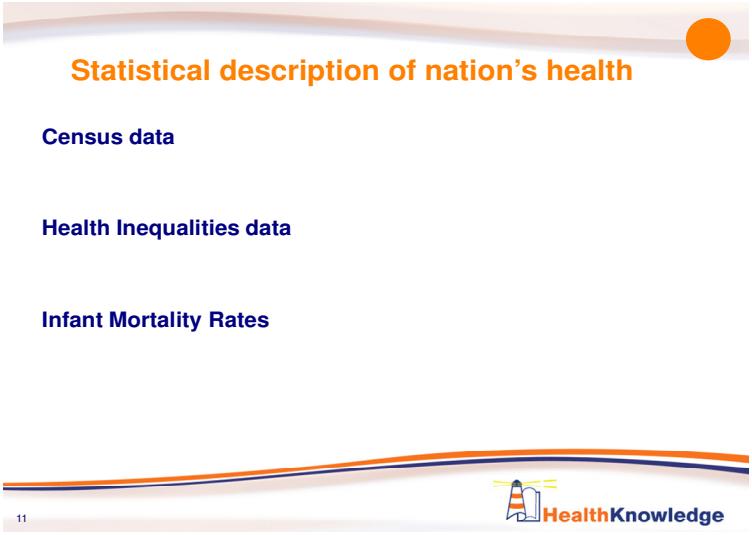
Public health is defined as *'the science and art of preventing disease, prolonging life and promoting health through the organized efforts of society'*[7]. It therefore deals with preventive rather than curative aspects of health and with population-level, rather than individual level health issues. It does this by using public health methodology of surveillance of disease cases and through promoting healthy behavior. Public health focuses on health's wider determinants and social inequalities:



…and faces some difficult challenges – particularly around health behaviour:

[7] C.E. A. Winslow, "The Untilled Fields of Public Health," Science, n.s. 51 (1920), p. 23

How is health measured?



Gradient of inequalities in health

Health can only be understood within the wider context in which it is shaped. Poverty is a key indicator of health outcomes but it should not be viewed as singularly causal. Social determinants play an important part in understanding the gradient of inequalities, as Michael Marmot points out: *"It shows that, among other things, the nature of children's upbringing, adults' workings lives, or older people's experiences of ageing are critically shaped by the quality of social relationships, access to particular material resources and services, and the nature of our neighborhoods and wider environments. It may be uncomfortable and complicated and suggest a lack of magic bullets (or pills) to cure all ills but reflects a complex reality in which many of our health risks reflect lifetime exposure to a range of tolerated hazards."*[8]

For further information on the Social Determinants of Health look at the World Health Organisation[9] and for world inequality statistics see Gapminder[10].

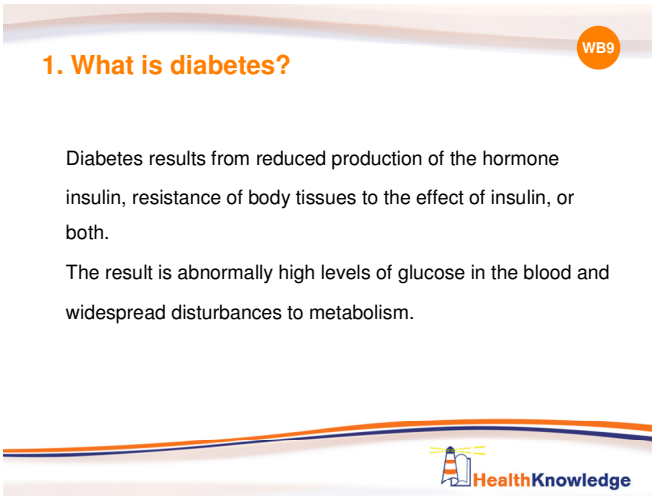
[8] http://www.hsj.co.uk/comment/opinion/michael-marmot-on-why-health-inequalities-matter/5000345.article

[9] http://www.who.int/social_determinants/en/index.html

[10] http://www.gapminder.org/

PART 1: DIABETES AS A PUBLIC HEALTH PRIORITY

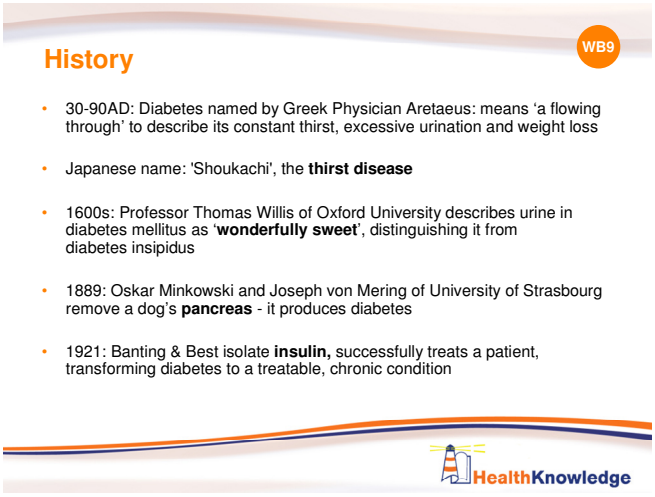
1. What is diabetes?



We now recognise diabetes mellitus as a chronic disease resulting from inability to produce or reduced sensitivity to insulin.

History

Our perceptions of diabetes have changed, since the condition was first recognised thousands of years ago[11] [12] [13].



[11] http://www.diabetes.ca/about-diabetes/what/history/

[12] http://www.diabetes.co.uk/diabetes-history.html

[13] McNalty, AS. 1964. History of Diabetes. BMJ.

The thirst disease?

The Greek Physician Aretaeus (30-90CE) gave diabetes its name, which means ‘a flowing through’ in recognition of the symptoms of constant thirst, excessive urination and loss of weight. Similarly before the 18th century the Japanese referred to diabetes mellitus as 'Shoukachi', the thirst disease.

A taste of honey?

In the 1600s, Professor Thomas Willis of Oxford University describes the ‘wonderfully sweet’ flavour of urine in diabetes mellitus, thus distinguishing it from diabetes insipidus (also characterised by excessive urination and thirst).

A disorder of the pancreas?

The link between diabetes and the function of the pancreas was illustrated by two scientists at the University of Strasbourg in 1889; Oskar Minkowski and Joseph von Mering removed a dog’s pancreas to demonstrate that it produces diabetes.

The role of insulin

The defining feature of diabetes, a problem with insulin production or sensitivity, was not recognised until the twentieth century; in 1921, Fredrick Banting isolated insulin. His discovery, that insulin extracts from animals can treat diabetes, transformed diabetes from a fatal sentence to a treatable, chronic condition.

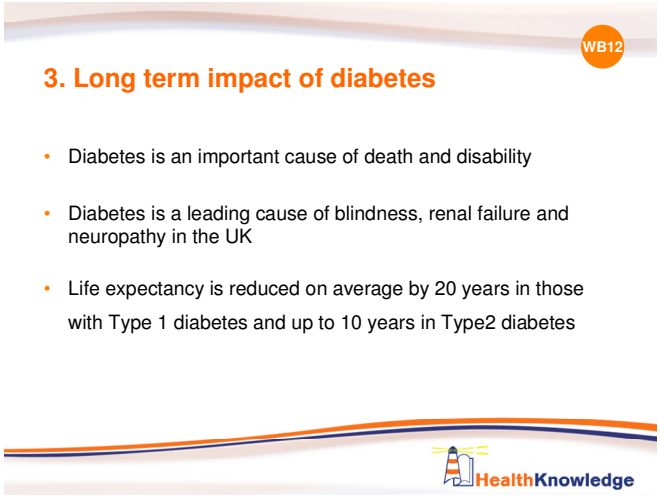
In the normal body, after a meal, our body breaks down carbohydrates in the stomach, releasing glucose into the blood. In the healthy body, the pancreas produces insulin to regulate glucose levels in the blood, which acts to:

- trigger the liver to store glucose as glycogen
- encourage cells in the rest of the body to take up glucose
- prevent cells from releasing protein and fat as energy

Diabetes – standard definition

Diabetes results from reduced production of the hormone insulin, resistance of body tissues to the effect of insulin, or both. The result is abnormally high levels of glucose (sugar) in the blood and widespread disturbances to metabolism[14].

Importance of diabetes:



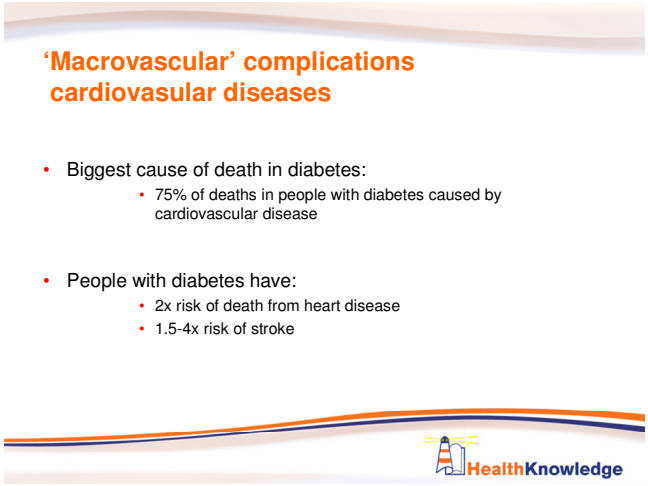
Diabetes is a major cause of death and disability.

Life expectancy is reduced on average by 20 years in those with Type 1 diabetes and up to 10 years in Type 2 diabetes.

[14] Definition taken from Scottish Public Health Observatory [http://www.scotpho.org.uk/home/Healthwell-beinganddisease/Diabetes/diabetes_intro.asp]

Common complications:

a) Macrovascular:

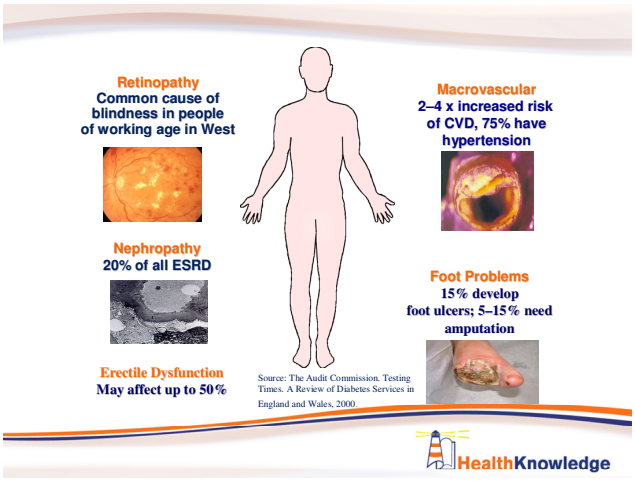


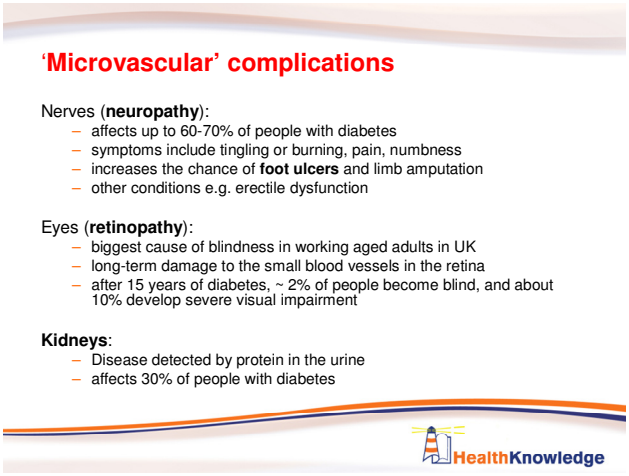
75% of deaths in people with diabetes are caused by cardiovascular disease

People with diabetes have:

- Twice the average risk of death from heart disease
- 1.5-4 times the average risk of stroke

b) Microvascular:





Nerves (neuropathy):

- affects up to 60-70% of people with diabetes
- symptoms include tingling or burning, pain, numbness
- increases the chance of **foot ulcers** and limb amputation
- other conditions e.g. erectile dysfunction

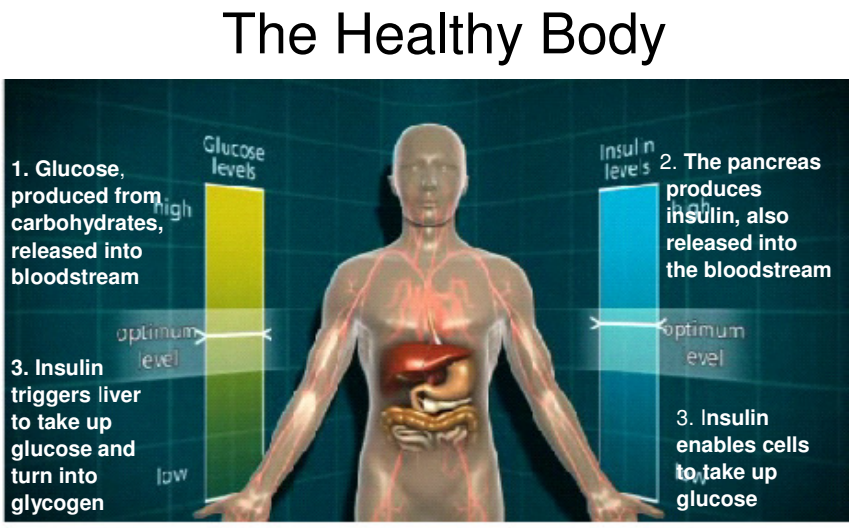
Eyes (retinopathy):

- biggest cause of blindness in working aged adults in UK
- long-term damage to the small blood vessels in the retina
- after 15 years of diabetes, ~ 2% of people become blind, and about 10% develop severe visual impairment

Kidneys (renal failure):

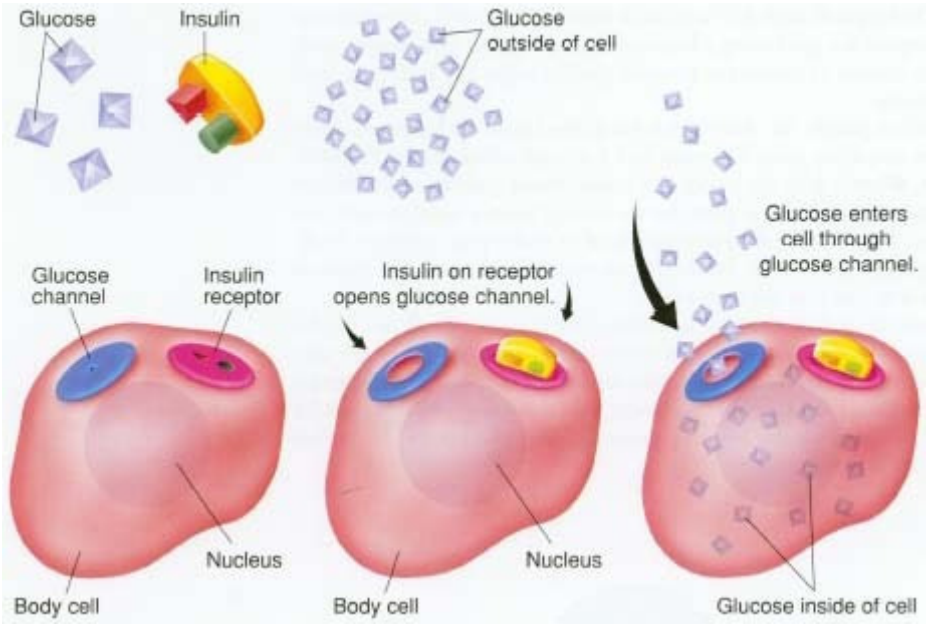
- disease detected by protein in the urine
- affects 30% of people with diabetes

Figure 1: diabetes and the body

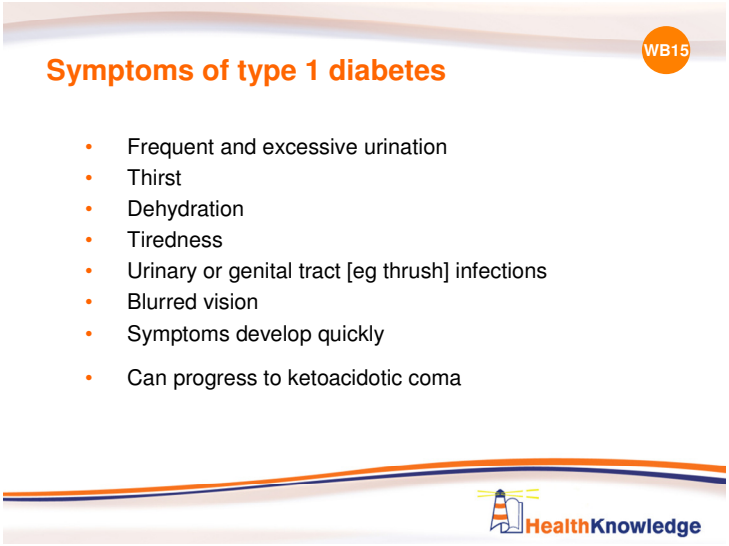


Source: Diabetes UK, Diabetes and the Body animation (www.diabetes.org.uk/Guide-to-diabetes/Introduction-to-diabetes/What_is_diabetes/Diabetes-and-the-body/)

Figure 2: Insulin (i) enables cells to take in glucose from the blood (g)



Signs and Symptoms



In diabetes, the production of insulin or the body's sensitivity to insulin is reduced. This results in too much glucose in the blood.

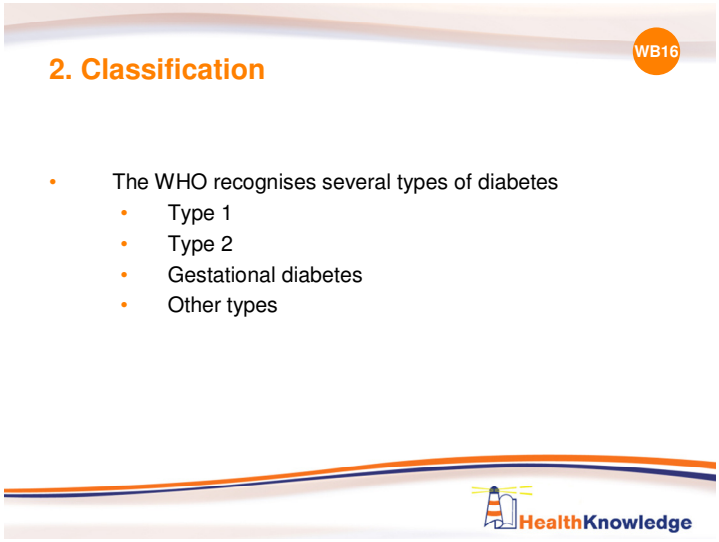
Some of the excess glucose is filtered out by the kidneys, causing them to excrete more salt and water, leading to **passing large amounts of urine**. As a result, people with diabetes can experience **thirst and dehydration**. This can also lead to dehydration of the lens in the eye, causing **blurred vision**.

Some of the excess glucose can also pass into the urine, giving it a sweet smell. The sugars in urine make it a fertile ground for bacteria to grow, which increases the risk of lower urinary or genital tract infections (such as **thrush**).

Because the glucose has not entered cells to be used for energy, people with diabetes can feel very **tired**. Also, cells are not prevented from releasing proteins and fats, diabetes can also lead to **weight loss**.

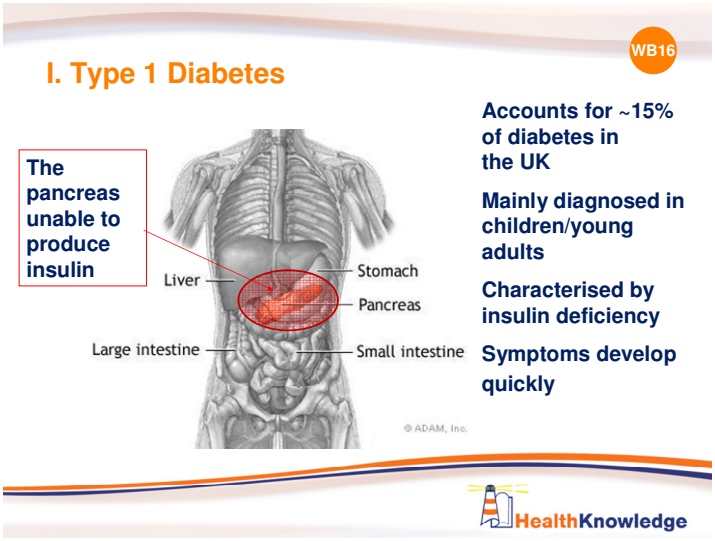
2. Classification of diabetes

The World Health Organisation recognises four distinct types of diabetes[15].



Type 1 diabetes

In **type 1 diabetes**, the pancreas is unable to produce insulin.

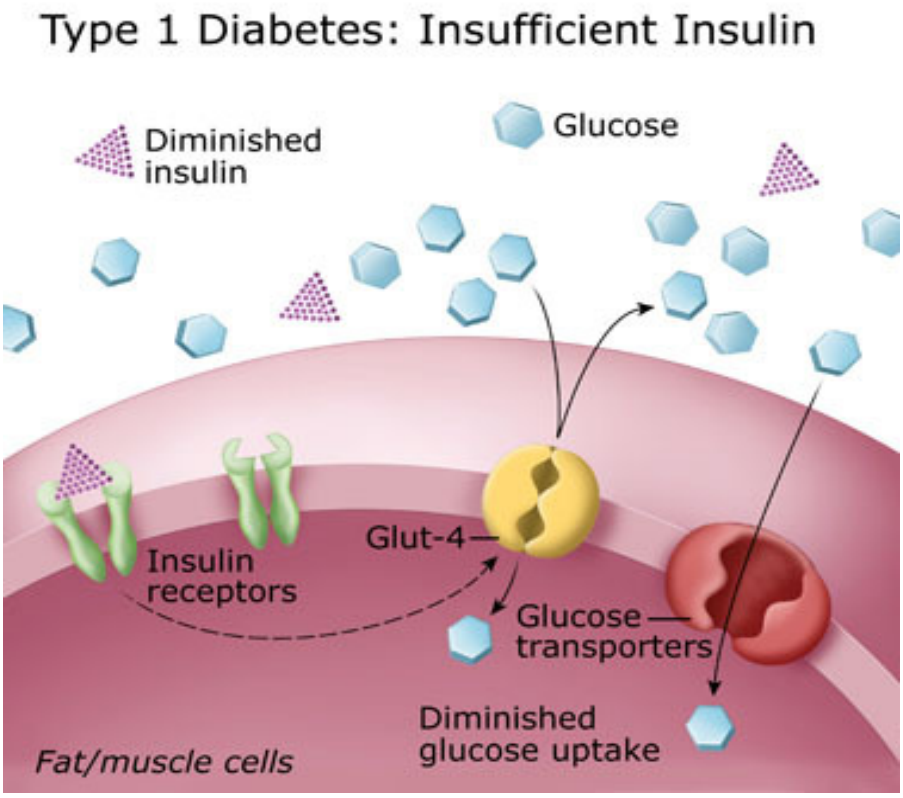


Symptoms usually develop quickly; if untreated, fats and protein build up in cells can cause people to enter a *ketoacidotic coma*, which requires urgent hospital treatment with

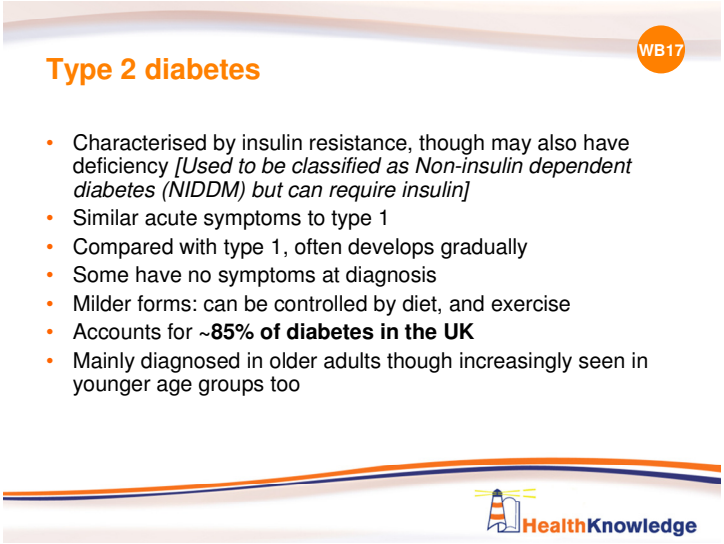
[15] WHO's classification recognises three key types, type 1, type 2 and gestational as well as a group of other disorders which are grouped under 'other'. WHO, Definition, diagnosis and classification of diabetes mellitus and its complications. Report of a WHO consultation, Part 1: Diagnosis and classification of diabetes mellitus, Geneva: WHO/NCD/NCS/99.2 http://whqlibdoc.who.int/hq/1999/WHO_NCD_NCS_99.2.pdf

insulin and fluids. People with severe type 1 diabetes require insulin treatment for survival. Type 1 accounts for around 15% of diabetes in the UK and is most commonly diagnosed in childhood.

Figure 3: In type 1 diabetes, cells are unable to take in glucose (g) without insulin



Type 2 diabetes



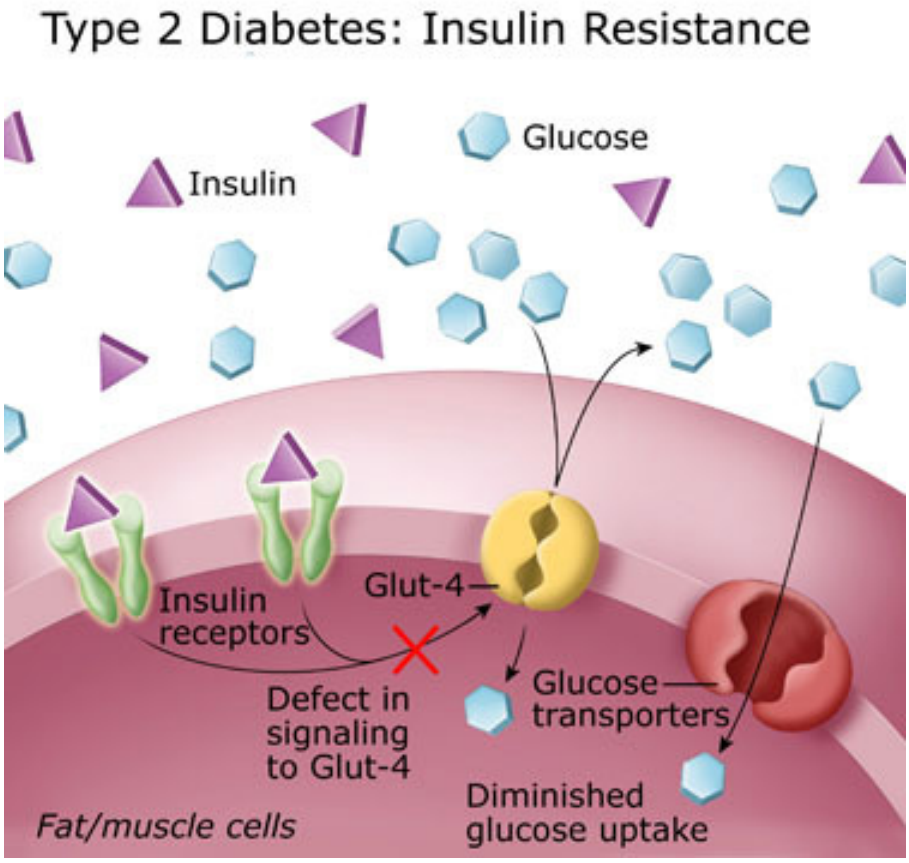
Type 2 diabetes is *the most common form* of diabetes mellitus and is characterised by *resistance to insulin*. In type 2 diabetes, the body can still produce insulin to varying extents. However, in most cases of type 2 diabetes, insulin can no longer work as effectively to allow glucose into cells because of fat deposits in the cells. So, glucose levels in the blood remain high. This triggers the pancreas to work even harder to produce more insulin to reduce glucose. Eventually the pancreas is unable to produce more insulin and stops working.

Many of the acute symptoms experienced by individuals with type 1 diabetes are common to type 2 diabetes. However, in contrast to type 1 diabetes, symptoms in type 2 diabetes generally develop gradually, sometimes over years. Symptoms of type 2 diabetes can vary; in very severe cases a build up of very high glucose levels can lead to coma (Diabetic Hyperosmolar Non-ketotic Syndrome – HONK, distinct from the comas due to ketoacidosis seen in type 1 diabetes). Conversely, some people with type 2 diabetes experience no symptoms at all, and therefore may be unaware they have the condition.

Type 2 diabetes accounts for 85% of people with diabetes in the UK[16]. It is most commonly diagnosed in adults. While many of the symptoms of type 1 and 2 diabetes are similar, the public health implications of these two types are very different; type 2 diabetes is the biggest priority for public health – it accounts for most of the diabetes in the UK, it is *largely preventable* but often remains undiagnosed.

[16] http://www.diabetes.org.uk/Guide-to-diabetes/Introduction-to-diabetes/What_is_diabetes/

Figure 4: In type 2 diabetes, fat deposits affect cells' insulin (i) sensitivity. They are less able to take in glucose (g)



Previously, type 1 and type 2 diabetes were distinguished by their dependence on insulin, with type 1 referred to as Insulin dependent diabetes mellitus (IDDM) and type 2 as non-Insulin dependent diabetes mellitus (NIDDM). However, this distinction is no longer seen as helpful, partly because it does not tell us anything about the causes of diabetes (which are quite distinct) and also because it can be confusing – some people with type 2 diabetes may require insulin.

Gestational diabetes

The WHO classification for gestational diabetes encompasses both diabetes mellitus and hyperglycaemia resulting from impaired glucose regulation that occurs during pregnancy. Gestational diabetes occurs in 3 – 5% of all pregnancies (around 1 in 20)[17]. NICE estimate that about 87.5% of pregnancies complicated by diabetes are due to gestational diabetes, with 7.5% being due to type 1 diabetes and the remaining 5% being due to type 2 diabetes. Gestational diabetes is often diagnosed in the second trimester of pregnancy. It may be due to the body's increased needs for insulin at this stage.

This unit will focus on types 1 and 2 diabetes, but it is important to be aware of gestational diabetes because it has health consequences for both the mother and the baby. Where blood glucose is not well controlled in pregnancy, the risks to individuals and to the population's health include:

- birth complications, leading to more caesarean sections, still births and perinatal deaths
- very high birthweight babies
- more birth defects
- obesity and diabetes in the child

[17] http://www.diabetes.co.uk/gestational-diabetes.html

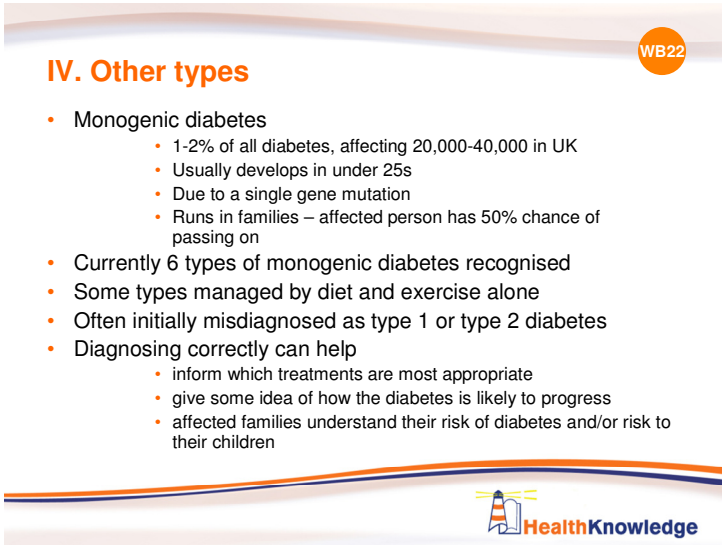
While glucose levels in most women with gestational diabetes return to normal after they have had their baby, they are at increased risk of type 2 diabetes in the longer term (30% as opposed to 10% in the general population)[18] and they have a higher risk that any future pregnancies may be complicated by diabetes.

For more information on gestational diabetes and its management, see:

- Diabetes UK - http://www.diabetes.org.uk/Guide-to-diabetes/Introduction-to-diabetes/What_is_diabetes/Gestational_diabetes/
- NICE diabetes and antenatal guidelines:
- http://www.nice.org.uk/nicemedia/pdf/DiabetesFullGuidelineRevisedJULY2008.pdf
- Antenatal care: routine care for the healthy pregnant woman, March2008: http://www.nice.org.uk/nicemedia/pdf/CG62FullGuidelineCorrectedJune2008July2009.pdf

[18] From Diabetes UK - http://www.diabetes.org.uk/

Other types of diabetes



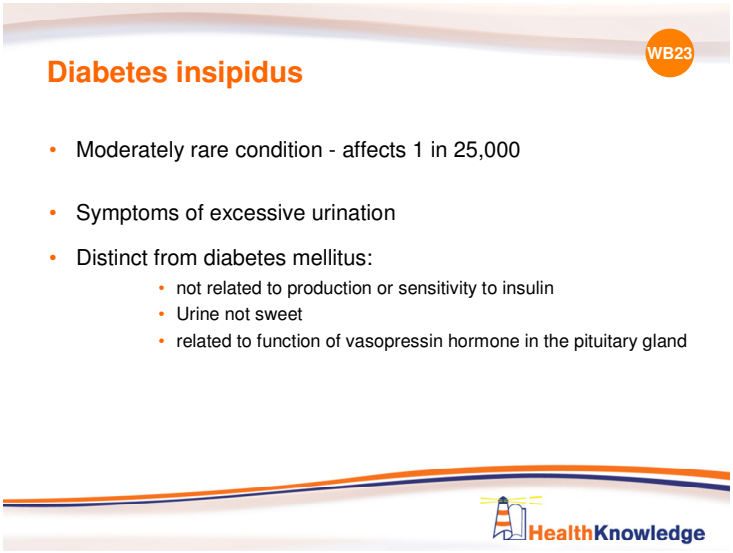
There are a range of other types of diabetes, some linked to genetic defects, some to problems in insulin secretion following infection, drugs or exposure to toxins. One of the genetic subtypes, **monogenic diabetes,** accounts for 1-2% of all diabetes, affecting about 20,000-40,000 people in the UK. These were formerly called Maturity Onset Diabetes in the Young (MODY) and they usually develop between the ages of 5 and 30 years. Monogenic diabetes are caused by a single gene mutation in one of 6 genes leading to defects in pancreatic beta cells. They are often initially misdiagnosed as type 1 or type 2 diabetes. Monogenic diabetes run in families - they are often *autosomal dominant* genetic traits, so only one parents needs the gene for it to be inherited.

Some types of monogenic diabetes are relatively mild and do not require insulin; some can be managed by diet and exercise alone. Diagnosing monogenic diabetes correctly can help to inform which treatments are most appropriate and can give some idea of how the diabetes is likely to progress. It can also help affected families to understand their risk of developing diabetes and/or of passing on these genes to their children.

For more information on types of monogenic diabetes, see:

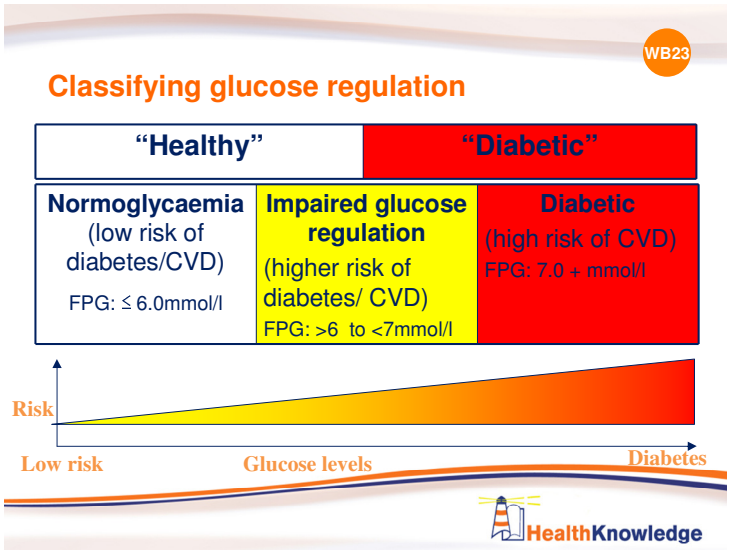
- National Support Team Monogenic Diabetes factsheet 2008 www.diabetes.nhs.uk
- Peninsula Medical School website, where a number of studies into monogenic diabetes are taking place: www.diabetesgenes.org

Diabetes insipidus



Diabetes insipidus is a rare condition with symptoms of excessive urination. Apart from its name and the symptoms of urination and thirst, it shares few other characteristics in common with diabetes mellitus; it is not related to production or sensitivity to insulin. This unit focuses on diabetes mellitus but for more information on diabetes insipidus, see www.pituitary.org.uk/content/view/70/81/.

Classification of diabetes, and impaired glucose regulation



The WHO recommends that diabetes is diagnosed using fasting plasma glucose levels of 7mmol/l or higher.

It can be easy to think of diabetes as a well defined condition, distinct from healthy glucose control. However, the World Health Organisation also recommends distinguishing between healthy levels of glucose associated with a low risk of CVD complications "normoglycaemia" and those with levels of glucose not high enough to diagnose diabetes but indicating impaired glucose regulation. Epidemiological studies indicate that individuals with these glucose levels are at increased risk of diabetes.

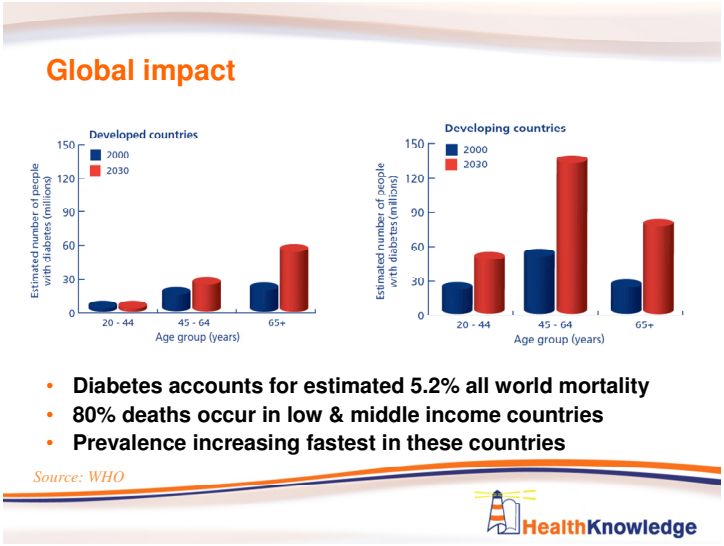
Diagnostic criteria	**Fasting plasma glucose levels**
Diabetes	≥ 7.0 mmol/l
Impaired glucose regulation	≥6.1 and <7.0mmol/l
'Normal'	≤ 6.0mmol/l

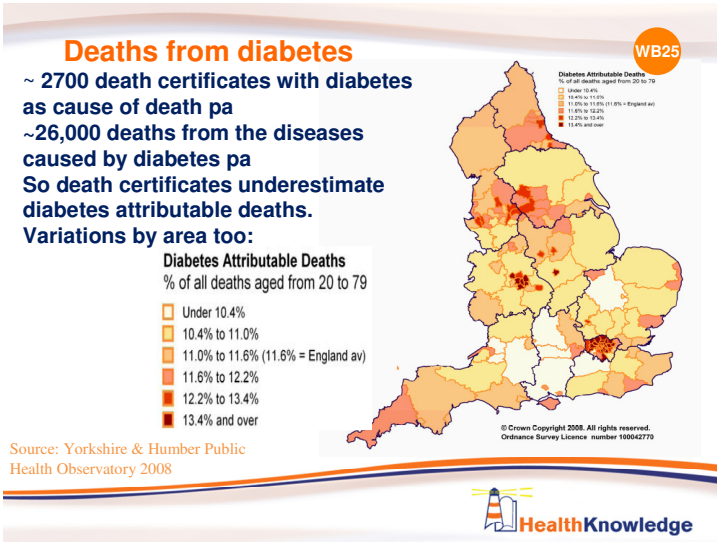
Source: Vascular risk handbook 2008. www.screening.nhs.uk/vascularrisk

These cut-off points to differentiate between diabetes, impaired glucose regulation and normal glycaemic control have been agreed to provide consistent standards in the management of diabetes. However, the WHO recognise that there are limitations in the cut-off points chosen to differentiate diabetes from non-diabetes. Ultimately we may consider glucose levels on a continuum of vascular risk, with diabetes at the high end of the continuum. On this continuum, impaired glucose regulation is usually divided into impaired fasting glucose and impaired glucose tolerance – please see the glossary for further information.

3. How common is diabetes?

Diabetes worldwide

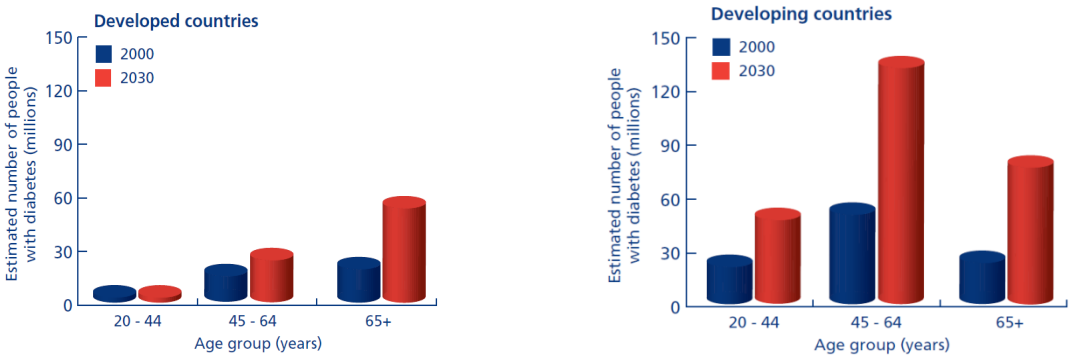




More than 180 million people worldwide have diabetes. While this module focuses on diabetes in England, it is important to recognise the burden of diabetes in developing and middle income countries. According to the WHO, almost 80% of diabetes deaths

occur in low and middle-income countries[19] and the prevalence in these countries is rising faster than in high income countries. The reasons are complex, but appear to be related to global adoption of 'Westernised' less active lifestyles and diet[20].

Fig 5: Graph of expected rise in diabetes worldwide[21]



In England, there are over 2 million people on GP diabetes registers. However, the government estimate that there may be over 400,000 people with undiagnosed diabetes in England, so information about diagnosed diabetes is likely to underestimate the true prevalence of diabetes.

Cost of diabetes

- Diabetes is a clinical area of high expenditure
  - eg in one year, October 2007 to September 2008, there were 31.9 million NHS items prescribed = £581.2 million
- ~ 5% of total NHS spend is used for the care of people with diabetes
- The growth in expenditure on prescribing for diabetes is greater than any other major clinical area

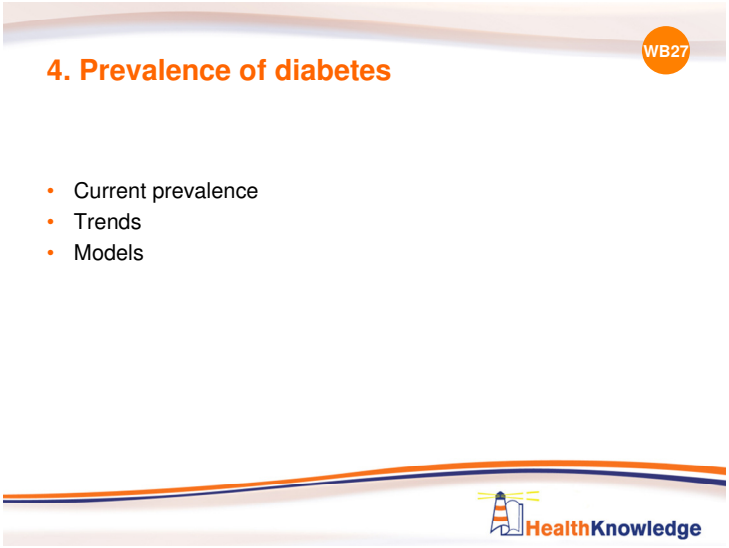
HealthKnowledge

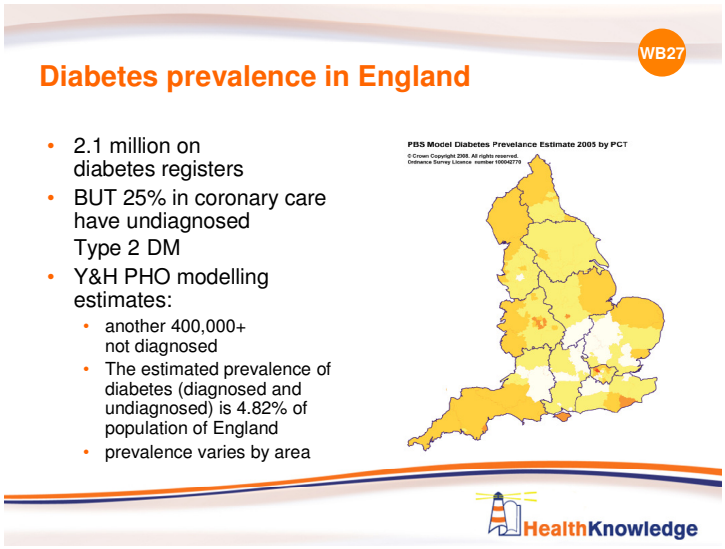
[19] http://www.who.int/mediacentre/factsheets/fs312/en/

[20] Hossain, P, Kawar, B, El Hahas, M, Obesity and Diabetes in the Developing World — A Growing Challenge *NEJM,* 356:213-215, 2007

[21] http://www.who.int/diabetes/actionnow/en/diabprev.pdf

Already, 5% of NHS expenditure is on the treatment of diabetes mellitus.

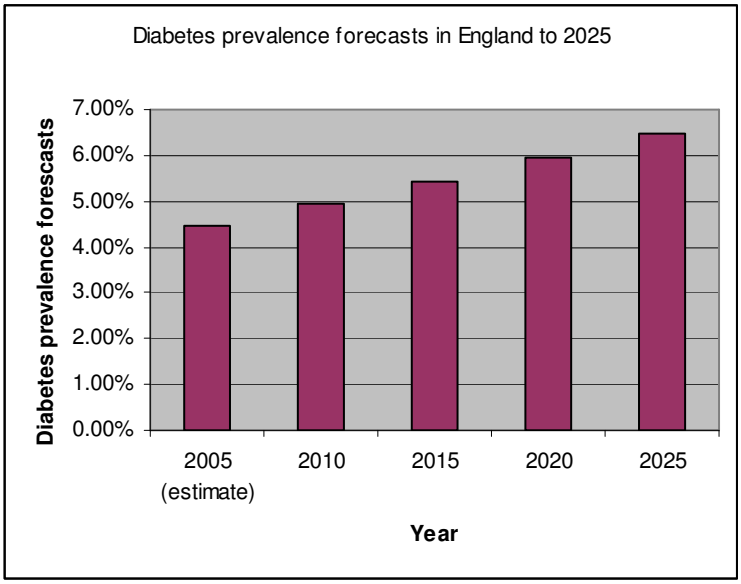




In order to estimate the prevalence of diagnosed and of undiagnosed diabetes, the Yorkshire and the Humber Public Health observatory have developed a model that generates expected total numbers of persons with Type 1 and Type 2 diabetes mellitus (diagnosed plus undiagnosed combined) in England as a whole and in local areas within England. They have used age/sex/ethnic group-specific estimates of diabetes prevalence rates, derived from epidemiological population studies as the basis of the model.

Using this model, YHPHO [22] estimates that just under 2.5 million have diabetes, accounting for 4-5% of the population. Total population prevalence has been rising and is expected to rise still further due to a) the increasing prevalence in obesity and b) to our ageing population, see graph below.

Fig 6: Graph of diabetes prevalence forcasts, England



Source: PBS model Phase 3 - http://www.yhpho.org.uk

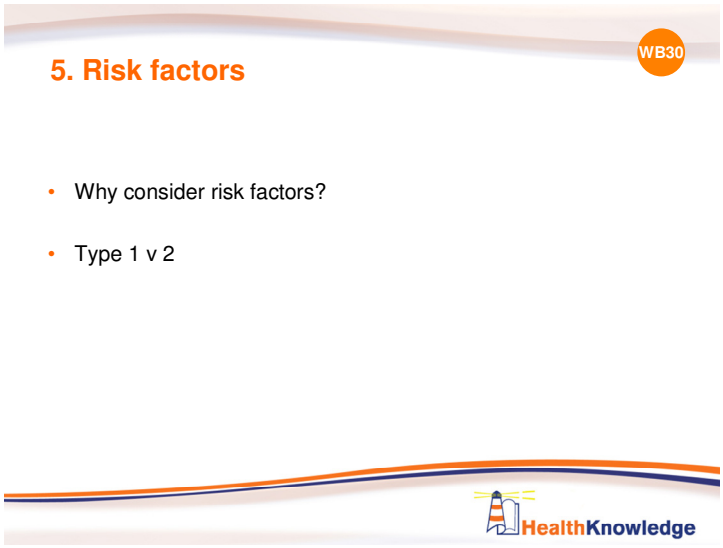
[22] http://www.york.ac.uk/yhpho/documents/pbsdpm/pbs%20phase%202/PBS%20FAQ%20-%20Phase2.pdf Yorkshire and Humber Public Health Observatory, National Diabetes Support Team. Diabetes in England. November 2008. www.diabetes.nhs.uk

Case study: Diabetes UK 'Silent Assassin'

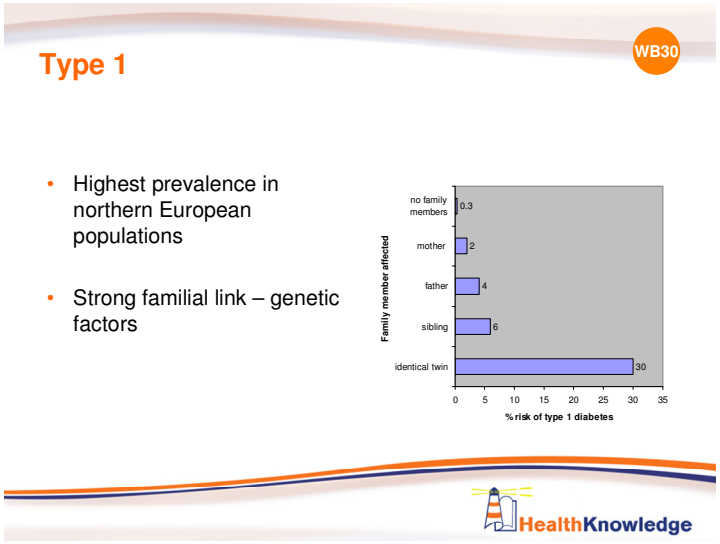
Diabetes UK launched their 'Silent Assassin' advertising campaign in October 2008 to increase awareness of diabetes. The campaign aimed to:

- raise awareness that **diabetes is serious but often underestimated**; their advertisements were accompanied by straplines that highlighted how diabetes deaths can go unrecognized ("*The death certificate will say heart attack. It was really diabetes.*")
- promote **early diagnosis** through increasing awareness of risk factors for diabetes. Their campaign activities included an online tool that people could use to assess their own risk of type 2 diabetes.

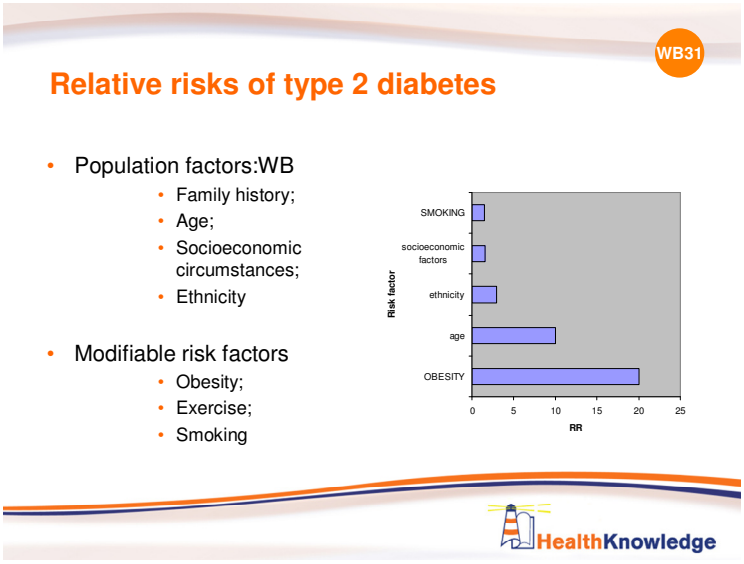
4. What are the risk factors for diabetes?



From the previous section, we know that diabetes - types 1 and 2 - affects about 5% of our population, but the risk factors for different types of diabetes are not the same.



Type 1 diabetes is present in most races, but it is highest in Northern European populations. People with a strong family history are at increased risk of type 1 diabetes. If no member of the family has type 1 diabetes, the risk of a child developing type 1 diabetes before 18 years of age is about 0.3%.The risk increases to 2% chance if the mother and 4% chance if the father has type 1 diabetes. If a sibling is affected, there is 6% chance of having type 1 diabetes.



This section focuses on the risks associated with type 2 diabetes. Some population groups are at greater risk of diabetes. Age, socioeconomic deprivation and ethnicity are the most important determinants. Because some people may be unaware they have type 2 diabetes, it is useful to know what puts people at risk of diabetes in order to find people at greater risk of undiagnosed diabetes to improve detection, treatment and service planning.

- Modifiable risk factors:
- Obesity
- Lack of Exercise
- Smoking

- Population risk factors:
- Family history
- Age
- Socioeconomic circumstances;
- Ethnicity

Information on modifiable risk factors and vulnerable groups is useful to inform prevention programmes and for service planning.

Learning from research

Lots of our learning about the risk of, and from, type 2 diabetes comes from observational studies such cross-sectional surveys and 'cohort' studies (which involves following participants over time – see glossary) some key examples include:

- The Health Survey for England[23] is a series of annual surveys started in 1993, to measure health and health related behaviours in adults and children. It asks a series of core questions every year, on general health, smoking, drinking and fruit and vegetable consumption. It also measures height, weight, blood pressure and takes blood and saliva samples. In selected years, it asks more detailed questions and collects biological measures around specific topics such as cardiovascular disease.

- The Whitehall II Study[24] has been following the health, employment, social circumstances and lifestyles of 10,000 civil servants at all grades in London since 1985 to find out why people at lower grades often experience worse health and premature death than people at higher grades.

- In the US, the Nurses Health Study[25] has been following the health of nurses since 1976. There are two cohorts running, each with around 100,000 nurses, who respond to surveys and their health and health-related topics including smoking, hormone use, pregnancy history, menopausal status.

Overweight and obesity

Obesity is the most important predictor of type 2 diabetes. It is normally measured using the body mass index (BMI) (Weight (kg)/height squared (m2), with agreed cut-offs to indicate a healthy weight and obesity (see table below)[26].

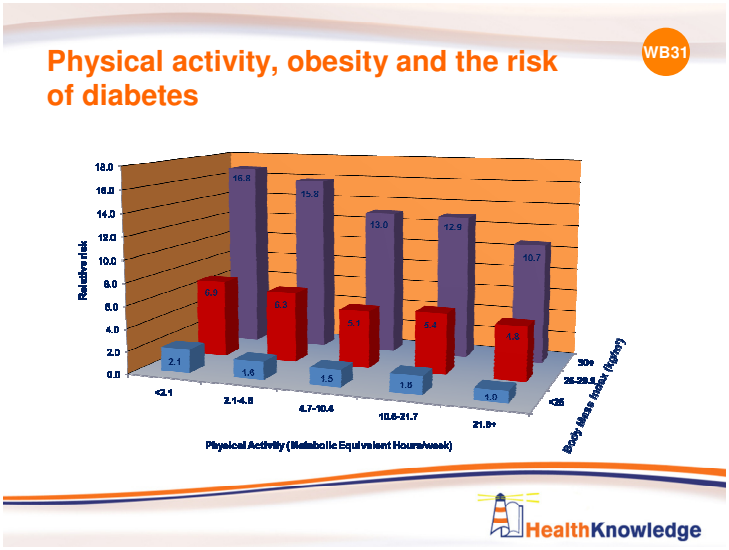
	Underweight	Normal weight	Overweight	Obese	Morbidly obese
BMI	Under 18.5	18.5-24.9	25-29.9	30-39.9	40+

[23] http://www.ic.nhs.uk/statistics-and-data-collections/health-and-lifestyles-related-surveys/health-survey-for-england/health-survey-for-england-2007-latest-trends-%5Bns%5D

[24] http://www.ucl.ac.uk/whitehallII/index.htm

[25] http://www.channing.harvard.edu/nhs/

[26] http://www.nhs.uk/chq/Pages/850.aspx?CategoryID=51&SubCategoryID=165



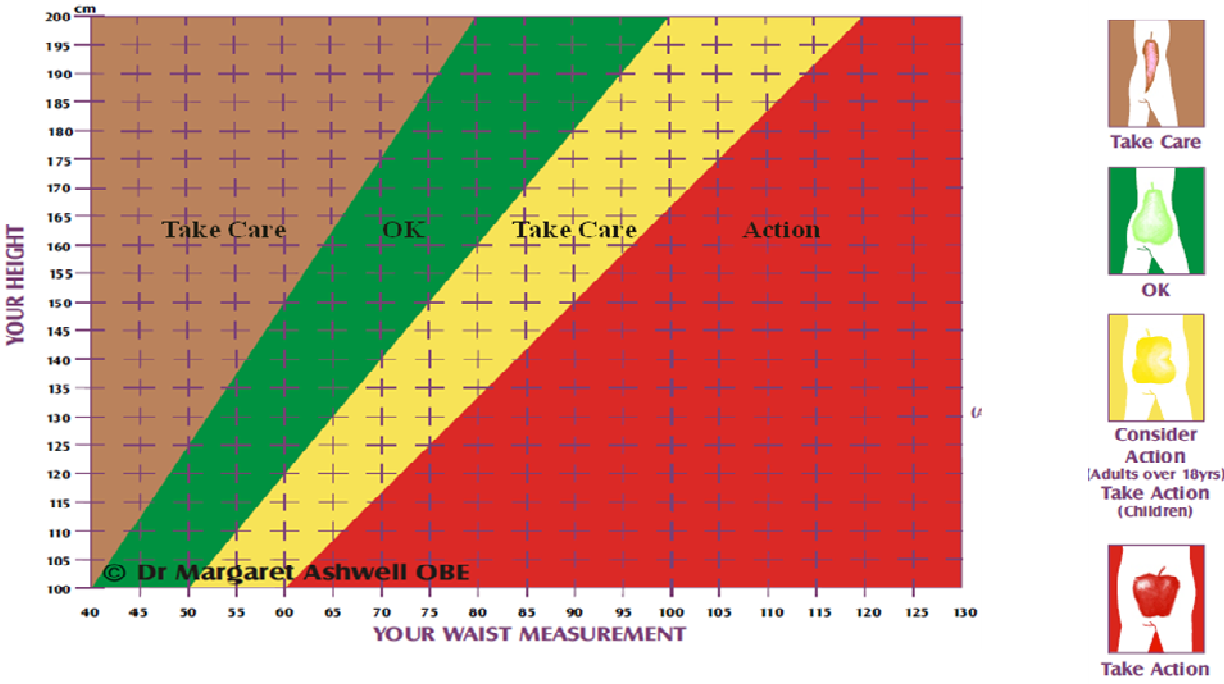
The risk of developing diabetes in the Nurses Health Study was nearly **40 times higher** in those with a BMI of 35 and over, and **20 times higher** for those with a BMI or 30-34.9 compared with women with a BMI of 23 or less.

However, BMI has limitations for assessing risk in diabetes and it does not take account of body shape (for example, someone with well developed muscles could have a higher BMI but still be healthy). Studies now indicate that the *distribution* of fat is important; our waist size, and waist-to-hip ratio could be better predictors of cardiovascular diseases such as diabetes and risk of deaths, particularly in those with a low BMI who might be seen as 'low risk' [27]. A build-up of fat around the waist is linked to insulin resistance, which is implicated in the development of type 2 diabetes. This information is now used as a guide to the risk from obesity, see Ashwell© chart below[28].

[27] Pischon T, Boeing H, K. Hoffmann, K,Bergmann M et al, General and Abdominal Adiposity and Risk of Death in Europe n engl j med 359;20; November 13, 2008

[28] Ashwell, M. Waist to height ratio and the Ashwell shape chart could predict the health risks of obesity in adults and children in all ethnic groups. Nutrition and food science, 2005,35; 5, pp.359-364

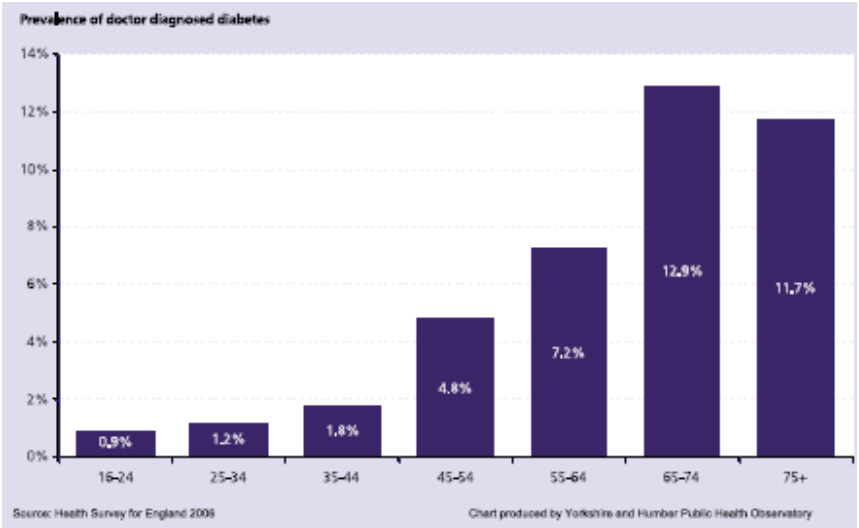
Fig 7: Ashwell shape chart



Age

While Type 1 diabetes commonly develops in children, the risk of type 2 diabetes increases with age. As data from the Health Survey for England show, the prevalence of diabetes in those aged 65-74 (at 12.9%) in about 10 times higher than those aged 25-34 (1.3%).

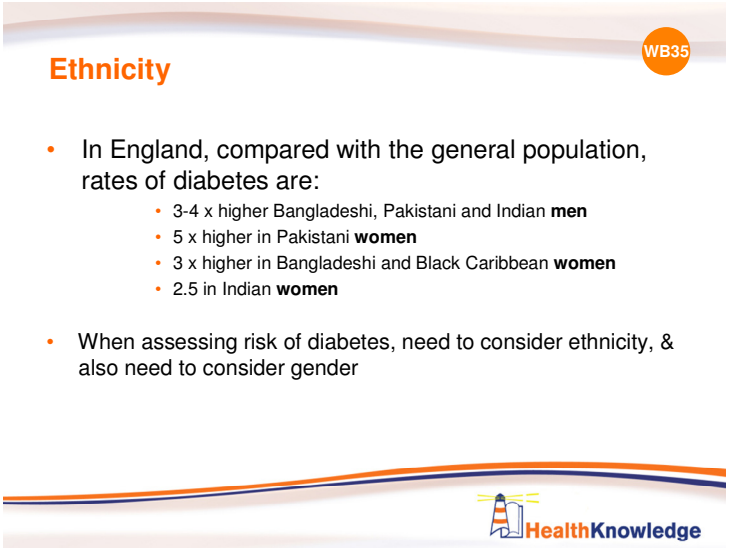
Fig 8: Graph of prevalence of doctor-diagnosed diabetes



Source: Yorkshire and the Humber Public Health Observatory, using data from Health Survey for England 2004

However, the profile is changing; worryingly, in children and young people, type 1 diabetes is rising sharply and doctors are diagnosing more type 2 diabetes, which was previously extremely rare in this age group. The rise in type 2 diabetes is likely to be due to the rise in childhood obesity. The age profile of diabetes worldwide is also expected to change as the prevalence of diabetes rises in developing countries, linked to our ageing population and the rise in obesity worldwide.

Ethnicity



Type 2 diabetes is more common in certain ethnic groups than others. The most dramatic example of ethnic diversity is the risk of diabetes in the Pima Indians of Arizona, half of all adults have the condition[29]. In England the variations are less extreme but still significant; according to figures from the Health Survey for England 2004, after adjusting for age:[30]

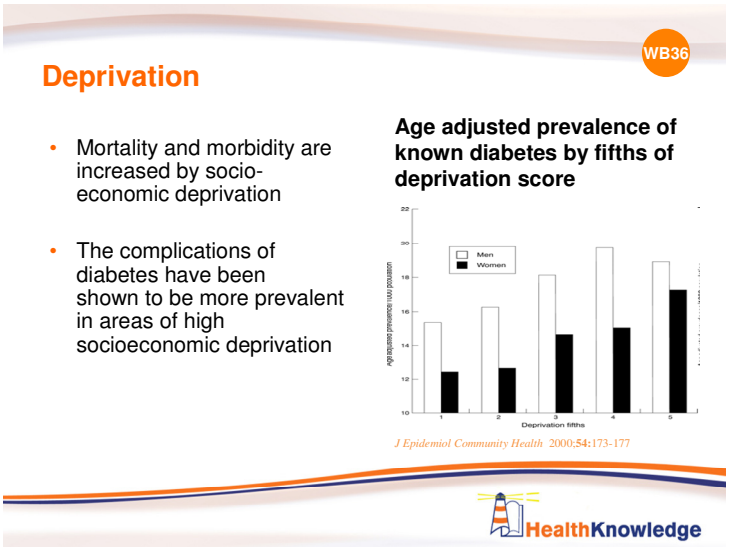
- In men, doctor-diagnosed diabetes was 3-4 times as common in Bangladeshi, Pakistani and Indian men compared with the general population

[29] Adherence to Long Term Therapies. World Health Organisation Geneva 2003.
[30] Sources: YHPHO Diabetes in England; HSE 2004 Health in Ethnic Minorities: http://www.ic.nhs.uk/statistics-and-data-collections/health-and-lifestyles-related-surveys/health-survey-for-england/health-survey-for-england-2004:-health-of-ethnic-minorities--full-report

- In women, diabetes was 5 times as common in Pakistani women, 3 times as common in Bangladeshi and Black Caribbean women and 2 and a half times as common in Indian women compared with the general population

This means that when we consider individuals' risk of diabetes, we also need to take into account their ethnicity. So, someone from a Pakistani background with the same BMI as someone from a While British background may actually be at higher risk of diabetes.

Socioeconomic deprivation



Several different studies have found an association between the prevalence of diabetes and a range of socioeconomic circumstances. Dalstra and colleagues[31] (2005) examined diabetes prevalence across eight different European countries in relation to individuals' level of education. They found that the odds of having diabetes amongst those with less education (just primary school or less) were 1.6 times higher than those with more education (secondary, post secondary and tertiary levels). Interestingly, they found the odds of diabetes associated with low education to be greater for women (2.2) than men (1.3).

[31] Dalstra J, Kunst A, Borrell C, Breeze E, Cambois E et al, Socioeconomic differences in the prevalence of common chronic diseases: an overview of eight European countries *International Journal of Epidemiology* 2005;**34:**316–326; doi:10.1093/ije/dyh386

In the Whitehall II study, men and women in lower employment grades were more likely to have diabetes than those in higher grades. They found that this increased risk could in part be explained by higher body mass index and health behaviours in those in lower grades. However, in men they also found diabetes in lower grades was associated with greater stress and over-commitment at work.

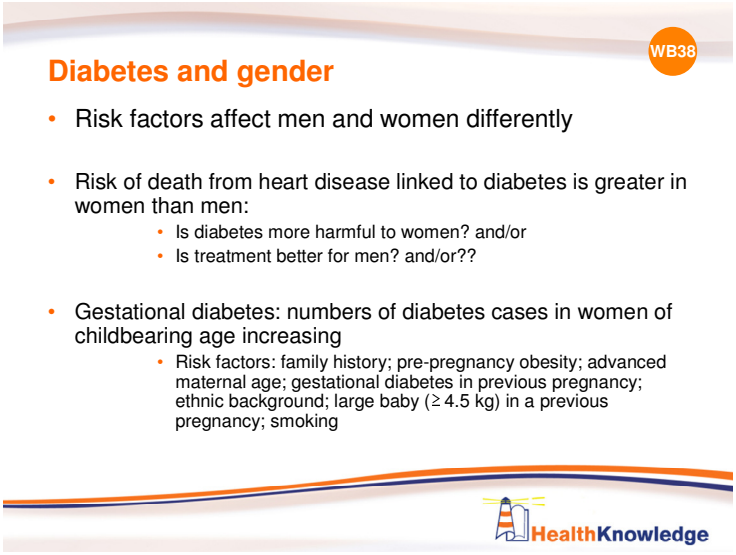
We also see these patterns at a population level; for example, Connolly and colleagues[32] report higher levels of type 2 (but not type 1) diabetes in areas of socioeconomic deprivation in Middlesbrough and East Cleveland. This indicates that people in areas of high deprivation are likely to benefit from optimal access to diabetes prevention and management services.

Other risk factors for diabetes

Smoking: Given its role as the leading cause of death, it should not be a surprise to learn that cigarette smoking also increases the risk of type 2 diabetes. In a systematic review of several papers examining the relationship between diabetes and smoking, Willi et al (2007)[33] report that that the risk of diabetes 50% greater in those that smoke compared to non smokers, with the biggest risk for heaviest smokers compared with

[32] Connolly V, Unwin N, Sherriff P, Bilous R, Kelly W. Diabetes prevalence and socioeconomic status: a population based study showing increased prevalence of type 2 diabetes mellitus in deprived areas *Epidemiol Community Health* 2000;**54:**173-177
[33] Willi C, Bodenmann P, Ghali WA et al (2007) Active Smoking and the Risk of Type 2 Diabetes. A Systematic Review and Meta-analysis. *JAMA*. 298(22):2654-2664.

light smokers or ex-smokers. While this risk is much smaller than that for obesity (1.5 times compared to 40 times, given that 20-30% of the adult population in England still smokes, it is still a significant and preventable risk for diabetes).



Diabetes and women: While the prevalence of diabetes seems similar in men and women (Connolly finds lower prevalence in women, but the difference may be the result of under diagnosis in women), the risk factors and the implications of diabetes (see box 1) are different. For example, as described in the previous section, we have seen a stronger relationship between socioeconomic deprivation and diabetes in women than men.

Pregnancy and gestational diabetes[34] [35]*:* The increase in type 2 diabetes in younger age groups, combined with the tendency to have children at older age groups mean that women of child-bearing age are more at risk of diabetes than previously.[36] The consequences of gestational diabetes can be severe, for both the mother and the baby. The risk factors for gestational diabetes are similar to those of diabetes mellitus:

[34] http://www.nice.org.uk/nicemedia/pdf/CG62FullGuidelineCorrectedJune2008July2009.pdf
[35] http://www.nice.org.uk/nicemedia/pdf/DiabetesFullGuidelineRevisedJULY2008.pdf

[36] Frost G and Dornhurst A. Encyclopedia of Human Nutrition 2006

- family history
- pre-pregnancy obesity or increased maternal weight gain in early adulthood
- advanced maternal age
- having gestational diabetes in a previous pregnancy (after a first pregnancy, 30-84% develop gestational diabetes again)
- ethnic background
- having a large baby (≥ 4.5 kg) in a previous pregnancy
- being a current smoker

Polycystic ovary syndrome: Women with polycystic ovary syndrome (PCOS) can have increased resistance[37] to insulin, which puts them at increased risk of diabetes.

Physical health problems affecting insulin sensitivity or production: Diabetes has been found to be more common in people with circulatory problems linked to increased resistance to insulin, such as heart disease and high blood pressure.

In some people[38] infections or pancreatic disease have preceded their diabetes and led to damage to the pancreas and an inability to produce insulin.

Mental health: Mental ill-health and stress have been linked to diabetes. The Whitehall Study found that people that experienced stress at work were twice as likely to develop diabetes[39]. There has been conflicting evidence over whether schizophrenia is a predictor of diabetes. Several antipsychotic treatments cause significant weight gain so it is possible that the higher risks of diabetes observed in people with schizophrenia are linked to the weight gain associated with the treatment of the condition.

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[37] Legro R et al (1999) Prevalence and Predictors of Risk for Type 2 Diabetes Mellitus and Impaired Glucose Tolerance in Polycystic Ovary Syndrome: A Prospective, Controlled Study in 254 Affected Women. *The Journal of Clinical Endocrinology & Metabolism* Vol. 84, No. 1 165-169. The Endocrine Society

[38] WHO Classification guide 1999

[39] Heraclides A and Brunner E, Social mobility and social accumulation across the life-course. *J Epidemiol Community Health*.2009; jech.2009.087692v1-jech.2009.087692

Summary

- Diabetes is a chronic condition that can have serious health consequences. While type 1 and type 2 diabetes share similar symptoms, they have very different public health implications. Type 2 diabetes accounts for 85% of all diabetes in the UK. Obesity is the most important modifiable risk factor for type 2 diabetes.

- There are challenges to measuring the prevalence of diabetes – about a fifth of people with type 2 diabetes remain undiagnosed. Its impact on health can also be underestimated if we look at mortality data alone; diabetes is seldom recorded as the cause of death although its complications – heart disease, stroke, renal failure – are among leading causes of death.

- Diabetes is more common in some population groups than others. Type 2 diabetes is usually diagnosed in people over 40 years. However, it is becoming increasingly common in younger age groups and people in certain ethnic groups – Pakistani, Bangladeshi, Indian and African Caribbean – are at risk from age 25. Some population groups - women and those in poorer socioeconomic circumstances - are also more at risk of its complications.

Exercise 1: 'Westport' PCT: assessing local needs

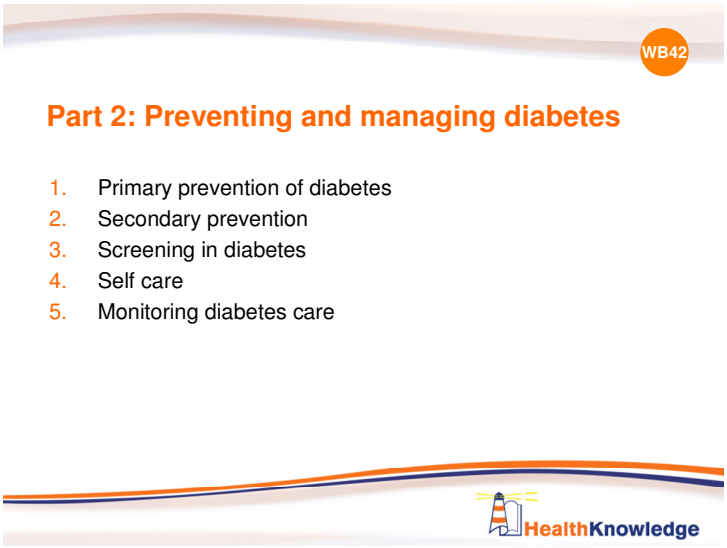
Priorities should be set by local health agencies following an objective assessment of the health needs of the population to be served. This process is called a ***needs assessment***.

'Westport' PCT is focussing a current *needs assessment* exercise on diabetes. Its first stage is to understand the current impact of diabetes in 'Westport' on its population – prevalence, health consequences as well as demands on services, and to forecast the impact of diabetes in the future. 'Westport' PCT serves a population of 250,000 in an industrial area of high social deprivation with a large minority ethnic community mainly from South Asia.

- From what you've learnt in the module so far, how would you find out about the impact of diabetes on your local population?
- What sources of data could you access to provide this information? Think about both national and local data sources, advantages/limitations of the data.
- What information would you collect specifically? Who would you ask?

PART 2: PREVENTING AND MANAGING DIABETES

1. Primary prevention of diabetes

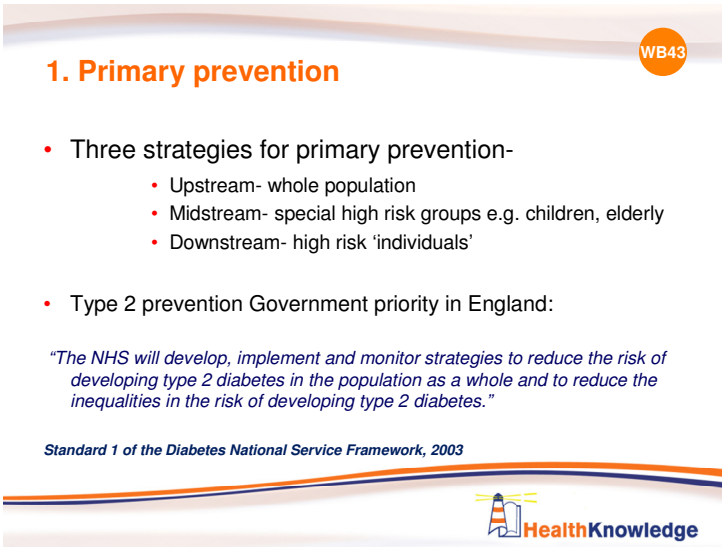


As we've seen in the first part of this module, diabetes may impact substantially on individuals' quality of life, and increase their risk of serious health problems. At a population level, it accounts for 10% of hospital stays and a significant part of the NHS budget, as well as the economic costs to society more widely. So, preventing people from getting diabetes is arguably the most important public health aim in relation to diabetes.

In England, the Department of Health published a 10 year plan setting out standards and milestones for improving diabetes care. The first standard in the Diabetes National Service Framework for Diabetes (NSF – see appendix) concerns prevention:

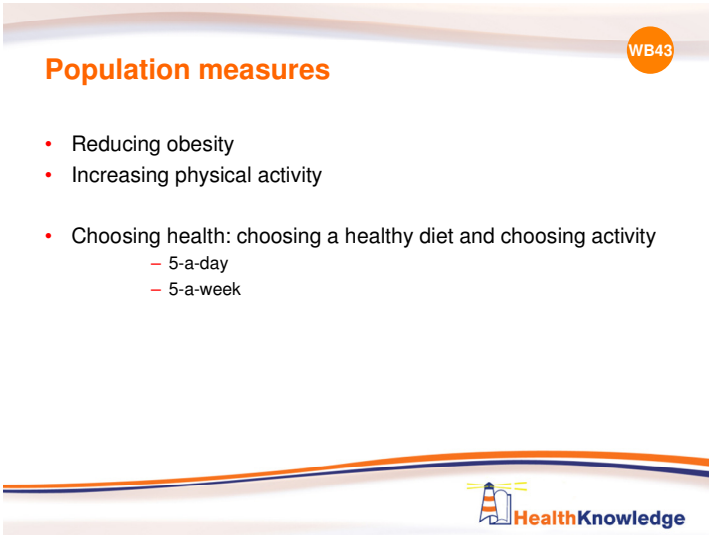
> *Standard 1: The NHS will develop, implement and monitor strategies to reduce the risk of developing type 2 diabetes in the population as a whole and to reduce the inequalities in the risk of developing type 2 diabetes.*

Implementing strategies for primary prevention



It is not possible to prevent type 1 diabetes with our present state of knowledge. However, research shows that a proportion of type 2 diabetes, which accounts for most of the diabetes in the UK, is potentially preventable through tackling some of the risk factors for diabetes.

Lifestyle interventions for weight management:



We know that overweight and obesity are amongst the most important modifiable risk factors for developing type 2 diabetes. Research suggests that programmes to reduce weight through encouraging lifestyle change can have big effects on people at risk of diabetes.

Learning from research

The **Finnish Diabetes Prevention Study**[40] tested whether a programme of advice and support to adopt a healthier diet and increase exercise levels could reduce the risk of diabetes. This study involved individuals already at higher risk of diabetes – to be eligible for the study they needed to be 40-64 years old, have a BMI of over 25 and to have impaired glucose regulation.

Half of the participants took part in the lifestyle programme lasting about 4 years, where they received advice and support to adopt a diet lower in fat and higher in fibre and to increase exercise levels to half an hour each day. The other half – the control group - were given care as usual.

The group that took part in the programme on average adopted healthier lifestyles and lost much more weight than the control group. They were also **58% less likely to develop diabetes** than those who did not receive the lifestyle support. The effects of the programme lasted too - when researchers followed up these study participants 3 years after the programme finished, those that received the programme were still 43% less likely to have diabetes than the control group.

Researchers in China[41] (Da Qing), India[42] (Indian Diabetes Prevention Programme) and America[43] (US Diabetes Prevention Program, involving ethnic groups affected disproportionately by diabetes such as African, Hispanic, and Asian Americans; Pacific Islanders; and American Indians) have reported similar results, suggesting that these programmes can reduce the risk of diabetes in people in different cultures and different ethnic groups too.

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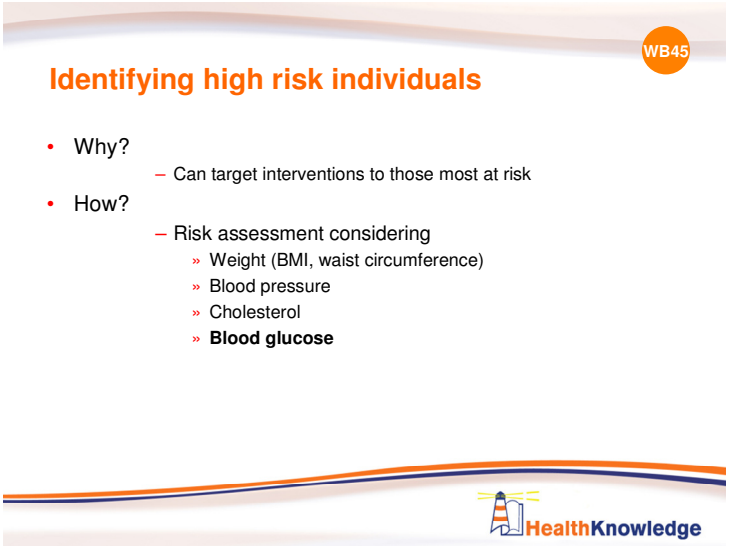
[40] Lindstrom J, Ilanne-Parikka P, Peltonen M, Aunola S, Eriksson J, Hemio K. Sustained reduction in the incidence of type 2 diabetes by lifestyle intervention: follow-up of the Finnish Diabetes Prevention Study. Lancet 2006; 368: 1673-1679

[41] Pan X, Li g, Hu Y, Wang J, Yang W, An Z. Effects of diet and exercise in preventing NIDMM in people with impaired glucose tolerance. The Da Qing IGT and Diabetes Study. Diabetes Care 1997; 20: 537-544

[42] Ramachandran A, Snehalatha C, Mary S, Mukesh B, Bhaskar AD, Vijay V. The Indian Diabetes Prevention Programme shows that lifestyle modification and metformin prevent type 2 diabetes in Asian Indian subjects with impaired glucose tolerance (IDPP-1). *Diabetologia*. 2006;49:289-297.

[43] Knowler W, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM. Reduction in the incidence of type 2 with lifestyle intervention or metformin. N Engl J Med 2002; 346: 393-403

Encouraging healthier lifestyles in England: the population approach



Primary prevention starts with stopping people becoming high risk, adopting population based measures to reduce increase physical activity and reduce obesity. The Government's obesity strategy, *Healthy Weight Healthy Lives* [44] endorses healthy eating and increasing exercise levels amongst the whole population. These strategies include:

- "At least 5 a week",[45] to encourage everyone to take at least 30 minutes physical activity five times a week
- clearer food labelling to highlight the fat, sugar and salt content of the food we buy
- 'Five a day' portions of fruit and vegetables and healthy school meals

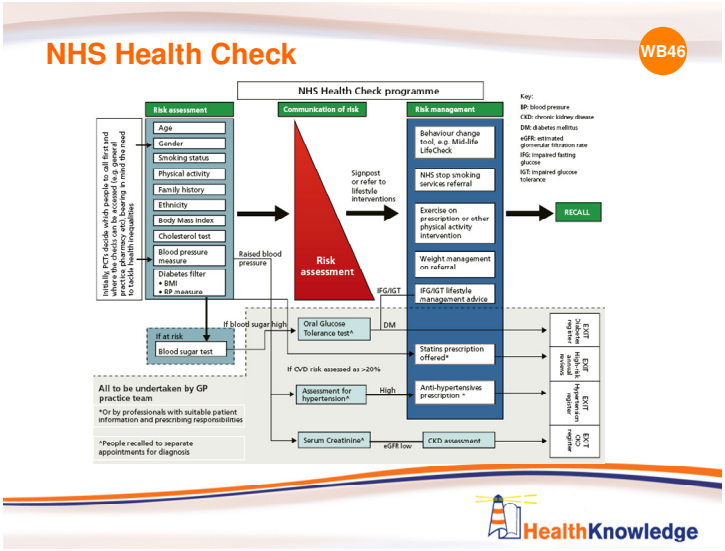
Identifying people at risk of diabetes

The studies described above involved people who were already at risk of diabetes through being overweight and/or having impaired glucose regulation.

[44] Healthy weight healthy lives, a cross government strategy for England. Department of Health, 2008
http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_084024.pdf

[45] http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4080981.pdf

This suggests that targeted prevention may require identifying people already at high risk of diabetes. However, impaired glucose tolerance, like high blood pressure, doesn't necessarily come with any symptoms, so individuals may not realise they are at risk.



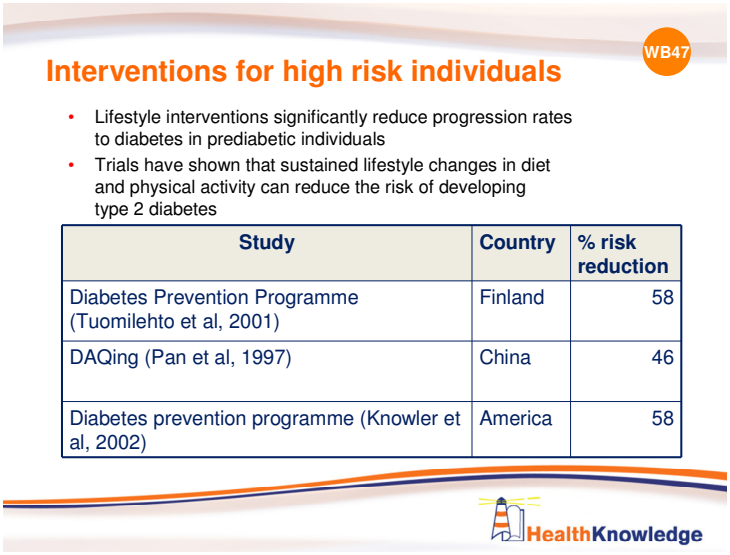
In England, the **NHS Health Check** programme [2009][46] is designed to identify individuals at increased risk of diabetes, heart disease, stroke or kidney disease to reduce the risk of individuals developing these diseases and to reduce premature deaths from these diseases. Most of the risk factors for diabetes are common to other vascular diseases, so it makes sense to assess the risk of these diseases in one assessment combined with specific tests to detect those at particularly high risk of each condition. See unit on CHD for further information.

Under the NHS Health Check Programme, primary care services (usually general practices) invite individuals aged 40-74 on their practice lists to assess their risk of vascular disease. In terms of diabetes, patients with a high BMI or high blood pressure, family risk factors and other health conditions associated with diabetes (eg gestational diabetes, see Part 1), would have their blood glucose levels (or HBA1c levels) measured. The glucose results will help identify:

[46]NHS Health Check 2009: http://www.nhs.uk/planners/nhshealthcheck/Pages/NHSHealthCheck.aspx

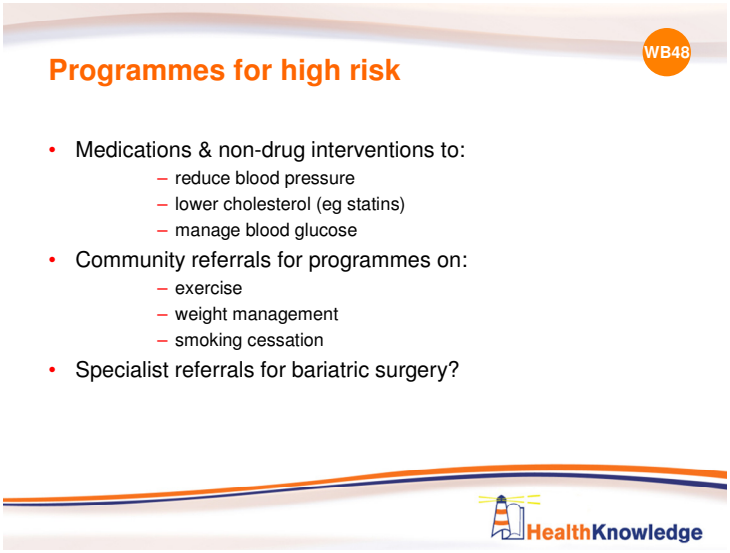
- individuals with diabetes, so treatment and advice on managing their condition can be started early
- individuals with high levels of glucose, who are at greater risk of diabetes in the future, and can be referred to programmes to reduce their risk
- individuals with normal levels of glucose – this group still has a high BMI or blood pressure so is still at risk of diabetes

Interventions for high risk individuals



Interventions to reduce the likelihood of developing diabetes or associated cardiovascular conditions in high risk individuals usually include some or all of the following:

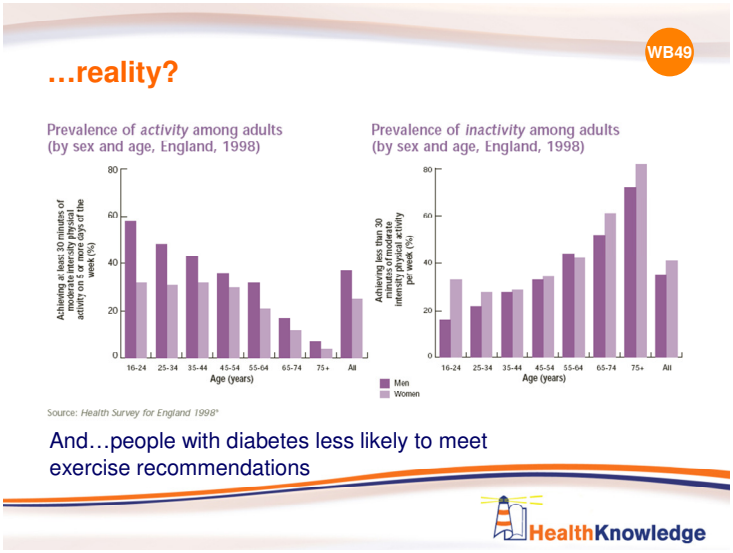
- prescriptions for medications to reduce blood pressure, lower cholesterol (eg statins)
- referrals to exercise, weight management and smoking cessation programmes



It may also include referrals for bariatric surgery for those with morbid (extreme) obesity (ie BMI over 40kg/m2). Bariatric surgery (ie weight loss surgery usually by gastric banding or bypass) is an expensive and radical weight loss strategy, but it has been shown to be very effective in resolving the clinical manifestations and biological markers of type 2 diabetes 2 years after the operation[47].

[47] *Buchwald* H, Estok R, Fahrbach K, *et al*. Weight and type 2 diabetes after bariatric surgery: Systematic review and meta-analysis. Am J Med *2009*;*122*(3):*248-256*

The challenge of exercise: In England, there are interventions available for groups with a high risk of developing diabetes such as **exercise referral schemes**[48] [49], where GPs and other health professionals can refer high risk individuals to free or subsidised exercise programmes tailored to individuals' abilities or interests and might include swimming classes, gym membership, a 3 month varied exercise programme. People at risk of diabetes through having a high BMI as well as those with diagnosed diabetes are eligible for exercise referral.



However, it appears more difficult to motivate those at risk of, or from diabetes, to take exercise. Zhao and colleagues (2008)[50] compared rates of exercise in people with and without diabetes in the USA using data from the Behavioral Risk Factor Surveillance System Survey, which is conducted in all American states annually. They found people with diabetes were less likely to take recommended levels of physical activity. Moreover, whilst exercise levels in the whole population increased the previous 5 years, they remained static in people with diabetes, suggesting that exercise promotion messages are proving less effective in this group.

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[48] http://guidance.nice.org.uk/PH2 DH guidance: http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4079009.pdf

[49] Individual schemes: http://www.huntsdc.gov.uk/Health/Exercise+Referral+Scheme

[50] Zhao G et al, *'Compliance with physical activity recommendations in US adults with diabetes'* Diabetes Medicine Vol 25 No2 p 221 -227

Moreover, while the benefits of exercise are not in doubt, the National Institute of Health and Clinical Excellence [NICE] in England has highlighted there is no evidence of exercise referral schemes' effectiveness, recommending that practitioners, policy makers and commissioners should only endorse exercise referral schemes to promote physical activity that are part of a properly designed and controlled research study to determine effectiveness[51].

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Exercise 2: Encouraging healthy eating and regular exercise - target high risk or provide for the whole population?

In public health, there is often debate about whether to target high-risk individuals or offer population wide strategies to promote health/ prevent disease.

Think of some of the pros and cons of these contrasting approaches for interventions to adopt healthier diets and take more exercise to prevent diabetes

[51] http://www.nice.org.uk/PHI002 NICE guidance: Four commonly used methods to increase physical activity, March 2006

Drug therapy to control diabetes risk factors[52]

The "STOP-NIDDM" trial involved people in Canada, several European countries and Israel with impaired glucose regulation. It tested whether acarbose, a drug that improved blood glucose levels and sensitivity to insulin, could prevent people with impaired glucose tolerance from developing diabetes. Acarbose reduced the risk of diabetes by 25% in those in the control group, which is about half the effect achieved in the studies using lifestyle interventions to prevent diabetes. Other studies of drugs to control glucose levels show similar reductions.

While drugs may have a place in preventing diabetes, the research suggests that lifestyle interventions are the most important step for prevention.

2. Secondary prevention

While is it possible to reduce the risk of type 2 diabetes, this is unlikely to be 100% effective and not all the risk factors for type 2 diabetes are modifiable (eg age, ethnicity, genetic factors). So, secondary prevention focused on managing diabetes effectively is also extremely important.

Learning from research

Two major studies - the US Diabetes Control and Complications Trial (DCCT) into type 1 diabetes and the UK Prospective Diabetes Study (UKPDS) , showed that the complications of diabetes are not inevitable; they can be reduced with intensive management.

In the case of type 2 diabetes, the UKPDS found that the group with tight control of blood pressure limits were 24 - 44% less likely to experience a range of poor outcomes linked to diabetes, including stroke, heart attacks [*macro*vascular] and *micro*vascular conditions such as retinopathy. They were also 32% less likely to die due to diabetes.

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[52] Bassuk, quoting Gillies CL, Abrams KR, Lambert PC, et al. Pharmacological and lifestyle interventions to prevent or delay type 2 diabetes in people with impaired glucose tolerance: systematic review and meta-analysis.*BMJ.* 2007;334:299.

Control of blood glucose using drugs such as metformin and sulphonylureas reduced microvascular complications.

Secondary prevention in practice

Initiatives to promote effective management of diabetes include:

Incentives for practitioners in primary care: The current contract for UK general practice has incentive payments linked to clinical and organisational goals. The Quality and Outcomes Framework [QOF] sets out these goals for clinical areas and awards points, based on performance[53]. Diabetes is the largest single clinical area in the QOF and has 18 separate indicators covering:

- **maintaining a register** of patients with diabetes: this is an important tool for assessing the prevalence of diabetes and monitoring the care that all diabetic patients receive
- **measurement** of blood pressure, cholesterol level, and glycaemic (HbA_{1c}) levels
- **control** of blood pressure, cholesterol level, and glycaemic (HbA_{1c}) levels

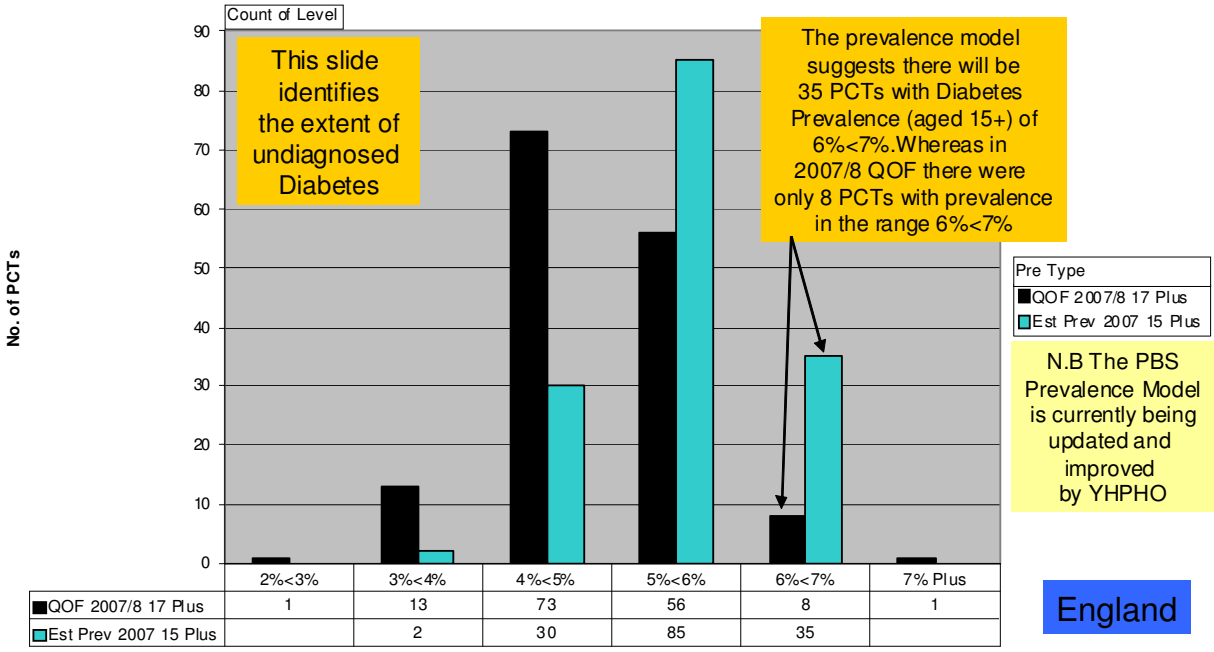
Research to date suggests that while diabetes care is improving, patients receiving suboptimal care may not be captured within QOF[54]. The Department of Health has compared estimates for diabetes prevalence using the YHPHO PBS model with those from QOF registers. This indicates that GP registers are still missing cases of diabetes. (see figures below)

[53] Campbell S, Reeves D, Kontopantelis E, Middleton E. Quality of Primary Care in England with the Introduction of Pay for Performance. NEJM; 357:181-190, 2007 http://content.nejm.org/cgi/content/full/357/2/181?ijKey=43f998b885f70fc53cda13fb6c38aef743460112&keytype2=tf_ipsecsha

[54] Calvert M, Shankar A, McManus R,Lester H, Freemantle N. 2009. Effect of the quality and outcomes framework on diabetes care in the United Kingdom: retrospective cohort study. BMJ;338:b1870; doi:10.1136/bmj.b1870

Fig 9: Diabetes QOF Prevalence and Estimated Prevalence

Diabetes – QOF Prevalence (Aged 17 Plus) 2007/8 & Estimated Prevalence (Aged 15 plus) by Prevalence Banding – England – By PCT



	2%<3%	3%<4%	4%<5%	5%<6%	6%<7%	7% Plus
QOF 2007/8 17 Plus	1	13	73	56	8	1
Est Prev 2007 15 Plus		2	30	85	35	

(1) Modelled estimates of prevalence for people aged 15 plus from Yorkshire & Humber Public Health Observatory – The PBS Diabetes Population Prevalence Model Phase 3. Percentage prevalence calculated using estimated cases aged 15 plus in 2007 and QOF denominator for population aged 17 plus.

3. Screening in diabetes

3. Screening

WB53

- **Primary prevention**
  - To identify people at increased risk of disease
- **Secondary prevention**
  - To identify early stages of disease

NSC found no evidence to implement national screening for diabetes in UK.

Better strategy to:

- optimise management of blood pressure and hyperglycaemia in people with known diabetes; and
- ensure universal screening for eye disease

HealthKnowledge

The UK National Screening Committee defines screening as:
"*Screening is a process of identifying apparently healthy people who may be at increased risk of a disease or condition. They can then be offered information, further tests and appropriate treatment to reduce their risk and/or any complications arising from the disease or condition.*"

Screening may be used in **primary prevention**, to identify individuals at increased risk of developing a disease, with the potential for behavioural modification as well as treatment (e.g. BP, glucose levels). Guidance from the National Screening Committee in England suggests that risk assessment, rather than screening, is more appropriate to measure the extent of people's risk of vascular diseases such as diabetes. Screening can also be used in **secondary prevention**, to identify early stages of a disease, so that treatment can be started to early to improve outcomes. Screening for Diabetic Retinopathy would fall into this category.

Screening programmes have the potential to bring significant public health benefits but they are expensive and are not risk free. Therefore, the National Screening Committee in England have developed well established criteria to decide whether or not to implement screening programmes based on three principles:

- **the disease**: important, with a known natural history and where early intervention can help
- **the test**: practical – inexpensive and tolerated by patients/professionals; reliable; with good predictive properties (characterized as having high sensitivity and specificity, and high positive predictive values and negative predictive values)
- **the treatment**: available and effective – leads to better outcomes

Even when the criteria for a programme to be established are met, screening programmes need to be implemented effectively to achieve their public health goals. This is likely to include monitoring health outcomes – for example: does the programme reduce serious sequelae from disease? And, regarding processes of programme delivery: is screening offered to/accessed by those at risk?

The UK National Screening Committee (NSC) evaluation of Type 2 diabetes mellitus screening against the NSC screening criteria concluded that there was no evidence to support implementation of universal diabetes screening in the UK. However, it did find in individuals opportunistically identified as being at high-risk of heart disease, additional testing for hyperglycaemia may be of benefit[55].

Additionally the evaluation found that although the microvascular complications of diabetes are of public health importance, it is unclear whether screening for diabetes would significantly improve outcomes. It found that a more appropriate strategy was to:

- optimise management of blood pressure and hyperglycaemia in people with known diabetes; and
- ensure universal screening for eye disease and prompt treatment.

Screening for retinopathy

In England, the National Diabetic Retinopathy Screening Programme[56] has been introduced to screen all people with diabetes once a year.

The diabetic retinopathy screening programme fulfils the National Screening Committee criteria for screening programmes:

The disease: In developed countries diabetes is the leading cause of blindness in adults of working age. Loss of sight is due to retinopathy, when tiny blood vessels in the retina become damaged. In proliferative retinopathy, new vessels start to grow in the back of the eye, which can cause profound loss of sight. Retinopathy does not lead to problems with sight until damage to the retina (or macula) is well advanced. Those most at risk have uncontrolled diabetes or have had diabetes a long time.

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[55] http://www.screening.nhs.uk/diabetes
Evaluation of Type 2 Diabetes Mellitus Screening against the NSC Handbook Criteria. Dr N J Wareham, Department of Public Health and Primary Care, Cambridge, 2001 [http://www.library.nhs.uk/diabetes/ViewResource.aspx?resID=70950]
[56] http://www.retinalscreening.nhs.uk/userFiles/File/EyeScreeningForDiabetes.pdf

Screening test: The test, digital photography simple and non invasive - it involves taking a picture of the retina to see whether there is any damage to the blood vessels in the retina. Technicians grading these photographs have achieved 84% sensitivity and 89% specificity (ie over 8 out of 10 people with retinopathy will be picked up as positive and nearly 9 out of 10 people who don't have retinopathy will not be identified as having retinopathy).

The treatment: There is no cure for retinopathy. However, identifying retinal problems can indicate that blood glucose, cholesterol or blood pressure need better control. Moreover, laser treatment can prevent further damage by stopping blood vessels from growing or bursting. In the case of proliferative retinopathy, it can prevent severe loss of sight in 9 out of 10 cases. However, it is much less effective once the disease has progressed to causing sight problems.

4. Self care and monitoring through education and self management programmes

While clinical care in diabetes is important, people with diabetes have the biggest role in managing their condition day-to-day. Patients with the knowledge and skills about their diabetes are better able to control their vascular risk factors (blood glucose, blood lipids

and blood pressure). They may also have better quality of life, not just through having a lower risk of diabetes complications, but also through having more control over their own health.

In order to take an active role in their own care, patients need to understand about diabetes and their medication, how their lifestyle can impact on their condition and how to manage any complications that may develop as a result of their diabetes.

Patient education programmes come in all shapes and sizes; the National Institute of Health and Clinical Effectiveness (NICE) guidance on patient education in diabetes found for example that the costs of patient education ranged from £66 to £545 per person[57]. Patient education programmes can also have varying effects, though few have been extensively evaluated. Two well evaluated programmes are described in the boxes below:

[57] http://www.nice.org.uk/nicemedia/pdf/60Patienteducationmodelsfullguidance.pdf

DESMOND & DAFNE

Dose Adjustment for Normal Eating (DAFNE)[58] is an intensive education programme for people with **type 1 diabetes**. Patients with type 1 diabetes often take set amounts of insulin and adjust their diet accordingly. In contrast, DAFNE teaches patients skills in adjusting their insulin to match carbohydrate intake and lifestyle on a meal-by-meal basis. This allows them more freedom over their diet and also promotes autonomy 6-8 individuals attend a 5 day course to learn skills around matching their insulin to their carbohydrate intake. The educators delivering the training and course programme are prescribed to ensure consistency in the way DAFNE is delivered.

In a trial of DAFNE, researchers found those that receive the programme had better glycaemic control and their quality of life improved significantly after their training.

Diabetes Education and Self Management for Ongoing and Newly Diagnosed patients **(DESMOND)**[59] is based on a philosophy that patients are more motivated to manage their condition if they can identify their own health risks and develop goals related to their behaviour and health that are specific to their own circumstances. Six hours of group sessions are delivered to a maximum of 10 people, newly diagnosed with type 2 diabetes. They can choose whether to attend the sessions with a family member or friend. To ensure consistency and quality, DESMOND has a set curriculum and is delivered by health professionals trained in the programme.

DESMOND was trialled across 23 areas of the UK and over 800 patients. Up to 12 months after diagnosis, they found DESMOND patients had greater weight loss and smoking cessation and improvements in beliefs about illness but their HBA1c levels [ie measure of glycaemic control] were similar to patients that did not receive the programme.

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[58] http://www.dafne.uk.com/index-2.html; DAFNE Study Group. Training in flexible, intensive insulin management to enable dietary freedom in people with type 1 diabetes: dose adjustment for normal eating (DAFNE) randomised controlled trial BMJ Oct 2002; 325: 746; doi:10.1136/bmj.325.7367.746

[59] http://www.desmond-project.org.uk/

5. Monitoring diabetes services

The second half of this module has focused so far on the evidence base for interventions to prevent and manage diabetes. For effective public health action, we must interpret the evidence to identify which interventions are effective and appropriate for our population.

Evidence based programmes are most effective when they are delivered as intended to those that have the greatest capacity to **benefit from them**. The public health role also needs to encompass monitoring the quality and coverage of the services in place to ensure that effective services are reaching those that **most need them**. National surveys and data sources can help here. Some approaches are described below:

Do services reach those that need it? Diabetes services are generally provided at a local level, largely through general practice, supported by specialist services. However, the National Diabetic Retinopathy Screening Programme[60] has a target to offer screening to everyone with diabetes (age >=12) nationally, but has yet to meet this target amongst patients on GP diabetic registers; and those patients who are not registered with a GP are, of course, harder to reach.

[60] http://www.retinalscreening.nhs.uk/pages/default.asp?viewPoint=3

The Care Quality Commission[61], the healthcare regulator, reports that out of 152 PCTs, 138 (89%) met or nearly met the retinopathy screening target of screening over 95% of the eligible population. However, 17 PCTs did not meet the target; 8 (5%) were judged to have underachieved, screening between 90 and 95% of their eligible population and 9 (6%) trusts judged to have failed to meet the target, having screened less than 90% of their population.

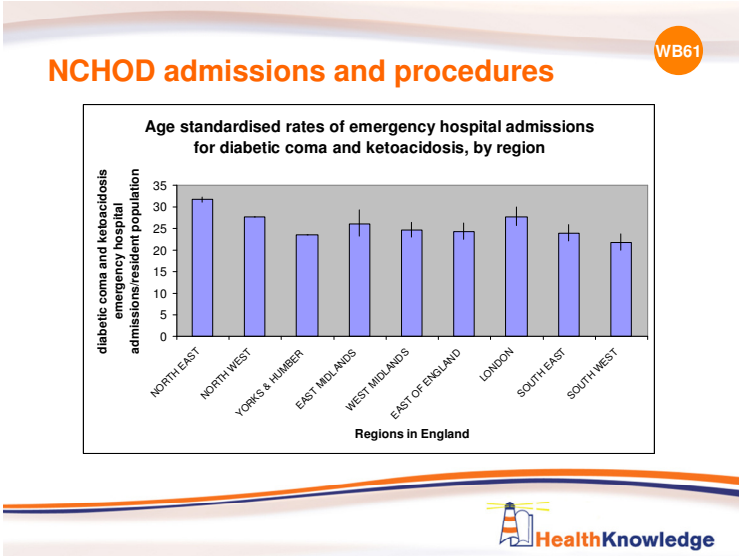
Inequalities in access to treatment and screening are particularly serious in those groups that are already at higher risk of diabetes and its related complications, such as people in areas of socioeconomic deprivation.

What do patients think?

In 2006, over 60,000 patients responded to a survey[62] about their diabetes care from the Healthcare Commission (now the Care Quality Commission). Their report indicates room for improvement in the information and education to help patients manage their condition. Most people (73%) said they received information about their condition. However, the Commission found, "only 11% of respondents said that they had participated in a course to help manage their diabetes; of those who had not participated in a course, about a quarter (26%) said they wanted to." In addition "17% of respondents did not know what type of diabetes they had".

[61] http://www.cqc.org.uk/guidanceforprofessionals/healthcare/nhsstaff/periodicreview2009/10/qualityofservices/existing/diabeticretinopathyscreening.cfm
[62] http://www.cqc.org.uk/publications.cfm?fde_id=559

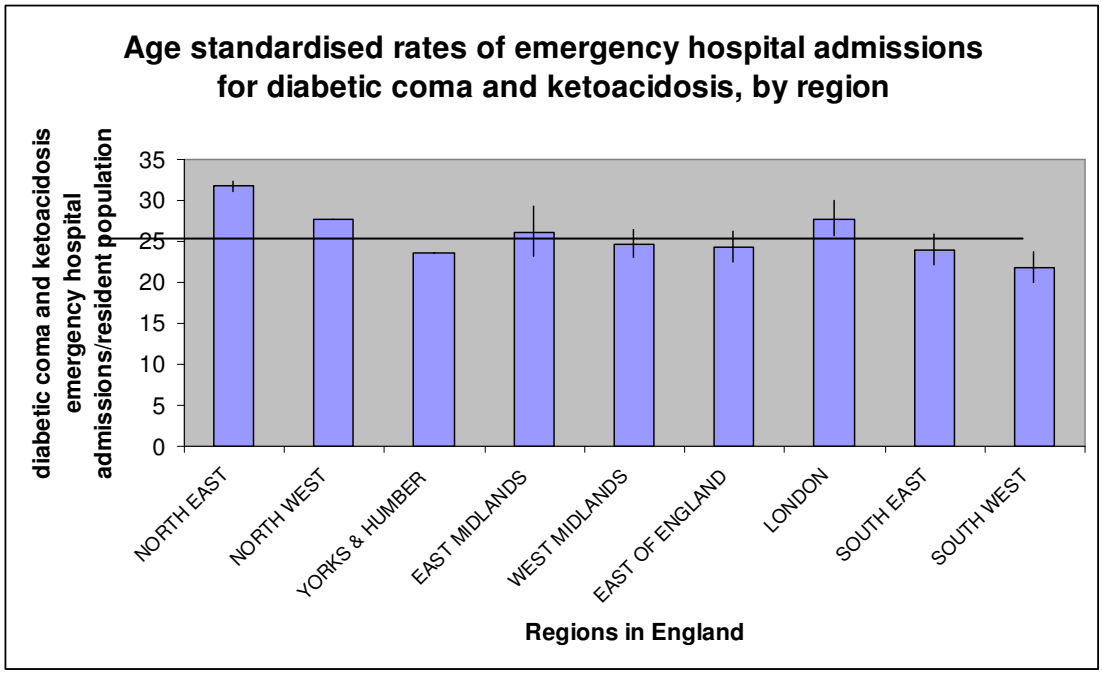
Are services having the impact they should?



The National Centre for Health Outcomes Development[63] produces a compendium of health outcomes to evaluate the outcome of health care. It uses data on emergency hospital admissions for ketoacidosis and diabetic coma and procedures for lower limb amputations – all serious, yet preventable, complications of diabetes - to provide indicators of the diabetes care outcomes. If diabetes is diagnosed promptly and managed well, most cases of ketoacidosis, diabetic coma, and lower limb amputations should be avoidable. So, high rates of emergency admissions for these conditions or of amputations in diabetic patients may signal some problems in the management of diabetes in local NHS services. Looking at these rates by region or organisation enables comparisons between organisations. For example, in the case of diabetic coma or ketoacidosis, the figures from NCHOD below might prompt investigation into services in the North East, North West and in London. These performance figures indicate that some areas achieved recognised measures of performance better than others. What factors might explain variations between areas in screening, patient satisfaction and ketoacidosis/diabetic coma? For further reading on Hospital Episode Statistics, see the Health Knowledge Website: http://www.healthknowledge.org.uk/trainingmodules/index_apho.asp

[63] http://www.nchod.nhs.uk/

Fig 10: Rates of emergency hospital admissions for diabetes



Source: NCHOD, 2006/2007, http://www.nchod.nhs.uk/

NCHOD: National Centre for Health Outcomes Development

Summary

Part 2 of this module has focused on preventing and managing diabetes. While type 1 diabetes cannot yet be prevented, there is lots of potential to reduce the risks of type 2 diabetes, particularly in those at high risk of diabetes, through:

- encouraging healthy eating and regular exercise
- drug therapy to reduce blood pressure, cholesterol and improve glucose regulation

Effective management of blood glucose and blood pressure and screening for diabetic retinopathy can reduce diabetes complications. Patients can be encouraged to take an active role in their own disease management with structured education too.

Monitoring the quality and equity of service delivery is important to ensure that effective services are reaching those that need them. National surveys and data collections indicate that there is room to improve the quality and equity of diabetes service provision.

Exercise 3: Shaping your local services

As a Stakeholder of 'Westport' PCT, you have been invited by the PCT to recommend how Westport should develop both its services for people with diabetes and its preventive services. They want to know

- how well local services are meeting the population's needs
- what would be your priorities for investing in services

1. How would you assess the impact of diabetes services provision locally?

2. From what you have learnt in the module, how would you decide on your top priorities for diabetes services in your local area?

Think about:

- Prevention vs. treatment
- Evidence based programmes vs. learning through doing
- National policy priorities and targets

Please use the space below for your answer.