National Diabetes Audit, 2020-21
Type 1 Diabetes

England and Wales

16 June 2022

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NDA 2020-21: Type 1 Diabetes

Executive summary and recommendations

Executive summary

Background

This is the second National Diabetes Audit (NDA) report dedicated to adults with type 1 diabetes.

A diagnosis validation process, which considers medication as well as recorded diagnosis, has been used to ensure that only adults with true type 1 diabetes are included.

Case ascertainment from General Practitioner (GP) records is >99% so geographical comparisons are comprehensive. But low rates of data submissions from specialist services, possibly hampered due to COVID-19, make provider reports patchy.

Key Findings:

- Due to the pandemic restrictions, care process completion reduced markedly in 2020-21 – for example glycated haemoglobin (HbA1c) checks reduced from 88% to 80% and Body Mass Index (BMI) measurements from 86% to 67%.
- By contrast, overall HbA1c treatment target achievement improved in 2020-21; for example, the median rate of achieving HbA1c ≤58mmol/mol (7.5%) has increased from 28% in 2019-20 to 31% in 2020-21.
- Use of non-invasive glucose monitoring and insulin pump technology was associated with lower HbA1c. These technologies were being used more by adults of white ethnicity and adults in areas of low deprivation than by adults of other ethnicities and in more deprived areas. Findings were similar for recorded completion of structured education.
- All care processes and treatment outcomes vary by location. For example, both comprehensive Clinical Commissioning Group/ Local Health Board (CCG/LHB) data and partial specialist service data show ranges of 20-45% in achievement of HbA1c ≤58mmol/mol (7.5%) by location.

Recommendations

Recommendation 1

Given that specialist services play a key role in leading the provision of type 1 diabetes care, it is imperative that all specialist services submit data to the audit. Details for the 2021-22 submission can be found at https://digital.nhs.uk/data-and-information/clinical-audits-and-registries/national-diabetes-audit/core - deadline 30th June 2022

Recommendation 2

Specialist services should work with local systems to ensure that everyone with type 1 diabetes, irrespective of age, sex, ethnicity or social circumstances has the opportunity to benefit from structured education, non-invasive glucose monitoring and insulin pump treatment as per guidelines from The National Institute for Health and Care Excellence (NICE). The NDA specialist service type 1 diabetes Quality Improvement Collaborative is launching in Autumn 2022. Every specialist service will be invited to participate. This will be an invaluable opportunity for networking and shared learning

Recommendation 3

Given the high variability of care process completion and treatment target achievement, specialist services and local systems should try to find ways to understand the reasons for these differences with the aim of improving the level of outcomes overall and reducing their variability. The regional 'deep dives', as undertaken by NHS England, are a mechanism for drawing attention to variability and promoting shared learning and change

NDA type 1 diabetes advisory group expert by experience* perspective

"We cannot underestimate the challenges of providing care for people with type 1 diabetes during the COVID-19 pandemic but we are concerned to see the reduction in the essential healthcare checks we should be receiving every year. We hope that routine care for people with type 1 diabetes can return to and improve on pre-pandemic levels as soon as possible"

"It is heartening to see improvements in the proportion of people having a HbA1c within the recommended targets. The benefits of structured education, Flash and CGM and insulin pumps for people with type 1 diabetes are clear to see but there is too much inequality of access. Services need to work to reduce variation - whether that's due to if someone is living in poverty, their ethnicity or where they live. Commissioners, services and people with diabetes need to work together to understand the reasons for the variation and learn from other areas with higher levels of treatment target achievement"

* A person with lived experience of type 1 diabetes

NDA 2020-21: Type 1 Diabetes

Introduction

Introduction

The National Diabetes Audit (NDA) provides a comprehensive view of diabetes care in England and Wales. It measures the effectiveness of diabetes healthcare against NICE Clinical Guidelines and NICE Quality Standards*,**

This is the **Type 1 Diabetes report**. It details the findings and recommendations relating to diabetes care process completion, treatment target achievement and structured education for people with type 1 diabetes aged 19 years and over. The 2020-21 audit covers the period 01 January 2020 to 31 March 2021.

Type 1 cohort

The diagnosis validation process***, introduced for the first type 1 report (2019-20), has been repeated, and extended to include anyone extra who was identified by a specialist service as being on an insulin pump. Therefore the type 1 cohort used for this report will not be the same as the type 1 cohort used in the NDA Core Report 1 2020-21. The cohort used for this report consists of people:

- Recorded as being diagnosed with type 1 diabetes within the 2020-21 NDA core audit
- Aged 19 years and over
- Prescribed insulin treatment consistent with 1 of the following regimens between the period 01 January 2020 to 31 March 2021:
  - Insulin pump
  - Basal-bolus
  - Fixed mix

  Or on an insulin pump according to a NDA submission from a specialist service

Table 1: Number and percentage of people with type 1 diabetes age 19+ by available data sources, England and Wales, 2020-21

	Type 1 Diabetes	
	Number	Per cent
Total	*223,600*	-
GP practice and specialist service	85,305	38.2
GP practice only	137,765	61.6
Specialist service only	535	0.2

* NICE Clinical Guidelines – NG17: Type 1 diabetes in adults: diagnosis and management http://www.nice.org.uk/guidance/ng17 ** NICE – Diabetes in Adults Quality Standard http://guidance.nice.org.uk/QS6 *** This validation process should minimise the number of adults with type 2 diabetes inadvertently coded as type 1, but may exclude a few frail type 1 individuals who are treated compassionately with very simple insulin regimens.

National Diabetes Audit Participation

Primary care participation stood at 99.3% in 2020-21 in England and Wales.

In all but 6 Clinical Commissioning Groups (CCGs) and Local Health Boards (LHBs) - 107 out of 113 - GP practice participation was 95% and over. Participation did not fall below 88% at any CCG/LHB.

108* specialist services participated in 2020-21 in England**.

- 51 services submitted both the NDA core dataset and the insulin pump dataset
- 9 services submitted only the insulin pump dataset
- 48 services submitted only the NDA core dataset

Altogether, there are 138 NHS Acute Trusts in England, some of which have more than 1 hospital providing specialist diabetes care. Specialist services generally take the lead in care for type 1 diabetes services and also often for younger people with type 2 diabetes. Their more comprehensive involvement is important as part of the drive to improve the poorer results for these patients.

For more information on the level of participation in 2020-21 by CCG and LHB please see **National Diabetes Audit, Report 1- Care Processes and Treatment Targets 2020-21, Underlying data:** https://digital.nhs.uk/data-and-information/publications/statistical/national-diabetes-audit/report-1--care-processes-and-treatment-targets-2020-21-underlying-data

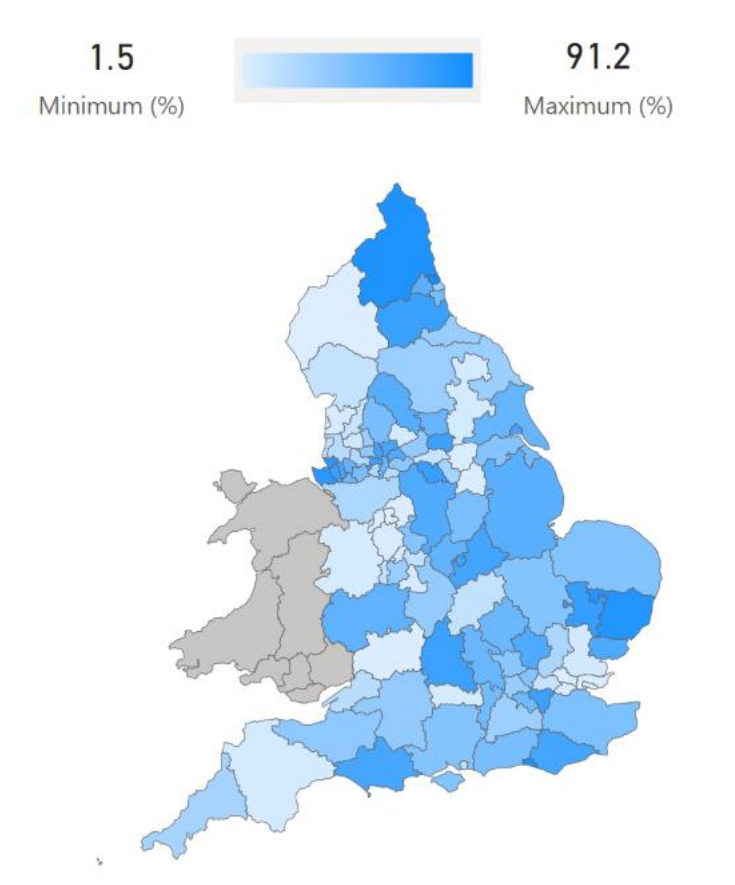
* 1 of the services had only a small number of adults with type 2 diabetes so is not included in this report ** 4 Welsh specialist services from 2 LHBs submitted insulin pump data to the NDA.

Specialist services participation

The map shows the percentage of adults with type 1 diabetes in each CCG for whom data was submitted by specialist services

- Only 39 CCGs had specialist services data submitted for at least half of the type 1 adults for whom there were primary care submissions
- Percentages ranged from only 1.5% in Stoke-on-Trent CCG to over 90% in North Tyneside CCG

Map 1: Percentage of adults with type 1 diabetes for whom there is a specialist services data submission, England, 2020-21*



* Wales specialist services only submit data for insulin pump users.

NDA 2020-21: Type 1 Diabetes

What are the characteristics of adults diagnosed with type 1 diabetes?

Type 1 Diabetes: Age, Ethnicity, Deprivation

- The distribution of adults with type 1 diabetes across age bands, ethnicity groups and social deprivation quintiles is similar to the distribution shown in the 2019-20 type 1 report.
- No quintile of deprivation is associated with a higher or lower likelihood of having type 1 diabetes.

Figure 1: Adults with type 1 diabetes and general population totals, by age band, England and Wales, 2020-21*

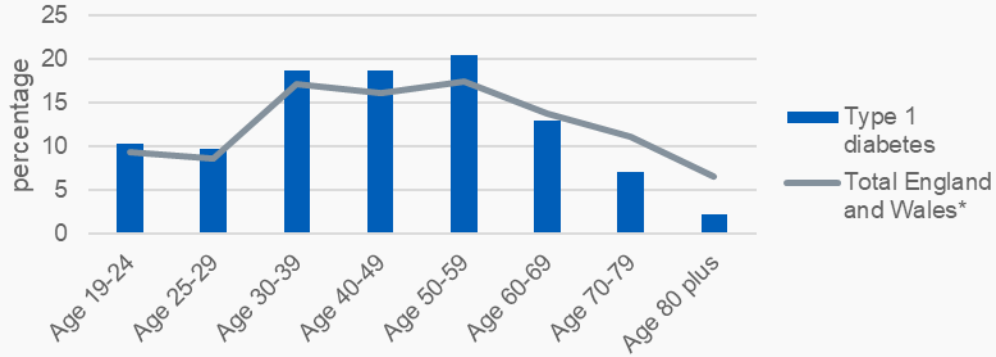


Figure 2: Adults with type 1 diabetes and general population totals, by ethnicity, England and Wales, 2020-21**,***

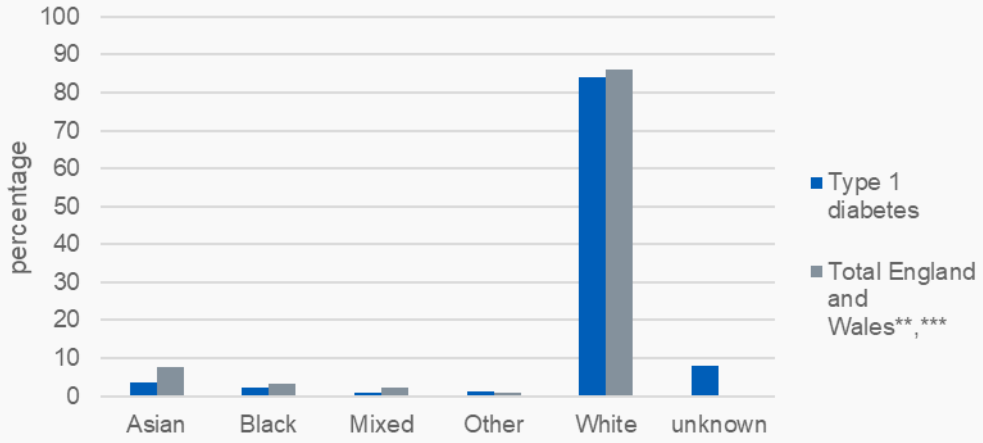
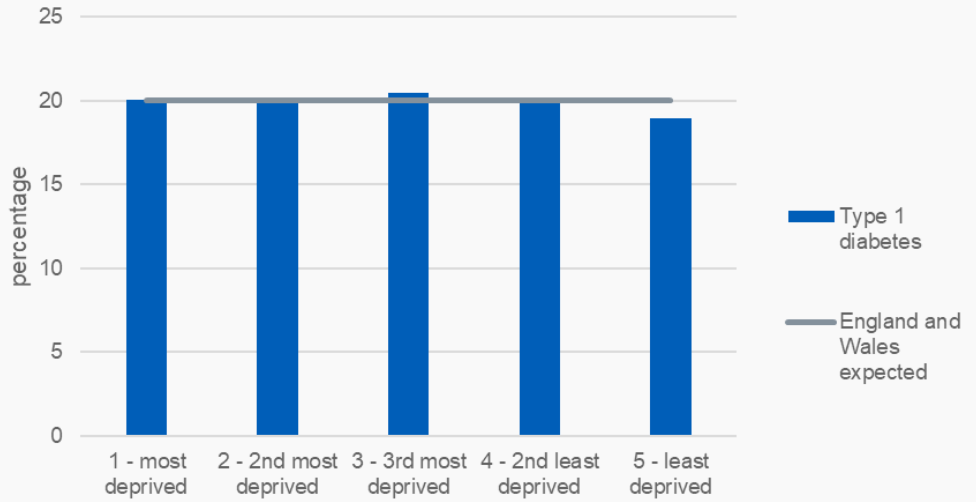


Figure 3: Adults with type 1 diabetes and expected totals, by social deprivation quintile, England and Wales, 2020-21



* ONS 2020 mid-year population estimates for England and Wales. ** Data from 2011 Census (England and Wales). *** People whose ethnicity is 'Unknown / Not stated' excluded from calculation.

Type 1 Diabetes: Smoking status, Diabetes duration

The distribution of adults with type 1 diabetes across smoking status groups is similar to the pattern seen in the Health Survey for England in 2019

It is usually more difficult to achieve glucose control targets after 5 to 10 years of type 1 diabetes.

- Three-quarters of adults with type 1 diabetes have a diabetes duration of 10 or more years.

Figure 4: Adults with type 1 diabetes and England, by smoking status, England and Wales, 2020-21*,**

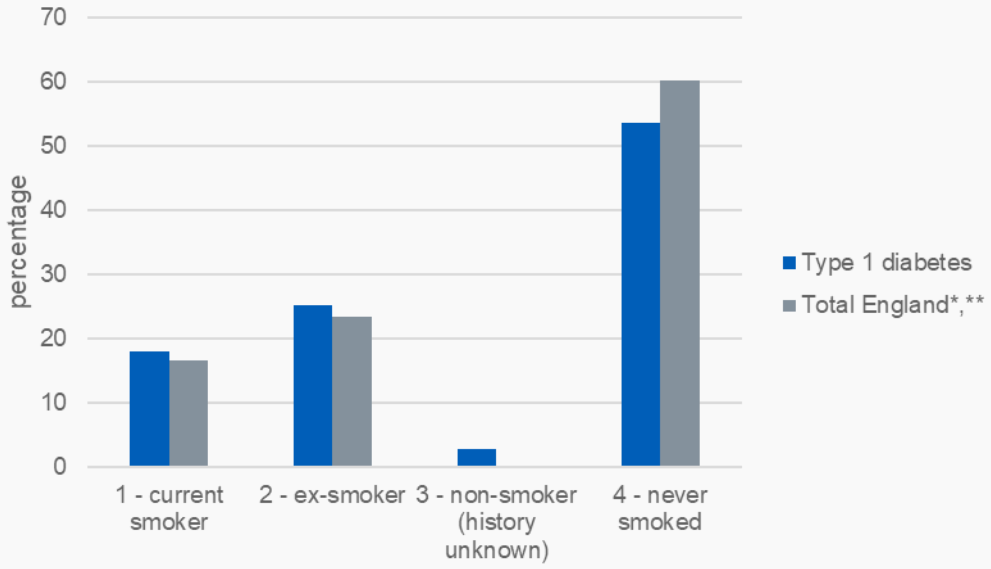
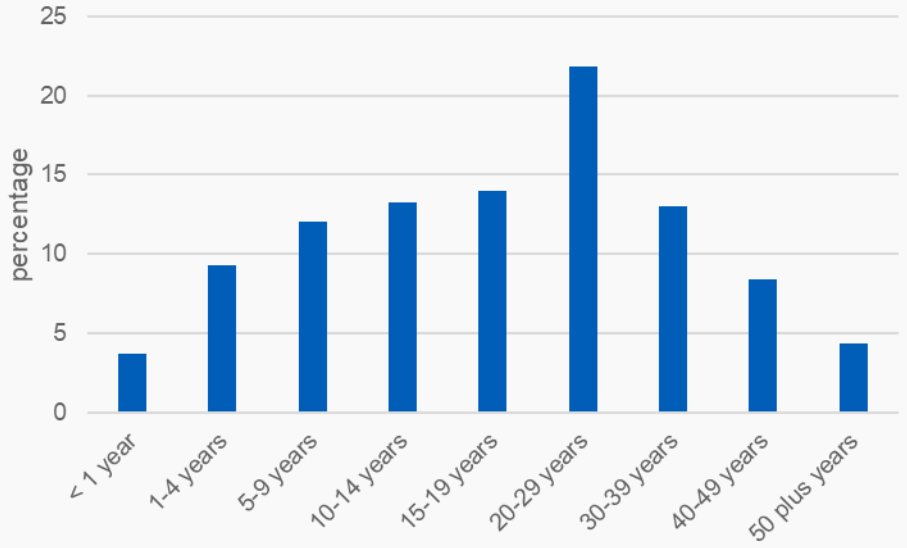


Figure 5: Distribution of diabetes duration, adults with type 1 diabetes, England and Wales, 2020-21



* Health Survey for England 2019.**Health Survey for England groups do not include the generic “non-smoker (history unknown)” category

NDA 2020-21: Type 1 Diabetes

How many adults received the care processes that are recommended to manage their type 1 diabetes?

Care Processes – NICE (annual)

All people with diabetes aged 12 years and over should receive all of the 9 NICE recommended care processes and attend a structured education programme shortly after diagnosis*.

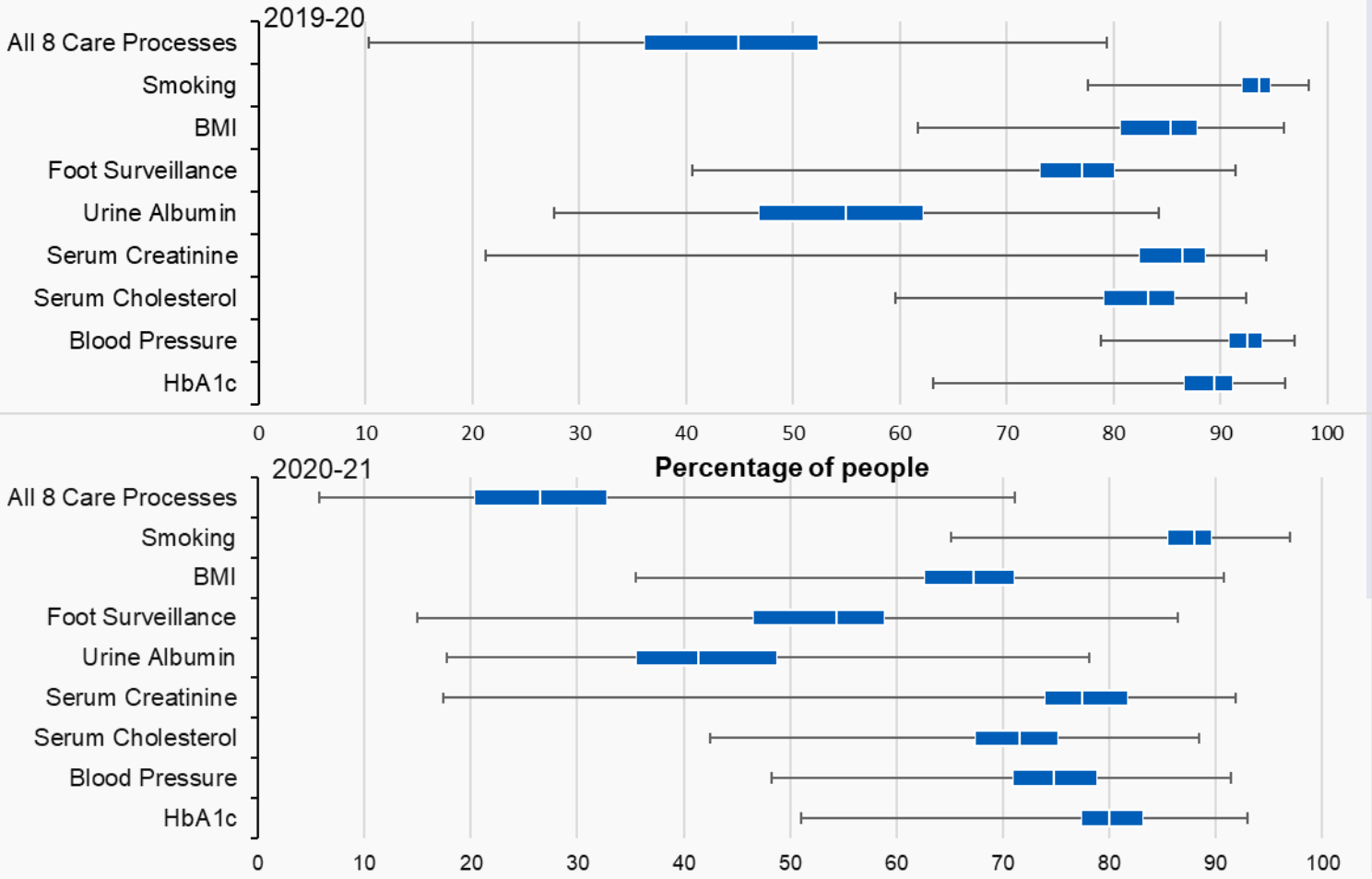
Table 2: 9 Annual Care Processes for all people with diabetes aged 12 and over	
Responsibility of Diabetes Care providers (comprising the NDA 8 Care Processes)	
1. HbA1c (blood test for glucose control)	**5. Urine Albumin/Creatinine Ratio** (urine test for risk of kidney disease)
2. Blood Pressure (measurement for cardiovascular risk)	**6. Foot Risk Surveillance** (examination for foot ulcer/amputation risk)
3. Serum Cholesterol (blood test for cardiovascular risk)	**7. Body Mass Index** (measurement for cardiovascular risk)
4. Serum Creatinine** (blood test for kidney function)	**8. Smoking History** (question for cardiovascular risk)
Responsibility of NHS Diabetes Eye Screening*** (NHS England)	
9. Digital Retinal Screening (photographic eye test for early detection of eye disease)	

For NDA 2020-21, **Diabetes Eye Screening (DES) data** has been collected directly from DES providers. However, due to temporary service closures during the pandemic, the data is incomplete. Therefore this report does not report on retinal screening

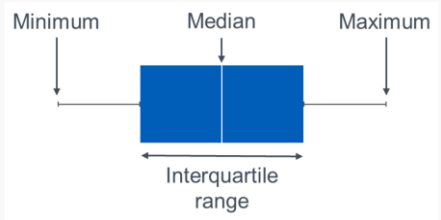
* NICE Clinical Guidelines – NG17: Type 1 diabetes in adults: diagnosis and management http://www.nice.org.uk/guidance/ng17 ** There is a potential issue with the SNOMED codes used to identify if a person has had their creatinine diabetes care process check. 2 creatinine plasma codes were removed from the NDA creatinine code set during the universal SNOMED code refresh. This has affected creatinine care process completion percentage, and potentially the all 8/9 NICE care processes completion percentage, for organisations/areas that still use these codes. To resolve the issue, the NDA business rules are currently being amended to add these code into future NDA data extractions *** Responsibility of Public Health England up to September 2021

Care Processes – CCGs/LHBs

Figure 6: The range of CCG/LHB care process completion*, for adults with type 1 diabetes,** England and Wales, 2019-20 and 2020-21



- Rates of care process completion were lower in 2020-21 than in 2019-20 with a median completion rate of 80% or less for all care processes except smoking in 2020-21
- Care processes requiring face to face contact, such as foot surveillance, were reduced the most
- The ranges of rates of care process completion across CCG/LHBs were wider in 2020-21 than in 2019-20
- Nevertheless, despite the pandemic, rates of over 90% of care process completion were achieved by some CCG/LHBs for some of the care processes

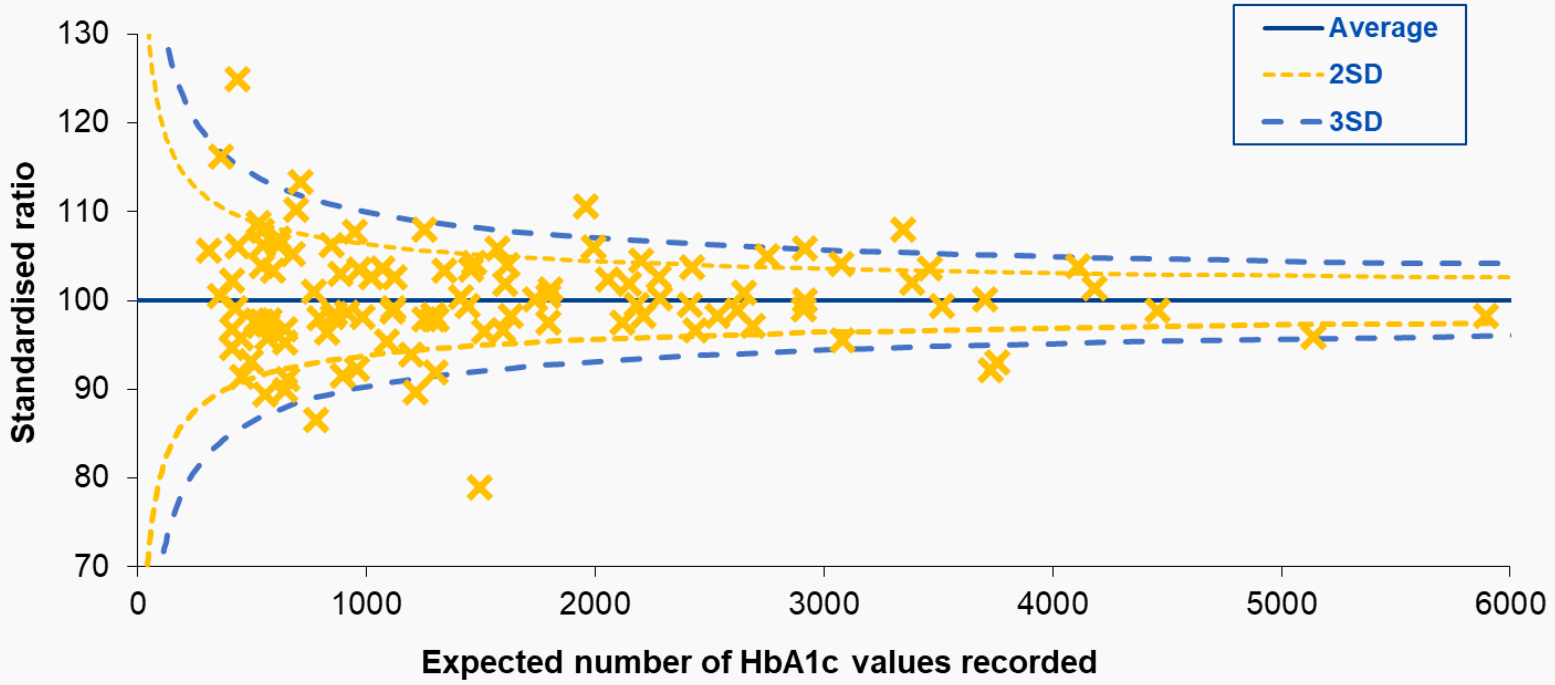


* The 9th NICE care process, digital retinal screening, is not included; therefore this figure comprises the first 8 care processes only. ** There is a potential issue with the SNOMED codes used to identify if a person has had their creatinine diabetes care process check. Two creatinine plasma codes were removed from the NDA creatinine code set during the universal SNOMED code refresh. This has affected creatinine care process completion percentage, and potentially the all 8/9 care process completion percentage, for organisations/areas that still use these codes. To resolve the issue, the NDA business rules are currently being amended to add these code into future NDA data extractions.

HbA1c care process – CCG/LHB variation in recording HbA1c values

- As a result of low care process completion and incomplete HbA1c values, in cases where the HbA1c check had taken place, the number of values recorded in 2020-21 was considerably lower than in 2019-20
- A logistic regression model was used to produce expected numbers of HbA1c values recorded for each CCG/LHB
  - The model c-statistic was 0.79 (strong)
- Of 113 CCG/LHBs, 30 were more than 2 standard deviations (SD) outside the expected number of adults with a value recorded for the HbA1c care process
  - 16 CCG/LHBs were above expectation
  - 14 CCG/LHBs were below expectation

Figure 7: Funnel plot of CCG/LHB standardised ratios of recording an HbA1c value, England and Wales, 2020-21



Variables used in the model:
Sex
Age group
Duration of diabetes
Ethnicity
Deprivation quintile
BMI group
Smoking status
Insulin regimen
Continuous Glucose Monitoring (CGM) status
Frailty status

For an explanation of how funnel plots are interpreted click here

* For explanations of odds ratios, logistic regression and forest plot interpretation please see Additional Information: 'Definitions – Statistical terms'.

HbA1c – contributing factors (HbA1c recorded)

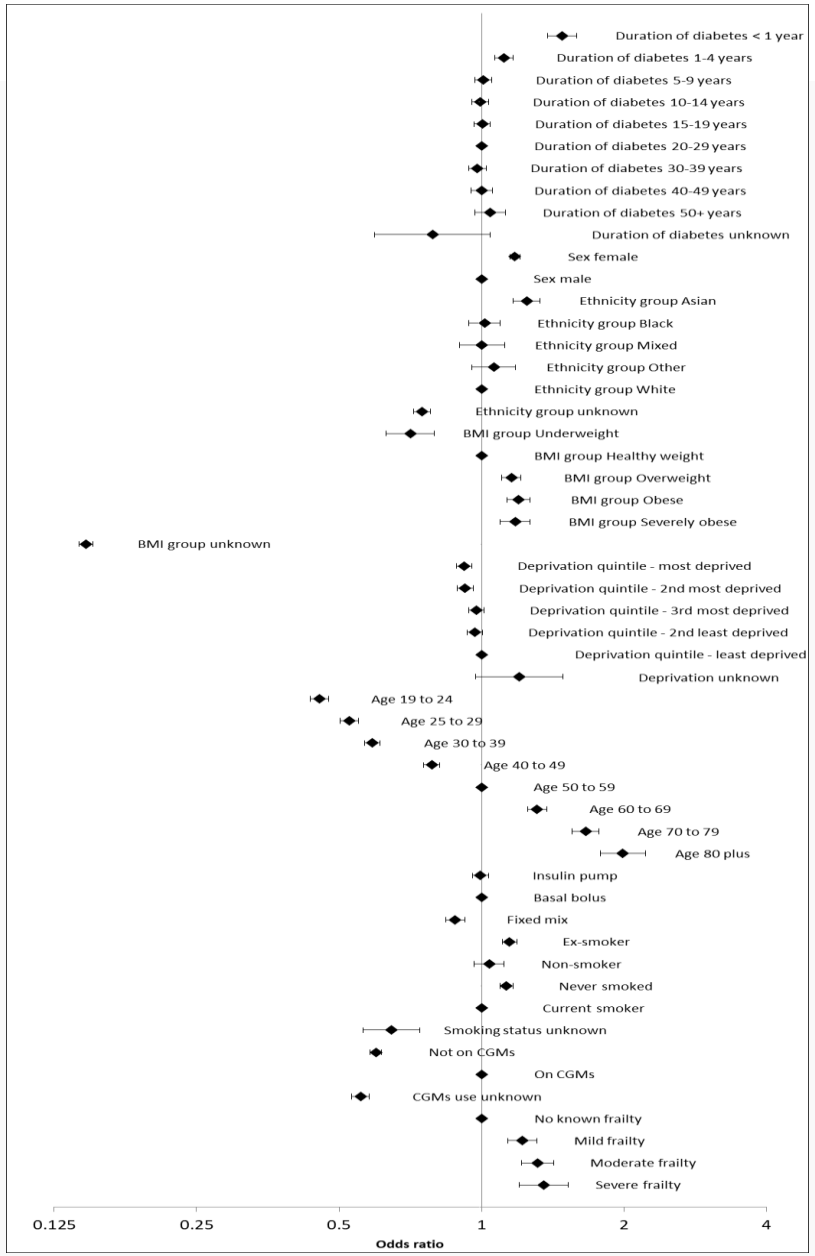


Figure 8: Individual person characteristics in adults with type 1 diabetes and likelihood of HbA1c being recorded, England and Wales, 2020-21

Figure 8 shows a forest plot of odds ratios which illustrate the individual person characteristics associated with an HbA1c value being recorded in the 2020-21 audit year. These odds ratios were derived from a logistic regression model*.

- Factors associated with higher likelihood of HbA1c being recorded:
  - Shorter duration of diabetes (up to 4 years)
  - Female sex
  - Asian ethnicity
  - BMI higher than 25 kg/m^2
  - Being older (60+ years of age)
  - Being an ex-smoker or never having smoked
  - Being on CGM
  - Being frail
- The factors associated with a lower likelihood of HbA1c being recorded were:
  - BMI under 18 kg/m^2 or unknown
  - Living in an area in the most or 2nd most deprived quintile
  - Being under 50 years of age
  - On fixed mix insulin

* For explanations of odds ratios, logistic regression and forest plot interpretation please see Additional Information: 'Definitions – Statistical terms'.

NDA 2020-21: Type 1 Diabetes

How many adults with type 1 diabetes met their recommended treatment targets?

HbA1c achievement – Time series

In 2020-21:

- There was no change in the distribution of HbA1c treatment target achievement in those with a recorded value between 2017-18 and 2019-20, but there has been a change between 2019-20 and 2020-21
  - In 2020-21 there were 6.9% fewer adults with a recorded HbA1c value
  - But there has been a significant improvement in achievement of treatment targets which does not appear to be due to a biased cohort (see appendix slides 42,43 for further comparison of achievement for adults with HbA1c records in 2019-20 and 2020-21)
- 9.8% achieved the NICE HbA1c target of 48 mmol/mol or lower*.
- Almost 1 in 5 had an HbA1c result of 53 mmol/ml or lower (19.5%), and 32.3% achieved the HbA1c treatment target of 58 mmol/mol or lower.
- 14.4% had a very high risk HbA1c result of above 86 mmol/mol in 2020-21, compared to 15.9% in 2019-20

Figure 9: Distribution of HbA1c achievement, England and Wales, 2017-18 to 2020-21

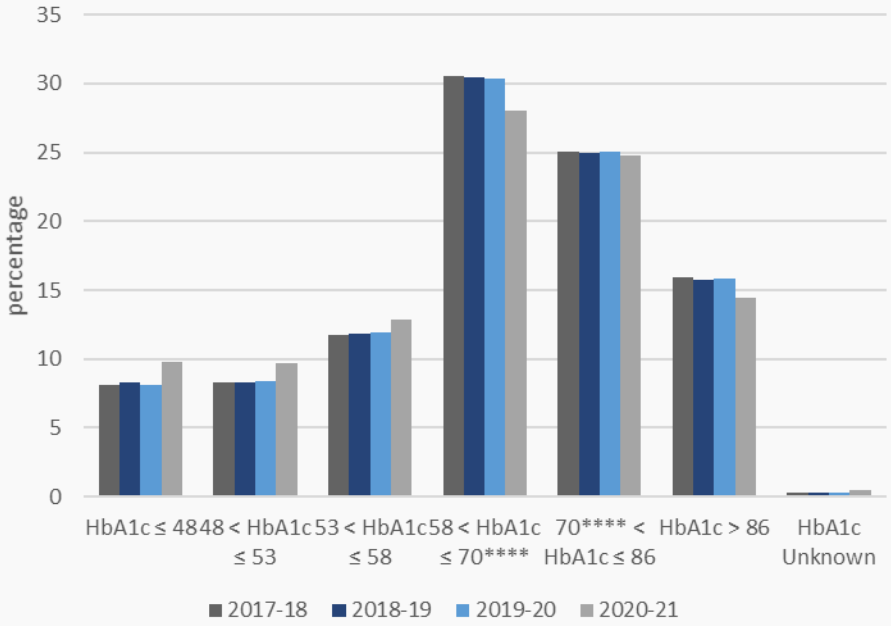


Table 3: Adults with type 1 diabetes, by HbA1c result (mmol/mol)*****, England and Wales, 2017-18 to 2020-21

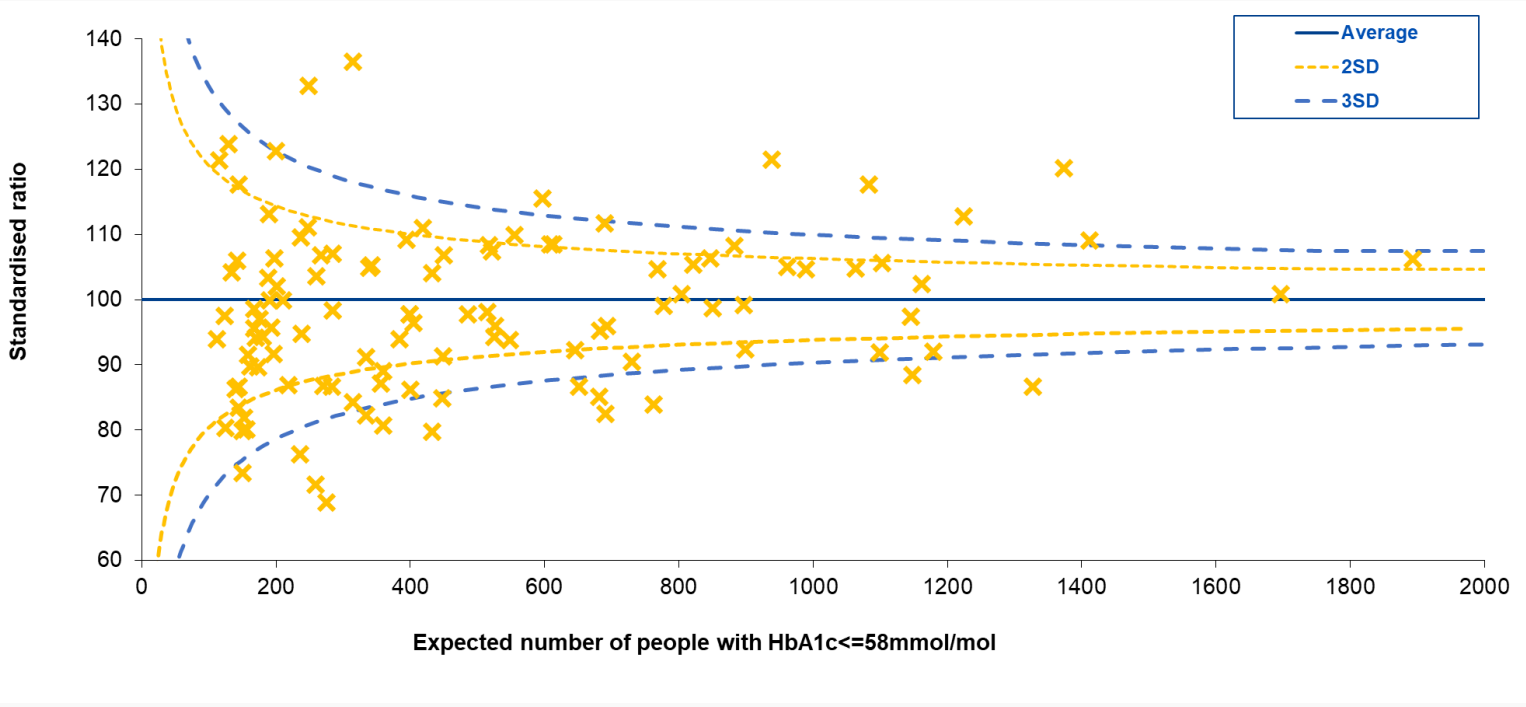
Audit period	Total	HbA1c ≤ 48		48 < HbA1c ≤ 53		53 < HbA1c ≤ 58		58 < HbA1c ≤ 70****		70**** < HbA1c ≤ 86		HbA1c > 86		HbA1c Unknown	
	Number	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
2020-21	175,395	17,170	9.8	16,990	9.7	22,490	12.8	49,130	28.0	43,480	24.8	25,260	14.4	875	0.5
2019-20	192,320	15,630	8.1	16,175	8.4	22,940	11.9	58,395	30.4	48,140	25.0	30,495	15.9	545	0.3
2018-19	194,715	16,160	8.3	16,195	8.3	23,110	11.9	59,265	30.4	48,655	25.0	30,735	15.8	600	0.3
2017-18	193,235	15,710	8.1	16,030	8.3	22,730	11.8	59,025	30.5	48,375	25.0	30,745	15.9	615	0.3

* NICE Guideline 17.1.6: https://www.nice.org.uk/guidance/ng17/chapter/Recommendations ** In 2020-21, severely frail adults are excluded *** Only includes adults who had a recorded HbA1c check within the audit period. **** 58<HbA1c<=69 and 69<HbA1c<=86 in 2020-21

HbA1c treatment target – CCG/LHB variation in proportion meeting treatment target (HbA1c ≤ 58 mmol/mol, 7.5%)

- A logistic regression model was used to produce expected numbers of adults meeting the HbA1c ≤ 58 mmol/mol treatment target in each CCG/LHB
  - The model c-statistic was 0.64 (weak)
- Of 113 CCG/LHBs, 50 were more than 2 SD beyond the expected number of adults achieving the treatment target
  - 19 CCG/LHBs were above expectation
  - 31 CCG/LHBs were below expectation

Figure 10: Funnel plot of CCG/LHB standardised ratios of adults achieving HbA1c ≤ 58mmol/mol, England and Wales,



Logistic regression model used for standardisation.
Variables used in the model:
Sex
Age group
Duration of diabetes
Ethnicity
Deprivation quintile
BMI group
Smoking status
Insulin regimen
CGM status
Frailty status

For an explanation of how funnel plots are interpreted click here

* For explanations of odds ratios, logistic regression and forest plot interpretation please see Additional Information: 'Definitions – Statistical terms'.

HbA1c – contributing factors (HbA1c ≤ 58mmol/mol)

Figure 11: Individual person characteristics in adults with type 1 diabetes and likelihood of meeting the HbA1c ≤ 58 mmol/mol treatment target , England and Wales, 2020-21

Figure 11 shows a forest plot of odds ratios which illustrate the individual person characteristics associated with adults meeting the HbA1c ≤ 58mmol/mol treatment target. These odds ratios were derived from a logistic regression model*.

- Non-modifiable factors associated with reduced likelihood of an HbA1c ≤ 58mmol/mol (7.5%):
  - Diabetes duration between 10 and 19 years
  - Being female
  - Being of Black or Asian ethnicity
  - Living in a more deprived area than the least deprived
  - Being age 19-24
  - Not being moderately or severely frail

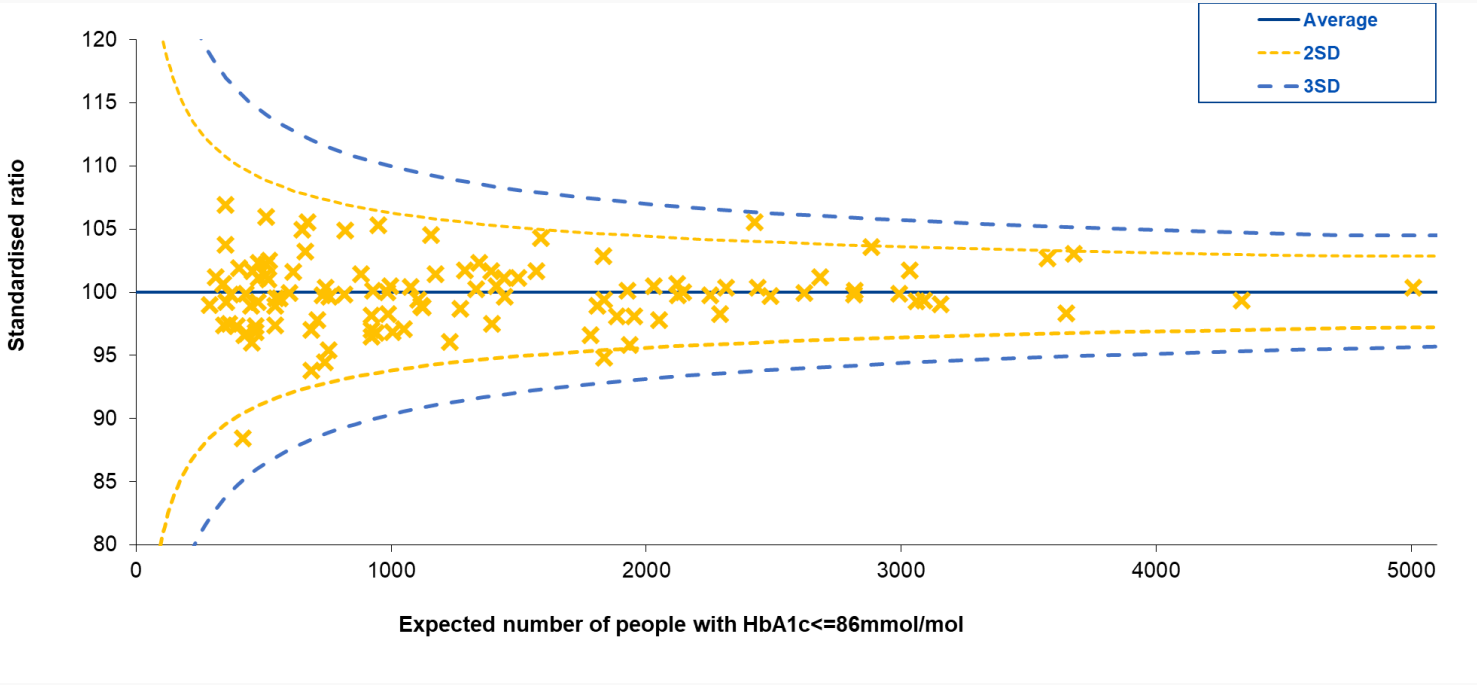
- Modifiable factors associated with likelihood of an HbA1c ≤ 58mmol/mol (7.5%):
  - Healthy weight (BMI 18.5-24.9)
    - Overweight, obesity and underweight are all associated with lower rates of HbA1c ≤ 58
  - Being on an insulin pump or fixed mix insulin
  - Not smoking
  - Using CGM

* For explanations of odds ratios, logistic regression and forest plot interpretation please see Additional Information: 'Definitions – Statistical terms'.

HbA1c treatment target – CCG/LHB variation in proportion meeting treatment target (HbA1c ≤ 86 mmol/mol, 10%)

- A logistic regression model was used to produce expected numbers of adults meeting the HbA1c<= 86 mmol/mol treatment target in each CCG/LHB
  - The model c-statistic was 0.73 (moderate)
- Of 113 CCG/LHBs, only 3 were more than 2 SD beyond the expected number of adults achieving the treatment target, and none were outside of 3 SD
  - 1 CCG/LHB was above expectation
  - 2 CCG/LHBs were below expectation

Figure 12: Funnel plot of CCG/LHB standardised ratios of adults achieving HbA1c ≤ 86mmol/mol, England and Wales, 2020-21



Logistic regression model used for standardisation.
Variables used in the model:
Sex
Age group
Duration of diabetes
Ethnicity
Deprivation quintile
BMI group
Smoking status
Insulin regimen
CGM status
Frailty status

For an explanation of how funnel plots are interpreted click here

* For explanations of odds ratios, logistic regression and forest plot interpretation please see Additional Information: 'Definitions – Statistical terms'.

HbA1c – contributing factors (HbA1c ≤ 86mmol/mol)

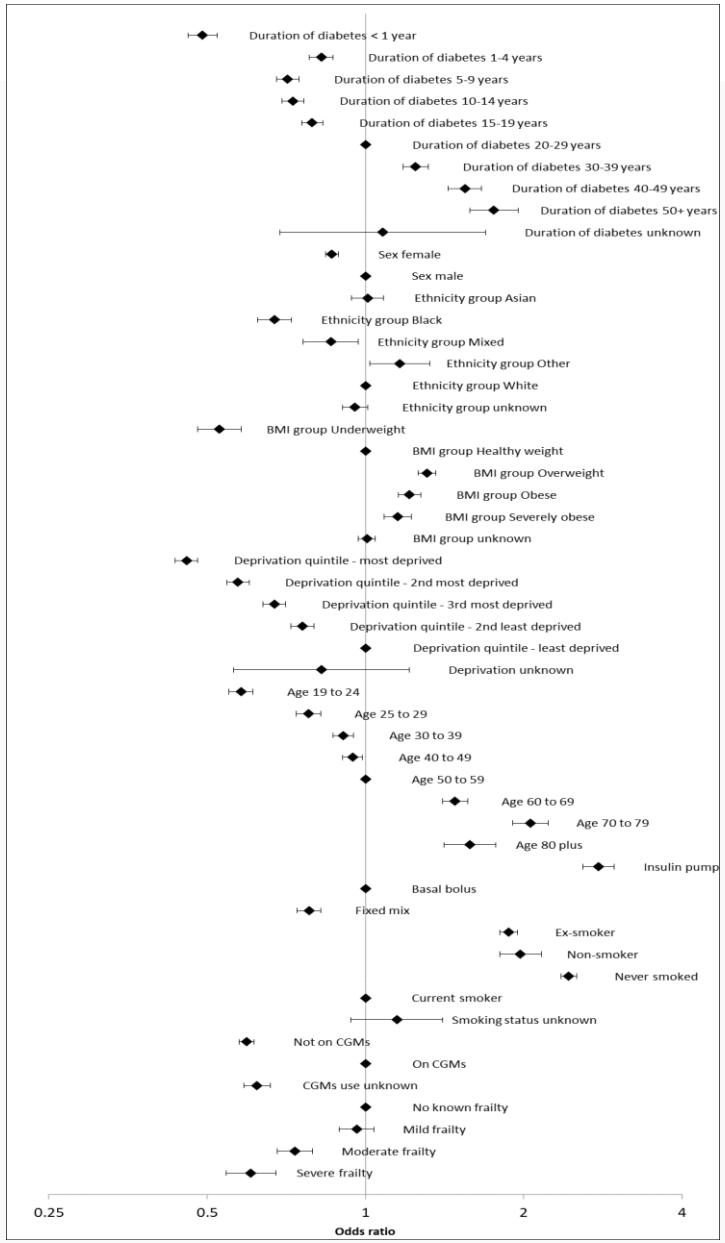


Figure 13: Individual person characteristics in adults with type 1 diabetes and likelihood of HbA1c up to 86mmol/mol, England and Wales, 2020-21

Figure 13 shows a forest plot of odds ratios which illustrate the individual person characteristics associated with an HbA1c value up to 86 mmol/mol. These odds ratios were derived from a logistic regression model*.

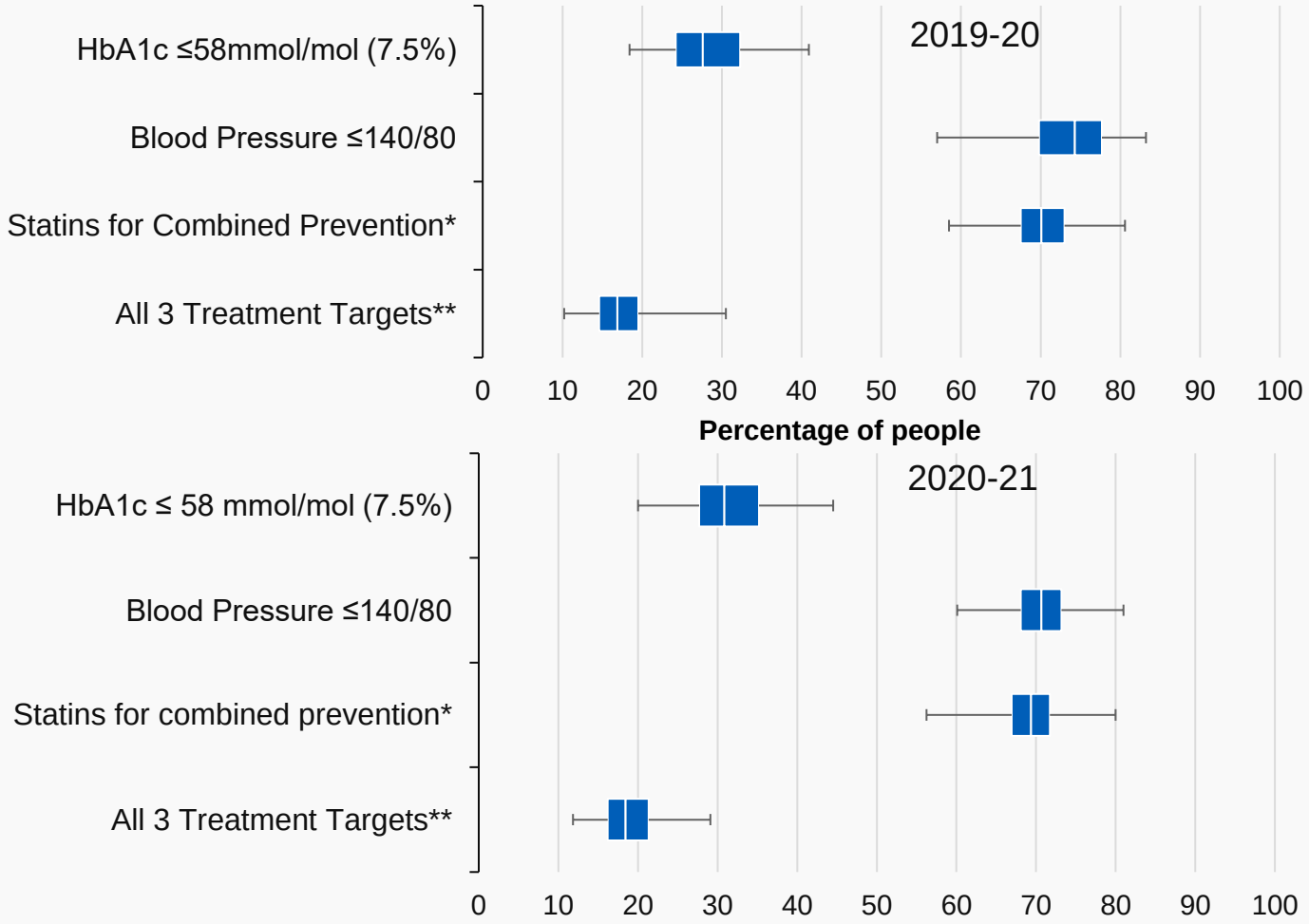
- Non-modifiable factors associated with likelihood of a high HbA1c (i.e. not achieving HbA1c<=86 mmol/mol):
  - Younger age (up to 49 years)
  - Shorter duration of diabetes (up to 19 years)
  - Female sex
  - Black or mixed ethnicity
  - Living in a more deprived area than the least deprived
  - Being moderately or severely frail.

- Modifiable factors associated with achieving HbA1c<=86 mmol/mol:
  - Being on an insulin pump
  - Having a BMI higher than 25 kg/m^2
  - Not smoking
  - Using CGM

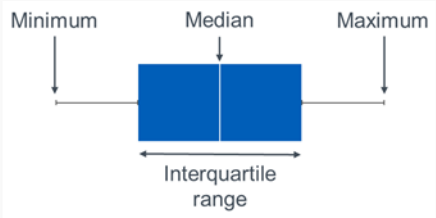
* For explanations of odds ratios, logistic regression and forest plot interpretation please see Additional Information: 'Definitions – Statistical terms'.

Treatment target – CCG/LHB

Figure 14: The range of CCG/LHB treatment target achievement*, for adults with type 1 diabetes,** England and Wales, 2019-20 and 2020-21***



- The rates of treatment target achievement did not all change in the same direction between 2019-20 and 2020-21
  - Percentage achievement of the HbA1c target was up
  - Percentage achievements of Statins for combined CVD prevention and blood pressure targets were down
- The median rate of achieving HbA1c ≤ 58mmol/mol (7.5%) increased from 27.6% in 2019-20 to 30.8% in 2020-21



* Achievement rates of statins for Primary, Secondary and Combined Prevention only include people eligible for statins in calculation. ** Defined as having HbA1c ≤58mmol/mol, blood pressure ≤140/80 and for people falling in the combined prevention CVD group: receiving statins. *** 2020-21 achievement only calculated for adults who were not severely frail

NDA 2020-21: Type 1 Diabetes

**Glucose control,
structured education,
continuous glucose monitoring
and insulin regimen**

Structured Education

NICE* recommends that people with type 1 diabetes should be offered structured education 6 to 12 months after diagnosis. If this has not been undertaken within 12 months, it should be offered at any time that is clinically appropriate and suitable for the person, regardless of duration of type 1 diabetes.

Figure 15: Profile (percentage) of adults who have/have not attended structured education at any time across HbA1c groups, England and Wales, 2020-21

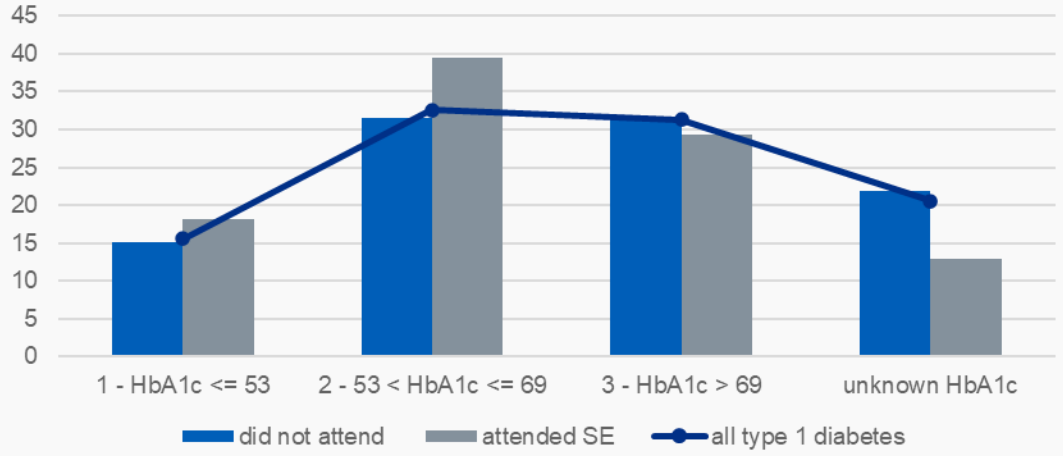
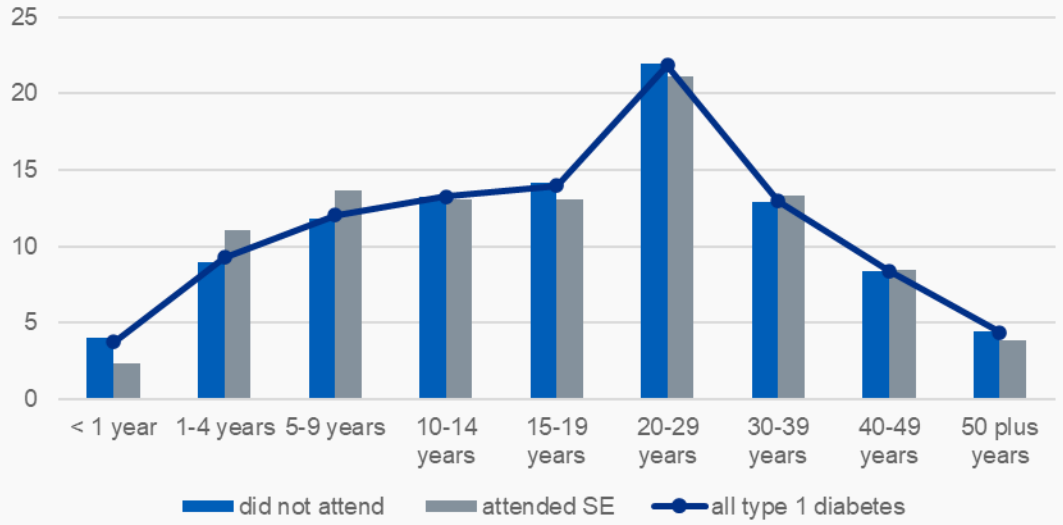


Figure 16: Profile (percentage) of adults who have/have not attended structured education at any time across duration of diabetes groups, England and Wales, 2020-21

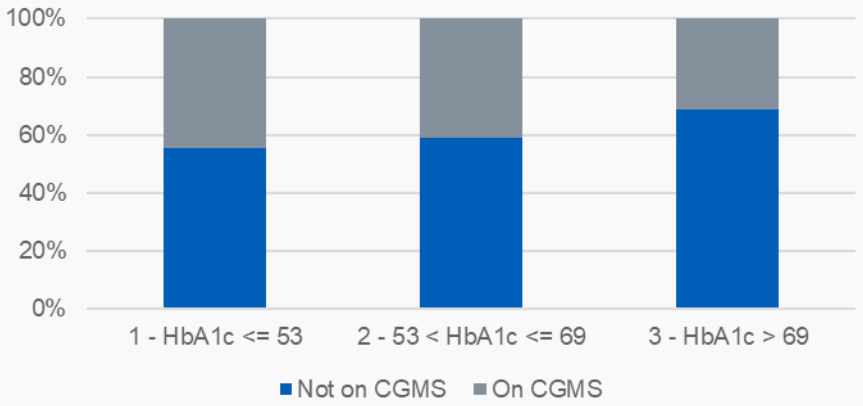


- Higher proportions of adults who had a record of attending structured education can be seen in the low and medium HbA1c groups (up to 53 mmol/mol and 54-69 mmol/mol respectively)
- Across duration groups the profile is similar for “attendance recorded” and “attendance not recorded” groups, although a significantly higher percentage of those with a record of attending structured education had been diagnosed for less than 10 years

* NICE Guideline 17.1.3: https://www.nice.org.uk/guidance/ng17/chapter/Recommendations

HbA1c groups by Use of Continuous Glucose Monitoring (CGM), insulin regimen and structured education

Figure 17: HbA1c achievement groups by use of CGM, England*, 2020-21



Comparing the group of adults with the lowest levels of HbA1c (up to 53 mmol/mol) with the group who had the highest HbA1c (>69 mmol/mol):

- a significantly higher proportion were on CGMs
- a significantly higher proportion were using an insulin pump
- a significantly higher proportion had a record of attending structured education

A total of 58,810 adults with type 1 diabetes were on basal bolus and had an HbA1c result of higher than 69 mmol/mol, making them eligible for an insulin pump, according to NICE criteria

Figure 18: HbA1c achievement groups by insulin regimen, England and Wales, 2020-21

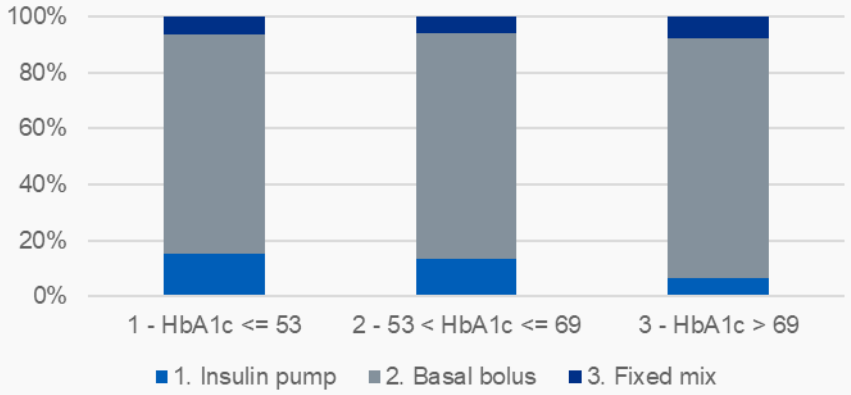
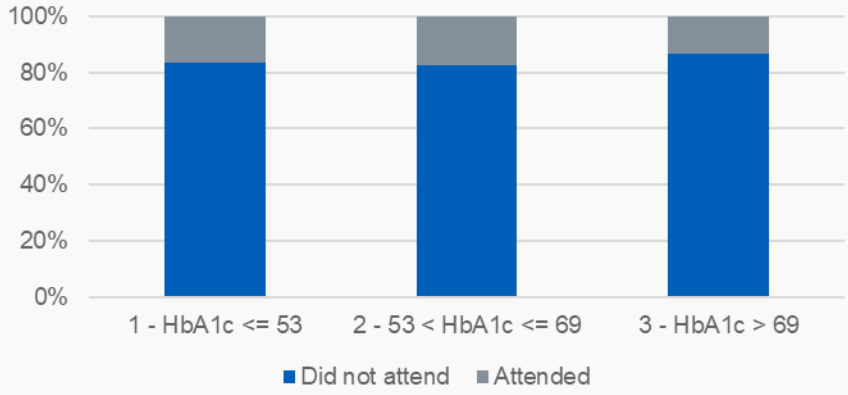


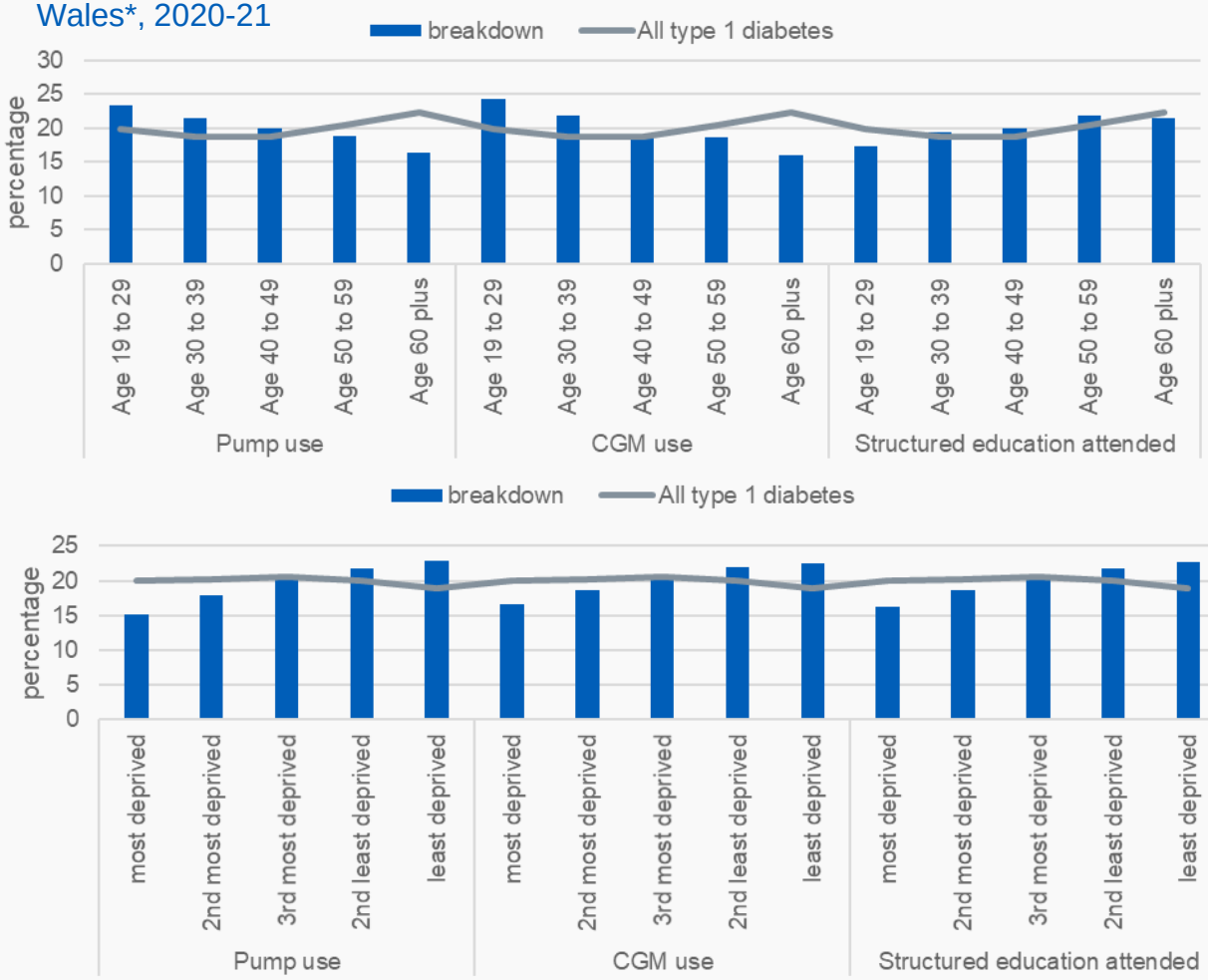
Figure 19: HbA1c achievement groups by attendance at structured education, England and Wales, 2020-21



* A technical data extraction issue has meant that flash glucose data was not available for Wales for 2020-21, so Wales was not included in CGM breakdowns

Use of Continuous Glucose Monitoring (CGM), insulin pump and recorded structured education by demographics

Figures 20, 21: Age groups (top) and deprivation quintiles (bottom) of adults who have accessed CGM, insulin pump, structured education compared to overall type 1 breakdown, England and Wales*, 2020-21



Use of CGM or insulin pumps and recorded attendance at structured education are not distributed evenly across age bands, deprivation quintiles or ethnicity groups within the overall profile of the adult type 1 population

- Use of CGM and insulin pump were more prevalent in the younger age groups
- Use of CGM, insulin pumps and recorded structured education were more prevalent in the least deprived quintiles and amongst adults of White ethnicity

Table 4: Ethnicity profile of adults who have accessed CGM, insulin pump, structured education compared to overall type 1 breakdown, England and Wales*, 2020-21

Ethnicity group	All type 1 diabetes		Pump use	CGM use	Structured education attended
Asian	3.6		2.2	2.9	3.4
Black	2.4		1.0	1.5	2.1
Mixed/Other	2.2		2.1	2.0	1.9
White	83.9		88.0	89.2	88.9
unknown	7.9		6.8	4.4	3.6

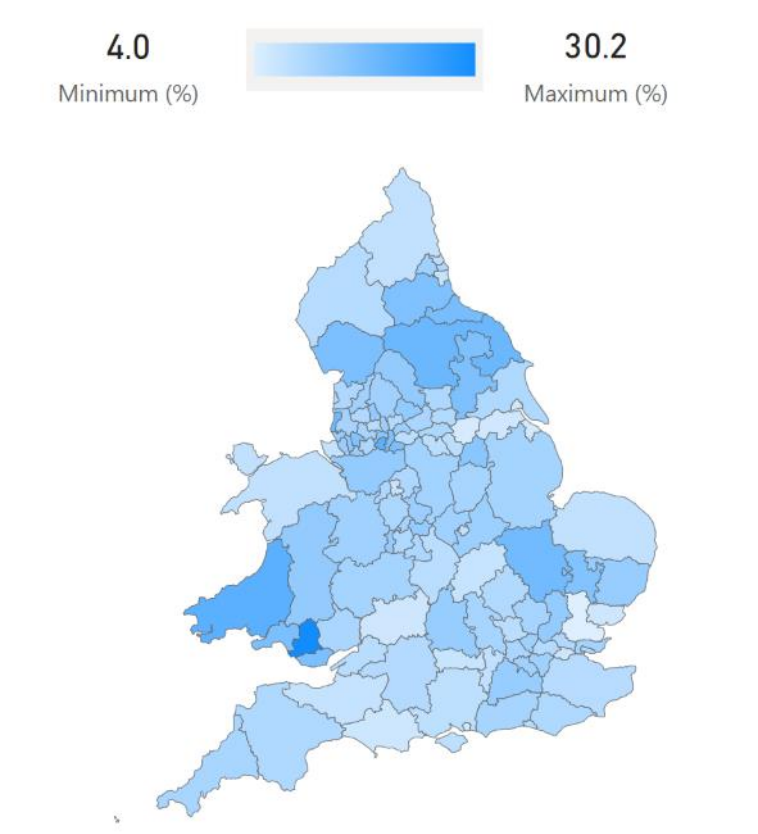
* A technical data extraction issue has meant that flash glucose data was not available for Wales for 2020-21, so Wales not included in CGM breakdowns

Distribution of insulin pump use and flash glucose monitoring by CCG/LHB

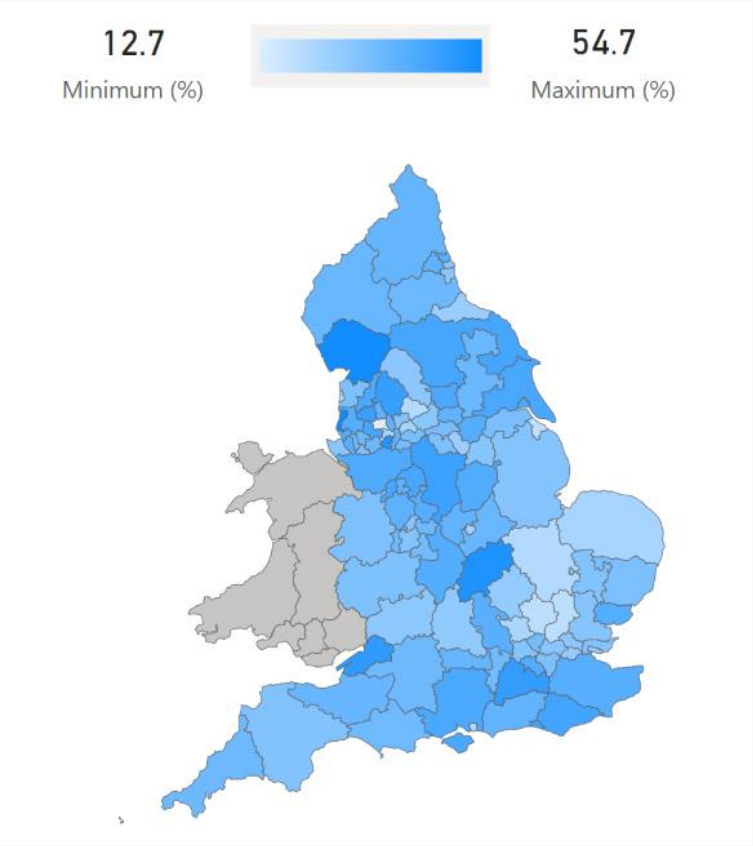
These maps illustrate that there is considerable geographical variation in the percentages of type 1 adults who are using insulin pump technology, and flash glucose monitoring

- The percentage using insulin pump ranged from 4% in Mid Essex CCG to 30% in Cwm Taf Morgannwg ULHB
- The percentage using flash glucose monitoring ranged from 13% in Bolton CCG to 55% in Morecambe Bay CCG

Map 2: Percentage of adults with type 1 diabetes in each CCG/LHB who are on insulin pump, England and Wales, 2020-21



Map 3: Percentage of adults with type 1 diabetes in each CCG who are on flash glucose monitoring, England, 2020-21*



* A technical data extraction issue has meant that flash glucose data was not available for Wales for 2020-21

NDA 2020-21: Type 1 Diabetes

Additional information

Definitions

Diabetes

Diabetes is a condition where the amount of glucose in the blood is too high because the pancreas doesn't produce enough insulin. Insulin is a hormone produced by the pancreas that allows glucose to be used as a body fuel and other nutrients to be used as building blocks. There are 2 main types of diabetes: Type 1 diabetes (no insulin); Type 2 diabetes (insufficient insulin).

Glucose control

A flash glucose monitor is a small sensor that is worn just under the skin and known as flash for short. It records glucose (sugar) levels continuously throughout the day and night. The information collected can be obtained by scanning the device.

A continuous glucose monitor (CGM) also records glucose (sugar) levels continuously throughout the day and night, but the information collected is fed through to a display device. The user can also set alerts for high/medium/low levels.

Annual Review

This is a GP appointment where the annual NICE recommended Care Processes are undertaken.

Care Processes (NICE recommends all of these at least once a year)

Blood Pressure is a measurement of the force driving the blood through the arteries. Blood pressure readings contain 2 figures, e.g.130/80. The first is known as the systolic pressure which is produced when the heart contracts. The second is the diastolic pressure which is when the heart relaxes to refill with blood.

BMI measurement – Body Mass Index is calculated from weight and height and used to classify body weight as low, normal, overweight and obese.

Serum creatinine – this is a blood test used to measure kidney function.

Urinary albumin – this urine test detects the earliest stages of kidney disease.

Cholesterol - this blood test measures a type of fat that can damage blood vessels.

Foot check - this examination checks the blood supply and sensation (feeling) in the feet. Loss of either is a risk for foot disease.

Smoking Status - this records whether the person is a smoker. Smoking increases the diabetic risk for heart attacks and stroke.

HbA1c – this is a blood test for average blood glucose levels during the previous 2 to 3 months.

Treatment Targets (NICE defines target levels to reduce risks of complications for people with diabetes)

HbA1c - the closer this is to normal (less than 42mmol/mol) the lower is the risk of all long term complications of diabetes.

Blood Pressure – high levels are a risk for heart attacks and strokes; they also drive progression of eye and kidney disease.

Primary prevention of CVD – the prescription of statins for people with diabetes aged 40 to 80 years with no history of cardiovascular disease (CVD) to reduce the risk of CVD.

Secondary prevention of CVD – the prescription of statins for people with diabetes (any age) with a history of cardiovascular disease (CVD) to reduce the risk of CVD.

Combined prevention of CVD – the prescription of statins for people with diabetes that fall into either of the primary or secondary prevention groups.

Meeting all 3 treatment targets – having HbA1c ≤58mmol/mol, blood pressure ≤140/80 and for people falling in the combined prevention CVD group: receiving statins.

Specialist Service

This is a service (often hospital based but sometimes delivered in a community setting) which includes diabetes specialists working in multidisciplinary teams. These teams usually comprise physicians (diabetologists), diabetes specialist nurses and dieticians; it may also include clinical psychologists.

Insulin Administration

Basal-bolus insulin treatment comprises background, slow acting (basal) insulin, self-injected once or twice daily, plus rapid acting (bolus) insulin at mealtimes

Fixed mix insulin combines rapid and longer acting insulin at a fixed ratio. It is usually self-injected twice daily.

Insulin pump or Continuous Insulin Infusion therapy uses rapid acting insulin delivered subcutaneously under the control of a 'Pump'. Background rates are programmed and mealtime boluses are added manually.

Definitions: Statistical terms

Where a result is flagged as **significant at 0.05 level**, there is only a 5% probability that the result is due to chance.

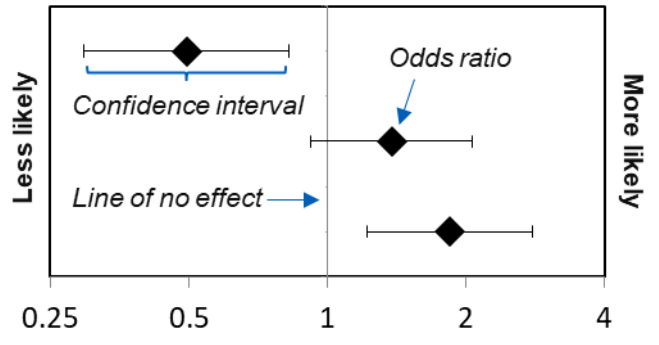
Logistic regression is used to examine the relationship between an outcome (e.g. HbA1c ≤ 58 mmol/mol) and related variables (e.g. insulin treatment regimen). Backwards elimination is used to remove variables found not to be significant at 0.05 level, producing a final model that includes variables with significant associations only.

2 outputs are particularly useful when interpreting the results of a logistic regression model:

- The **c-statistic** can be used to assess the goodness of fit, with values ranging from 0.5 to 1.0. A value of 0.5 indicates that the model is no better than chance at making a prediction of membership in a group and a value of 1.0 indicates that the model perfectly identifies those within a group and those not. Models are typically considered reasonable when the c-statistic is higher than 0.7 and strong when the c-statistic exceeds 0.8 (Hosmer and Lemeshow, 2000*).
- **Odds ratios** (OR) illustrate how strongly a particular value of a variable is associated with the outcome. The further from 1 the ratio is (either above or below), the stronger the association between it and the outcome. For example, an odds ratio of 0.764 would suggest a stronger association than an odds ratio of 0.830. An odds ratio of 1 would show that the variable value has no bearing on how likely the outcome is.

  The degree of uncertainty inherent in the odds ratio is described by the confidence interval. The wider the confidence interval, the less certainty there is in the odds ratio. If the confidence intervals are either side of 1 (the line of no effect) this indicates that the value taken by the variable (e.g. female) has no bearing on how likely the outcome is (e.g. HbA1c ≤ 58 mmol/mol). Where the confidence interval approaches 1 this indicates that the association with the outcome may be weak. Odds ratios can be displayed on a forest plot (see example forest plot right).

Forest plot showing odds ratios indicating how strongly variables are associated with the outcome



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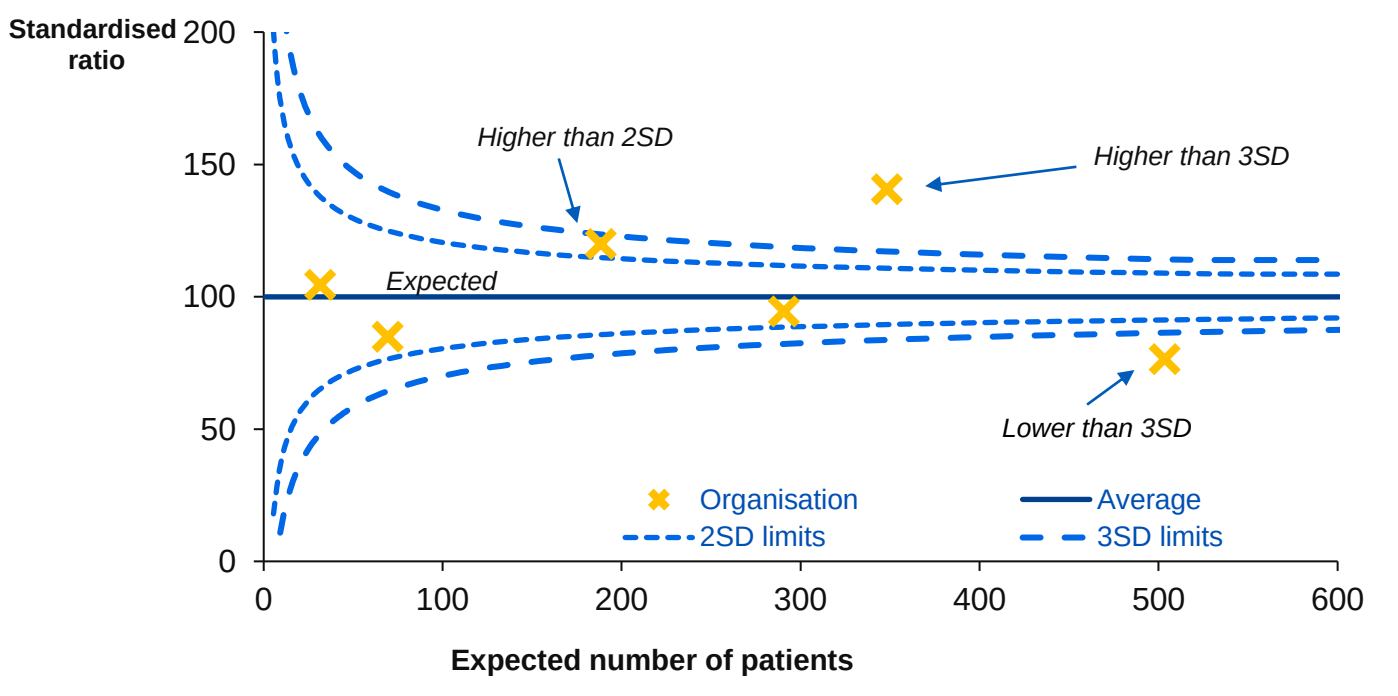
* Hosmer DW, Lemeshow S (2000) Applied Logistic Regression (2nd Edition) New York, NY: John Wiley & Sons.

Modelling – interpreting a funnel plot

- Adjusting for each service's unique patient casemix allows fairer comparisons between services.
- Statistical models for outcomes were built. The models were used to estimate the number of events expected to occur at each CCG/LHB. The expected figures were then compared with the observed number of events, to produce a standardised ratio (SR).
- If more patients had the event than expected the SR is greater than 100 and if there were fewer than expected the SR is less than 100. Deviation from 100 does not necessarily mean that an organisation is performing better or worse than expected. Instead, control limits (2 and 3 standard deviations (SD)) are used to assess whether the SR for an organisation is within an expected range or not. Results are displayed on a funnel plot.

Figure 22: Example funnel plot



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Notes and Additional Information

Suppression:

- Disclosure control has been applied to mitigate the risk of patient identification. Zeros are reported, and all numbers are rounded to the nearest 5, unless the number is 1 to 7, in which case it is rounded to ‘5’. This allows for more granular data to be made available.

- Rounded numbers are used to calculate percentages such as care process completion and treatment target achievement. At CCG/LHB level and above this makes virtually no difference to the resultant percentages. At Specialist Service Provider level, where the numbers can be small, this rounding can have a relatively large impact. However, where numbers are small, percentages are volatile and should already be treated with caution.

Prepared in collaboration with:

The National Diabetes Audit (NDA) is commissioned by the **Healthcare Quality Improvement Partnership (HQIP)** as part of the National Clinical Audit and Patient Outcomes Programme (NCAPOP). HQIP is led by a consortium of the Academy of Medical Royal Colleges, the Royal College of Nursing, and National Voices. Its aim is to promote quality improvement in patient outcomes, and in particular, to increase the impact that clinical audit, outcome review programmes and registries have on healthcare quality in England and Wales. HQIP holds the contract to commission, manage, and develop the National Clinical Audit and Patient Outcomes Programme (NCAPOP), comprising around 40 projects covering care provided to people with a wide range of medical, surgical and mental health conditions. The programme is funded by NHS England, the Welsh Government and, with some individual projects, other devolved administrations and crown dependencies.
www.hqip.org.uk/national-programmes

NHS Digital is the trading name for the Health and Social Care Information Centre (HSCIC). NHS Digital managed the publication of the annual report.

Diabetes UK is the charity leading the fight against the most devastating and fastest growing health crisis of our time, creating a world where diabetes can do no harm.

National Diabetes Audit, 2020-21
Type 1 Diabetes

Published by NHS Digital

Part of the Government Statistical Service

For further information

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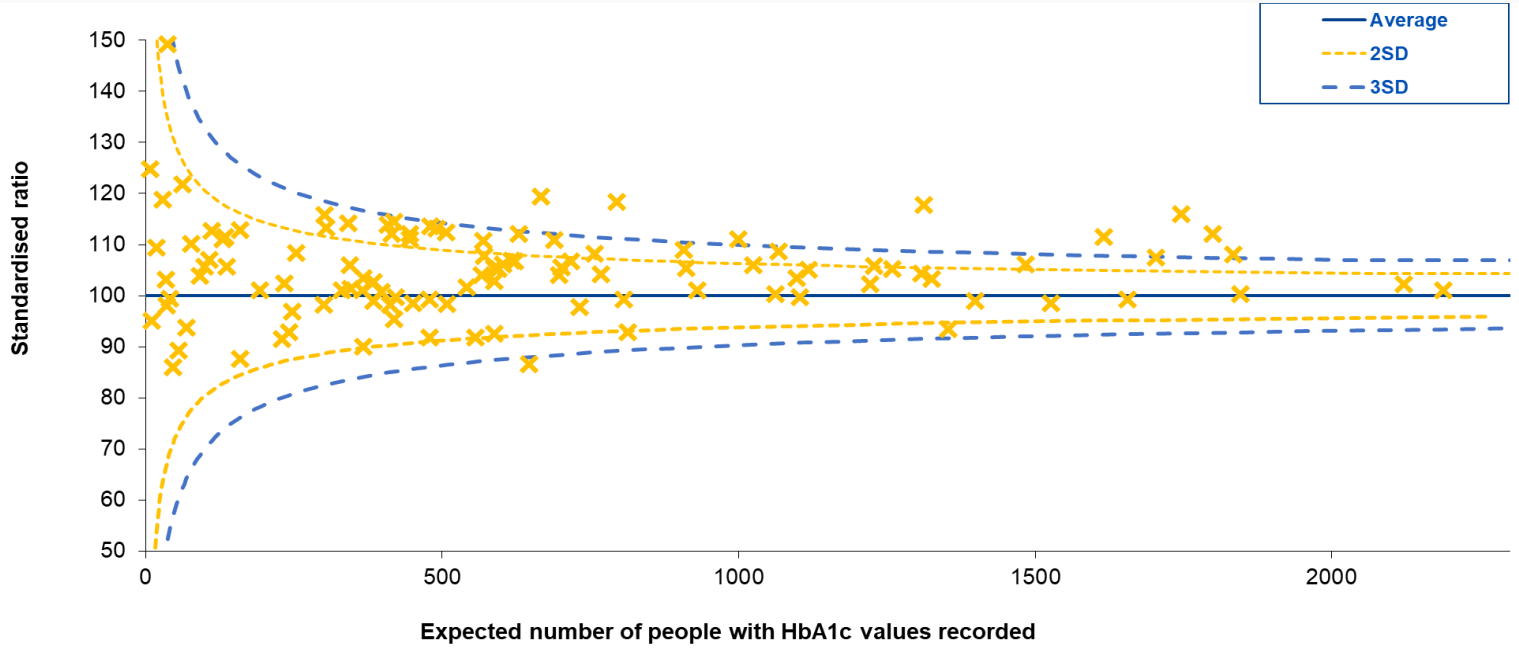
NDA 2020-21: Type 1 Diabetes

Appendix

HbA1c – specialist service variation in recording HbA1c values

- Data was available from 110* specialist services in England and Wales
- As a result of low care process completion and incomplete HbA1c values in cases where the HbA1c check had taken place, the number of values recorded in 2020-21 was considerably lower than in 2019-20
- A logistic regression model** was used to produce expected numbers of HbA1c values recorded for each provider
  - The model c-statistic was 0.79 (strong)
- Of 110 specialist services, 33 were more than 2 SD from the expected number of adults with a recorded HbA1c care process
  - 29 specialist services were above expectation
  - 4 specialist services were below expectation

Figure A1: Funnel plot of specialist service level standardised ratios of recording an HbA1c value, England and Wales, 2020-21



Logistic regression model used for standardisation.
Variables used in the model:
Sex
Age group
Duration of diabetes
Ethnicity
Deprivation quintile
BMI group
Smoking status
Insulin regimen
CGM status
Frailty status

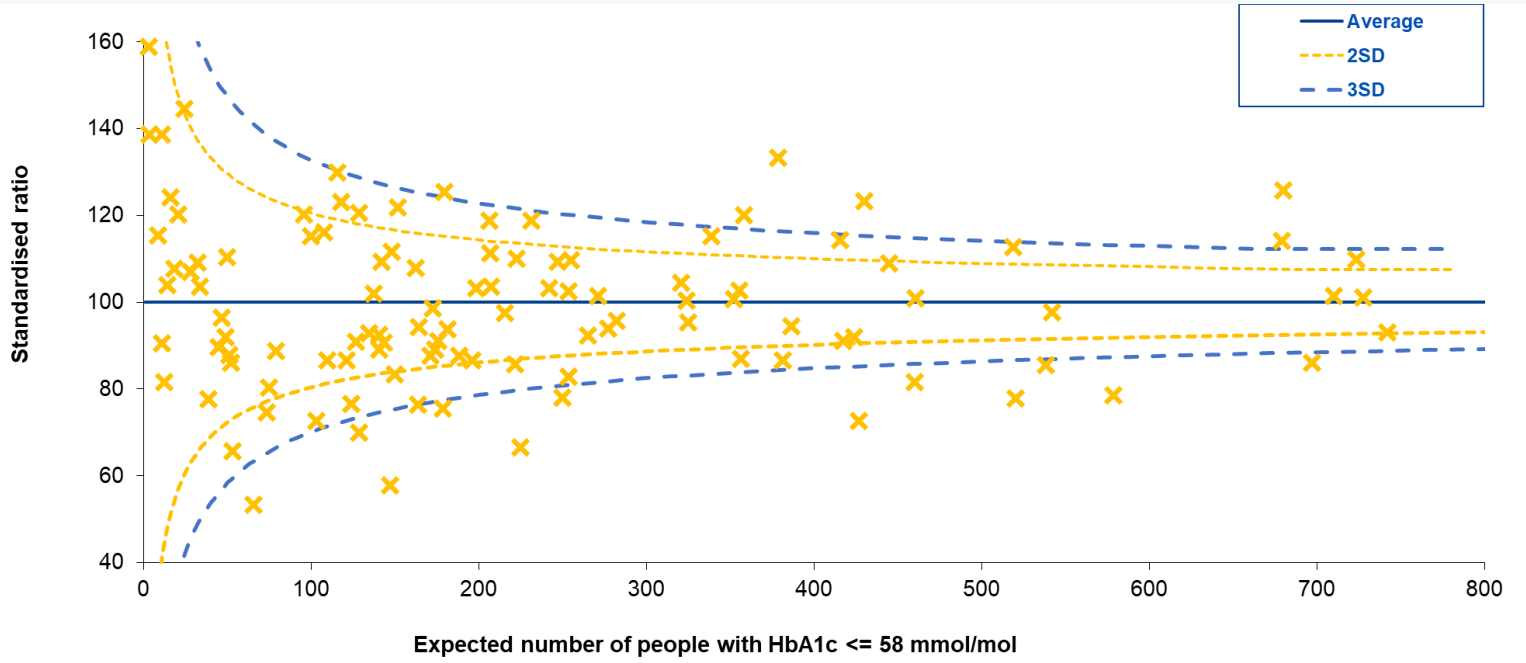
For an explanation of how funnel plots are interpreted click here

* 1 service was excluded as the number of adults with type 1 diabetes was too small** For explanations of odds ratios, logistic regression and forest plot interpretation please see Additional Information: 'Definitions – Statistical terms'.

HbA1c – specialist service variation in proportion of adults meeting an HbA1c treatment target (HbA1c ≤ 58 mmol/mol, 7.5%)

- A logistic regression model* was used to produce expected numbers of adults meeting the HbA1c ≤ 58 mmol/mol treatment target in each specialist service provider
  - The model c-statistic was 0.64 (weak)
- Of 110** specialist services, 38 were more than 2 SD from the number of adults expected to achieve the treatment target
  - 16 specialist services were above expectation
  - 22 specialist services were below expectation

Figure A2: Funnel plot of provider standardised ratios of achieving HbA1c ≤ 58mmol/mol, England and Wales, 2020-21



Logistic regression model used for standardisation.
Variables used in the model:
Sex
Age group
Duration of diabetes
Ethnicity
Deprivation quintile
BMI group
Smoking status
Insulin regimen
CGM status
Frailty status

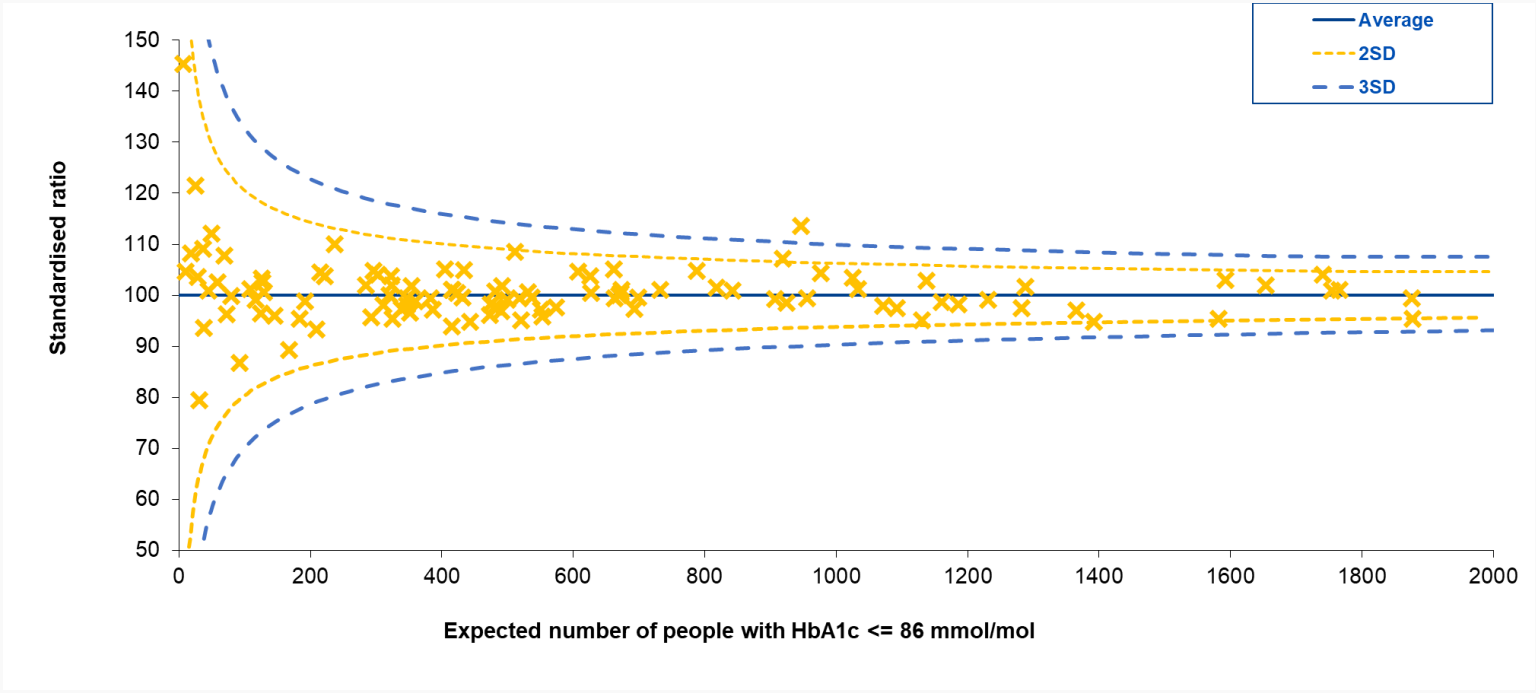
For an explanation of how funnel plots are interpreted click here

* For explanations of odds ratios, logistic regression and forest plot interpretation please see Additional Information: 'Definitions – Statistical terms'. ** 1 service was excluded as the number of adults with type 1 diabetes was too small

HbA1c – specialist service variation in proportion of adults meeting an HbA1c treatment target (HbA1c ≤ 86 mmol/mol, 10%)

- A logistic regression model* was used to produce expected numbers of adults meeting the HbA1c ≤ 86 mmol/mol treatment target in each specialist service provider
  - The model c-statistic was 0.73 (moderate)
- Of 110** specialist services, only 4 were more than 2 SD away from the number of adults expected to achieve the treatment target
  - 2 specialist services were above expectation
  - 2 specialist services were below expectation

Figure A3: Funnel plot of specialist service standardised ratios of achieving HbA1c ≤ 86mmol/mol, England and Wales, 2020-21



Logistic regression model used for standardisation.
Variables used in the model:
Sex
Age group
Duration of diabetes
Ethnicity
Deprivation quintile
BMI group
Smoking status
Insulin regimen
CGM status
Frailty status

For an explanation of how funnel plots are interpreted click here

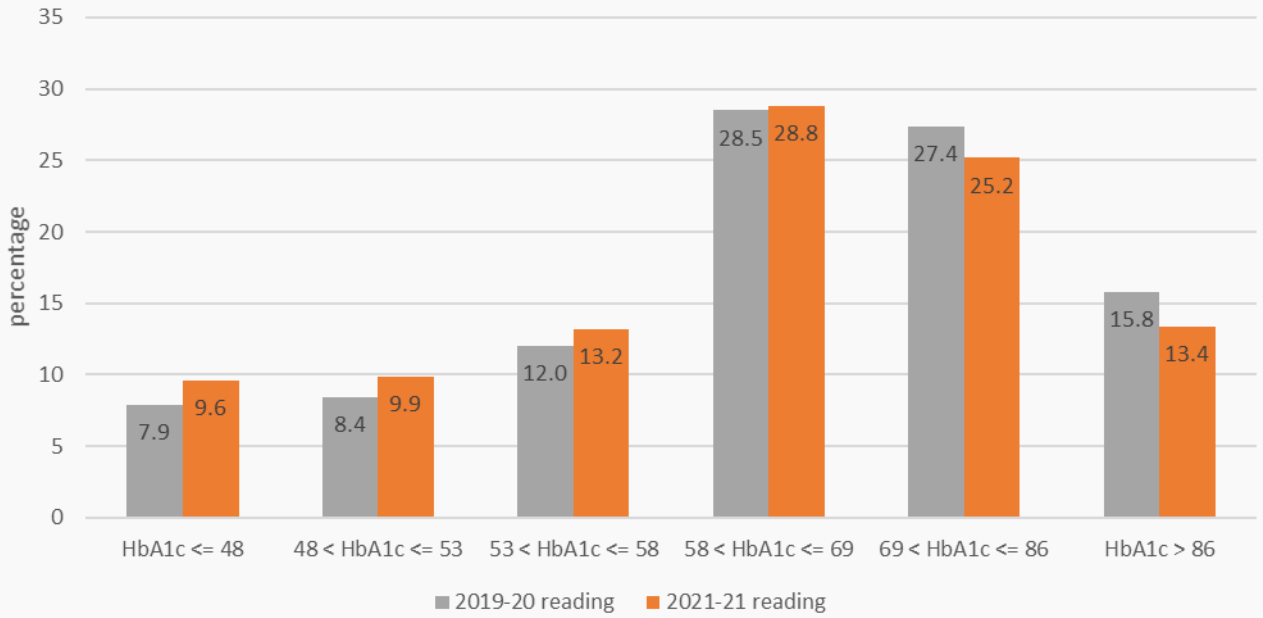
* For explanations of odds ratios, logistic regression and forest plot interpretation please see Additional Information: 'Definitions – Statistical terms'. ** 1 service was excluded as the number of adults with type 1 diabetes was too small

HbA1c achievement – 2019-20 and 2020-21 direct comparison

Adults with type 1 diabetes who had an HbA1c result in both 2019-20 and 2020-21 were compared:

- There were almost 160,000 adults with a result in both audit years.
- This cohort has been analysed separately to test whether the overall improvement detailed in the main report might have been influenced by missing data.
- The profile of HbA1c achievement was compared across the years and showed that there has been a significant improvement in achievement of targets.
    - The percentage of adults in each of the 3 lower HbA1c groups (HbA1c ≤ 48, 48 < HbA1c ≤ 53 and 53 < HbA1c ≤ 58 mmol/mol) was significantly higher in 2020-21 than in 2019-20.
    - The percentage of adults in each of the 2 highest HbA1c groups (69 < HbA1c ≤ 86 and HbA1c > 86 mmol/mol) was significantly lower in 2020-21 than in 2019-20.
- This provides reassurance that there has been a genuine improvement between 2019-20 to 2020-21.

Figure A4: Distribution of HbA1c achievement among adults who had a result in both years, England and Wales, 2019-20 and 2020-21



HbA1c achievement – 2019-20 and 2020-21 sensitivity analysis

In order to further examine the issue of potential bias in 2020-21 achievement, the 2019-20 and 2020-21 cohorts were further compared using a sensitivity analysis.

First the number of people with HbA1c checks in 2019-20 and 2020-21 were both increased to the size of the overall 2020-21 cohort with every additional person assigned an HbA1c levels above 86 mmol/mol. The percentages in each HbA1c group were recalculated using the same denominator.

This analysis was repeated, this time building both cohorts up only to the size of the cohort who had the HbA1c care process in 2019-20.

In both cases the percentage of people in each of the HbA1c groups up to 58mmol/mol was significantly higher in 2020-21

Table A1: HbA1c achievement groups using overall 2020-21 cohort size, with the assumption that anyone added in falls into the highest HbA1c group England and Wales, 2019-20 and 2020-21

	2019-20		2020-21	
HbA1c achievement	Count	Percentage of total	Count	Percentage of total
HbA1c ≤ 48	15,630	7.1	17,170	7.8
48 < HbA1c ≤ 53	16,175	7.4	16,990	7.7
53 < HbA1c ≤ 58	22,940	10.4	22,490	10.2
58 < HbA1c ≤ 70*	58,395	26.6	49,130	22.4
70* < HbA1c ≤ 86	48,140	21.9	43,480	19.8
HbA1c > 86	58,395	26.6	70,415	32.1
total	219,675		219,675	
Total with HbA1c ≤ 58		24.9		25.8

Table A2: HbA1c achievement groups using 2019-20 HbA1c care process cohort size, with the assumption that anyone added in falls into the highest HbA1c group England and Wales, 2019-20 and 2020-21

	2019-20		2020-21	
HbA1c achievement	Count	Percentage of total	Count	Percentage of total
HbA1c <= 48	15,630	8.1	17,170	8.9
48 < HbA1c <= 53	16,175	8.4	16,990	8.8
53 < HbA1c <= 58	22,940	11.9	22,490	11.7
58 < HbA1c ≤ 70*	58,395	30.4	49,130	25.5
70* < HbA1c ≤ 86	48,140	25.0	43,480	22.6
HbA1c > 86	31,040	16.1	43,060	22.4
total	192,320		192,320	
Total with HbA1c <= 58		28.5		29.5

* 58<HbA1c<=69 and 69<HbA1c<=86 in 2020-21