



Review Article

# Critical Assessment of Current Health Policies Used for Managing Diabetes in the United Kingdom

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## Abstract

Type 2 diabetes mellitus is a global epidemic accelerating especially in developing world, with increased prevalence in younger age groups. In the UK, it is increasingly diagnosed in children. In the USA, 1 in 3 adults have prediabetes out of which 80% isn't aware of this condition [1]. Prediabetes is also linked to a higher mortality rate in elderly. Therefore, there is a strong need for universal screening interventions, which would allow preventative measures introduced early enough to stop this debilitating disease. Identification of pre-diabetic patients and increasing their awareness could prevent them from developing diabetes or at least prolong the time prior to need for medical intervention, reducing the cost spent on medical treatment. Moreover, hospitalisation and mortality rates related to viral diseases inclusive of Covid-19 could be greatly reduced by improvement of current health policies for diabetes and prediabetic conditions. In this manuscript, existing universal and targeted interventions that are used to deal with diabetes in the United Kingdom are discussed. The aim of this work is to assess current screening policies in the UK, critically evaluating their strength and limitations to conclude which type of screening interventions used globally might be of interest for implementation in the UK and other countries.

## Highlights

- Diabetes is a growing public health concern requiring readjusting existent health policies
- Scientific evidence shows benefits of early screening programmes for detection of diabetes
- Gestational diabetes screening using NICE guidelines doesn't allow detection of asymptomatic cases
- Mortality rate from viral diseases could be reduced by improving diabetes policies.
- Universal populational screening for T2D in the UK has not been introduced

**Keywords:** Type 2 diabetes mellitus; Gestational diabetes; Universal screening; Health policy; Diabetes prevention; Diabetes intervention programme, NHS Health Check, Health equity, Health equality

## Introduction

Diabetes mellitus is a group of chronic, metabolic diseases in which the body's ability to either produce or respond to production of insulin is impaired, resulting in abnormal metabolism and elevated systemic levels of glucose. There are few types of diabetes:

- Type one –juvenile diabetes (familial form) caused by inability of pancreas to produce sufficient levels of insulin. Type 1 diabetes disease isn't preventable through lifestyle changes [2].
- Type 2 – sporadic diabetes is a very common metabolic disease caused by insufficient insulin secretion by pancreas and the desensitization of insulin receptors on tissues and organs. Resulting disease of hyperglycaemia leads to damage of heart, kidneys, nervous system [3].
- Gestational diabetes – relating to elevated glucose in the blood during pregnancy, usually resolving after birth but might result in chronic type 2 diabetes.

Prediabetes is a silent, asymptomatic condition of hyperglycaemia, very common amongst adults aged  $\geq 65$ , preceding T2DM development. The asymptomatic hyperglycaemia can be often detected as early as 7-10 years before the onset of diabetes (10). Prediabetes often also described as Impaired Glucose Tolerance (IGT), where blood glucose levels are higher than normal but not yet at a diabetic level, - is of major public health importance. The IGT/prediabetic state is very dangerous as it is silent and predisposes individuals to cardiovascular disease, increases susceptibility to infectious diseases or a sudden death [4].

T2DM can occur in all age groups. In the UK, it is increasingly diagnosed in children. In the USA, 1 in 3 adults have prediabetes out of which 80% isn't aware of this condition [1]. Prediabetes is also linked to a higher mortality rate in elderly [5]. Moreover, undiagnosed diabetes was associated with 4.7-fold increase in non-cancer, non-CVD related mortality [5]. Globally, WHO reported diabetes as a global epidemic accelerating especially in developing world, with increased prevalence in younger age groups [6].

In 2017, 352 (7.3%) million adults were living with prediabetes worldwide, and this number is expected to increase to 587 million (8.3%) by 2045. In the UK about 8% of people have type 1 diabetes, whereas the prevalence of type 2 diabetes mellitus (T2DM) is much higher; there are currently 3.4 million people with Type 2 diabetes in England with around 200,000 new diagnoses every year [7]. The National Health Service spends

approximately £10 million a day on a diabetes-related care [8]. In the USA, it was estimated that one in four people was not aware they had diabetes [9]. Harris, et al. demonstrated that the onset of type 2 diabetes occurs at least 4-7 years before clinical diagnosis; hence, early screening would benefit both the patient and healthcare. Diabetes is a challenging non-communicable disease that requires more public attention and introduction of new health policies before it's too late. Specially during the recent outbreak of Covid-19 epidemics, clinical research clearly showed correlation and association of intensive care unit admissions with prolonged length of stay for those with pre-existing diabetic and pre-diabetic conditions [11]. Therefore, given that, patients with T2D have increased rate of hospitalization and mortality related to viral diseases such as COVID-19, it should become a priority to improve screening policies and reduce the burden on healthcare system.

## Situational Analysis of Current Policies in the Country of Interest

In England large scale-population screening for diabetes isn't currently recommended by the NSC, as per most recent review undertaken in 2019. This decision was based on evidence showing no difference in screened group versus non screened one [12,13]. Other criterion, under which screening for T2D was rejected in the UK, was the limitation of the current screening tests. In Scotland neither there is a systemic screening programme for diabetes or pre-diabetes. The NSC review suggests that more research is needed to understand how pre-diabetes might develop into T2DM. NSC failed to find enough evidence that screening for T2DM in general population is beneficial, despite large worldwide studies showing contrary [14,15]. Until 2013 there was not enough of evidence derived from RCTs that screening is more beneficial than the lack of it.

In the UK, there is a current health policy for targeted diabetes screening as a part of NHS Health Check programme [16]. Targeted groups eligible for screening are in the age groups  $>45$  years with proven increased risk for developing T2DM ( $>45$  yrs group). This service however isn't strictly devoted to T2DM screening, and if a family survey excludes key risk factors, individuals may not be given a priority for a glucose blood test. The major limitation of this screening method is that prediabetic individuals or people with generally good BMI would be excluded, but they still might be asymptomatic for glucose intolerance or prediabetes.

NSC claims that the current NHS programmes for diabetes: NHS Health Check and NHS Diabetes Prevention Programme are already very efficient in their preventative power [17,18]. However, NHS health check doesn't always promote glucose screening, and mostly it focuses on prevention of Cardiovascular Diseases (CVD). Moreover, NHS Health Check is a targeted screening for those aged 40-74 years, therefore leaving younger population

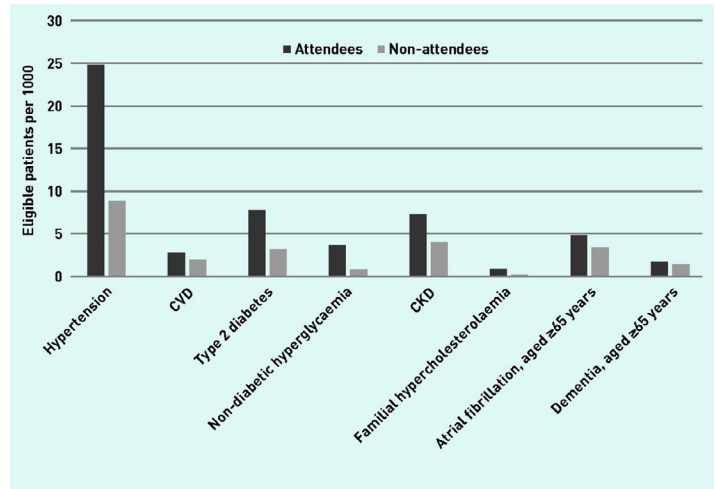
far behind detection limit [18]. Therefore, there is a clearly an unintended outcome of NHS Health Check where the younger population is omitted and could/might develop disease, hence it excludes population which might have had benefited from this screen. Therefore, this service doesn't serve well health equality. The best way to improve this approach would be to universalize NHS Health Check and make it available to all adults. On the other hand, stratification of patients who would benefit from the screen on the base of risk factors such as obesity, familial history, clinical syndromes already reduce the burden on both healthcare and patient, providing health equity.

NHS Health Check has been implemented into health policy in England from year 2009 with the main purpose of reducing cardiovascular disease. The most recent review [19] based on 29 independent studies, confirmed the significant increase in detection of multiple risk factors and morbidities including diabetes mellitus. However, the review identified many limiting factors for efficacy of this programme; that is the selective prevalence of women and people with a higher socioeconomic status. Therefore, a major limitation of NHS Health Check programme seems to relate to subpopulation selection, rather than health equality. One of the solutions that has been implemented in some of the regions, was sending invitations to prompt male and individuals who might not be aware of the programme. Opportunistic invitations however weren't implemented nationally, therefore this approach requires further policy adjustments and standardisation across all nation. To improve the outcome of this policy it should be uniformly implemented across the country and magnitude of health promotion shouldn't differ at the local level, improving this way the health equality.

Another limitation of efficacy for this programme has been investigated in 2017 [20]. The authors stratified key impediments on why the NHS-HC attendance is lower than expected, these were suggested as follows:

- Lack of awareness or knowledge about the NHS-HC program and its purpose
- Difficulty with getting GP appointment
- Stigma on confidentiality and privacy

Despite herein discussed limitations of NHS-HC targeted screening programme, analytic investigation of its effectiveness between 2013-2017 showed improved detection of T2DM in attendees than in no attendees, see Figure 1. Those findings suggest that after further reduction of above-mentioned limitations in line with expanding scope of the programme for younger population these outcomes might be further improved in the future [21].



**Figure 1:** Comparison of new diagnoses of diseases tested by NHS Health Check in attendees and non-attendees across years 2013-2017 in England [17].

Multiple existing publications suggest that type 2 diabetes is emerging young population epidemics, therefore health policies and screening programmes should be adjusted accordingly to new data sources (Rosenbloom et al. Kumar et al, Akinci 2021).

Second existent universal awareness programme in the UK is the NHS Diabetes scheme. As much as NHS Diabetes is a good programme to deliver behavioural change prompting those diagnosed with diabetes for lifestyle changing decisions, it is only directed to those already diagnosed, leaving those who might benefit of lifestyle change far behind (prediabetic, unaware of disease population). Since NHS Diabetes isn't itself a screening programme but rather a prevention programme, it wouldn't be further discussed here.

Another targeted screening evaluated in the UK is NICE (The National Institute for Health and Clinical Excellence) programme stratified for women with Gestational Diabetes Mellitus (GDM) which relied only on selection of women with risk factors. Randomized control trials revealed however that using NICE Guidelines [22] would have missed over a 3<sup>rd</sup> of total observed women with GDM [23]. Currently in the UK the standard OGTT test is used for screening purposes, only performed if patient has 1 or more risk factors for gestational diabetes, usually undertaken between 24-28 weeks of pregnancy. The limitation of this type of screening programme is potential asymptomatic development of GDM. However, the costs for blood screening along with imposing stress on pregnant women during pregnancy seem to be valid arguments against general testing. According to NICE, women

who showed glycosuria on 2 antenatal appointments should be followed up with OGTT test [24]. Therefore, to avoid time and cost-consuming tests, targeting those who show symptoms seems to be both ethical and logical.

Interestingly, recent research proves superiority and effectiveness of NICE screening guidance over the Royal College of Obstetricians and Gynaecologist guidance. The evaluation research has been done on efficacy of tests run during covid-19, clearly showing that the RCOG screening failed to detect 47 (20%) out of 82 (57%) women with gestational diabetes [25]. RCOG screening guidance published and implemented in many healthcare settings in March 2020, involved cancelling 2-hour OGTT test and replacing this test with HbA1c and Random Plasma Glucose (RPG) test, both tests recommended at 28 weeks of pregnancy [24]. The outcome of this cohort study clearly demonstrates that the choice of incorrect tests for screening and using modified guidelines during Covid-19 outbreak caused a 45% statistically significant reduction in the detection of gestational diabetes. It is clear that carefully optimized screening plans allow not only providing early detection, quick treatment, and a better healthcare, but also reducing the overall cost of screening on a large scale.

### **Universal Interventions in Screening for Diabetes Available Globally**

Early diagnosis and treatment of diabetes improves clinical outcomes, prevents costly complications and most of the times may even help in reverting the course of the disease [9,26].

#### **Diabetes screening tests**

There are already few tests that showed to pass NSC screening criterion of safety, precision, and efficacy. Those tests are already in use in some countries like the USA as part of a universal screening program. Blood tests include following tests:

- A1C (haemoglobin A1c test) measures average levels of glucose attached to haemoglobin over the past 2-3 months. This test has been used in the USA as a substitute to fasting blood glucose as diagnostic test for diabetes. The test is efficient in detecting chronic glycaemic cumulative issues but also it correlates with risk of long-term diabetes complications [27].
- Fasting Blood Glucose (FPG) test is performed in the morning before a meal. It is a test suitable for screening purposes, however it requires peripheral blood sample, therefore it is not an easy test to implement without involving healthcare set up and trained personnel. However, sensitivity and specificity of this test has been questioned by scientists, especially in obese individuals and investigation of impaired glucose tolerance [28].
- Oral Glucose Tolerance Test (OGT) is more time per patient

consuming because it measures sugar levels with hours of time lapses to establish physiological responses to consumed glucose and monitors hyperglycaemia. However, it was shown to be very efficient in assessing glucose tolerance [28].

- Random blood sugar test is also used routinely, mostly in general practice or hospitals, with results being kept as a medical record. It provides only real time sugar levels information, but many times GPs include the test in yearly check-ups. A blood sugar level of 200 mg/dL is indicative for diabetes [29].
- Other tests without need for blood sampling include urine sample test, which is part of a dip strip method, measuring secreted ketones or micro albumin in urine. This test however is less reliable than blood test and not used for diagnostic purposes, however it is routinely used for screening purposes by general practice (e.g. during pregnancy).
- Gestational diabetes associated with pregnancies is detected with blood test and it is already part of a universal screening during pregnancy, at least in the UK and in the USA.

### **Comparison and Evidence of Efficiency and Overall Benefit of T2DM Screening**

Identification of pre-diabetic patients and increasing their awareness could prevent them from developing diabetes or at least prolong the time prior to need for medical intervention, reducing the cost spent on medical treatment [30]. Type 2 diabetes is a preventable disease, therefore early intervention and awareness would have huge impact on reduction of the burden of disease. T2DM is a leading cause of retinopathy, having a major impact on increased disability related to this disease, hence prevention should be emphasized [33,34].

The problem with efficiency of pre-diabetic test is the lack of empirical proof that the stratified people who exhibit higher glucose level would eventually develop diabetes if no change to lifestyle/diet has been introduced. There are missing randomised control trials studies, comparing those groups on a large scale and longitudinally over many years. Both, observational and longitudinal study comparing those with pre-diabetes along those healthy ones could massively help in answering those urging questions. Very recent Swedish large-scale longitudinal cohort study, including 2575 healthy participants showed progress in diabetes diagnoses over time to assess the rate at which prediabetes progresses to diabetes and to identify prognostic factors [35]. This 12-years follow-up study demonstrates how powerful is early diagnosis in preventing mortality and reverting normoglycemia in individuals with prediabetes. Amongst those with prediabetes, 13% progressed to full disease outset, however 22% reversed back to normoglycemia by introducing lifestyle and diet changes. Another Swedish longitudinal research study considered birth cohort to



describe metabolic profiles and insulin resistance at early age of 6 years [32]. This research clearly showed that children at the early age might have already developing insulin resistance, therefore predisposing them to diabetes, cardiovascular disease, and obesity.

From a logical and ethical point of view, populational glucose level screen in mid-adult life could gratefully help in motivating those with unhealthy lifestyle to change habits and improve their life, therefore having enormous preventative power before it is too late and full onset of disease had emerged. Introducing 'glucose-awareness' early in adulthood through routine GP blood tests and pre-diabetes survey, would allow young population to lead a healthier lifestyle and made the right choices in diet early before the problem arises. So, the screening fulfils the criterion for effectiveness of lifestyle interventions. Most recently global intervention publications showed that screening for T2DM and life-style intervention had led to reduction of waist circumference at 12 months, reduction in blood pressure and lower HbA1c levels [36].

However, there is no data showing gradual rise in problems with coping with glucose levels, hence the bigger problem lies in false negatives. Giving reassurance of health, when the problem might be apparent in few years ahead is a large ethical issue when choosing the right screening programme. Therefore, screening would need to be routinely implemented in the healthcare system (e.g. every few years through GP general health check).

Continuation of national and global efforts to undertake randomized control trials and observational studies to assess the effectiveness of screening programmes along with an investment into awareness-enhancing programmes are all priority to reduce the burden of this non-communicable disease. Most recent data published by Centres for Disease Control and Prevention (CDC) showed surge in youth diabetes cases between year 2001 and 2017 by 95% for T2DM and 45% for T1DM [1,37]. The report has been generated based on a large cross-sectional, longitudinal, observational study involving 3.4 million young participants diagnosed with diabetes. Further forecasting conducted by the SEARCH study in the USA estimated that the prevalence of T2DM amongst age group 10-19 years will reach prevalence of 0.8 cases per 1000 youth by year 2050 [38]. Overall based on the quintessence of the most recent research and epidemiological assessment, along with economic evaluation of screening methods, the UK NSC criterion of benefit of populational screens for pre-diabetes should be fulfilled.

### **Cost Analysis and Estimation of Profit in Medical Industry**

Diabetes isn't only disease affecting glucose levels, but it extends on multiple bodily functions, ranging from retinopathy,

immune deficiencies, cardiovascular diseases, proneness to bacterial and fungal infections, neuropathy, liver disease, sleep apnoea, dyslipidaemia and other non-directly linked diseases (e.g. depression), which imposes added cost burden on healthcare. In the UK it is estimated that diabetes and associated with it complications costs NHS £13 billion a year (www.diabetes.org.uk, Hex 2012). Therefore, solving the problem in its infancy is the most efficient way for policymaking, rather than dealing with burden of the disease and its repercussions. It was estimated that the average economic cost per person with diagnosed diabetes equals to \$13,240, followed by \$4,250 for undiagnosed patient, followed by the lowest cost for pre-diabetic patients amounting to \$500 [9]. This estimation clearly shows how early diagnosis and screening to stratify pre-diabetic groups would benefit the budget of a health care system. The economic evidence for cost effectiveness of the NHS-HC programme was unclear however surprisingly the individual interventions showed to be more cost effective than a non-targeted interventions [9,17,39].

### **Conclusions**

Since diabetes is, a chronic, debilitating disease which increases worldwide to epidemic proportions it is of major importance to re-think current policies and screening strategies to reduce the burden of this non-communicable disease [40-42]. Since 2019, United Kingdom didn't review evidence-based research nor their current screening policies efficiency in detecting and preventing diabetes. Therefore, there is urgent need to re-evaluate the current strategies and perhaps introduce more stringent screening protocols which would account for younger population. As the most recent cohort study data suggests, there is also need for reducing the socioeconomic inequalities when designing universal or targeted screening protocols, promotions, and awareness programmes. Clearly enough the recent epidemiological data presented here shows that diabetes isn't only age-related disease, therefore new approaches for screening criteria need to be strategized urgently.

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