NPDA
National Paediatric Diabetes Audit

RCPCH Audits

NPDA spotlight audit report Type 2 Diabetes

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- educate and examine those concerned with the health of children
- advance the education of the public (and in particular medical practitioners) in child health; which means the protection of children, the prevention of illness and disease in children and safeguarding their optimal development.

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Front Cover artwork:

Joe Stone-Lee, winner of the NPDA art competition asking children and young people to design an image based on the theme of 'living healthily with diabetes'.

Contents

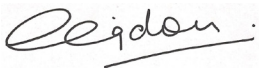
1. Foreword

I am very pleased to introduce the first National Paediatric Diabetes Audit (NPDA) spotlight report on Type 2 diabetes. Type 2 diabetes in the young is considered to be a more aggressive disease than Type 2 diabetes in adults, with more rapid onset of complications at a younger age threatening long-term health and quality of life in adulthood. It therefore should take high priority amongst commissioners of children's diabetes services. This report also clearly demonstrates the overrepresentation of children and young people with Type 2 diabetes living in the most deprived areas in England and Wales and coming from minority ethnic groups. Despite the small numbers receiving care in most paediatric diabetes services compared to Type 1 diabetes, and with numbers with the condition rising, it is essential that paediatric diabetes teams are supported by the best available information and guidelines to support optimal management amongst this vulnerable cohort.

Paediatric diabetes teams are well placed to provide comprehensive child and family centric care to those with Type 2 diabetes, being multidisciplinary in composition and incorporating paediatric, endocrine, psychological, dietetic and specialist nursing expertise. However, this report suggests that more can be done to ensure that children and young people with Type 2 diabetes receive all the recommended health checks for this condition, and for those with obesity where applicable. It also highlights the necessity of addressing the outcomes of the checks that are provided, in terms of increased support for weight management, and treatment for hypertension and albuminuria.

I commend this report to anyone with an interest in Type 2 diabetes in children and young people with diabetes, especially those involved in the diagnosis and management of this condition. More broadly, this report is important for everyone interested in child health because of the associations demonstrated between Type 2 diabetes and deprivation and some of our more vulnerable communities. I also commend the efforts of the teams who submitted data during an exceptionally difficult year, and the National Network for Children and Young People with Diabetes for their efforts in support of this audit, and towards sharing and defining best practice for this vulnerable cohort.

I would like to thank all those involved in writing the report and developing its recommendations, including the NPDA Project Board, Methodology and Dataset Group, the audit team, and Clinical Lead, Professor Justin Warner. I would like to thank the paediatric diabetes teams across England and Wales for their support to the audit and for their efforts to make improvements in their local services.



Camilla Kingdon
President, Royal College of Paediatrics and Child Health

2. Key terms used within this report

Acanthosis nigricans
Dry, darker patches of skin that usually appear on the neck, armpits or groin. This is a cutaneous marker of insulin resistance and is associated with a range of conditions including obesity and Type 2 diabetes.

Alanine transaminase (ALT)
An enzyme found mostly in the liver, which has a crucial role in converting food into energy. Higher levels in the blood stream can indicate an inflamed or damaged liver.

Albuminuria
Albumin is a protein usually found in the blood. If kidneys become damaged, they may become leaky and allow albumin to pass from the blood into the urine, which is referred to as albuminuria.

Ambulatory blood pressure monitoring (ABPM)
When your blood pressure is measured whilst you as you go about your normal daily activities, for up to 24 hours.

Body Mass Index (BMI)
A measure taking into account your height and weight that is used to classify healthy and unhealthy weight categories.

HbA1c
The term HbA1c refers to glycated haemoglobin. Measuring HbA1c gives an indication of a patient's average blood sugar levels over a period of a few months. Consistently higher HbA1c is associated with higher risks of developing diabetes-related complications.

Hyperlipidaemia
A high level of lipids (fats, cholesterol and triglycerides) circulating in the blood.

Hypertension
A condition in which blood pressure is high enough that it may eventually cause health problems, such as heart disease.

Insulin
A hormone made in the pancreas, which is an organ in your body that helps with digestion. Insulin helps your body use glucose (sugar) for energy.

Metformin
A medicine used to treat Type 2 diabetes. It reduces the amount of sugar your liver releases into your blood and also makes your body respond better to insulin.

Non-alcoholic fatty liver disease (NAFLD)
A range of conditions caused by a build-up of fat in the liver usually seen in people who are overweight or obese, which can lead to serious liver damage.

Paediatric diabetes unit (PDU)
A paediatrician-led multidisciplinary team of health professionals within an NHS trust, hospital or Health board delivering diabetes care to children and young people.

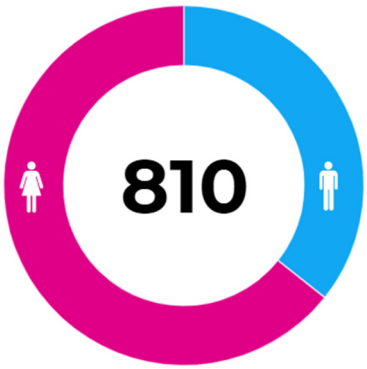
Triglycerides
Types of fat (lipids) combined with glycerol, a form of glucose. Higher levels of triglycerides in the blood contribute to the risk of developing heart and circulatory disease.

Type 1 diabetes
An autoimmune condition where the body can no longer produce insulin, so insulin injections or infusions are needed.

Type 2 diabetes
A condition with both genetic and lifestyle factors, where the body is unable to make enough insulin, or where the insulin that is produced doesn't work effectively.

3. Key findings

Patient characteristics and care at diagnosis



810 children and young people with Type 2 diabetes received care from a PDU in England and Wales in 2019/20. The majority were girls (64.3%).

71.4% lived in the two most deprived quintile areas of the country. **65.1%** came from minority ethnic backgrounds.

Almost a third (30.1%) of children or young people with Type 2 diabetes are being cared for in a PDU with five or fewer cases of the condition. Only 22/172 PDUs cared for more than 10 children with Type 2 diabetes.

There is no one criterion, clinical or biochemical, that makes a diagnosis of Type 2 diabetes; a combination of careful clinical evaluation and biochemical evaluation is necessary to make a swift diagnosis.

Dietetic support was offered to 99.3% of children and young people at diagnosis of Type 2 diabetes, **with 69.9% being offered psychological support at diagnosis.**

Four-fifths (78.9%) had no delay in the diagnosis of Type 2 diabetes. Delay was associated with higher HbA1c at diagnosis.

Most (>85%) had a family history of Type 2 diabetes, mainly amongst female relatives.

Over four fifths (84.8%) had three or more clinical or biochemical markers of Type 2 diabetes; Clinically, the presence of obesity (85.9%) and acanthosis nigricans (50.9%), combined with raised HbA1c (77.6%) and absence of diabetes antibodies (40.1%) in the presence of a raised blood glucose (46.6%), appear to provide the highest markers for early diagnosis.

Recommended health checks around sleep assessment (21.7%), liver ultrasound (18.5%) and 24-hour ambulatory blood pressure monitoring (2.8%) were poorly performed in the first year following a diagnosis of Type 2 diabetes.

Over half (50.9%) were hypertensive (BP >98th centile) at diagnosis.

Care and outcomes in 2019/20

Completion of NICE recommended health checks (HbA1c, BMI and blood pressure) in children and young people with Type 2 diabetes was good (~95%) with rates similar to those recorded for Type 1 diabetes from the core audit of the same year. Lipid profiling (77.3%), urinary albuminuria (63.9%) and liver function tests (66.7%) were less well completed.

Dietetic (94.6%) and psychological support (56.4%) were offered in 2019/20 at rates similar to those at diagnosis.

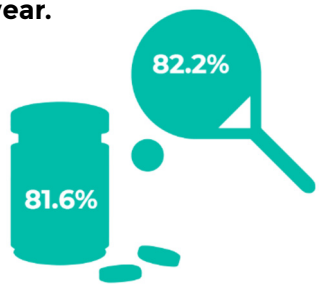
Albuminuria was only treated in 3.4% of children and young people with Type 2 diabetes with a further 6.9% deemed as requiring treatment. However, the core NPDA audit reported albuminuria in 25.7%.

Liver ultrasound was poorly performed with 88.2% not having the investigation. Where ultrasound was completed at diagnosis and repeated in 2019/20, a higher percentage were now found to have fatty liver.

Despite 42.3% having high blood pressure, only a minority (3.7%) were referred on for 24 hour ambulatory blood pressure monitoring, and only 5.9% were offered antihypertensive therapy.

Almost all children and young people with Type 2 diabetes were either overweight (6.5%) or obese (92.0%) in 2019/20. Of those with obesity at diagnosis in years prior to 2019/20, only 8% reduced their BMI to a lower category by this audit year.

In 2019/20, lifestyle modification (82.2%) and metformin (81.6%) were the most highly utilised therapies. Insulin was used by 26.5% of the cohort, and there was infrequent use of sulphonylureas, GLP1 agonists, DPP-4 and SGLT2 inhibitors.



The median HbA1c for children and young people with Type 2 diabetes was 52.5 mmol/mol in 2019/20 compared to 62.0 mmol/mol for Type 1 diabetes.

Therapies for severe obesity such as extreme low-calorie diets, Orlistat or bariatric surgery were rarely used in children and young people with Type 2 diabetes.

4. Recommendations

The National Children and Young People's Diabetes Network should:

1. Develop protocols for the diagnosis and management of children and young people with Type 2 diabetes to:
   - Support compliance with NICE guidance for Type 2 diabetes and associated comorbidities
   - Ensure comorbidities are managed appropriately where identified
   - Support good care locally.

Paediatric diabetes units should:

2. Maintain their multidisciplinary expertise in Type 2 diabetes by networking with other PDUs, especially if they are managing smaller numbers with the condition.
3. Ensure that children and young people with Type 2 diabetes are screened for complications such as fatty liver (NICE, NG49), hypertension and albuminuria (NICE, NG18), and manage these when they are found according to the best available evidence.
4. Ensure that obesity associated with Type 2 diabetes is addressed using the existing guidance for obesity in children (NICE, QS94).

NHS trusts and Health Boards should:

5. Ensure that children and young people with Type 2 diabetes are able to receive a multidisciplinary approach to management similar to Type 1 diabetes, including consultants with an interest in Type 2 diabetes, paediatric specialist nurses, dietitians and psychologists.

Public health services should:

6. Raise awareness of prevention measures, and reduce the prevalence of Type 2 diabetes, by including strategies in public health campaigns which target and educate children and young people in high risk groups of developing Type 2 diabetes (those with obesity, living in a deprived area in England and Wales and those who have ethnic minority status).

5. Introduction

The National Paediatric Diabetes Audit (NPDA) was established in 2003 to monitor the prevalence and incidence of diabetes amongst children and young people in England and Wales, and to measure the quality of care provided by paediatric diabetes units (PDUs). It is funded by the NHS England and NHS Wales, commissioned by the Healthcare Quality Improvement Partnership (HQIP) and delivered by the Royal College of Paediatrics and Child Health (RCPCH). NPDA reports focus on patient level care and outcomes measured against standards produced by the National Institute for Health and Care Excellence (NICE, NG18).

Over 29,000 children and young people with diabetes mellitus are being managed by PDUs in England and Wales (RCPCH, 2021), with the majority having Type 1 diabetes, and around 5% having Type 2 diabetes. Type 2 diabetes differs from Type 1 diabetes in that the body can still produce insulin. Despite the small percentage with Type 2 diabetes, the NPDA has reported year on year increases in numbers with the condition being managed by paediatric diabetes teams.

There are small numbers of children and young people with Type 2 diabetes being managed within most PDUs, which limits the experience of managing this cohort for most teams, compared to Type 1 diabetes. The condition also carries a high risk of complications, and there is a lack of comprehensive guidelines for its diagnosis and management. For these reasons, the National Children and Young People's Diabetes Network convened a working group to share research and experience, and to develop consensus around best practice in this area. This spotlight audit was designed in concert with this group to assess variation in current practice in paediatric Type 2 diabetes management, and to provide a baseline for measuring the impact of guidelines developed in the future.

5.1. Aims of the Type 2 diabetes spotlight audit

This spotlight audit aimed to build on the reporting of the core NPDA by looking in greater detail at the diagnosis, treatment, and comorbidities of children and young people living with Type 2 diabetes, beyond the scope of NICE guidelines for the diagnosis and management of Type 1 and Type 2 diabetes (NG18, 2015). Rather than solely measuring against agreed standards of care, this audit aimed to provide a 'state of the nation' snapshot of current practice.

5.2 Scope of the Type 2 diabetes spotlight audit

All PDUs in England and Wales were requested to submit information from all children and young people with Type 2 diabetes being managed within their service. The dataset included information on each patient's

- characteristics
- diagnosis
- care at diagnosis irrespective of the year in which they were diagnosed, and
- care received within the 2019/20 audit year (01 April 2019- 31 March 2020).

5.3 How to read this report

The results for all children and young people with Type 2 diabetes described in this report are presented against each audit question in Appendices 1-3 of this report, broken down by response option. The main body of the report provides narrative and further detail of the audit's findings. Where comparisons are made to the care and outcomes of those with Type 1 diabetes, these results are taken from the 2019/20 NPDA report on care processes and outcomes (RCPCH, 2021).

6. Children and Young people with Type 2 diabetes included in the spotlight audit

6.1 How many children and young people with Type 2 diabetes are being managed within PDUs in England and Wales?

The 2019/20 Type 2 diabetes spotlight audit report includes information on 810 children and young people up to the age of 24 years under the care of a consultant paediatrician in England and Wales. Seven hundred and forty (91.4%) of these children were reported by 129 PDUs who participated in the spotlight audit, whereas 70 (8.6%) children and young people were reported in the concurrent 2019/20 core NPDA audit by 19 PDUs who did not participate in the Type 2 spotlight audit (Figure 1). Twenty four PDUs reported not managing any cases with Type 2 diabetes.

Only one PDU from a total of 173 didn't participate in either the core audit 2019/20 or the Type 2 spotlight audit 2019/20, having reported 5 children with Type 2 diabetes in 2018/19.

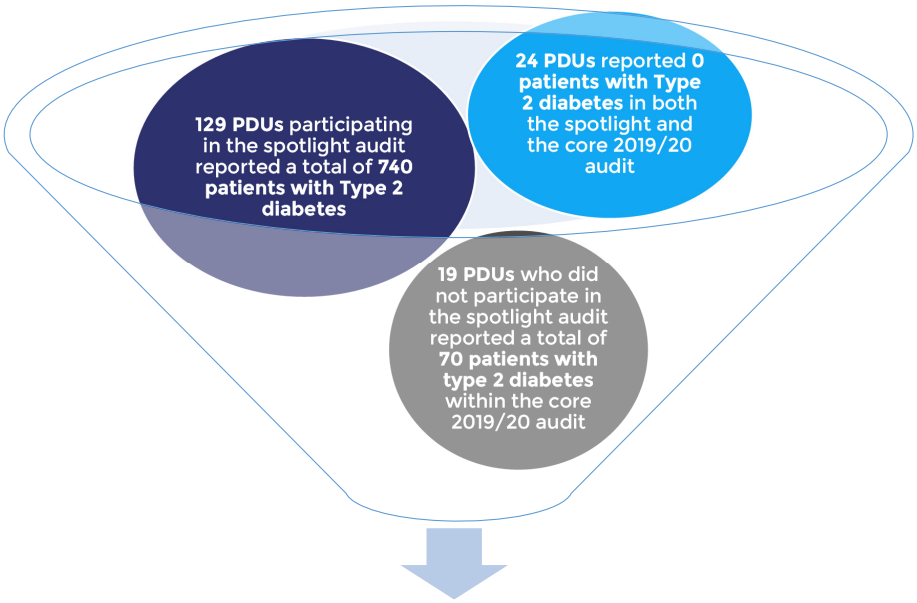


Figure 1: How the total number of children and young people with Type 2 diabetes was calculated

6.2 What is the prevalence and incidence of Type 2 diabetes amongst children and young people?

The NPDA calculates prevalence and incidence of diabetes amongst children and young people 0-15 years old since case ascertainment drops after this age, as young people transition into adult services, or are seen instead in primary care. The NDA Young Type 2 report (NHS Digital, 2021) suggests that in 2019/20, around 80% of those under 16 were seen in paediatric services; dropping to a third of those aged 16 to 18.

Based on information collected for the NPDA core audit and submitted for the Type 2 diabetes spotlight audit, the prevalence of Type 2 diabetes in 2019/20 was 4.5 per 100,000 children and young people up to the age of 15, with higher prevalence in females (Figure 2). The incidence of Type 2 diabetes was 1.7 per 100,000 children and young people up to the age of 15, with 222 being diagnosed in the 2019/20 audit year (Figure 2).

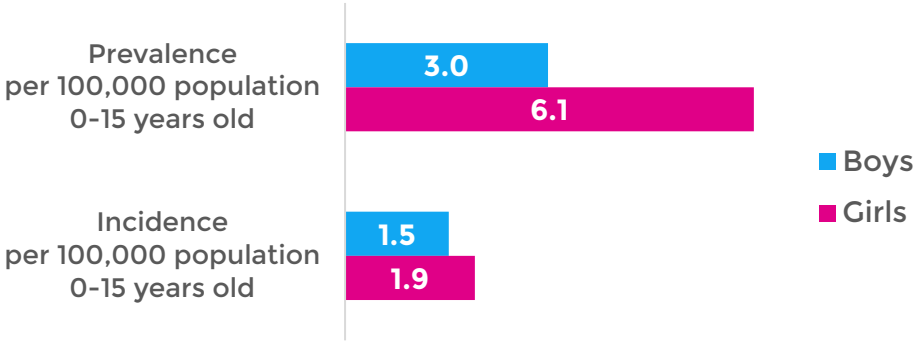


Figure 2: Prevalence and incidence of Type 2 diabetes per 100,000 children and young people aged 15 years and under by sex, 2019/20

6.3 Where are children and young people with Type 2 diabetes receiving care?

Table 1 gives a breakdown of the numbers and percentages being managed by country and region based on the location of their PDU.

Table 1: Number of children and young people with Type 2 diabetes identified within the 2019/20 core NPDA and spotlight audits

	Spotlight and core audit combined 2019/20 n (%)
England and Wales	**810 (100.0)**
England	787 (97.2)
Wales	23 (2.8)
East Midlands	42 (5.2)
East of England	49 (6.0)
London and South East	251 (31.0)
North East and North Cumbria	29 (3.6)
North West	89 (11.0)
South Central	52 (6.4)
South West	38 (4.7)
West Midlands	150 (18.5)
Yorkshire and Humber	87 (10.7)

Table 2 shows that almost a third of children and young people with Type 2 diabetes were being managed in a clinic where there were fewer than six being managed for the condition. The maximum number of patients being managed within one PDU was 34.

Table 2: Number and percentage of PDUs by caseload with Type 2 diabetes, 2019/20

	Number of PDUs n (%)	Number of children and young people with Type 2 diabetes n (%)
Total	**172 (100.0)**	**810 (100.0)**
PDUs with 0 children with T2D	24 (14.0)	0 (0.0)
PDUs with 1-5 children with T2D	101 (58.7)	244 (30.1)
PDUs with 6-10 children with T2D	25 (14.5)	194 (24.0)
PDUs with 11-20 children with T2D	16 (9.3)	216 (26.7)
PDUs with 21+ children with T2D	6 (3.5)	156 (19.3)

6.4 What are the characteristics of children and young people with Type 2 diabetes (with comparison to Type 1 diabetes)

Figures 3, 4, and 5 highlight the demographic differences between those with Type 1 diabetes and Type 2 diabetes.

The distribution across ages for Type 2 diabetes was similar to Type 1 diabetes, although nearly two thirds (64.3%) were female and cases younger than 10 years were rare (Figure 3). Most were from a minority ethnic background, with Asian children and young people having the highest representation (38.6%) (Figure 4).

There was over representation of Type 2 diabetes amongst those living in the most deprived areas of England and Wales (Figure 5).

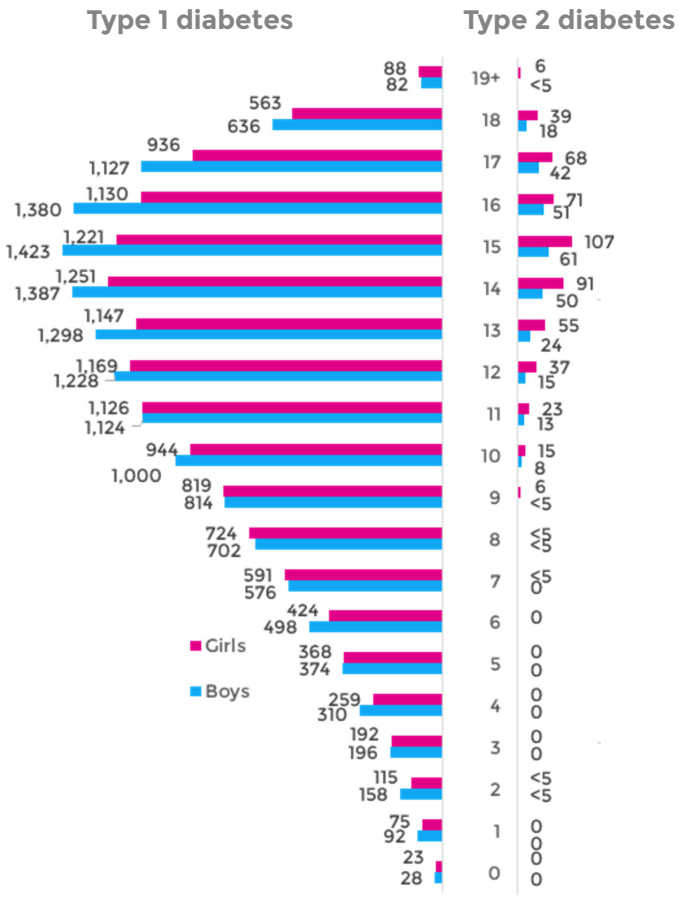


Figure 3: Numbers of children and young people with Type 1 and Type 2 diabetes in 2019/20, by age and sex

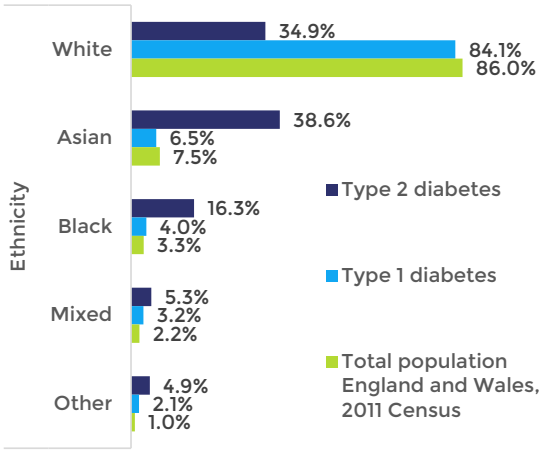


Figure 4: Percentage of children and young people with Type 2 and Type 1 diabetes by ethnic group in 2019/20, compared to the 2011 census

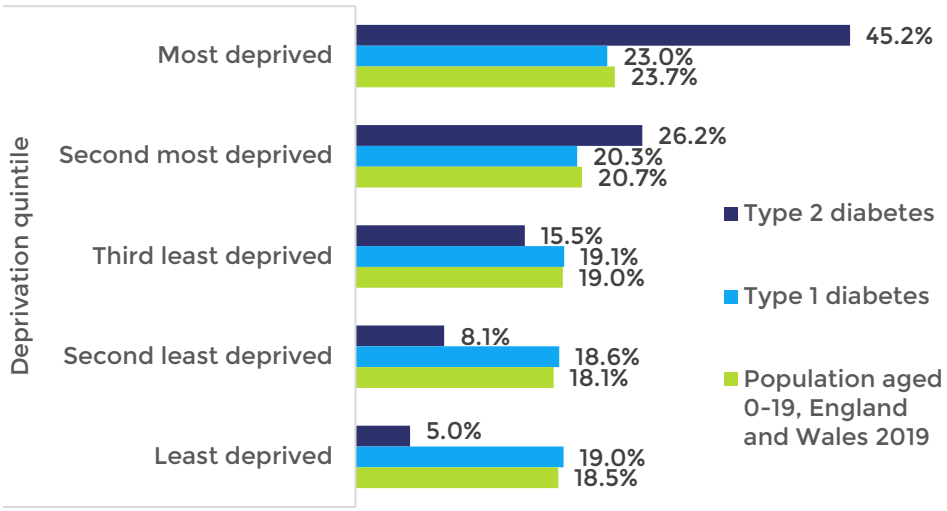


Figure 5: Percentage of children and young people with Type 2 and Type 1 diabetes by deprivation quintile, compared to ONS data

6.5 How common is a family history of Type 2 diabetes amongst children and young people diagnosed with Type 2 diabetes?

Most, 556 (85.4%), had at least one family member with Type 2 diabetes (Figure 6). Of these, 59.9% had a mother and 36.7% had a father with the condition (Figure 7).

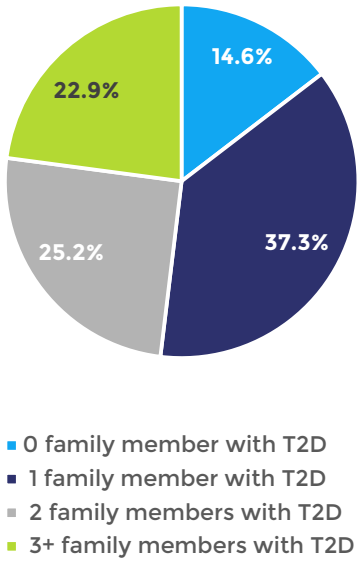


Figure 6: Percentage of children and young people with Type 2 diabetes (T2D) by number of family members with the same condition

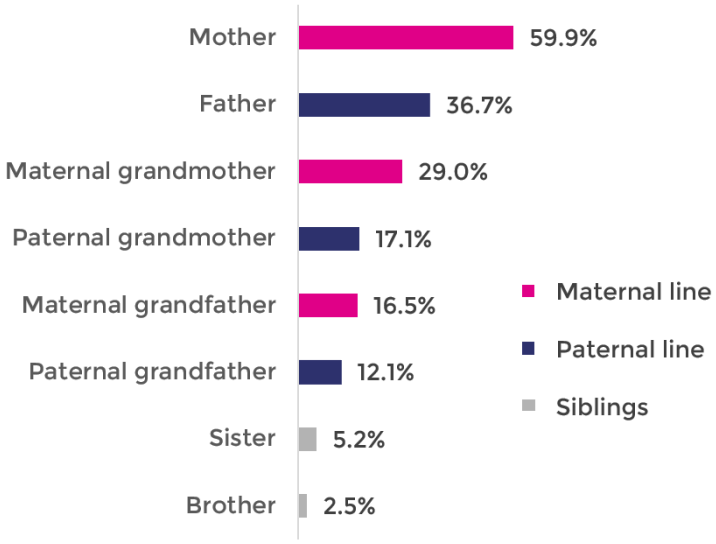


Figure 7: Percentage of children and young people with a family history of Type 2 diabetes with specified family members with the condition

7. Diagnosis of Type 2 diabetes

7.1 Are children and young people receiving timely diagnosis of Type 2 diabetes?

Type 2 diabetes is amongst the rarer forms of diabetes in childhood and can pose diagnostic difficulty. The spotlight audit examined the time between diagnosis of diabetes and a confirmed, specific diagnosis of Type 2 diabetes. One hundred and fifty six (21.1%) were not initially diagnosed with Type 2 diabetes. Of those with a later confirmed diagnosis, 87/156 (55.8%) had a confirmed Type 2 diabetes diagnosis within three months from initial diagnosis of diabetes (Figure 8).

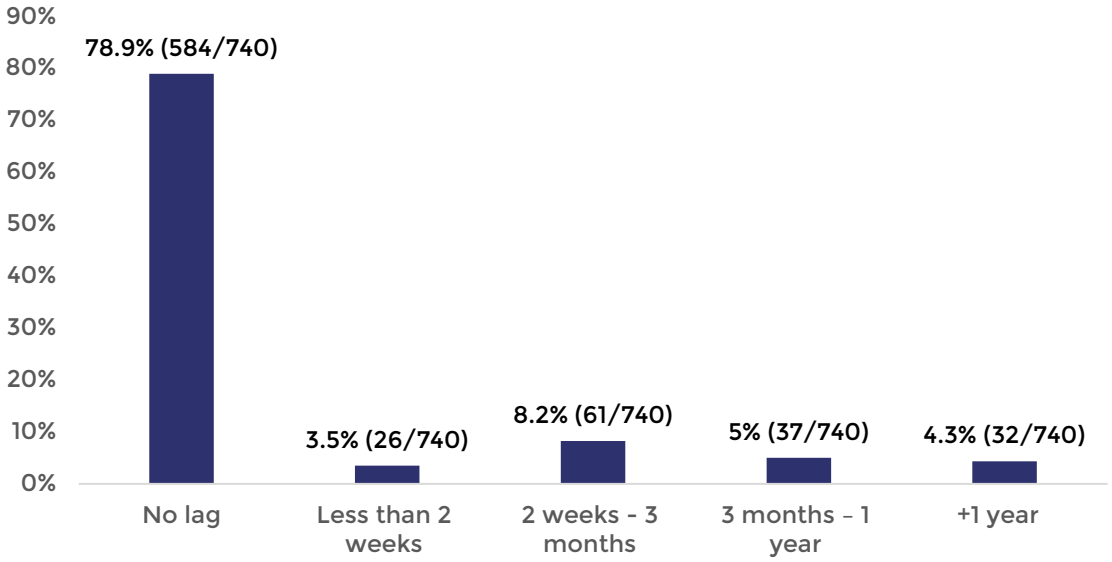


Figure 8: Breakdown of time between initial diagnosis of diabetes and confirmation of Type 2 diabetes for children and young people included in the Type 2 diabetes

Lag times between the finding of hyperglycaemia and the attribution of final diagnosis of Type 2 diabetes greater than three months, was more common in PDUs looking after fewer than six children with Type 2 diabetes, amongst children and young people without obesity, and amongst those with higher HbA1c at diagnosis (Figure 9).

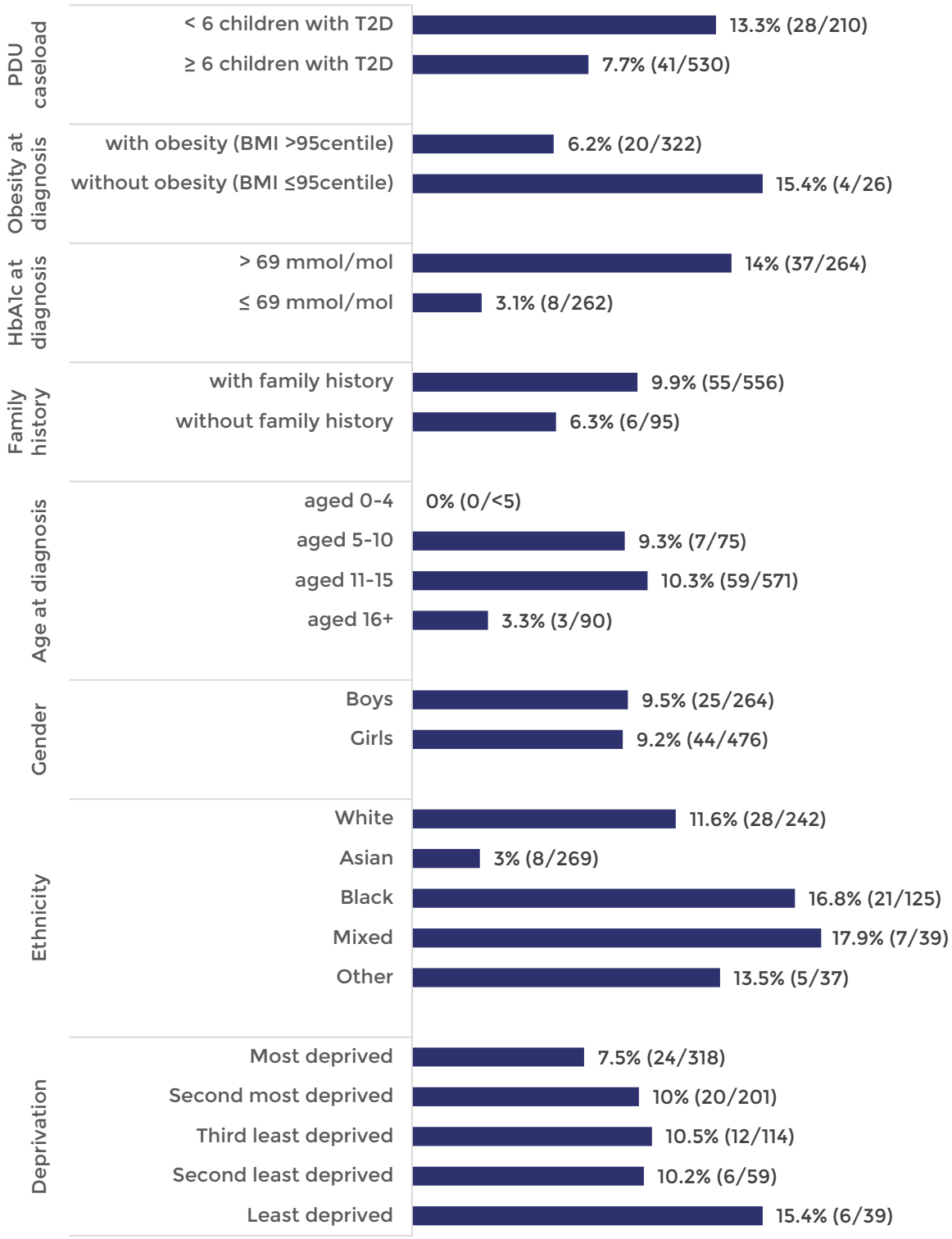


Figure 9: Percentage of children and young people with later diagnosis (>3 months) of Type 2 diabetes, by demographic characteristics

7.2 What criteria are being used to make a diagnosis of Type 2 diabetes?

Obesity was the single most common clinical marker recorded (85.9%) at diagnosis, followed by acanthosis nigricans (50.9%) (Figure 10). Top biochemical markers were an HbA1c >48 mmol/mol (77.6%), blood glucose > 11 mmol/l at random on two or more occasions (46.6%), and absence of pancreatic antibodies (40.1%).

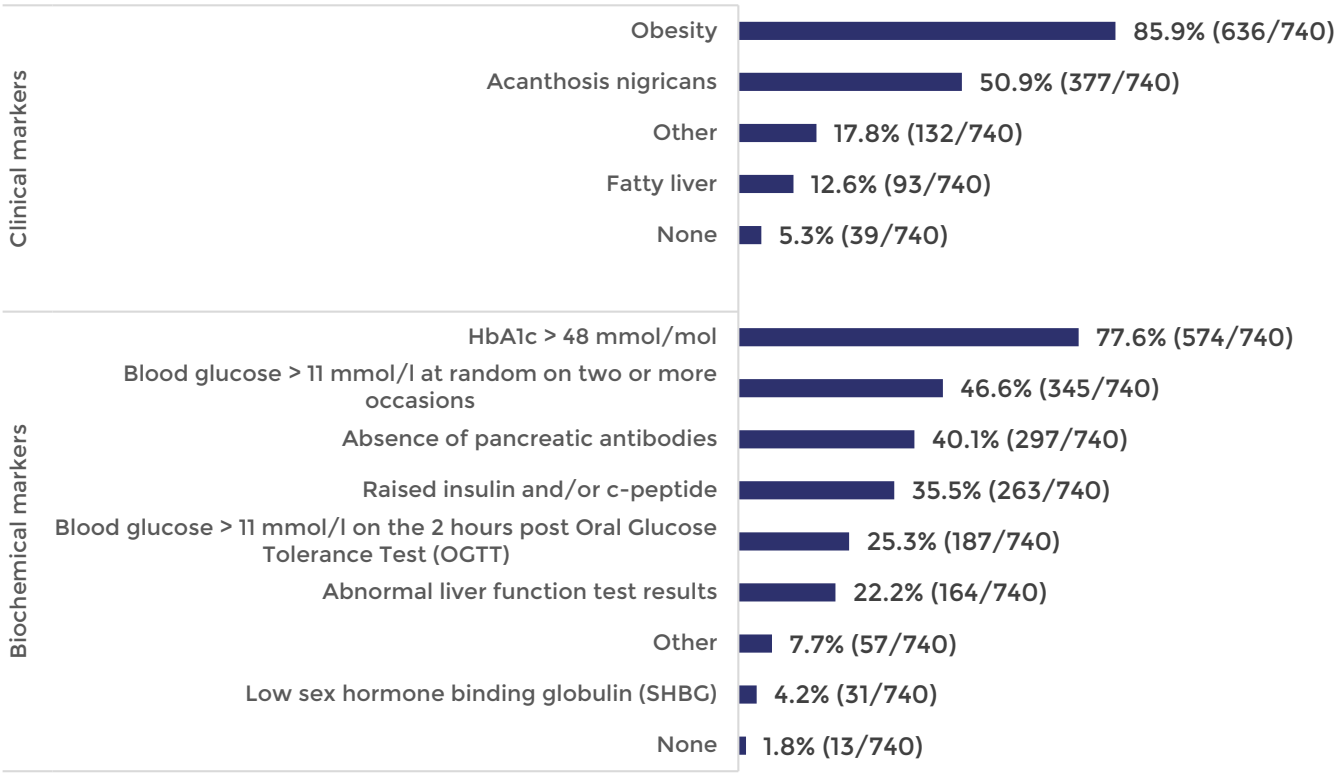


Figure 10: Percentages of children and young people with specified and/or biochemical markers at diagnosis of Type 2 dieabetes

Figure 11 provides a breakdown of clinical and biochemical markers recorded at diagnosis of Type 2 diabetes by ethnic group. It shows that acanthosis nigricans was recorded for half as many White children and young people with Type 2 diabetes compared to those of Asian ethnicity, and that more White children had abnormal liver function test results recorded at diagnosis of Type 2 diabetes than those of other ethnic groups. Variation in recording of some markers should be interpreted with caution given small denominators.

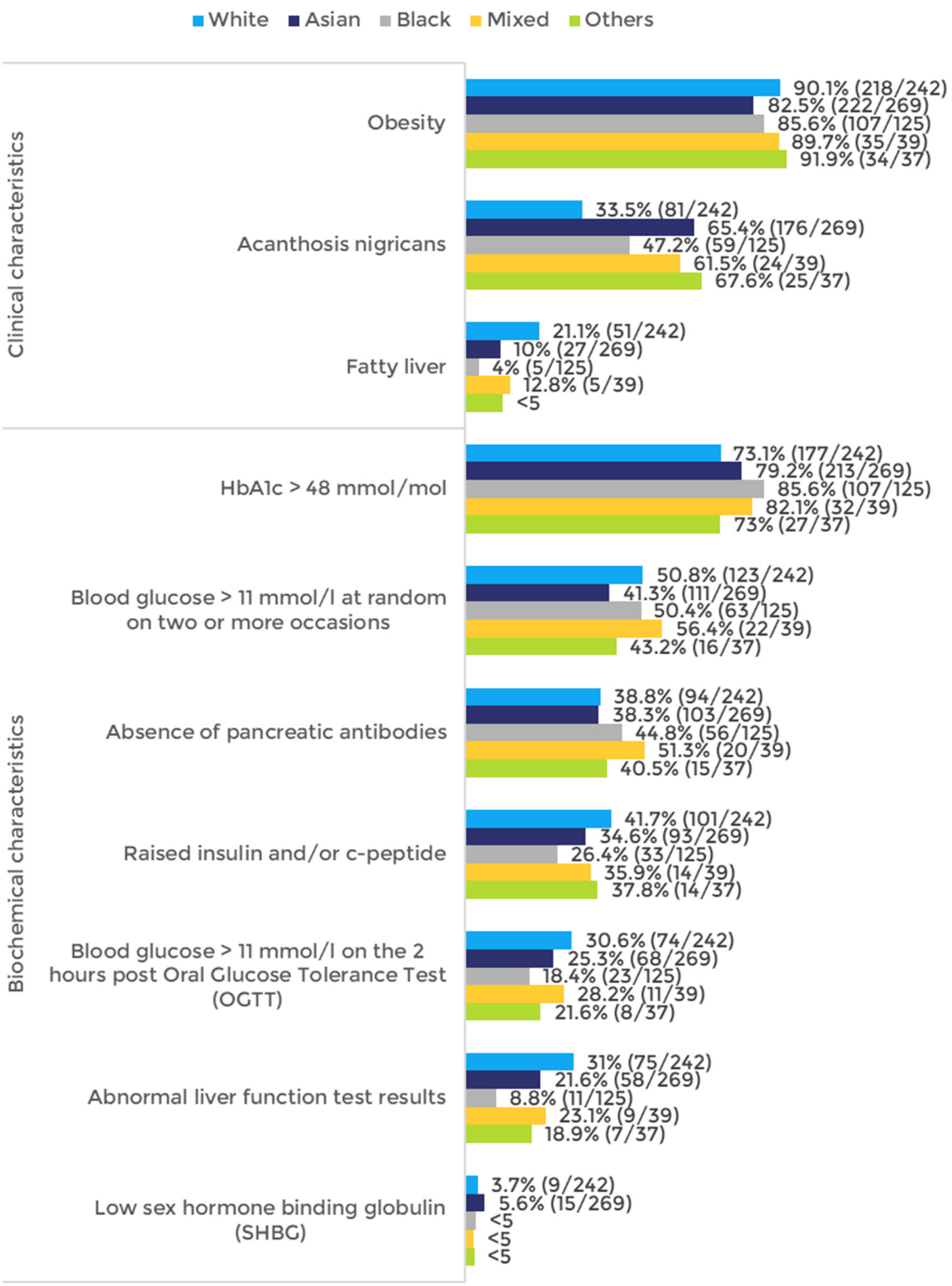


Figure 11: Clinical and biochemical characteristics recorded at diagnosis of Type 2 diabetes, by ethnic group

Most children and young people with a diagnosis of Type 2 diabetes (84.8%) had three or more clinical and/or biochemical markers recorded at diagnosis with two thirds (68.4%) having both obesity and HbA1c higher than 48 mmol/mol.

Figure 12 provides a breakdown of numbers of clinical and/ or biochemical markers identified per patient included in the spotlight audit.

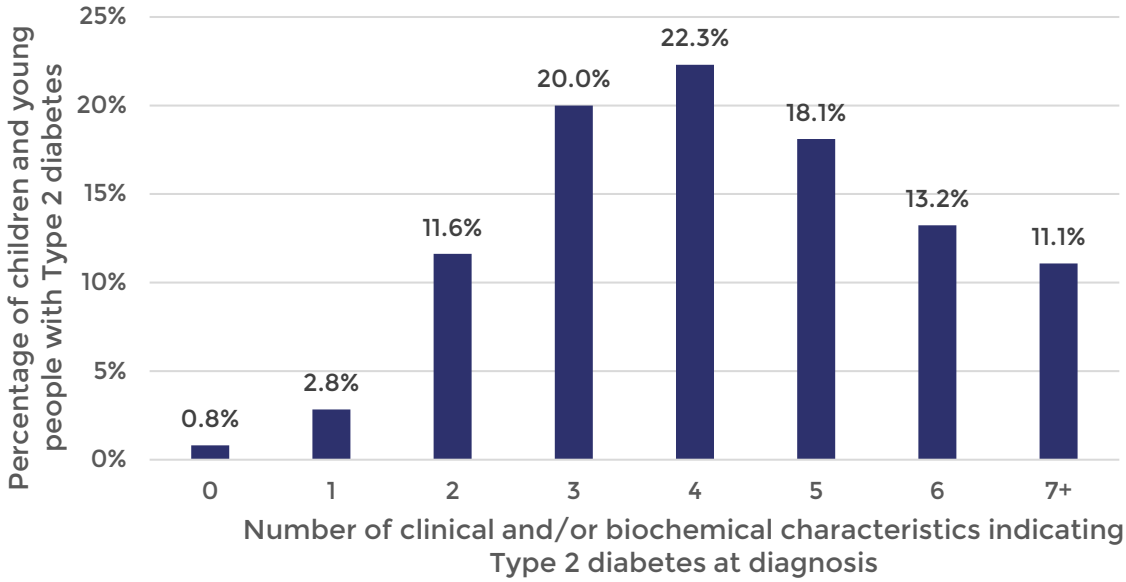


Figure 12: Percentage of children and young people included in the Type 2 diabetes audit, by number of clinical and/or biochemical markers used to make their diagnosis

7.3 What antibody tests are being used to aid the diagnosis of children and young people with Type 2 diabetes?

Typically, a lack of antibodies associated with the development of Type 1 diabetes helps to delineate a diagnosis of Type 2 diabetes. Figure 13 shows the percentages of children and young people that were tested for specific diabetes antibodies, and the percentage of those tested having a positive result. The percentage of children with Type 2 diabetes and positive antibody results was low but not zero, with less than 10% of those tested having positive results in any of the antibody types tested.

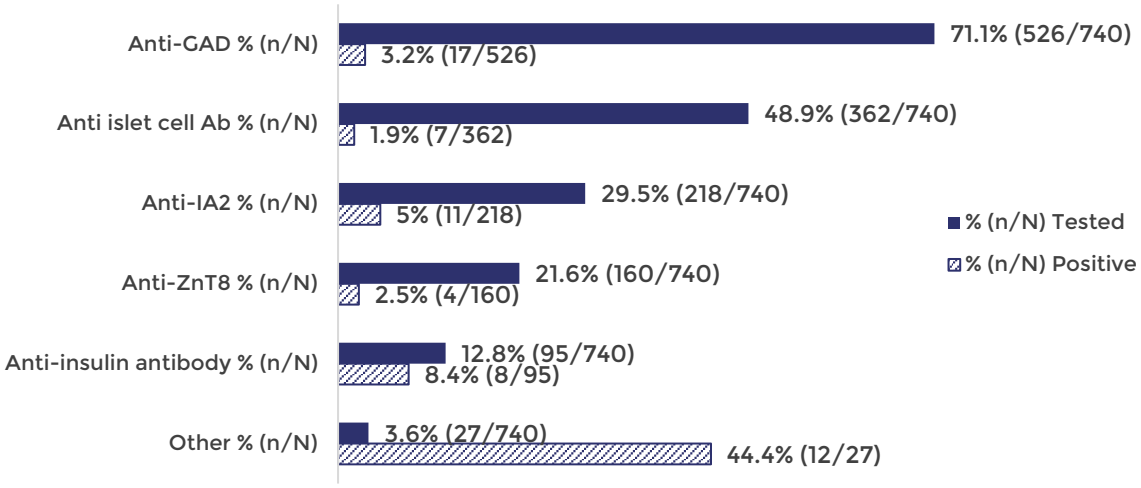


Figure 13: Percentages of children and young people with Type 2 diabetes receiving specific antibody tests at diagnosis, with percentages of positive results recorded for each one

7.4 What health checks did children with Type 2 diabetes receive at diagnosis?

Figure 14 shows the completion of health checks following initial diabetes diagnosis, by different periods of time up to one year. Nearly three quarters (73.0%) had an HbA1c recorded within a fortnight of diagnosis, and half had BMI recorded (50.8%), and a liver function test performed (50.1%) in the same period of time.

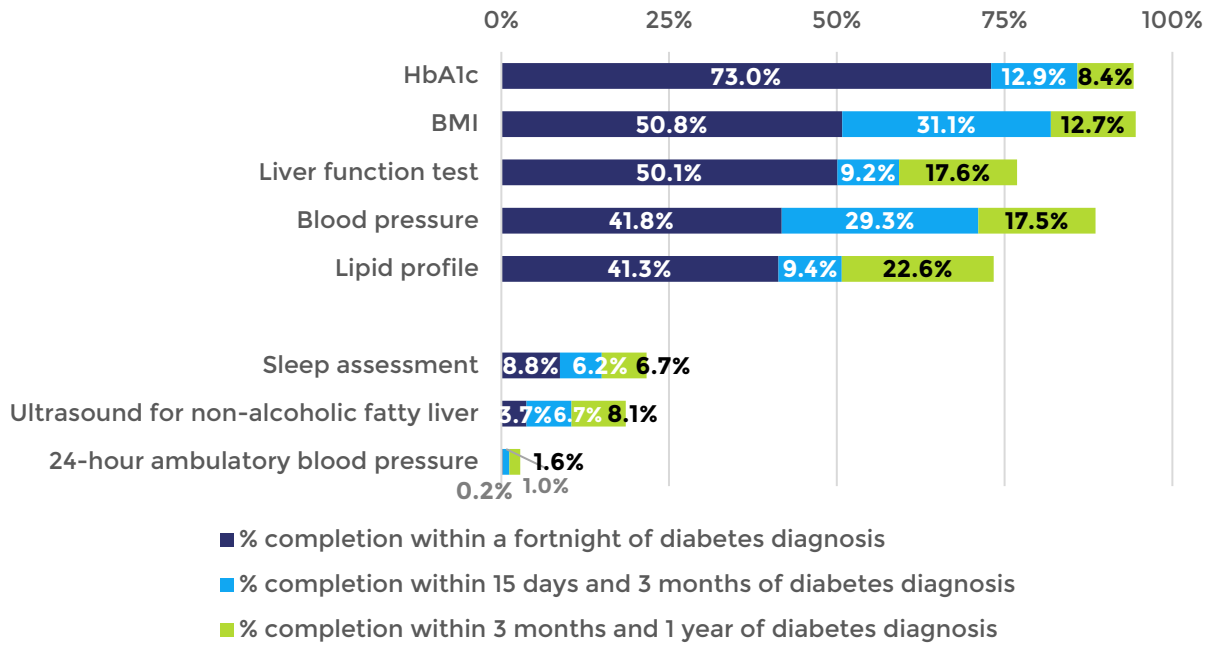
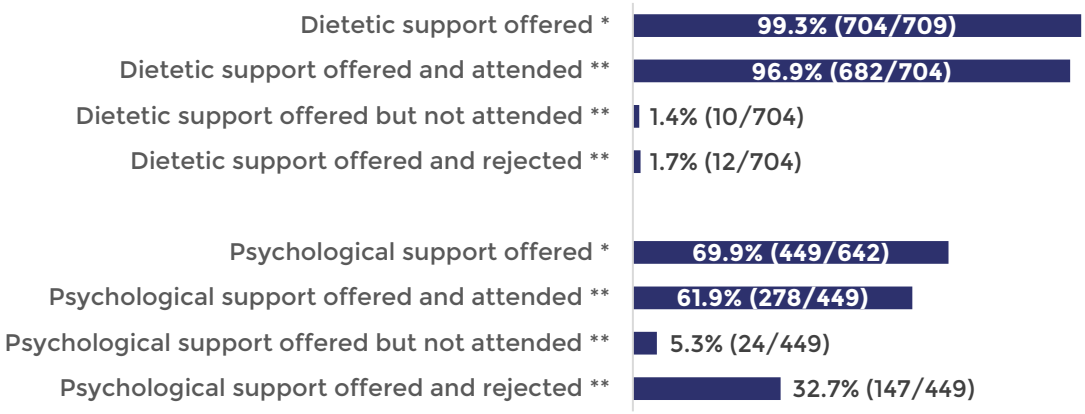


Figure 14 Completion of health checks following initial diabetes diagnosis, by time between diagnosis and completion

7.5 Are dietetic and psychological support offered at diagnosis of Type 2 diabetes?

Almost all children and young people with Type 2 diabetes were offered dietetic support (99.3%), and just over two thirds (69.9%) were offered psychological support in the first year of diagnosis. Take up of dietetic support was higher than psychological support, with a third (32.7%) of psychological appointments rejected.



** Denominator excludes "Not known"*

*** Denominator excludes support not offered*

Figure 15: Percentages of children and young people with Type 2 diabetes who were offered dietetic and psychological support, and who attended the sessions offered, following initial diabetes diagnosis

Figure 16 shows that dietetic support was typically accessed closer to diagnosis compared to psychological support, with half attending within a fortnight and 80% attending in the first 3 months following diagnosis.

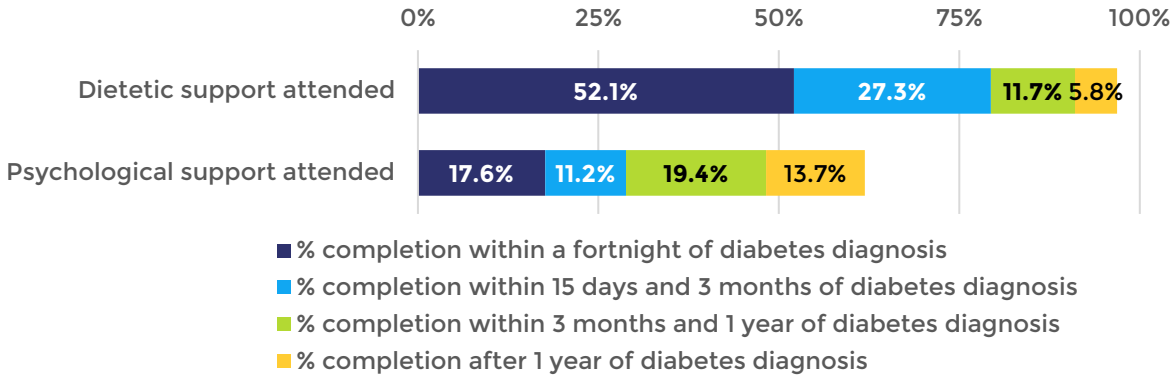


Figure 16: Percentages of children and young people with Type 2 diabetes attending dietetic and psychological support within specific time periods up to a year after diagnosis of diabetes

7.6 What were the outcomes of health checks at diagnosis?

7.6.1 HbA1c at diagnosis of Type 2 Diabetes

The median HbA1c within two weeks of diagnosis of Type 2 diabetes was 70.0 mmol/mol with a skewed distribution towards lower HbA1c compared to children and young people with Type 1 diabetes (Figure 17). Nearly three quarters (71.1%) of children and young people included in the spotlight audit had an HbA1c recorded within a fortnight of diagnosis.

Type 1 values correspond to 1,324 children and young people diagnosed between the 1st of April 2019 and the 31st of March 2020 (core NPDA audit 2019/20); whereas Type 2 values correspond to 526 children and young people reported to the spotlight audit with a valid HbA1c recorded within a fortnight of diagnosis, with dates of diabetes diagnosis that range between the 2nd of October 2010 and 16th of March 2020.

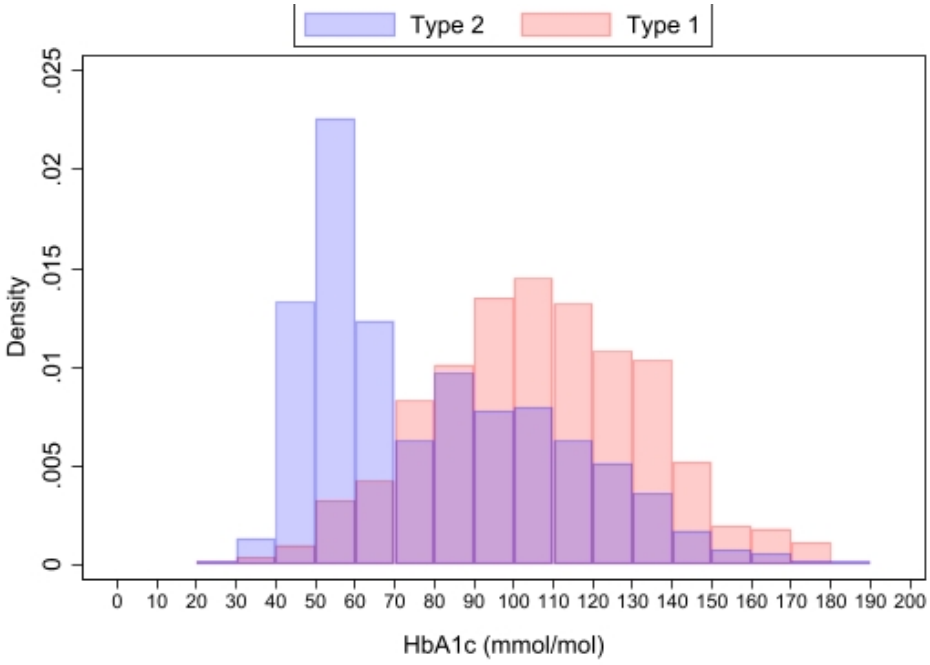


Figure 17: Distribution of HbA1cs recorded within a fortnight of diagnosis for children and young people with Type 2 diabetes (diagnosed in any audit year) and Type 1 diabetes (diagnosed in 2019/20)

Higher HbA1c at diagnosis may be associated with a delay in diagnosis of diabetes from onset of hyperglycaemia, or the rate of progression of hyperglycaemia with time.

Figure 18 shows the mean HbA1c of those included in the spotlight audit with an HbA1c recorded within 14 days of diagnosis, irrespective of when they were diagnosed, by patient characteristic. Higher HbA1c at diagnosis was associated with Black and mixed ethnicity.

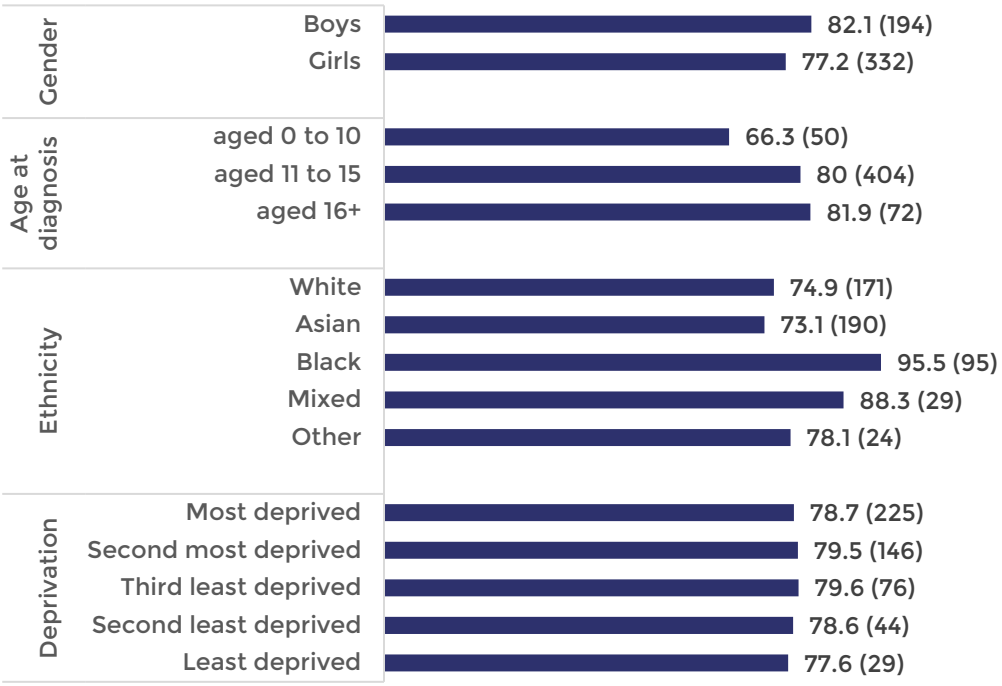


Figure 18: Mean HbA1c (mmol/mol) within a fortnight of diabetes diagnosis, for children and young people reported to the Type 2 diabetes spotlight audit, by sex, age group at diagnosis, ethnicity, and deprivation

7.6.2 Lipid profile at diagnosis of Type 2 diabetes

Figure 19 shows a breakdown of results of the 291 of children and young people with Type 2 diabetes who had a lipid profile performed within a fortnight of diabetes diagnosis. Although most had normal results, one third had high total cholesterol, one third had low HDL cholesterol, and two fifths had high triglycerides.

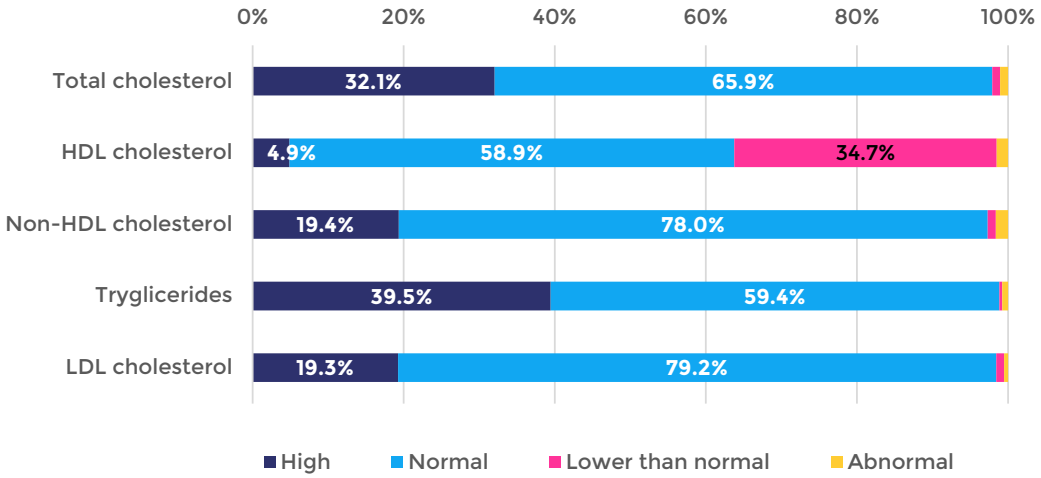


Figure 19: Lipid profile results recorded within a fortnight of diabetes diagnosis, for children and young people reported to the Type 2 diabetes spotlight audit

7.6.3 Liver function at diagnosis of Type 2 diabetes

Figure 20 shows the percentages of those with a recorded alanine aminotransferase (ALT) level within a fortnight of diagnosis and a known outcome of ultrasound screen for fatty liver in the first year following diagnosis (n=93), with or without fatty liver.

Fatty liver was highly prevalent (90.8%) in those that had an elevated ALT level, however it was also present in two thirds (67.9%) of those without a raised level. The absence of a raised level did not imply lack of fatty liver.

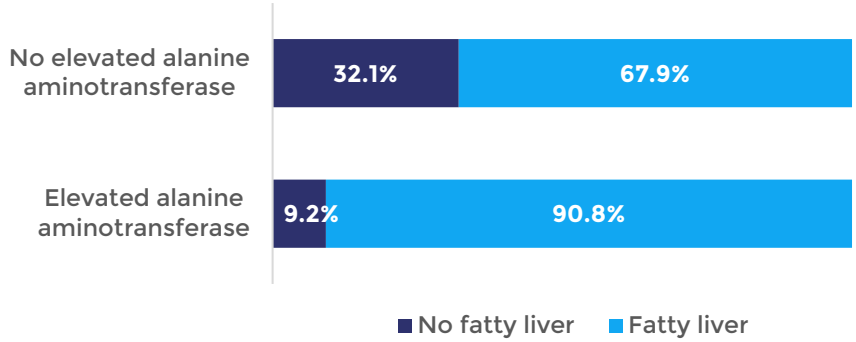


Figure 20: Percentage of children and young people with Type 2 diabetes with fatty liver, with and without elevated aminotransferase

7.6.4 Blood pressure at diagnosis of Type 2 diabetes

Figure 21 shows that half of all children and young people with Type 2 diabetes had either a high systolic or diastolic blood pressure at diagnosis, with the majority having high diastolic blood pressure.

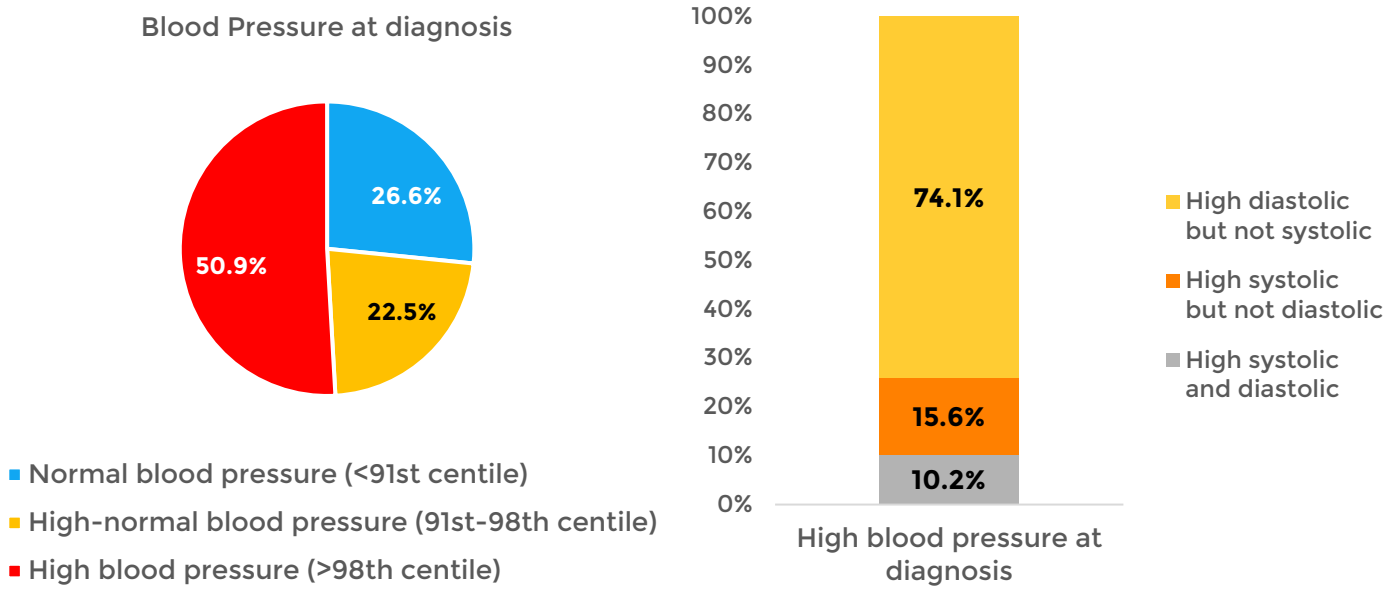


Figure 21: Breakdown of blood pressure results within a fortnight of diabetes diagnosis for children and young people reported to the Type 2 diabetes spotlight audit

7.6.5 Body Mass Index at diagnosis of Type 2 diabetes

Almost all (92.5%) children and young people with Type 2 diabetes were obese at diagnosis. Figure 22 shows little variation in this percentage by patient characteristic. Higher variation between groups should be interpreted with caution due to smaller denominators within some.

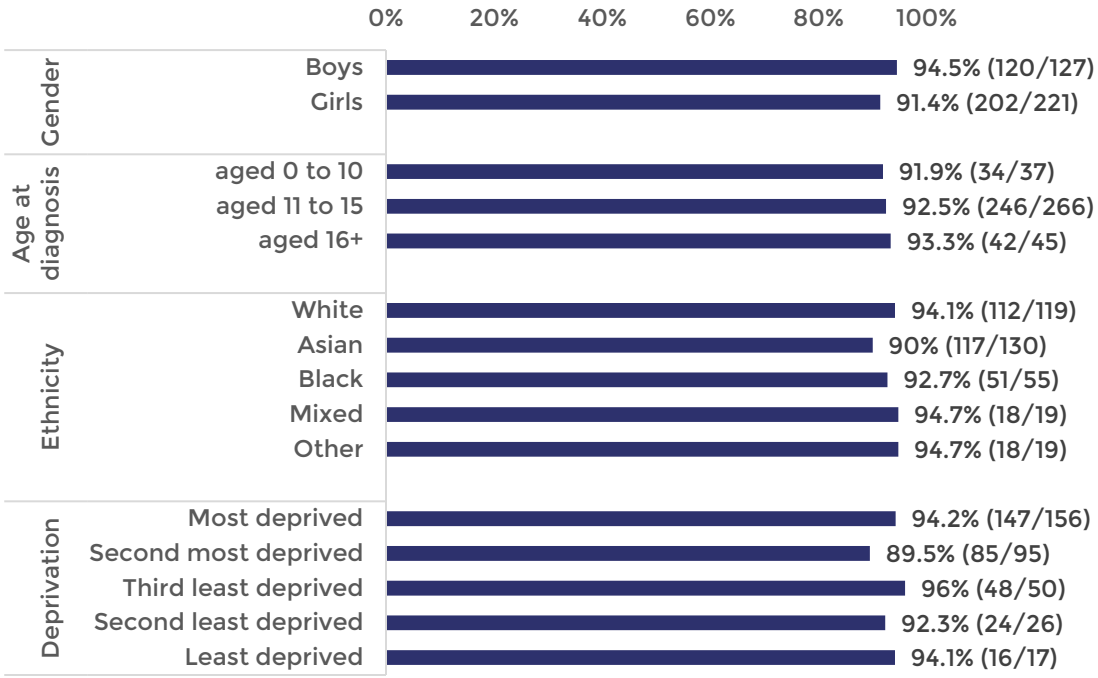


Figure 22: Percentage of children and young people with obesity within a fortnight of diabetes diagnosis, by sex, age group at diagnosis, ethnicity and deprivation

7.6.6 What management options were children and young people offered at diagnosis of Type 2 diabetes?

At diagnosis of diabetes, 81.8% of the children and young people included in the spotlight audit were offered advice on lifestyle modifications (diet and exercise), 65.6% were offered Metformin, 34.0% were offered insulin, and 1.6% were offered other blood glucose lowering agents (Figure 23). Fewer than five were offered a sulphonylurea, GLP1-a, DPP-4, or SGLT2 inhibitor.

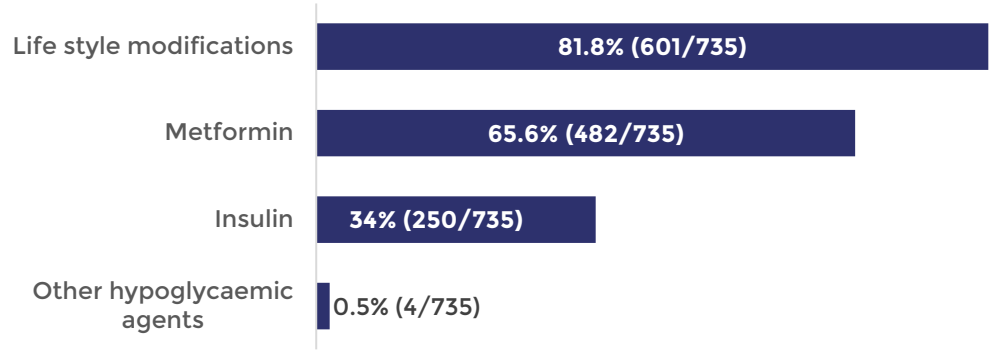


Figure 23: Treatment offered at initial diabetes diagnosis to all children and young people included in the spotlight audit

A fifth (21.2%) had a change of treatment further to a later confirmation of Type 2 diabetes diagnosis following initial diabetes diagnosis. Figure 24 shows that just over a third of these were taken off insulin (36.4%), and almost two thirds (64.9%) were prescribed Metformin after confirmation of Type 2 diabetes diagnosis.

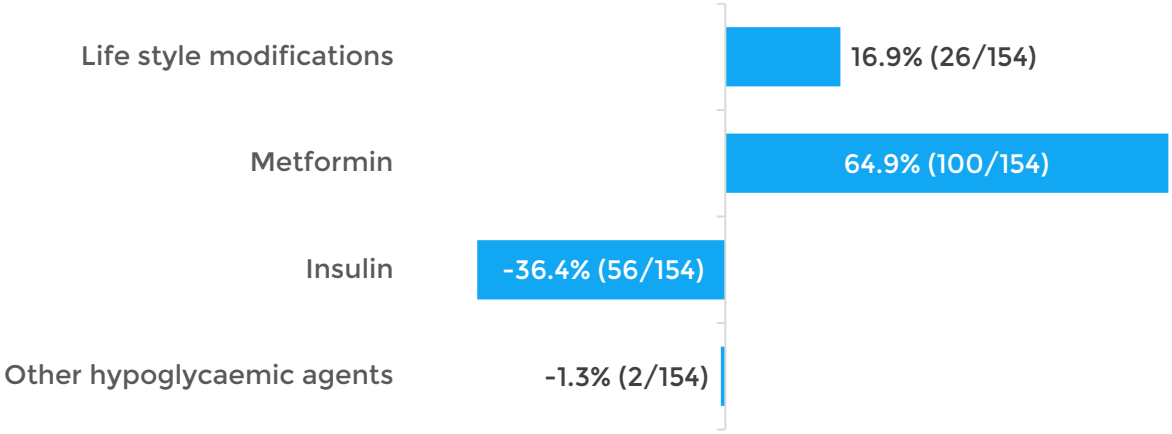


Figure 24: Percentage increase/decrease in the use of each treatment, for children and young people with treatment change after confirmation of Type 2 diabetes

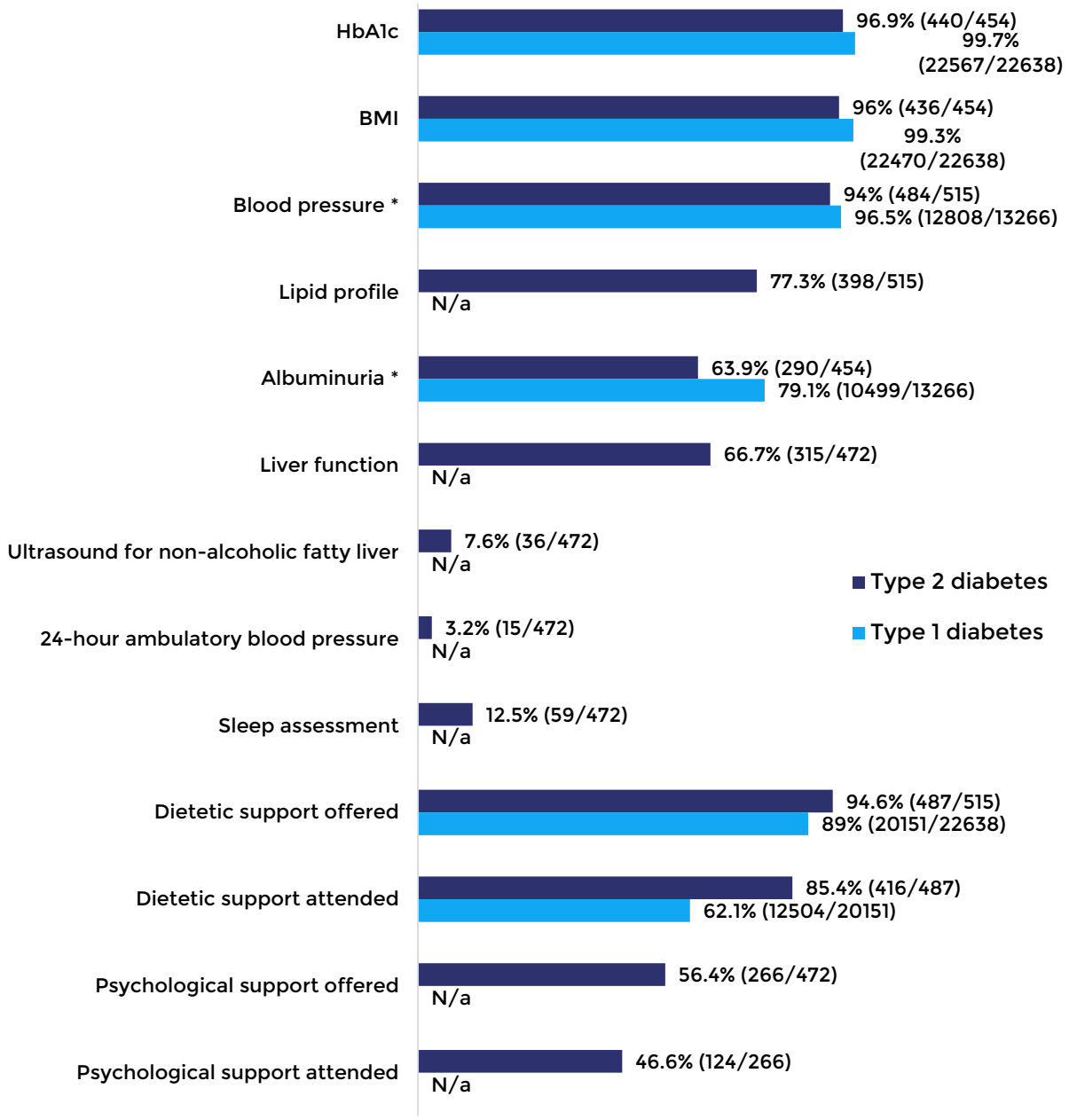
8. Health checks and outcomes for Type 2 diabetes in 2019/20

8.1 How many children and young people with Type 2 diabetes received recommended health checks and care in 2019/20?

Figure 25 shows the completion of NICE recommended health checks in the audit year 2019/20 for children and young people with Type 2 diabetes against those with Type 1 diabetes for comparison (where applicable), for all those with a complete year of care.

Analysis for those with Type 2 diabetes incorporated information collected as part of the contemporaneous 2019/20 core NPDA audit where missing data were identified in the spotlight audit and the data items collected were the same. The results for those with Type 1 diabetes are those reported in the core 2019/20 NPDA. Figure 24 shows that completion rates for HbA1c, BMI, and blood pressure were comparable, but those with Type 2 diabetes were less likely to receive a check for albuminuria, despite this cohort having a higher prevalence of kidney disease. Conversely, those with Type 2 diabetes were more likely to be offered and take up a dietetic appointment.

Of those attending a dietetic appointment within the audit year, with a known provider of dietetic care (n=409), the majority (93.9%) saw a hospital-based specialist paediatric diabetes dietitian.



** Denominators include children and young people aged 12 or older with a complete year of care for Type 1 diabetes, and children and young people with Type 2 diabetes of all ages with a complete year of care*

Figure 25: Completion of health checks in the audit year 2019/20 for children and young people with Type 2 and Type 1 diabetes

8.2 What were the outcomes of key health checks for Type 2 diabetes in 2019/20?

8.2.1 Blood pressure in Type 2 diabetes 2019/20

Figure 26 shows the percentage of children and young people with high blood pressure (>98th centile), those with 24 hour ambulatory blood pressure monitoring performed, and those with medical treatment for hypertension given within the audit year 2019/20.

Despite 42.3% of children and young people with Type 2 diabetes having high blood pressure, very few are being referred for 24 hour ambulatory monitoring. Furthermore, medical treatment was not considered as required in most hypertensive children and young people with Type 2 diabetes. This lack of intervention may be due to a variety of confounding factors including lack of recognition of hypertension, lack of guidance as to when high blood pressure should be treated and lack of clinical trial data in this area.

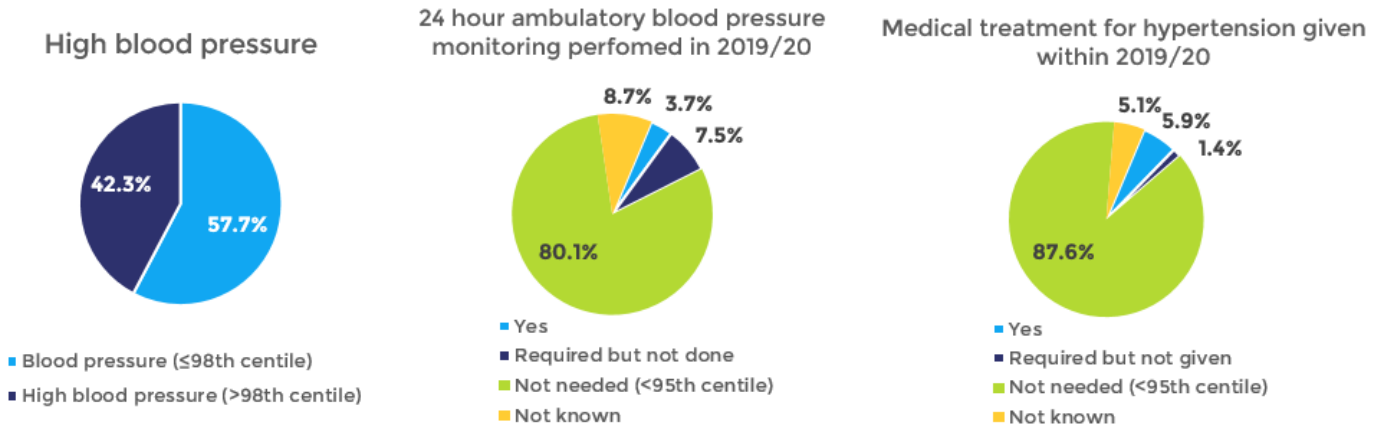


Figure 26: Percentage of children and young people with Type 2 diabetes having high blood pressure (>98th centile), 24 hours ambulatory blood pressure monitoring, and medical treatment for hypertension, within the 2019/20 audit year

8.2.2 Lipid profile in Type 2 diabetes 2019/20

Figure 27 shows the lipid profile of children and young people with Type 2 diabetes not diagnosed in the 2019/20 audit year. Results are similar to the lipid profiles at recorded at diagnosis (Figure 19). Most children and young people had normal results, although over a third had high triglycerides. Only 0.6% of children were taking medical treatment for hyperlipidaemia, 3.2% were reported as requiring but not taking medical treatment and 96.2% were reported as not needing medical treatment.

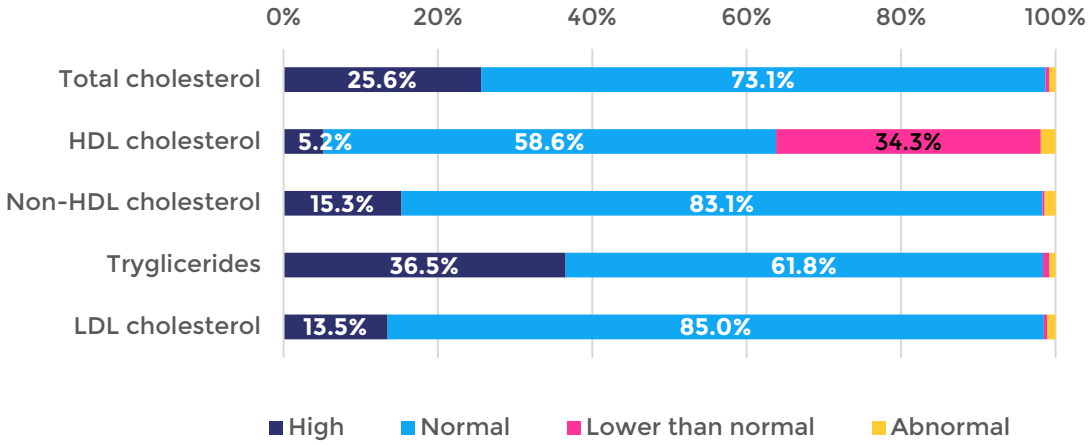


Figure 27: Lipid profile of children and young people reported to the Type 2 diabetes spotlight audit, not newly diagnosed with diabetes within the 2019/20 audit year

8.2.3 HbA1c in Type 2 diabetes 2019/20

Comprehensive breakdown of HbA1c results for children and young people with Type 2 diabetes are available in the core 2019/20 NPDA report.

Figure 28 and Table 3 show that of amongst those not diagnosed in the audit year, HbA1c was, on average, lower amongst those with Type 2 diabetes compared to those with Type 1 diabetes. Whereas the median HbA1c at diagnosis of Type 2 diabetes was 70 mmol/mol (Table 3), it was 52.5 mmol/mol amongst those not newly diagnosed in2019/20.

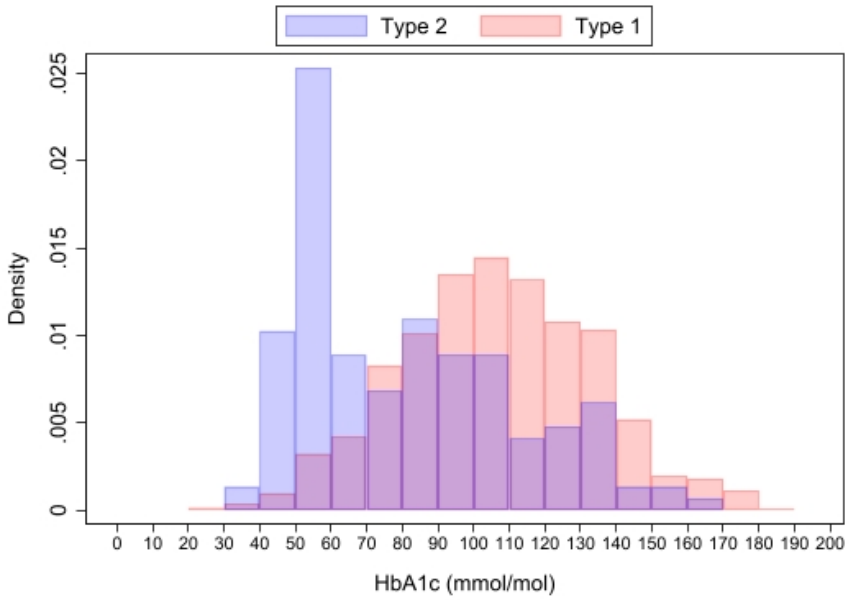


Figure 28: Distribution of HbA1c values for children and young people with Type 1 diabetes for those not newly diagnosed with Type 2 diabetes within the 2019/20 audit year

Table 3: Average HbA1c values for children and young people with Type 1 and Type 2 diabetes, not diagnosed in the audit year, 2019/2020

	Type 1 diabetes	Type 2 diabetes
Denominator	24,446	512
HbA1c mmol/mol - Mean (SD)	65.7 (16.9)	59.8 (23.8)
HbA1c mmol/mol - Median (IQR)	62.0 (17.0)	52.5 (30.8)

8.2.4 Liver function in Type 2 diabetes, 2019/20

In 2019/20, a total of 362 children and young people with Type 2 diabetes not diagnosed during this year had a known interpretation of a liver function test performed. Of these, 125 (34.5%) had elevated alanine aminotransferase (ALT), lower than the proportion with elevated ALT within a fortnight of diabetes diagnosis (43.1%).

Of the 536 children and young people included in the Type 2 diabetes spotlight audit not diagnosed during the 2019/20 audit year, only 40 (7.5%) had an ultrasound for fatty liver repeated within with a known result (Figure 29). Figure 30 shows that of these, more than half (55.0%) had no change from previous ultrasound and almost a third (30.0%) had developed a fatty liver since diagnosis.

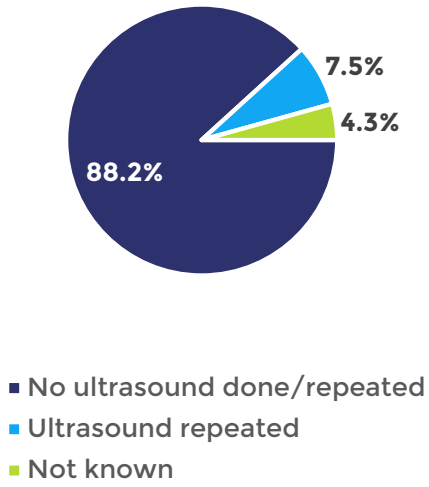


Figure 29: Percentages of children and young people with Type 2 diabetes, not diagnosed in the audit year, with/without an ultrasound for fatty liver performed in 2019/20

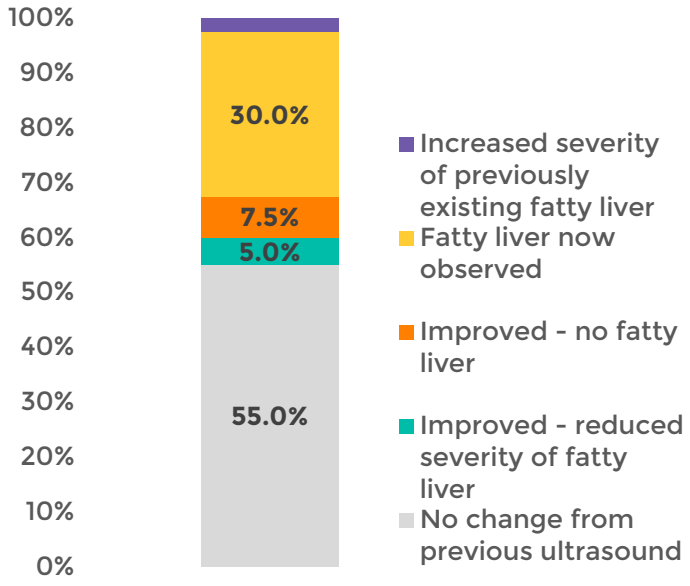


Figure 30: Breakdown of repeated fatty liver results for those with ultrasounds performed at diagnosis and in 2019/20

8.2.5 Treatment for albuminuria in Type 2 diabetes 2019/20

In 2019/20, of all the children and young people included in the Type 2 diabetes spotlight audit, 25 (3.4%) had treatment for albuminuria, and 5 (0.7%) were recorded as requiring treatment but not receiving it (Figure 31). However, data collected in the contemporaneous core NPDA showed that 25.7% of those with Type 2 diabetes had micro or macro albuminuria. This reluctance to treat may be due to several factors including lack of experience in treating albuminuria in paediatric practice and lack of evidence for therapeutic intervention in children and young people with Type 2 diabetes.

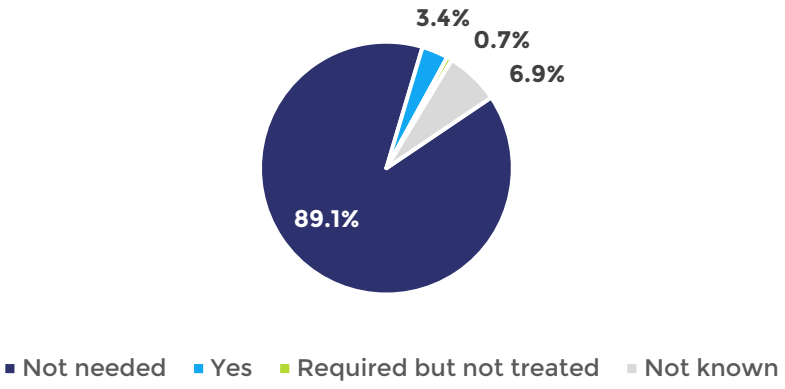


Figure 31: Albuminuria treatment in children and young people with Type 2 diabetes 2019/20

8.2.6 BMI in Type 2 diabetes, 2019/20

In the 2019/20 NPDA, 87.3% of those with Type 2 diabetes also included within the spotlight audit were obese, 7.8% had over weight, and 4.9% were a healthy weight or underweight. Of those included in the spotlight audit who were diagnosed before the 2019/20 audit year, and with recorded obesity within a fortnight of their diagnosis, 92.0% remained obese in 2019/20, with only 8% reducing their BMI into a lower range (Figure 32).

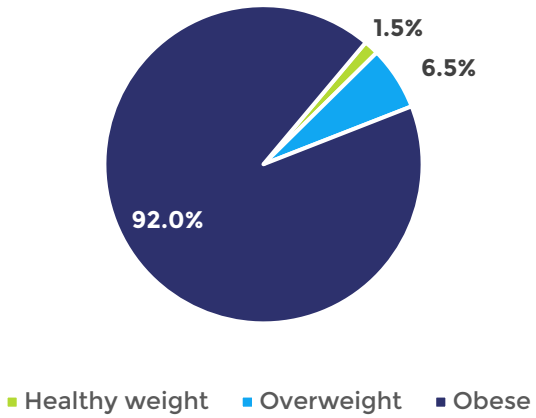


Figure 32: Percentage of children with Type 2 diabetes with obesity at diagnosis in different BMI categories in in 2019/20

8.3 How was Type 2 diabetes being managed in 2019/20?

Figure 33 provides a breakdown of Type 2 diabetes management options being used amongst children and young people being managed for the condition in 2019/20. It shows that lifestyle modifications and Metformin were being used most commonly, and that a quarter (26.5%) were using insulin.

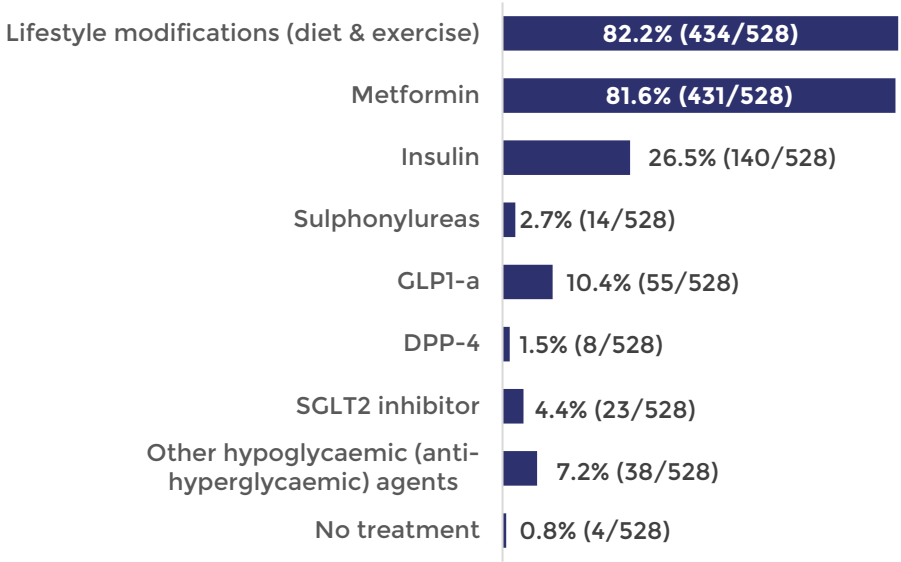


Figure 33: Treatment types being used as at 31/03/2020, for children and young people with Type 2 diabetes, not diagnosed in the audit year

There was little variation in management by patient characteristics.

8.4 Have children and young people received specific treatments for obesity?

Of all children and young people included in the spotlight audit, 110 (15.1%) received treatment for obesity over and above conventional therapy. Figure 34 shows the percentages receiving different options.

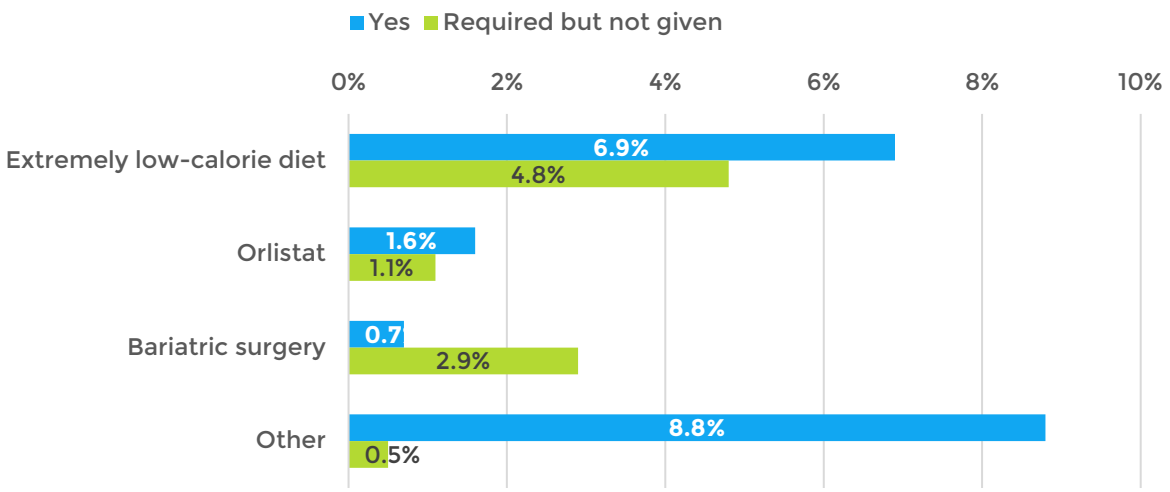


Figure 34: Treatment for obesity given in exceptional circumstances at any point since diagnosis, for children and young people reported to the spotlight audit

9. Discussion

This spotlight audit reports on the diagnosis and management of children and young people with Type 2 diabetes, receiving care from paediatric diabetes units in England and Wales and builds on the findings of the core NPDA annual audit. It provides insight into further improvements needed in the routine care of this cohort, and a benchmark from where to build quality standards.

Given that Type 2 diabetes remains a rare condition amongst children and young people, and that the majority of new diagnoses of diabetes in children and young people are Type 1 diabetes, it is perhaps reassuring that the majority (78.9%) are receiving a timely and correct diagnosis, with delays in diagnosis being associated with higher HbA1c, which is typically associated with Type 1 diabetes. There was no one clinical or biochemical marker associated with making a diagnosis of Type 2 diabetes, however obesity, an HbA1c greater than 48 mmol/mol and the presence of acanthosis nigricans were used to make a diagnosis in over half.

In addition to obesity, patient characteristics associated with the condition were: female sex, living in a more deprived area, and belonging to a minority ethnic group. A family history of the condition was also typical, with 85.4% having at least one family member with the same diagnosis, with higher prevalence along the maternal line. Given the deprivation profile of the condition in children and young people, and associated limitations on travel to bigger centres, it is essential that all PDUs are supported to provide excellent multidisciplinary care for Type 2 diabetes. This will help ensure that the needs of children and young people with this condition can be met locally.

NICE guidance on the identification, assessment and management of obesity (CG189, 2014) recommends that tier 3 services assess liver function, blood pressure, and perform a (preferably fasted) lipid profile. However, completion rates of these varied, with 50% or fewer having these checks within a fortnight of their diagnosis. Rates of sleep assessment, ultrasound for fatty liver, and 24 hour ambulatory blood pressure were lower, with fewer than 25% of children and young people being assessed within a year of their diagnosis.

Where health checks were completed, this audit found that treatment based on the results was not commonly provided. Two fifths (42.3%) were found to have hypertension in 2019/20, but only 5.9% received treatment within the audit year. Similarly, whilst 25.7% of those with Type 2 diabetes were reported to have micro or macro albuminuria in the contemporaneous NPDA core audit (RCPCH, 2021), only 3.4% of patients submitted to the spotlight audit received treatment for albuminuria. More research is required to guide therapeutic interventions in both these complications, and for the development of guidelines for management in children and young people with Type 2 diabetes who develop these early complications of the disease.

NICE guidance (NG49, 2016) recommends the provision of liver ultrasound to test children and young people with Type 2 diabetes for non-alcoholic fatty liver disease (NAFLD), but rates of ultrasound were low. Fewer than a quarter were screened within a year of Type 2 diabetes diagnosis, and less than 10% with more than one year's duration of Type 2 diabetes received an ultrasound for NAFLD in 2019/20. It is concerning that where comparison was possible against ultrasound at diagnosis, a higher percentage had gone on to develop NAFLD (30%) than had reduced the severity or recovered from the NAFLD previously observed.

It is also concerning that despite receiving input from multidisciplinary PDU teams, the majority (92.5%) of those who were recorded to have obesity at diagnosis of Type 2 diabetes were still recorded as having it in 2019/20. This suggests that intensification of efforts to support children and young people to achieve a healthy weight is necessary.

Multidisciplinary paediatric diabetes teams have shown commitment to improving the care and outcomes of children with Type 2 diabetes through voluntary participation in this spotlight audit, and through the establishment of and participation in the National Children and Young People's Diabetes Network working group aiming to identify, share, and standardise best practice in the management of this cohort. The results of this spotlight audit will support the aims of this work by highlighting where additional focus on the needs of children and young people with Type 2 diabetes is needed.

10. References

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11. List of tables

12. List of figures

Acknowledgements

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Appendix 1: Characteristics of children and young people with Type 2 diabetes

N.B Results marked '*' are those masking small numbers or where results indicated 100% of patients had a particular characteristic/outcome in accordance with the RCPCH small number reporting policy.

Q No.	Question	Data Item	England and Wales	England	Wales
1.1	NHS number	Total number of children and young people with Type 2 diabetes receiving treatment within PDUs on 31st March 2020 - n	810	787	23
		Prevalence (per 100,000 population 15 years old or younger, in 2020)	4.5	4.6	3.4
1.6	Date of diabetes diagnosis	Total number of newly diagnosed children and young people with Type 2 diabetes from 1/4/2019 to 31/3/2020 - n	222	214	8
		Incidence (per 100,000 population 15 years old or younger, in 2020)	1.7	1.8	1.2
1.7	Date of Type 2 diabetes diagnosis *Denominator includes all children in the Spotlight audit, with known dates for initial diabetes diagnosis and Type 2 diabetes diagnosis*	Percentage of children and young people who were initially diagnosed with a different Type of diabetes and later diagnosed as Type 2 diabetes - % (n/N)	21.1 (156/740)	*	
1.2	Date of birth *Denominator includes all children with Type 2 diabetes in the Spotlight and Core audits, with known date of birth*	aged 0 to 10 - % (n/N)	4.6 (37/810)	*	
		aged 11 to 15 - % (n/N)	58.8 (476/810)	58.2 (458/787)	78.3 (18/23)
		aged 16 to 24 - % (n/N)	36.7 (297/810)	*	
1.4	Gender *Denominator includes all children with Type 2 diabetes in the Spotlight and Core audits, with known gender*	Girls - % (n/N)	64.3 (521/810)	64.2 (505/787)	69.6 (16/23)

Q No.	Question	Data Item	England and Wales	England	Wales
1.5	**Ethnicity** *Denominator includes all children with Type 2 diabetes in the Spotlight and Core audits, with known ethnicity*	White - % (n/N)	34.9 (271/777)	34 (258/759)	56.5 (13/23)
		Asian - % (n/N)	38.6 (300/777)	*	
		Black - % (n/N)	16.3 (127/777)	*	
		Mixed - % (n/N)	5.3 (41/777)	*	
		Other - % (n/N)	4.9 (38/777)	*	
1.3	**Postcode** *Denominator includes all children with Type 2 diabetes in the Spotlight and Core audits, with known postcode*	Most deprived - % (n/N)	45.2 (362/801)	45.4 (354/779)	36.4 (8/22)
		Second most deprived - % (n/N)	26.2 (210/801)	*	
		Third least deprived - % (n/N)	15.5 (124/801)	15 (117/779)	31.8 (7/22)
		Second least deprived - % (n/N)	8.1 (65/801)	*	
		Least deprived - % (n/N)	5 (40/801)	*	

Appendix 2: Care at diagnosis

This section is based on information recorded in the Type 2 diabetes spotlight audit.

N.B Results marked '*' are those masking small numbers or where results indicated 100% of patients had a particular characteristic/outcome in accordance with the RCPCH small number reporting policy.

Q No.	Question	Data Item	England and Wales	England	Wales
	Denominator	Total number of children and young people recorded in the Spotlight audit - n	740	723	17
2.1	Clinical markers for concluding a Type 2 diabetes diagnosis - select all that apply *Denominator includes all children in the Spotlight audit*	Obesity % (n/N)	85.9 (636/740)	85.8 (620/723)	94.1 (16/17)
		Acanthosis nigricans % (n/N)	50.9 (377/740)	50.9 (368/723)	52.9 (9/17)
		Fatty liver on ultrasound scan % (n/N)	12.6 (93/740)	*	
		Other % (n/N)	17.8 (132/740)	*	
		None % (n/N)	5.3 (39/740)	5.4 (39/723)	0 (0/17)
2.2	Biochemical markers for concluding a Type 2 diabetes diagnosis - select all that apply *Denominator includes all children in the Spotlight audit*	Blood glucose > 11 mmol/l at random on two or more occasions % (n/N)	46.6 (345/740)	46.9 (339/723)	35.3 (6/17)
		Blood glucose > 11 mmol/l on the 2 hours post Oral Glucose Tolerance Test (OGTT) sample % (n/N)	25.3 (187/740)	25 (181/723)	35.3 (6/17)
		HbA1c > 48 mmol/mol % (n/N)	77.6 (574/740)	77.6 (561/723)	76.5 (13/17)
		Abnormal liver function test results % (n/N)	22.2 (164/740)	22.3 (161/723)	17.6 (3/17)
		Absence of pancreatic antibodies % (n/N)	40.1 (297/740)	39.8 (288/723)	52.9 (9/17)
		Raised insulin and/or c-peptide % (n/N)	35.5 (263/740)	35.4 (256/723)	41.2 (7/17)
		Low sex hormone binding globulin (SHBG) % (n/N)	4.2 (31/740)	*	
		Other % (n/N)	7.7 (57/740)	7.5 (54/723)	17.6 (3/17)
		None % (n/N)	1.8 (13/740)	1.8 (13/723)	0 (0/17)

Q No.	Question	Data Item	England and Wales	England	Wales
2.3	**Details of antibodies tested** *Denominator includes all children in the Spotlight audit*	Anti-GAD tested % (n/N)	71.1 (526/740)	71.1 (514/723)	70.6 (12/17)
		Anti-IA2 tested % (n/N)	29.5 (218/740)	29.9 (216/723)	11.8 (2/17)
		Anti-ZnT8 tested % (n/N)	21.6 (160/740)	22 (159/723)	5.9 (1/17)
		Anti-insulin tested % (n/N)	12.8 (95/740)	12.9 (93/723)	11.8 (2/17)
		Anti islet cell Ab tested % (n/N)	48.9 (362/740)	48.8 (353/723)	52.9 (9/17)
		Other tested % (n/N)	3.6 (27/740)	3.7 (27/723)	0 (0/17)
2.3	**Details of antibodies tested (positive)** *Denominators for each antibody reflect the number of children with known results*	Positive Anti-GAD % (n/N)	3.2 (17/526)	*	
		Positive Anti-IA2 % (n/N)	5 (11/218)		
		Positive Anti-ZnT8 % (n/N)	2.5 (4/160)		
		Positive Anti-insulin % (n/N)	8.4 (8/95)		
		Positive Anti islet cell Ab % (n/N)	1.9 (7/362)		
		Positive other % (n/N)	44.4 (12/27)		
2.4	**Family history of Type 2 diabetes?** *Denominator includes all children in the Spotlight audit, with a yes/no answer to this question*	Yes % (n/N)	85.4 (556/651)	85.1 (543/638)	100 (13/13)
2.4a	**If yes, select which family member(s)** *Denominator includes all children with at least one family member with T2D*	Mother % (n/N)	59.9 (333/556)	60 (326/543)	53.8 (7/13)
		Father % (n/N)	36.7 (204/556)	*	
		Sister % (n/N)	5.2 (29/556)	5.3 (29/543)	0 (0/13)
		Brother % (n/N)	2.5 (14/556)	2.6 (14/543)	0 (0/13)
		Maternal grandmother % (n/N)	29 (161/556)	*	
		Paternal grandmother % (n/N)	17.1 (95/556)		
		Maternal grandfather % (n/N)	16.5 (92/556)		
		Paternal grandfather % (n/N)	12.1 (67/556)		
		Other % (n/N)	21.4 (119/556)	*	
2.5	**Has HbA1c been measured following diabetes diagnosis?** *Denominator includes all children in the Spotlight audit, with a yes/no answer to this question, and diagnosed before the 17/03/2020*	Percentage of children with HbA1c measurement date before 15 days from initial diabetes diagnosis % (n/N)	73 (526/721)	73.2 (515/704)	64.7 (11/17)

Q No.	Question	Data Item	England and Wales	England	Wales
2.5a	**HbA1c result at diagnosis of diabetes** *Include all measurements taken before 15 days from initial diabetes diagnosis*	HbA1c at diagnosis mmol/mol Median (IQR)	70 (49)	70 (49)	61 (38)
		HbA1c at diagnosis mmol/mol Mean (SD)	79 (30.2)	79.2 (30.3)	70 (21.2)
2.6	**Has a lipid profile been performed following diabetes diagnosis?** *Denominator includes all children in the Spotlight audit, with a yes/no answer to this question, and diagnosed before the 17/03/2020*	Percentage of children with lipid profile date before 15 days from initial diabetes diagnosis % (n/N)	41.3 (291/704)	41.7 (287/688)	25 (4/16)
2.6b	**Was the lipid profile performed fasting or non-fasting?** *Includes lipid profiles performed before 15 days from initial diabetes diagnosis, with known fasting/non-fasting method*	Percentage of children with lipid profile performed fasting at diagnosis % (n/N)	33.2 (71/214)	33.2 (70/211)	33.3 (1/3)
2.6c	**Total cholesterol at diagnosis** *Includes total cholesterol performed before 15 days from initial diabetes diagnosis, with a known interpretation of the values recorded*	High % (n/N)	32.1 (92/287)	*	
		Normal % (n/N)	65.9 (189/287)		
		Lower than normal % (n/N)	1 (3/287)		
		Abnormal % (n/N)	1 (3/287)		
2.6d	**HDL cholesterol at diagnosis** *Includes HDL cholesterol performed before 15 days from initial diabetes diagnosis, with a known interpretation of the values recorded*	High % (n/N)	4.9 (13/265)	*	
		Normal % (n/N)	58.9 (156/265)		
		Lower than normal % (n/N)	34.7 (92/265)	*	
		Abnormal % (n/N)	1.5 (4/265)		
2.6e	**Non-HDL cholesterol at diagnosis** *Includes non-HDL cholesterol performed before 15 days from initial diabetes diagnosis, with a known interpretation of the values recorded*	High % (n/N)	19.4 (36/186)	*	
		Normal % (n/N)	78 (145/186)		
		Lower than normal % (n/N)	1.1 (2/186)		
		Abnormal % (n/N)	1.6 (3/186)		

Q No.	Question	Data Item	England and Wales	England	Wales
2.6f	**Triglycerides at diagnosis** *Includes triglycerides performed before 15 days from initial diabetes diagnosis, with a known interpretation of the values recorded*	High % (n/N)	39.5 (103/261)	*	
		Normal % (n/N)	59.4 (155/261)		
		Lower than normal % (n/N)	0.4 (1/261)		
		Abnormal % (n/N)	0.8 (2/261)		
2.6g	**LDL cholesterol at diagnosis** *Includes LDL cholesterol performed before 15 days from initial diabetes diagnosis, with a known interpretation of the values recorded*	High % (n/N)	19.3 (37/192)		
		Normal % (n/N)	79.2 (152/192)		
		Lower than normal % (n/N)	1 (2/192)		
		Abnormal % (n/N)	0.5 (1/192)		
2.7	**Has a liver function test been performed following diabetes diagnosis?** *Denominator includes all children in the Spotlight audit, with a yes/no answer to this question, and diagnosed before the 17/03/2020*	Percentage of children with liver function date before 15 days from initial diabetes diagnosis % (n/N)	50.1 (352/702)	50.7 (348/686)	25 (4/16)
2.7b	**Elevated alanine aminotransferase (ALT) at diagnosis?** *Includes results from liver function tests performed before 15 days from initial diabetes diagnosis, with a known interpretation of alanine aminotransferase (ALT)*	Percentage of children with elevated alanine aminotransferase at diagnosis % (n/N)	43.1 (149/346)	*	
2.8	**Has an ultrasound for fatty liver been performed following diabetes diagnosis?** *Denominator includes all children in the Spotlight audit, with a yes/no answer to this question, and diagnosed before the 31/03/2019*	Percentage of children with ultrasound for fatty liver date within 1 year from initial diabetes diagnosis % (n/N)	18.5 (94/507)	18.9 (94/497)	0 (0/10)

Q No.	Question	Data Item	England and Wales	England	Wales
2.8b	**Non-alcoholic fatty liver disease seen on ultrasound at diagnosis** *Includes results from ultrasounds performed within 1 year from initial diabetes diagnosis, with a known interpretation of non-alcoholic fatty liver disease*	Percentage of children with fatty liver disease at diagnosis % (n/N)	79.6 (74/93)	79.6 (74/93)	N/a
2.9	**Has blood pressure been recorded following diabetes diagnosis?** *Denominator includes all children in the Spotlight audit, with a yes/no answer to this question, and diagnosed before the 17/03/2020*	Percentage of children with Blood Pressure date before 15 days from initial diabetes diagnosis % (n/N)	41.8 (291/696)	42.2 (287/680)	25 (4/16)
2.9a	**Systolic and diastolic values at diagnosis (mmHg)** *Include all measurements taken before 15 days from initial diabetes diagnosis*	Percentage of children with high-normal blood pressure at diagnosis % (n/N)	22.5 (65/289)	*	
		Percentage of children with high blood pressure at diagnosis % (n/N)	50.9 (147/289)	*	
2.1	**Has 24-hour ambulatory blood pressure been performed following diabetes diagnosis?** *Denominator includes all children in the Spotlight audit, with a yes/no answer to this question, and diagnosed before the 31/03/2019*	Percentage of children with 24-hour ambulatory blood pressure date within 1 year from initial diabetes diagnosis % (n/N)	2.8 (14/494)	2.9 (14/484)	0 (0/10)
2.11	**Was sleep assessed following diabetes diagnosis?** *Denominator includes all children in the Spotlight audit, with a yes/no answer to this question, and diagnosed before the 31/03/2019*	Percentage of children with sleep assessment date within 1 year from initial diabetes diagnosis % (n/N)	21.7 (94/434)	22.1 (94/426)	0 (0/8)

Q No.	Question	Data Item	England and Wales	England	Wales
2.11	**Was sleep assessed following diabetes diagnosis?** *Include sleep assessments performed within 1 year from initial diabetes diagnosis, with a known method of assessment recorded*	Percentage of children assessed via questioning for symptoms of respiratory problems at diagnosis % (n/N)	72.3 (68/94)	72.3 (68/94)	0 (0/0)
		Percentage of children assessed via sleep study at diagnosis % (n/N)	16 (15/94)	16 (15/94)	0 (0/0)
		Percentage of children assessed via questioning for symptoms of respiratory problems and sleep study at diagnosis % (n/N)	11.7 (11/94)	11.7 (11/94)	0 (0/0)
2.11b	**Was sleep apnoea diagnosed?** *Includes sleep assessments performed within 1 year from initial diabetes diagnosis, with a known diagnosis for sleep apnoea*	Percentage of children with sleep apnoea diagnosed % (n/N)	19.4 (18/93)	19.4 (18/93)	N/a
2.11c	**If yes, was non-invasive ventilation for sleep apnoea recommended?** *Includes children diagnosed with sleep apnoea within 1 year from initial diabetes diagnosis, with a known recommendation for non-invasive ventilation*	Percentage of children with non-invasive ventilation for sleep apnoea recommended at diagnosis % (n/N)	29.4 (5/17)	29.4 (5/17)	N/a
2.12	**Was height and weight recorded following diabetes diagnosis?** *Denominator includes all children in the Spotlight audit, with a yes/no answer to this question, and diagnosed before the 17/03/2020*	Percentage of children with height and weight date before 15 days from initial diabetes diagnosis % (n/N)	50.8 (365/719)	51.5 (362/703)	18.8 (3/16)
		Percentage of children with healthy weight, between the 2nd and 85th centile % (n/N)	1.7 (6/348)	*	
		Percentage of children with overweight, between the 85th and 95th centile % (n/N)	5.7 (20/348)	*	
		Percentage of children with obesity, above the 95th centile % (n/N)	92.5 (322/348)	*	

Q No.	Question	Data Item	England and Wales	England	Wales
2.13	Initial treatment Type(s) offered at diagnosis of diabetes - select all that apply *Denominator includes all children in the Spotlight audit, with known treatment Type(s) offered at initial diagnosis of diabetes*	Percentage of children with lifestyle modifications offered (diet & exercise) % (n/N)	81.8 (601/735)	81.3 (584/718)	100 (17/17)
		Percentage of children with Metformin offered % (n/N)	65.6 (482/735)	65.9 (473/718)	52.9 (9/17)
		Percentage of children with Insulin offered % (n/N)	34 (250/735)	34.4 (247/718)	17.6 (3/17)
		Percentage of children with GLP1-a offered % (n/N)	0.1 (1/735)	*	
		Percentage of children with DPP-4 offered % (n/N)	0.3 (2/735)	*	
		Percentage of children with SGLT2 inhibitor offered % (n/N)	0.1 (1/735)	*	
		Percentage of children with other hypoglycaemic (anti-hyperglycaemic) agents offered % (n/N)	1.6 (12/735)	1.7 (12/718)	0 (0/17)
		Percentage of children with no treatment offered % (n/N)	0 (0/735)	0 (0/718)	0 (0/17)
2.14	Was the initial treatment Type(s) offered at diagnosis of Type 2 diabetes the same as the initial treatment Type(s) offered at diagnosis of diabetes? *Denominator includes all children in the Spotlight audit, with known treatment Type(s) offered at initial diagnosis of diabetes and diagnosis of Type 2 diabetes*	Percentage of children with treatment change % (n/N)	21.0 (154/732)	21.3 (152/715)	11.8 (2/17)

Q No.	Question	Data Item	England and Wales	England	Wales
2.14a	If No, treatment Type(s) offered at diagnosis of Type 2 diabetes - select all that apply *Denominator includes all children in the Spotlight audit, with treatment changes at diagnosis of Type 2 diabetes*	Percentage of children with lifestyle modifications offered (diet & exercise) % (n/N)	76.6 (118/154)	*	
		Percentage of children with Metformin offered % (n/N)	88.3 (136/154)	*	
		Percentage of children with Insulin offered % (n/N)	44.8 (69/154)	45.4 (69/152)	0 (0/2)
		Percentage of children with Sulphonylureas offered % (n/N)	1.3 (2/154)	1.3 (2/152)	0 (0/2)
		Percentage of children with GLP1-a offered % (n/N)	0 (0/154)	0 (0/152)	0 (0/2)
		Percentage of children with DPP-4 offered % (n/N)	0 (0/154)	0 (0/152)	0 (0/2)
		Percentage of children with SGLT2 inhibitor offered % (n/N)	0 (0/154)	0 (0/152)	0 (0/2)
		Percentage of children with other hypoglycaemic (anti-hyperglycaemic) agents offered % (n/N)	3.9 (6/154)	3.9 (6/152)	0 (0/2)
		Percentage of children with no treatment offered % (n/N)	0 (0/154)	0 (0/152)	0 (0/2)
2.15	Was dietetic support offered following diabetes diagnosis? *Denominator includes all children in the Spotlight audit, for whom it is known if an offer for dietetic support was made at diagnosis*	Yes % (n/N)	99.3 (704/709)	99.3 (688/693)	100 (16/16)
2.15a	If yes, was dietetic support given/ attended following diabetes diagnosis? *Denominator includes all children in the Spotlight audit, with dietetic support offered at diagnosis, and diagnosed before the 17/03/2020*	Percentage of children attending dietetic support before 15 days from initial diabetes diagnosis % (n/N)	52.1 (366/702)	52.3 (359/686)	43.8 (7/16)

Q No.	Question	Data Item	England and Wales	England	Wales
2.16	**Was psychological support offered following diabetes diagnosis?** *Denominator includes all children in the Spotlight audit, for whom it is known if an offer for psychological support was made at diagnosis*	Yes % (n/N)	69.9 (449/642)	70.1 (439/626)	62.5 (10/16)
2.16a	**If yes, was psychological support given/attended following diabetes diagnosis?** *Denominator includes all children in the Spotlight audit, with psychological support offered at diagnosis, and diagnosed before the 31/03/2019*	Percentage of children attending psychological support within 1 year from initial diabetes diagnosis % (n/N)	48.2 (164/340)	48.6 (162/333)	28.6 (2/7)

Appendix 3: Care and outcomes after diagnosis, during the audit year 2019-20

This section combines information from the NPDA core report 2019/20 and the Type 2 spotlight audit wherever possible.

N.B Results marked '*' are those masking small numbers or where results indicated 100% of patients had a particular characteristic/outcome in accordance with the RCPCH small number reporting policy.

Q No.	Question	Data Item	England and Wales	England	Wales
	Denominators based on the Spotlight and Core audits	Number of children not diagnosed in the audit period 2019/2020 - n	588	573	15
		Number of children who complete a full year of care in 2019/2020 - n	515	502	13
	Denominators based on the Spotlight audit	Number of children not diagnosed in the audit period 2019/2020 - n	536	525	11
		Number of children who complete a full year of care in 2019/2020 - n	472	462	10
3.1	Treatment Type(s) that were being used as at 31/03/2020 - select all that apply *Denominator includes children in the Spotlight audit, not diagnosed in the audit period 2019/20, with known treatment Type(s) used as at 31/03/2020*	Percentage of children with lifestyle modifications (diet & exercise) % (n/N)	82.2 (434/528)	82 (424/517)	90.9 (10/11)
		Percentage of children with Metformin % (n/N)	81.6 (431/528)	82.2 (425/517)	54.5 (6/11)
		Percentage of children with Insulin % (n/N)	26.5 (140/528)	*	
		Percentage of children with Sulphonylureas % (n/N)	2.7 (14/528)	*	
		Percentage of children with GLP1-a % (n/N)	10.4 (55/528)	*	
		Percentage of children with DPP-4 % (n/N)	1.5 (8/528)	1.5 (8/517)	0 (0/11)
		Percentage of children with SGLT2 inhibitor % (n/N)	4.4 (23/528)	4.4 (23/517)	0 (0/11)
		Percentage of children with other hypoglycaemic (anti-hyperglycaemic) agents % (n/N)	7.2 (38/528)	7.4 (38/517)	0 (0/11)
		Percentage of children with no treatment % (n/N)	0.8 (4/528)	0.8 (4/517)	0 (0/11)

Q No.	Question	Data Item	England and Wales	England	Wales
3.2	**Was the patient offered dietetic support within the 2019-20 audit year?** *Denominator includes all children with Type 2 diabetes in the Spotlight and Core audits, who complete a full year of care 2019-20*	Yes % (n/N)	94.6 (487/515)	94.8 (476/502)	84.6 (11/13)
3.2a	**If yes, did the patient attend an appointment with a dietitian within the 2019-20 audit year?** *Denominator includes all children with a complete year of care and dietetic support offered within the 2019-20 audit year*	Percentage of children attending dietetic appointment within the audit year % (n/N)	85.4 (416/487)	85.5 (407/476)	81.8 (9/11)
3.3	**Dietitian(s) who delivered/were due to deliver dietetic support to this patient** *Denominator includes all children with a complete year of care, dietetic support offered within the 2019-20 audit year, and known specialist due to deliver the support*	Hospital-based specialist paediatric diabetes dietitian % (n/N)	93.9 (384/409)	94 (376/400)	88.9 (8/9)
		Hospital-based general paediatric dietitian % (n/N)	3.9 (16/409)	3.8 (15/400)	0.1 (1/9)
		Hospital-based non-paediatric dietitian % (n/N)	0.2 (1/409)	0.3 (1/400)	0 (0/9)
		Hospital-based weight management dietitian % (n/N)	1.7 (7/409)	1.8 (7/400)	0 (0/9)
		Community-based specialist paediatric diabetes dietitian % (n/N)	4.9 (20/409)	5 (20/400)	0 (0/9)
		Community-based general paediatric dietitian % (n/N)	0 (0/409)	0 (0/400)	0 (0/9)
		Community-based non-paediatric dietitian % (n/N)	0 (0/409)	0 (0/400)	0 (0/9)
		Community weight management dietitian % (n/N)	0.2 (1/409)	0.3 (1/400)	0 (0/9)
3.4	**Was the patient offered psychological support within the 2019-20 audit year?** *Denominator includes all children in the Spotlight audit, who complete a full year of care 2019-20*	Yes % (n/N)	56.4 (266/472)	56.3 (260/462)	60 (6/10)

Q No.	Question	Data Item	England and Wales	England	Wales
3.4a	**If yes, did the patient attend an appointment with a psychologist within the 2019-20 audit year?** *Denominator includes all children in the Spotlight audit with a complete year of care and psychological support offered within the 2019-20 audit year*	Percentage of children attending psychology appointment within the audit year % (n/N)	46.6 (124/266)	46.2 (120/260)	66.7 (4/6)
3.5	**Has blood pressure been recorded within the 2019-20 audit year?** *Denominator includes all children with Type 2 diabetes in the Spotlight and Core audits, who complete a full year of care 2019-20*	Percentage of children with BP date within the audit year and valid value recorded % (n/N)	94 (484/515)	94 (472/502)	92.3 (12/13)
3.5a	**Systolic and diastolic values (mmHg)** *Denominator includes all children with Type 2 diabetes in the Spotlight and Core audits, not diagnosed in the audit year 2019-20, with a valid value recorded during 2019-20*	Percentage of children with high-normal blood pressure (91st - 98th centile) % (n/N)	28.2 (151/536)	*	
		Percentage of children with high blood pressure (>98th centile) % (n/N)	43.1 (231/536)	42.5 (222/522)	64.3 (9/14)
3.6	**Was 24-hour ambulatory blood pressure monitoring performed within 2019-20 audit year?** *Denominator includes children reported in the Spotlight audit with a complete year of care 2019-20*	Not needed (blood pressure below 95th percentile) % (n/N)	75.8 (358/472)	76 (351/462)	70 (7/10)
		Yes % (n/N)	3.2 (15/472)	*	
		Required but not done % (n/N)	6.8 (32/472)	*	
		Not known % (n/N)	14.2 (67/472)	*	
3.7	**Was medical treatment for hypertension given within the 2019-20 audit year?** *Denominator includes all children reported in the Spotlight audit*	Not needed (blood pressure below 95th percentile) % (n/N)	86.1 (637/740)	86 (622/723)	88.2 (15/17)
		Yes % (n/N)	4.7 (35/740)	*	
		Required but not done % (n/N)	1.5 (11/740)	*	
		Not known % (n/N)	7.7 (57/740)	*	

Q No.	Question	Data Item	England and Wales	England	Wales
3.8	**Was a lipid profile performed within the 2019-20 audit year?** *Denominator includes all children with Type 2 diabetes in the Spotlight and Core audits, who complete a full year of care 2019-20*	Percentage of children with lipid profile date within the audit year and valid value recorded % (n/N)	77.3 (398/515)	77.5 (389/502)	69.2 (9/13)
3.8b	**Was the lipid profile performed fasting or non-fasting?** *Denominator includes children not diagnosed in the audit year 2019/20, with a known fasting/ non-fasting method recorded*	Percentage of children with lipid profile performed fasting % (n/N)	18.1 (55/304)	18.3 (55/300)	0 (0/4)
3.8c	**Total cholesterol** *Denominator includes children not diagnosed in the audit year 2019/20, with a known interpretation of total cholesterol values*	High % (n/N)	25.6 (100/391)	*	
		Normal % (n/N)	73.1 (286/391)	73 (281/385)	83.3 (5/6)
		Lower than normal % (n/N)	0.5 (2/391)	0.5 (2/385)	0 (0/6)
		Abnormal % (n/N)	0.8 (3/391)	*	
3.8d	**HDL cholesterol** *Denominator includes children not diagnosed in the audit year 2019/20, with a known interpretation of HDL cholesterol values*	High % (n/N)	5.2 (19/362)	*	
		Normal % (n/N)	58.6 (212/362)	58.1 (207/356)	83.3 (5/6)
		Lower than normal % (n/N)	34.3 (124/362)	*	
		Abnormal % (n/N)	1.9 (7/362)	*	
3.8e	**Non-HDL cholesterol** *Denominator includes children not diagnosed in the audit year 2019/20, with a known interpretation of non-HDL cholesterol values*	High % (n/N)	15.3 (45/295)	*	
		Normal % (n/N)	83.1 (245/295)	*	
		Lower than normal % (n/N)	0.3 (1/295)	*	
		Abnormal % (n/N)	1.4 (4/295)	*	
3.8f	**Triglycerides** *Denominator includes children not diagnosed in the audit year 2019/20, with a known interpretation of triglycerides values*	High % (n/N)	36.5 (133/364)	*	
		Normal % (n/N)	61.8 (225/364)	*	
		Lower than normal % (n/N)	0.8 (3/364)	*	
		Abnormal % (n/N)	0.8 (3/364)	*	
3.8g	**LDL cholesterol** *Denominator includes children not diagnosed in the audit year 2019/20, with a known interpretation of LDL values*	High % (n/N)	13.5 (36/267)	*	
		Normal % (n/N)	85 (227/267)	*	
		Lower than normal % (n/N)	0.4 (1/267)	*	
		Abnormal % (n/N)	1.1 (3/267)	*	

Q No.	Question	Data Item	England and Wales	England	Wales
3.9	**Was the patient taking medical treatment for hyperlipidaemia?** *Denominator includes children not diagnosed in the audit year 2019/20, with known treatment for hyperlipidaemia recorded*	Not needed % (n/N)	96.2 (480/499)	96.1 (469/488)	100 (11/11)
		Yes % (n/N)	0.6 (3/499)	0.6 (3/488)	0 (0/11)
		Required but not taking % (n/N)	3.2 (16/499)	3.3 (16/488)	0 (0/11)
3.1	**Was a liver function test performed within the 2019-20 audit year?** *Denominator includes all children in Spotlight audit with a complete year of care 2019/20*	Percentage of children with liver function date within the audit year % (n/N)	66.7 (315/472)	66.9 (309/462)	60 (6/10)
3.10b	**Elevated alanine aminotransferase (ALT)?** *Denominator includes children in Spotlight audit not diagnosed during the audit year 2019/20, with a known interpretation of alanine aminotransferase (ALT)*	Yes % (n/N)	34.5 (125/362)	*	
3.11	**Within the 2019-20 audit year, had ultrasound for fatty liver findings changed since diagnosis?** *Denominator includes children in Spotlight audit not diagnosed during the audit year 2019/20*	No ultrasound done/ repeated % (n/N)	88.2 (473/536)	88 (462/525)	100 (11/11)
		No change from previous ultrasound % (n/N)	4.1 (22/536)	4.2 (22/525)	0 (0/11)
		Improved - reduced severity of fatty liver % (n/N)	0.4 (2/536)	0.4 (2/525)	0 (0/11)
		Improved - no fatty liver % (n/N)	0.6 (3/536)	0.6 (3/525)	0 (0/11)
		Fatty liver now observed % (n/N)	2.2 (12/536)	2.3 (12/525)	0 (0/11)
		Increased severity of previously existing fatty liver % (n/N)	0.2 (1/536)	0.2 (1/525)	0 (0/11)
		Not known % (n/N)	4.3 (23/536)	4.4 (23/525)	0 (0/11)
3.12	**Was the patient treated for albuminuria within the 2019-20 audit year?** *Denominator includes all children reported in the Spotlight audit*	Not needed % (n/N)	89.1 (659/740)	88.8 (642/723)	100 (17/17)
		Yes % (n/N)	3.4 (25/740)	3.5 (25/723)	0 (0/17)
		Required but not treated % (n/N)	0.7 (5/740)	0.7 (5/723)	0 (0/17)
		Not known % (n/N)	6.9 (51/740)	7.1 (51/723)	0 (0/17)

Q No.	Question	Data Item	England and Wales	England	Wales
3.13	**Was sleep assessed during the 2019-20 audit year?** *Denominator includes children reported in the Spotlight audit with a complete year of care 2019/20*	Percentage of children with sleep assessment date within the audit year % (n/N)	12.5 (59/472)	12.8 (59/462)	0 (0/10)
3.13	**Was sleep assessed during the 2019-20 audit year?** *Denominator includes children not diagnosed in the audit year 2019/20, with a known method for sleep assessment*	Percentage of children assessed via questioning for symptoms of respiratory problems % (n/N)	76.6 (49/64)	76.6 (49/64)	0 (0/0)
		Percentage of children assessed via sleep study % (n/N)	20.3 (13/64)	20.3 (13/64)	0 (0/0)
		Percentage of children assessed via questioning for symptoms of respiratory problems and sleep study % (n/N)	3.1 (2/64)	3.1 (2/64)	0 (0/0)
3.13b	**If yes, was sleep apnoea diagnosed?** *Denominator includes children not diagnosed in the audit year 2019/20, with a known outcome for sleep apnoea*	Yes % (n/N)	16.1 (10/62)	16.1 (10/62)	0 (0/0)
3.13c	**If yes, was non-invasive ventilation for sleep apnoea recommended?** *Denominator includes children not diagnosed in the audit year 2019/20, with a known recommendation for non-invasive ventilation*	Yes % (n/N)	70 (7/10)	70 (7/10)	0 (0/0)
3.14	**Treatment for obesity given in exceptional circumstances at any point since diagnosis** *Denominator includes all children in Spotlight audit*	Yes % (n/N)	15.1 (112/740)	*	
3.14a	**Extremely low-calorie diet/ meal replacement** *Denominator includes all children in Spotlight audit, with known recommendation for extremely low-calorie diet/meal replacement*	Not needed % (n/N)	88.3 (605/685)	88.2 (590/669)	93.8 (15/16)
		Yes % (n/N)	6.9 (47/685)	7 (47/669)	0 (0/16)
		Required but not given % (n/N)	4.8 (33/685)	*	

Q No.	Question	Data Item	England and Wales	England	Wales
3.14b	**Orlistat** *Denominator includes all children in Spotlight audit, with known recommendation for Orlistat*	Not needed % (n/N)	97.3 (677/696)	97.4 (662/680)	93.8 (15/16)
		Yes % (n/N)	1.6 (11/696)	1.6 (11/680)	0 (0/16)
		Required but not given % (n/N)	1.1 (8/696)	*	
3.14c	**Bariatric surgery** *Denominator includes all children in Spotlight audit, with known recommendation for bariatric surgery*	Not needed % (n/N)	96.4 (677/702)	96.5 (662/686)	93.8 (15/16)
		Yes % (n/N)	0.7 (5/702)	0.7 (5/686)	0 (0/16)
		Required but not given % (n/N)	2.8 (20/702)	*	
3.14d	**Other** *Denominator includes all children in Spotlight audit, with known recommendation for other treatment for obesity*	Not needed % (n/N)	90.7 (569/627)	90.8 (556/612)	86.7 (13/15)
		Yes % (n/N)	8.8 (55/627)	*	
		Required but not given % (n/N)	0.5 (3/627)	*	

National Paediatric Diabetes Audit (NPDA)

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