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Diabetes

In this article...

● How various risk factors affect the likelihood of developing type 2 diabetes
● What the modifiable and non-modifiable risk factors are
● Why socioeconomic deprivation greatly increases the risk of developing type 2 diabetes

Type 2 diabetes: an overview of risk factors and prevention of onset

Key points

The UK population is becoming less healthy and adults can experience many years of ill health

It is predicted that the number of people with diabetes will increase if we do not act

Our challenge is to enable people to remain healthy and to reduce ill health

Nurses can do much to help stem the tide of diabetes

People at greater risk of diabetes can take steps to reduce their risk

Author Linda Nazarko is consultant nurse, physical health, West London NHS Trust.

Abstract The number of people with diabetes in the UK is predicted to rise, and most have type 2 diabetes. This condition can have a profound effect on a person's health and increases the risk of renal failure, heart attack, stroke, dementia, loss of vision and limb amputation. This second article in a series on type 2 diabetes explains what the modifiable and non-modifiable risk factors are, as well as what people can do to reduce their risk of developing type 2 diabetes.

The founders of the NHS assumed that the costs of healthcare would decrease as the population became healthier. Although people are living longer now many lives are marred by ill health. The average woman in the UK can expect to experience almost 22 years of disability, while the average man can expect almost 16 years of disability (Office for National Statistics (ONS), 2022; ONS, 2021). Our healthcare system, in common with others globally, has concentrated on treating disease rather than promoting health. Diseases once associated with middle age, such as diabetes, are becoming more common in young people (Lascar et al, 2018). This article explores diabetes risk factors and how some of them can be reduced.

Improving health by reducing the risks of developing type 2 diabetes

Almost 30 years ago type 2 diabetes mellitus (T2DM) was described as "a collision between thrifty genes and an affluent society" (Groop and Tuomi, 1997). Since then, the incidence of T2DM has reached crisis point nationally and globally – it has been described as a "modern, preventable pandemic" (Singer et al, 2022). A pandemic that is leading to people having heart attacks and strokes, losing vision and limbs, and developing kidney failure.

The prevalence of T2DM has risen in line with growing obesity levels (World Health Organization (WHO), nd). In the UK, at least one person in 16 has diabetes (Diabetes.co.uk, 2023) and the most important risk factor for T2DM is obesity (Diabetes UK, nda). If action is not taken one in 10 adults could have diabetes by 2030 (Iacobucci, 2021). However, nurses can help stem the tide of T2DM on both a personal and a professional level.

The UK has the fourth highest obesity rate among adults in Europe (WHO, 2022). Obesity increases the risk of a number of health conditions, including elevated blood pressure, severe illness from Covid-19, cancer, diabetes, dementia and heart disease (Carbone et al, 2019; Cancer Research UK, 2018). If we are to improve the health of adults and reduce the risk of T2DM, we need to understand what the risk factors are and how these can be reduced.

Fig 1 shows a strategy to improve health and wellbeing, involving prevention, disease remission, and effective management and support.

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"Biology is not destiny and the person at greater risk can take steps to reduce diabetes risk"

Understanding risk factors

A key risk factor for obesity and T2DM is socioeconomic deprivation – the condition is twice as common in people experiencing deprivation of this kind (Stringhini et al, 2016). Some of the increased incidence can be explained by higher levels of obesity and inflammation, which predisposes people to the development of T2DM. This association can be found across the world, even in countries that have free universal healthcare (Choi et al, 2020; Jacobs et al, 2019). Although health services cannot address social deprivation, they can help encourage people who are experiencing it to make lifestyle changes to improve their health. To fail to do this would be a counsel of despair.

The development and rate of progression of T2DM are influenced by both genetic and environmental and lifestyle factors, such as obesity, diet and physical inactivity (Heo and Choi, 2019).

Diabetes risk factors can be divided into two categories – modifiable (those we can change), and non-modifiable (those we cannot change).

Fig 2 provides an overview of modifiable and non-modifiable risk factors.

Non-modifiable risk factors
Age

The risk of T2DM increases with age. This is due to individual and age-related factors. Individuals can gain weight as they age and ageing is associated with a decrease in muscle mass and an increase in fat. Ageing is also associated with a decrease in functional cells in the islets of Langerhans, so older people produce less insulin. As people age, they become less sensitive to insulin (Hermann et al, 2021; Ingelfinger and Jarcho, 2017). Although no one can change their age, remaining fit and active and maintaining a healthy body weight will help reduce the impact of age-related changes.

Gender

Gender affects diabetes risk, and middle-aged men are at greater risk of developing T2DM than middle aged women with a higher body mass index (BMI). This is thought to be because men and women carry fat in different ways. Men tend to have central obesity and higher levels of fat

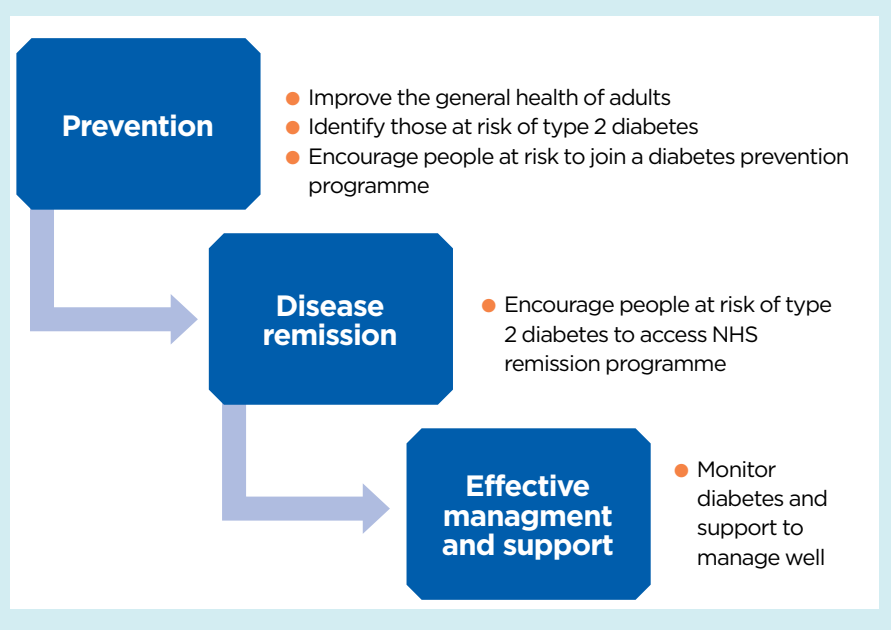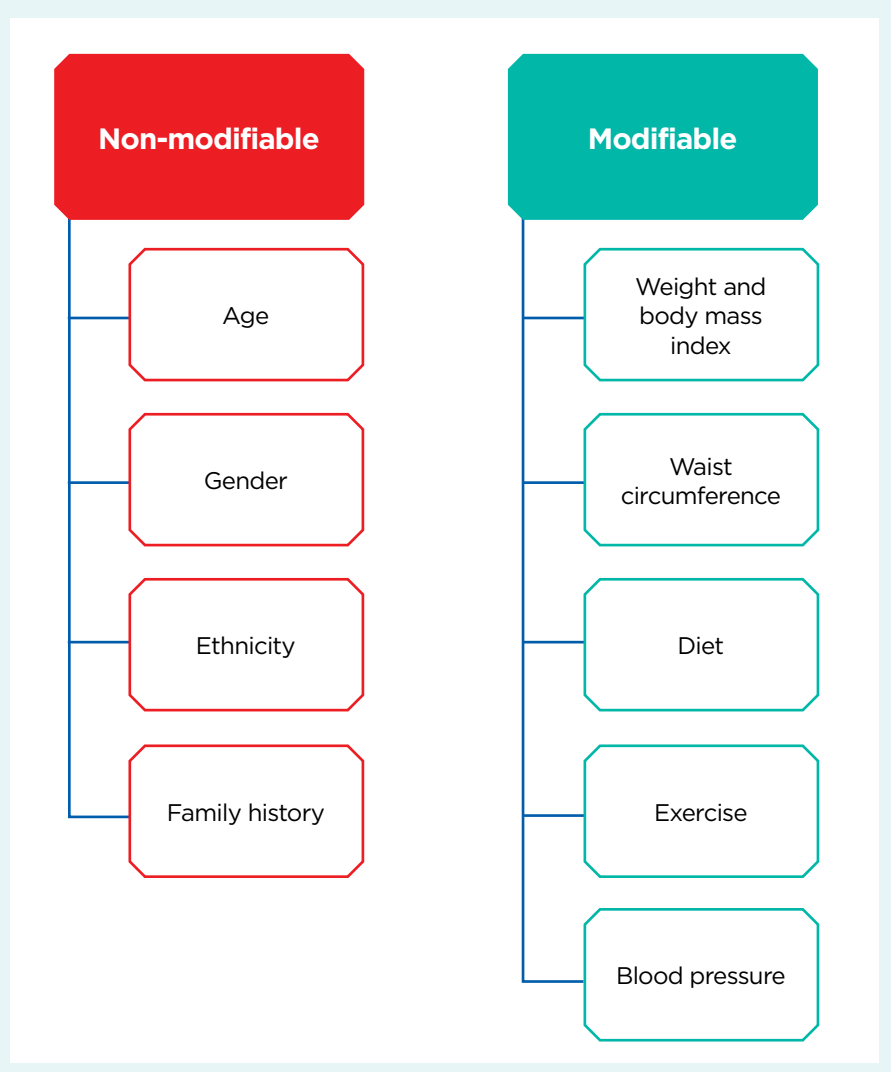Fig 1. **A strategy to improve health and wellbeing**

Prevention
- Improve the general health of adults
- Identify those at risk of type 2 diabetes
- Encourage people at risk to join a diabetes prevention programme

Disease remission
- Encourage people at risk of type 2 diabetes to access NHS remission programme

Effective managment and support
- Monitor diabetes and support to manage well

Fig 2. **Modifiable and non-modifiable risk factors**

Non-modifiable
- Age
- Gender
- Ethnicity
- Family history

Modifiable
- Weight and body mass index
- Waist circumference
- Diet
- Exercise
- Blood pressure

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"Family history of type 2 diabetes increases the risk of a person developing diabetes"

around the abdominal organs (visceral fat). Women tend to deposit more fat around the hips and have lower levels of visceral fat (Kautzky-Willer et al, 2016).

Ethnicity
Ethnicity affects diabetes risk. In some populations, the risk of T2DM increases at an earlier age and at a lower BMI level (NICE, 2018). People of South Asian and Chinese origin have a lower muscle mass than White populations and are at greater risk of developing diabetes than the White European population (Jenum et al, 2019).

People of African and Afro-Caribbean heritage have higher muscle mass than White populations (Misra, 2015). Despite this, people of Afro-Caribbean ethnicity have double the risk of T2DM than White people. This is thought to be due to Afro-Caribbean people carrying excess weight around the abdomen and increased insulin resistance. It is also thought that other, as yet unknown factors, including possibly reduced beta cell function, may contribute to risk (Pitts-Tucker, 2012).

UK research on first- and second-generation people of South Asian, mixed and Afro-Caribbean ethnicity found that second-generation migrants to the UK have 20% lower risk of T2DM compared with first-generation (Farmaki et al, 2022). About 20-33% of persistent excess diabetes risk in second-generation migrants, and those of mixed ethnicity, could be accounted for by adverse socioeconomic status and adiposity (levels of fat). People of mixed South Asian/European and of Afro-Caribbean/European ethnicity had diabetes risks similar to those of Europeans (Farmaki et al, 2022).

Although an individual's ethnicity can increase diabetes risk, biology is not destiny and the person at greater risk can take steps to reduce that risk.

Family history
Family history of T2DM also increases the risk of a person developing diabetes. A variety of population, family and twin-based studies show that heritability ranges from 20% to 80%. It should be noted that a significant proportion of this heritability reflects heritability of obesity rather than diabetes, as obesity is the major driver of T2DM in every population (Avery et al, 2019).

Table 1. Body mass index (BMI) interpretation

BMI	Comments
18.5-24.9kg/m^2	Normal weight
25-29.9kg/m^2	Overweight
30-34.9kg/m^2	Obesity I
35-39.9kg/m^2	Obesity II – may be referred to as 'morbidly obese'
>40kg/m^2	Obesity III – may be referred to as 'super obese'

Source: Weir and Jan (2023)

Table 2. FINDRISC score

Risk factor	Score
Age	
<45 years	0
45-54 years	2
55-64 years	3
>64 years	4
BMI	
≤25kg/m2	0
25-30kg/m2	1
>30kg/m2	3
Waist circumference	
Men <94cm; women <80cm	0
Men 94cm to <102cm; women 80cm to <88cm	3
Men ≥102cm; women ≥88cm	4
History of hypertension medication	
No	0
Yes	2
Previously measured high blood glucose	
No	0
Yes	5
Consumption of vegetables, fruits or berries	
Every day	0
Less often than once a day	1
Physical activity	
≥30 min/day	0
<30 min/day	2
Family history of diabetes	
No	0
Yes, secondary degree	3
Yes, first degree	5

Total risk score: <7 = low risk; 7-11 = slightly elevated risk; 12-14 = moderate risk; 15-20 = high risk; >20 = very high risk

Source: Lindström and Tuomilehto (2003)

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Box 1. **Resources**
- NHS BMI healthy weight calculator (**nhs.uk/live-well/healthy-weight/bmi-calculator**)
- NHS England Type 2 diabetes risk checker (**assets.nhs.uk/tools/self-assessments/index.mob.html?cookie_consent=true&variant=67**)
- NHS Diabetes Prevention Programme Know Your Risk tool (**preventing-diabetes.co.uk/know-your-risk-tool**)
- FINDRISC score calculator (**reference.medscape.com/calculator/236/findrisc-diabetes-risk-calculator**)

Modifiable risk factors
Although it is not possible to change age, gender, ethnicity or family history of diabetes, there are many actions that people can take to reduce the risk of developing T2DM.

Weight and BMI
T2DM is often the result of excess body weight and low physical inactivity (WHO, 2023). Adults can maintain or regain a healthy BMI.

The National Institute for Health and Care Excellence (NICE, 2017) recommends that we calculate a person's BMI by dividing their weight in kilograms by the square of their height in metres. This can be done by using an online tool (see Box 1). Table 1, based on Weir and Jan (2023), shows how BMI is used to classify normal weight and obesity. The aim of BMI is to measure adiposity. However, this varies according to ethnicity. Definitions for overweight and obesity were worked out using BMI based on morbidity and mortality data derived from White populations, and these have been applied to people of all ethnicities. BMI also does not take account of how ethnicity affects fat and muscle.

People of South Asian and Chinese origin have a lower muscle mass than White populations and a BMI of ≥23 kg/m² is considered overweight and BMI of ≥25 kg/m² is considered obese. People of African and Afro-Caribbean heritage have higher muscle mass than White populations (Misra, 2015).

Waist circumference
Waist circumference changes with weight and a high waist measurement indicates central obesity. Central obesity is associated with increased risk of diabetes and insulin resistance. It is also associated with cardiovascular disease. Losing weight will lead to a reduction in waist size and reduce the risk of diabetes and associated problems, such as elevated cholesterol (Papaetis et al, 2015).

Diet and exercise
Diet and exercise enable individuals to maintain or regain a healthy body weight. Calorie requirements depend on a person's age, metabolism and levels of physical activity. An inactive person will require fewer calories than an active person. Generally, women require fewer calories than men, as men have more muscle than women and muscle burns calories more quickly than fat. On average, women require 2,000 calories a day and men 2,500 (NHS, 2019a). Adults need a variety of different foods if they are to have a healthy balanced diet (NHS, 2022). A healthy diet consists of around one-third fruit and vegetables, one-third starchy carbohydrates, and 45-56g of daily protein including beans, pulses, fish, eggs and meat (NHS, 2022).

Evidence suggests that in the UK inactivity leads to around 69,000 preventable deaths annually (Heron et al, 2019). The chief medical officers for England and Wales, Scotland and Northern Ireland have produced guidelines on physical activity aimed at the entire population (Department of Health and Social Care (DHSC), 2019). Activity recommendations vary according to age. There is specific guidance for infants, toddlers and pre-school children, and for children and young people aged 5-18 years. The aim of the children and young people guidance is to enable them to develop movement skills and build strong bones and muscles (DHSC, 2019). The recommendations for adults aged 19-64 years state that they should aim to be physically active every day, that any activity is better than none and that high levels of activity, including vigorous activity, are encouraged (DHSC, 2019).

The recommendations for older adults, those aged ≥65, differ slightly in that there is an emphasis on maintaining physical function that takes into account age-related changes. The guidance for both adults and older adults stresses the importance of breaking up periods of sedentary activity with activity (DHSC, 2019).

Blood pressure
High blood pressure and the risk of developing diabetes are linked and treatment of hypertension – initially with weight loss and exercise, if this is ineffective with medication – can reduce diabetes risk (Tsimihodimos et al, 2018: Boned Ombuena et al, 2016). Excessive weight gain and dietary factors contribute to the development of hypertension (Faulkner and de Chantemèle, 2018).

Calculating diabetes risk
Risk assessment scores aim to identify people who have certain risk factors and to measure the level of risk an individual has of developing a certain condition or problem. As we have seen, the risk of developing diabetes varies according to ethnic group,

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weight and genetic factors, so all these must be taken into account. Using an online calculator can help determine level of risk.

- The NHS England website has an online calculator that asks seven questions to calculate diabetes risk: T2DM risk checker (Box 1);
- The FINDRISC score (Table 2) was developed in Finland and works out a person's risk of developing T2DM. It is a slightly more comprehensive assessment as it also checks diet and exercise (Lindström and Tuomilehto, 2003) (Box 1).

An estimated 13.6 million people in the UK are at increased risk of developing diabetes (Diabetes UK, ndb). Many risk factors are associated with the development of T2DM, including obesity, hypertension and dyslipidaemia. These factors, originally described as "insulin resistance syndrome", are also known as metabolic syndrome (Reaven, 1988). Metabolic syndrome in turn increases the risk of heart disease, stroke and other conditions that affect the blood vessels. A third of adults aged ≥50 are thought to have metabolic syndrome (NHS, 2019b). Box 2 outlines the features of metabolic syndrome.

Pre-diabetes is an elevation of blood glucose above the normal range but below the threshold for diabetes. It can be impaired fasting glucose or impaired glucose tolerance. The risk of developing diabetes is elevated in people who have metabolic syndrome.

Diabetes prevention programme
In England, the NHS has set up a diabetes prevention programme, working with the Office for Health Improvement and Disparities and Diabetes UK – Healthier You: NHS Diabetes Prevention Programme (Box 1). This offers intensive behavioural intervention and set goals for weight loss, diet and physical activity. The programme aims to enable people to make simple changes to reduce the risk of developing diabetes. It is open to people who are not pregnant, are aged over 18, do not have diabetes currently and have received a score of 16 or over when using the Know Your Risk tool. People can make a self-referral if a GP has informed them that they are at risk of diabetes and they have a high HbA1c or blood glucose measurement. A nurse or health professional can also refer them to the programme.

Conclusion
One of the triumphs of modern healthcare is that people are living longer. Unfortunately, as the UK population is becoming less healthy, diabetes is becoming more common in young people, and these young people will have longer periods of ill health and shorter lives than previous generations. Our challenge as a nation is to enable people to live healthier lives, to reduce ill health and enable people to experience the best possible quality of life, including by avoiding developing T2DM. **NT**

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