Received: 19 March 2021 | Accepted: 28 May 2021

DOI: 10.1111/dme.14616

DIABETIC Medicine

RESEARCH: EPIDEMIOLOGY

Cohort profile: National Diabetes Audit for England and Wales

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Funding information
This work was funded by Diabetes UK and NHS England and NHS Improvement.

Abstract

The National Diabetes Audit (NDA) collates and analyses data on the quality and variation in clinical care and outcomes for people with diabetes. It also provides opportunities to assess trends, determinants, and outcomes of diabetes to help guide clinical and public health priorities.

Cohort: Between 1 January 2003 and 31 March 2020, a total of 5,280,885 people diagnosed with diabetes were included in at least one NDA data collection. To this date, median follow-up was 12 and 8 years for people with type 1 diabetes and type 2 diabetes respectively. Comparisons with the 2019/20 Quality and Outcomes Framework show it included 98% of adults in England and Wales with diagnosed type 1 and type 2 diabetes. Data include demographic characteristics (age, sex, ethnicity, age at diagnosis, deprivation), risk factors (HbA_{1c}, blood pressure, cholesterol, body mass index, smoking status) diabetic and cardiovascular complications and deaths.

Secondary analysis: Secondary analyses have included comparisons of HbA_{1c} and blood pressure measurements in cohorts with similar characteristics to the Epidemiology of Diabetes Interventions and Complications study and the UK Prospective Diabetes Study; COVID-19 related mortality in people with type 1 and type 2 diabetes and incidence of type 2 diabetes following admission to intensive care units.

Future plans: Commissioned NDA reports will continue to inform service development in England and Wales. The same data, with or without linkages to other external datasets, are also a rich resource for clinically orientated research.

KEYWORDS

audit, cohort, dataset, diabetes

1 | INTRODUCTION

The National Diabetes Audit (NDA) was established in 2003 to assess the quality of, and variation in, diabetes clinical care and outcomes in order to inform service improvement across England and Wales. Its aim is to address five specific questions: (1) Is everyone with diabetes diagnosed and recorded on a practice diabetes register? (2) What percentage of people registered with a diagnosis of diabetes received the nine National Institute of Health and Care Excellence

(NICE) key processes of diabetes care? (3) What percentage of people registered with diabetes achieved NICE defined treatment targets for glucose control, blood pressure and management of cardiovascular risk? (4) What percentage of people registered with diabetes are offered and attend a structured education course? (5) For people with registered diabetes what are the rates of acute and long-term complications (disease outcomes)?

Over the past 15 years, the NDA has published annual reports comprising measures of health care and outcomes of people with diabetes. To facilitate evaluation of the NHS Diabetes Prevention Programme in 2017, an additional data collection was established alongside the primary care element of NDA to include people with diagnosed non-diabetic hyperglycaemia in England. The data extracts for the two datasets for each audit period can be combined to produce a longitudinal dataset following people with diagnosed hyperglycaemia and offers the opportunity to address research questions using 'real world' data.

What's new

- This paper details the National Diabetes Audit for England and Wales dataset and highlights its potential use to address research questions.
- The cohort includes details of over 5,280,000 people with diagnosed diabetes with a median follow up of 12 years for people with type 1 diabetes and 8 years for those with type 2 diabetes.

2 | COHORT DESCRIPTION

The NDA is an annual data collection process that, when combined, creates a continuous registry of people with diagnosed diabetes and the facility to examine singular or serial cross-sectional cohorts. It collates data on every person registered at participating health providers with a coded electronic record of diagnosed diabetes mellitus (excluding gestational diabetes). Diagnosis of diabetes is based on routine clinical practice in England and Wales. NICE recommends that diagnosis is based on HbA_{1c} measurements persistently above 48 mmol/mol, a random glucose of 11.1 mmol/L or greater in the presence of hyperglycaemic symptoms, a 2-h post 75-g glucose load of 11.1 mmol/L or greater or a fasting glucose of 7.0 mmol/L or greater. Where osmotic symptoms are present, one measurement in the diabetic range is sufficient for diagnosis of diabetes, otherwise two measurements on different days are advised.[1,2] Since January 2017, people registered with a general practice in England with a coded diagnosis of non-diabetic hyperglycaemia (NDH) in their electronic health record have also been collected for the NDH dataset. Standard practice is for non-diabetic hyperglycaemia to be diagnosed if the individual has had a single HbA_{1c} in the range 42–47 mmol/mol. Individuals are included in in the NDA only if they have a recorded diagnosis code; the biochemical data from the diagnostic measurements are not used. There are no age restrictions on inclusion in the NDA. Children and young people with a diagnosis of diabetes recorded in their primary care health record are also included in the NDA data even if the majority of their clinical care is provided by a paediatric specialist diabetes service. Historically, the National Paediatric Diabetes Audit (NPDA) provides more complete data on children and adolescents with diabetes than the NDA because it includes data contributed directly from paediatric specialist services.

Participation in the audit aims to include all primary healthcare providers in England and Wales and specialist care healthcare providers in England. Between 2003/04 and 2016/17 participation for primary care was governed by an practice level opt-in process. Some electronic clinical systems provided the facility to automatically create and submit the required data extract but local effort and expertise was often required. From 2017/18 onwards participation in the audit became 'opt-out' and, data extracts have been automated. In the first year of the NDA (2003/04), data were obtained from 965 general practices. Participation increased each year to 87% in 2011/12 before falling to 57% in 2013/14 and 2014/15. Since 2017/18 over 98% of general practices in England and Wales have provided data to the NDA. Individual people who have registered dissent from their data being used for secondary analysis through the National Data Opt-out scheme,[3] or specific clinical audit or NDA dissent established before the national data opt-out scheme, are not included in the data extractions. In June 2020 1,578,380 (2.6%) of all people registered with a general practice in England had exercised this option. The proportion of females that opt out is higher (2.8%) compared to males (2.4%). It also varies with age; the lowest percentage is among those aged 0 to 9 years old (1.4%) and the highest in people aged 70–79 years old (4.0%).[4] Whether proportions that opt out vary by co-morbidity is not known. However, analysis of hospital admissions after adjusting for people who have opted out shows that the proportion of hospital admissions for endocrine, nutritional and metabolic conditions (ICD-10 chapter 4, codes E01–E99) occurring among people who have exercised this option is the same as for all hospital admissions (2.9%).[5] Participation of specialist secondary care health service providers is by submission of an extract from their electronic clinical system via a secure collection platform provided by NHS Digital (Clinical Audit Platform).

Core primary care data that form part of the NDA data specification are now (since 2017) collected in England by the General Practice Extraction Service, a national automated

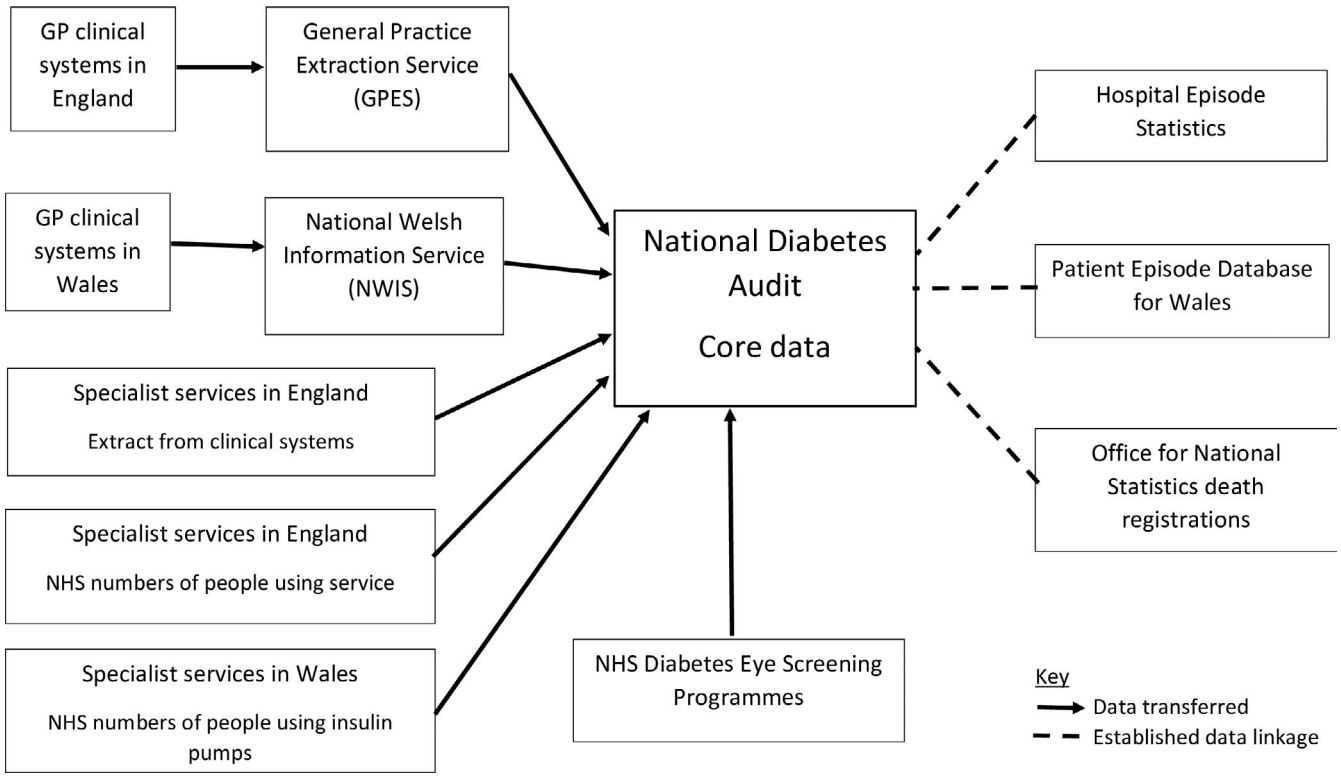

FIGURE 1 Data flows for the National Diabetes Audit

process that extracts data from primary care electronic patient records. Where they have EPRs, specialist adult diabetes services submit a pre-specified data extract via CAP. Data from general practices in Wales are taken from the National Welsh Information System.

From 2019/20 data on digital retinal screening and retinopathy outcomes have been submitted by the NHS Diabetes Eye Screening Programmes (see Figure 1). Data linkage is based on a unique NHS number used in all health records. All data collected are informed by codes and definitions set out in the NHS data dictionary.[6] A full specification of the patient level data extract is provided in the business rules for the NDA.[7]

The core NDA data is run on an annual cycle. Each analysed period covers 15 months from 1 January in the first year to 31 March in the second year. This was to align with the time period covered by the Quality and Outcomes Framework[8] and to provide a short period of leeway around the timescale for annual care processes. Data from primary care in England are compiled on a quarterly basis with data extracted approximately two months after the end of the quarter. This 'data release' is published at organisational level to show partial year progress against care processes and treatment targets. It also provides the latest position on structured education. It therefore can be used as an operational planning tool to assess progress to date. Data in England is published by GP practice, CCG, and Hospital Service. In Wales, data can only be published by Local Health Board.

Generation of complete data for the audit period, including reconciliation across different healthcare providers, is undertaken annually. The first NDA data collection covered the period 1 January 2003–31 March 2004. At the time of writing, data up to 31 March 2020 were available for analysis.

2.1 | Data collected

2.1.1 | Demographic data

The NDA collates data on each individual's date of birth, sex, ethnic group, date of diagnosis and type of diabetes in each data collection period.

The audit data collections from 2003/04 to 2012/13 extracted the year of birth and year of diagnosis rather than the full dates. From the audit collection 2013/14 onwards each person's full date of birth and date of diagnosis has been collated. Where it has only been possible to identify the year of birth or year of diagnosis the date of birth is allocated as 1 July in that year.

The individual's home postcode is also collected for each audit period. This enables the allocation of area-based measures of deprivation and other geographical characteristics.

Where it has only been possible to identify the year of diagnosis the date is allocated as 1 July of that year.

Where there are inconsistencies in the type of diabetes identified, the most recent type recorded by a specialist diabetes care provider is allocated, if available. If data have not been provided by a specialist diabetes service, the most recent type of diabetes recorded in primary care is attributed to the individual.

2.1.2 | Clinical care and intermediate outcomes

Data on HbA_{1c}, systolic blood pressure, diastolic blood pressure, total serum cholesterol, body mass index and tobacco smoking status are collated for people with a diagnosis of diabetes (all types). Data on albuminuria and serum creatinine is collected for those with a diagnosis of diabetes.

Glycated haemoglobin measurements between 4 and 20 are assumed to be recorded as a % and are converted to mmol/mol using the formula (HbA_{1c}/10.929) +2.15. HbA_{1c} measurements outside the range 20 to 195 mmol/mol are considered invalid and excluded from the dataset. Systolic blood pressure measurements less than 70 mmHg and greater than 300 mmHg and diastolic measurements less than 20 mmHg and greater than 150 mmHg are considered invalid and removed from the dataset. Cholesterol measurements outside the range 1–40 mmol/L and body mass index measurements outside 12–90 kg/m^2 are also removed from the dataset.

Between 1 January 2003 and 31 December 2015 only data on the last measurement of HbA_{1c}, blood pressure, cholesterol, albuminuria, creatinine, body mass index and smoking status during the relevant 15-month audit period was extracted for inclusion in the annual NDA data extract. Since 1st January 2016, data have been collated on all recorded instances of HbA_{1c}, blood pressure, cholesterol and body mass index.

The NDA includes a record of whether or not an individual has completed a foot (neurovascular) and an eye (digital retinal screening) examination to identify subclinical disease and evidence of progression. No details of the findings from foot examinations are collated and retinal screening data from the Diabetic Eye Screening programme on stage of retinopathy and visual outcome were only included for the first time in the 2019/20 data collection.

2.1.3 | Co-morbidities

Individuals with a diagnosed learning disability recorded in their primary care electronic health record have been identified within the 2015/16 and later NDA data collections. Individuals with a diagnose serious mental illness recorded in their primary care electronic health record have been identified within the 2016/17 and later NDA data collections.

2.1.4 | Drug treatments

Since 1 January 2017, the dates and drug classes of prescriptions issued to people with a diagnosis of diabetes in primary care for insulin, glucose lowering drugs, anti-hypertensive medication and statins have been included in the NDA dataset.

Since 1 January 2015, specialist diabetes care providers have been able to submit details of individuals using a subcutaneous insulin pump. This includes the year they started on an insulin pump, the primary goal of changing to an insulin pump (to reduce hypoglycaemia or to improve glucose control) and whether this goal was achieved.

2.2 | Information governance

The data collation process is managed and undertaken by NHS Digital which is the national provider of data and IT systems for the NHS in England. In England the legal basis for the NDA collection and use is (since 2017) a 'direction' under section 254 of the 2012 Health and Social Care Act from NHS England to NHS Digital; in Wales it is granted under section 270 of the Health and Social Care Act. The NDA has, under these regulations, the information governance permissions for access to the dataset to answer research questions related to the care and outcomes of people with diabetes. NHS Digital and NHS England and NHS Improvement are data controllers for the NDA data.

2.3 | Participants

Participation by general practices in the NDA has increased over time (see Table 2). The first data collection covering the period 1 January 2003 to 31 March 2004 included 250,400 people diagnosed with diabetes from 965 general practices. The latest data collection (1 January 2019 to 31 March 2020) includes data on 3,680,610 people from 7054 (99.2%) general practices and 96 specialist services in England and Wales.

A total of 5,280,885 people diagnosed with diabetes have been included in one or more NDA data collections. In the associated NDH collection 2,295,220 people diagnosed with non-diabetic hyperglycaemia, who may have subsequently been diagnosed with diabetes, have been included in one or more data collections. Median follow-up at 31 March 2020 was 12 years (IQR 7–14.4) and 8 years (IQR 4–12) for people with type 1 diabetes and type 2 diabetes, respectively.

86,827 (22.3%) people with type 1 diabetes and 2,550,580 (54.8%) of those with type 2 diabetes were born before 1950. 133,034 (34.2%) people with type 1 diabetes and 113,772 (2.4%) with type 2 diabetes were born after 1990. The median age of people included in the 2019/20 data collection was 43.6

(IQR 27.6–57.5) and 66.3 (IQR 56.1–76.0) for people with type 1 diabetes and type 2 diabetes, respectively. Diagnosis occurred before 1980 in 46,902 (12.0%) people with type 1 diabetes and 26,188 (0.6%) with type 2 diabetes. 94,199 (24.1%) people with type 1 diabetes and 2,190,018 (47.1%) people with type 2 diabetes have been diagnosed since 2010.

A valid ethnic group has been identified for 339,078 (87.1%) people diagnosed with type 1 diabetes and 3,850,702 (82.8%) diagnosed with type 2 diabetes. Among people with type 1 diabetes with a valid ethnic group recorded 86.5% were from white ethnic groups, 6.4% from Asian ethnic groups and 4.0% were from Black ethnic groups. The corresponding figures for those diagnosed with type 2 diabetes were 78.0%, 13.9% and 5.0%. Table 2 shows all participants irrespective of whether their ethnic group is recorded.

Among people with type 1 diabetes 35.4% had 10 or more HbA_{1c} measurements recorded in the NDA whilst 5.5% did not have any valid HbA_{1c} recorded. The corresponding figures for people with type 2 diabetes were 22.2% and 1.9%. 89.9% of people with diagnosed non-diabetic hyperglycemia had more than one HbA_{1c} measurement recorded in the audit data. 95.2% of people with type 1 diabetes, 96.6% with type 2 diabetes and 73.9% with non-diabetic hyperglycaemia had at least one body mass index measurement. One or more creatinine measurements were available for 91.9% of those with type 1 diabetes and 98.2% of those with type 2 diabetes (see Table S1).

In the 2019/20 data collection, 72.2% of people with type 2 diabetes had been issued with one or more prescription for glucose lowering drugs, 67.8% had one or more prescription for anti-hypertensive medications and 67.7% had one or more prescriptions for statins. 35.2% of people with type 1 diabetes had been issued with one or more prescriptions for anti-hypertensive medication and 39.9% for statins.

3 | EXAMPLES OF SECONDARY ANALYSIS

Although collected to produce regular quality monitoring reports the NDA data has great potential for answering research questions through secondary analysis. A small number of studies have been completed to date. Data from the 2012/13 NDA cohort were used to identify how the current 'real world' outcomes of people with newly diagnosed diabetes compare with the landmark but resource intensive Epidemiology of Diabetes Interventions and Complications and UK Prospective Diabetes Study (UKPDS) trials conducted among people with type 1 and type 2 diabetes respectively. Considerable improvements were reported in the intermediate clinical outcomes for those with type 2 diabetes although these findings should be considered in light of a trend towards higher body mass index at diagnosis and a greater proportion of people from South Asian and Black ethnic groups than were represented in the UKPDS trial. However, further progress is required to improve outcomes and close the gap between what can be shown in research settings and real world outcomes in people with type 1 diabetes.[9] Variations in outcomes by ethnic group have been documented using data from the NDA. After adjusting for demographic characteristics (age, sex, social deprivation), type and duration of diabetes, cardiovascular risk factors (HbA_{1c}, blood pressure, cholesterol, body mass index) and hospital admissions, people from South Asian and Black ethnic groups had lower short term mortality than those from white ethnic groups.[10] Analysis of data on kidney function recorded in the NDA identified an association between higher body mass index and diabetic kidney disease in people with type 1 diabetes and confirm the association in those with type 2 diabetes.[11]

Data from the NPDA and NDA contributed to an international comparative study of HbA_{1c} outcomes in children and adults across 19 regions or countries[12] and found considerable variation in the proportion of people with a HbA_{1c} of less than 58 mmol/mol (7.5%), particularly in young adults but little difference by sex.

A National Institute for Health Research funded study explored the long-term outcomes including diagnosis of type 2 diabetes following admission to intensive care using data collated from the Intensive Care Audit and Research Centre linked to the NDA (ref). Higher blood glucose levels recorded in the first 24 h of critical care, higher body mass index, non-White ethnicity, pancreatic surgery and severe liver disease were associated with a higher risk of subsequent diagnosis of type 2 diabetes over a median follow up of 2.8 years following admission to intensive care.

In the Spring of 2020, NDA data were used to understand the impact of the COVID-19 on people with diabetes as the novel infection spread across England through established linkages to death registrations with minimal delay. This found that people with type 1 diabetes and type 2 diabetes had a higher risk of COVID-19 related mortality than age-matched peers without diagnosed diabetes.[13] Analysis of risk factors amongst people with diagnosed type 1 and type 2 diabetes found a steeper association between high HbA_{1c} (defined as ≥86mmol/mol) and COVID-19 related mortality than in deaths where COVID-19 was not included on the death certificate. It also noted a u-shaped association with body mass index with greater mortality in those with a low (<20 kg/m^2) and high (≥30 kg/m^2) body mass index.[14] Further analysis of prescription records explored the COVID-19 related mortality risk associated with the main classes of glucose lowering drugs in people with type 2 diabetes and found no evidence to alter prescribing behaviour in response to the risk of COVID-19.[15]

Each year a report detailing the demographic characteristics and intermediate clinical outcomes of people with diabetes is produced by the NDA team. Further reports are produced which examine hospital admissions for cardiovascular and other diabetes related complications and mortality.

TABLE 1 Participation in the NDA and percentage of people with valid data by type of hyperglycaemia and audit period

	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
Number of people included in data collection								
Type 1 diabetes	17,425	42,640	71,480	130,612	149,400	166,415	185,960	202,135
Type 2 diabetes	79,605	227,945	480,720	1,040,755	1,236,490	1,501,530	1,762,185	1,986,610
Other specified type	2410	1915	2805	3585	4540	7385	26,115	19,465
Unspecified type	150,960	213,525	95,090	46,390	33,520	32,275	23,385	27,600
Non-diabetic hyperglycaemia	–	–	–	–	–	–	–	–
General practices included in audit								
Number	965	1868	2416	2416	4900	6072	6700	7030
Percentage	[b]	21.8%[a]	28.7% [a]	58.5%[a]	61.6%	68.7%	75.8%	81.2%
Type 1 diabetes								
HbA_{1c}	67.6%	70.9%	77.2%	83.3%	83.1%	84.4%	83.7%	83.7%
Blood pressure	69.4%	72.5%	79.4%	83.0%	85.1%	86.5%	85.5%	84.7%
Cholesterol	49.4%	59.1%	65.6%	74.5%	74.5%	75.5%	74.8%	74.2%
Albuminuria	21.9%	26.2%	30.6%	43.6%	44.8%	47.7%	52.4%	54.2%
Creatinine	56.0%	58.4%	70.5%	76.2%	76.8%	77.7%	77.2%	77.0%
Body mass index	57.8%	59.7%	72.6%	75.9%	79.4%	81.1%	80.6%	79.6%
Smoking status	63.8%	66.3%	72.2%	77.6%	76.8%	78.7%	77.2%	74.5%
Type 2 diabetes								
HbA_{1c}	65.4%	74.1%	82.0%	89.7%	92.2%	92.1%	90.9%	91.6%
Blood pressure	74.6%	82.7%	88.7%	93.0%	95.5%	95.7%	95.0%	94.6%
Cholesterol	63.4%	74.3%	83.6%	90.7%	92.5%	92.9%	92.2%	91.9%
Albuminuria	20.4%	34.4%	38.8%	58.3%	61.6%	65.6%	72.5%	75.1%
Creatinine	62.8%	69.6%	84.9%	91.7%	93.7%	93.6%	93.0%	92.7%
Body mass index	60.3%	66.0%	82.3%	86.3%	90.4%	90.4%	89.7%	89.3%
Smoking status	68.8%	77.7%	82.7%	88.8%	88.8%	88.8%	86.9%	84.7%
Non-diabetic hyperglycaemia								
HbA_{1c}	–	–	–	–	–	–	–	–
Blood pressure	–	–	–	–	–	–	–	–
Cholesterol	–	–	–	–	–	–	–	–
Body mass index	–	–	–	–	–	–	–	–
Smoking status	–	–	–	–	–	–	–	–

Abbreviations: NDA, National Diabetes Audit.

[a]Percentage of general practices in England who submitted data.

[b]The exact percentage of general practices operating in England in 2003/04 is not known but contemporary reports suggest that the percentage of general practices that supplied data to the NDA was approximately 20%.

A full list of the NDA reports can be found at https://digital.nhs.uk/data-and-information/publications/statistical/national-diabetes-audit.

4 | STRENGTHS AND LIMITATIONS

The strength of this cohort is that it is one of the largest and most comprehensive population-based datasets on people with diabetes. In 2019/20 it included data from 99.2% of general practices in England and Wales, and an estimated 98.4% of adults with diagnosed diabetes based on comparisons with the Quality and Outcomes Framework. The inclusion of data on 389,145 people with type 1 diabetes and 4,650,375 with type 2 diabetes means that it is possible to identify statistically significant variation amongst subgroups that make up a small proportion of the population with diabetes young people with type 1 diabetes and type 2 diabetes. The dataset also provides the scope to identify

2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
213,960	180,195	156,930	163,590	217,445	241,955	263,450	269,825	273,065
2,216,130	1,849,130	1,574,995	1,691,485	2,443,425	2,829,105	3,061,095	3,194,260	3,323,575
17,185	14,015	8165	8165	7475	9370	54,690	11,970	9295
25,965	31,785	23,355	31,645	52,950	112,320	19,235	61,335	69,645
–	–	–	–	–	–	1,294,495	1,778,085	2,140,090
7515	5980	4699	4696	6609	7375	7435	7183	7054
87.8%	70.6%	57.1%	57.3%	82.4%	95.3%	98.3%	98.0%	99.0%
81.4%	77.0%	78.8%	81.3%	82.4%	83.5%	83.7%	84.4%	81.9%
84.8%	82.5%	82.5%	84.1%	85.3%	86.5%	86.7%	87.5%	86.3%
74.0%	72.2%	72.5%	74.1%	75.1%	75.6%	75.7%	76.2%	73.1%
55.2%	50.2%	50.8%	46.0%	42.4%	38.2%	36.0%	38.8%	27.3%
77.7%	75.7%	74.2%	76.1%	77.8%	78.3%	78.8%	78.9%	76.1%
80.6%	78.8%	73.5%	72.2%	72.3%	72.6%	72.7%	75.4%	75.2%
75.5%	74.1%	72.3%	72.7%	74.6%	74.0%	92.4%	92.1%	92.4%
89.7%	90.8%	91.5%	93.3%	94.0%	94.7%	94.7%	94.6%	93.3%
94.6%	93.4%	93.2%	94.5%	94.7%	95.7%	95.4%	95.4%	94.4%
91.5%	90.5%	90.9%	91.7%	91.9%	92.2%	91.8%	91.7%	90.2%
75.9%	70.3%	72.7%	65.4%	58.1%	51.6%	47.3%	49.3%	30.8%
93.0%	91.8%	92.2%	93.5%	94.1%	94.6%	94.5%	93.9%	91.7%
89.9%	88.8%	83.7%	81.3%	80.9%	82.3%	79.5%	81.4%	82.1%
85.3%	85.0%	84.4%	84.1%	84.7%	84.7%	99.5%	99.2%	99.4%
–	–	–	–	–	–	73.0%	77.4%	77.3%
–	–	–	–	–	–	84.5%	84.7%	83.0%
–	–	–	–	–	–	69.0%	69.8%	68.4%
–	–	–	–	–	–	56.5%	58.7%	58.8%
–	–	–	–	–	–	99.8%	99.7%	99.7%

potential variation in care and outcomes by ethnicity with a high level of statistical power.

The primary weakness of the data is that it is compiled from information recorded as part of routine clinical care rather than comprising data collected specifically for a research purpose. This means that there may be more variation in the interpretation and use of clinical codes than would be found amongst data obtained in research studies. The rate of missing data is also likely to be higher (see Table 2). The coverage and completeness of the data collected varies over time (see Tables 1 and 2). In the early years of the NDA participation required specific action to be taken by healthcare providers, and therefore, it is likely that during this period the data collected may have been biased towards organisations with a greater focus on data collection and service improvement. The dip in participation by general practices, and therefore the reduction in the number of people with diabetes included in the NDA for 2013/14 and 2014/15, was due to the reorganisation of local NHS services during at a time when practices usually required support from local information services to

TABLE 2 Characteristics of people included in one or more NDA data collection, 2003/04–2019/20

	Type 1 diabetes		Type 2 diabetes		Other types of diabetes		Type of diabetes not stated		Non-diabetic hyperglycaemia	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%
Sex										
Male	219,985	56.5%	2,579,865	55.5%	21,105	40.4%	69,270	36.6%	1,167,140	48.4%
Female	169,145	43.5%	2,070,435	44.5%	31,075	59.5%	103,555	54.7%	1,246,305	51.6%
Not stated	15	0.0%	75	0.0%	10	0.0%	16,350	8.6%	10	0.0%
Year of birth										
Pre 1930	15,560	4.0%	493,910	10.6%	5245	10.0%	31,515	16.7%	77,180	3.2%
1930–1939	30,075	7.7%	934,450	20.1%	6105	11.7%	25,695	13.6%	353,540	14.6%
1940–1949	41,195	10.6%	1,122,220	24.1%	7170	13.7%	24,400	12.9%	605,275	25.1%
1950–1959	50,440	13.0%	967,150	20.8%	6675	12.8%	20,950	11.1%	563,065	23.3%
1960–1969	64,055	16.5%	706,890	15.2%	6775	13.0%	20,365	10.8%	459,110	19.0%
1970–1979	54,770	14.1%	311,745	6.7%	8565	16.4%	21,220	11.2%	233,640	9.7%
1980–1989	52,070	13.4%	94,600	2.0%	7755	14.9%	24,670	13.0%	94,265	3.9%
1990–1999	46,845	12.0%	17,090	0.4%	2710	5.2%	9545	5.0%	22,435	0.9%
2000 onwards	34,120	8.8%	2080	0.0%	1105	2.1%	2380	1.3%	4945	0.2%
Missing	15	0.0%	240	0.0%	90	0.2%	8445	4.5%	–	0.0%
Year of diagnosis										
Pre 1970	20,010	5.1%	9450	0.2%	150	0.3%	855	0.5%	–	–
1970–1979	26,890	6.9%	16,735	0.4%	185	0.4%	980	0.5%	–	–
1980–1989	45,295	11.6%	90,880	2.0%	455	0.9%	3350	1.8%	–	–
1990–1999	86,115	22.0%	500,345	10.8%	1865	3.6%	14,085	7.4%	–	–
2000–2009	114,980	29.4%	1,818,530	39.1%	9585	18.4%	32,255	17.0%	155,680	6.5%
2010 onwards	94,200	24.1%	2,190,020	47.1%	32,495	62.2%	42,610	22.5%	2,254,745	93.4%
Missing	3900	1.0%	25,685	0.6%	7470	14.3%	95,130	50.3%	3030	0.1%
Ethnic group										
White	293,445	75.4%	3,004,935	64.6%	30,145	57.8%	85,825	45.4%	1,618,550	67.1%
Mixed	4480	1.2%	42,935	0.9%	515	1.0%	1650	0.9%	25,350	1.1%
Asian	21,555	5.5%	534,080	11.5%	4790	9.2%	13,205	7.0%	263,545	10.9%
Black	13,500	3.5%	194,130	4.2%	1855	3.6%	6080	3.2%	108,060	4.5%
Other	6100	1.6%	74,625	1.6%	870	1.7%	2435	1.3%	22,270	0.9%
Not stated	50,065	12.9%	799,675	17.2%	14,010	26.8%	79,985	42.3%	375,680	15.6%
HbA_{1c} measurements[a]										
0	21,570	5.5%	87,865	1.9%	23,635	45.3%	119,960	63.4%	242,715	10.1%
1–3	75,260	19.3%	1,312,245	28.2%	19,505	37.4%	68,610	36.3%	2,170,740	89.9%
4–6	75,075	19.3%	1,262,800	27.2%	7475	14.3%	575	0.3%	–	–
7–9	79,290	20.4%	954,710	20.5%	1055	2.0%	45	0.0%	–	–
10+	137,950	35.4%	1,032,755	22.2%	520	1.0%	–	0.0%	–	–
Blood pressure measurements[a]										
0	17,840	4.6%	67,260	1.4%	20,430	39.1%	110,380	58.3%	178,640	7.4%
1–3	73,695	18.9%	1,290,050	27.7%	21,045	40.3%	77,820	41.1%	2,234,820	92.6%
4–6	73,470	18.9%	1,252,015	26.9%	8530	16.3%	900	0.5%	–	–

(Continues)

TABLE 2 (Continued)

	Type 1 diabetes		Type 2 diabetes		Other types of diabetes		Type of diabetes not stated		Non-diabetic hyperglycaemia	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%
7–9	79,455	20.4%	958,045	20.6%	1465	2.8%	65	0.0%	–	–
10+	144,685	37.2%	1,083,000	23.3%	720	1.4%	10	0.0%	–	–
Cholesterol measurements[a]										
0	38,360	9.9%	113,265	2.4%	25,155	48.2%	119,235	63.0%	394,575	16.3%
1–3	78,355	20.1%	1,326,715	28.5%	18,215	34.9%	68,970	36.5%	2,018,880	83.7%
4–6	77,825	20.0%	1,260,695	27.1%	7160	13.7%	890	0.5%	–	–
7–9	78,120	20.1%	950,130	20.4%	1145	2.2%	75	0.0%	–	–
10+	116,485	29.9%	999,575	21.5%	515	1.0%	15	0.0%	–	–
Body mass index measurements[a]										
0	18,565	4.8%	158,655	3.4%	22,925	43.9%	123,555	65.3%	630,370	26.1%
1–3	85,125	21.9%	1,422,985	30.6%	21,425	41.1%	65,155	34.4%	1,783,085	73.9%
4–6	83,130	21.4%	1,261,855	27.1%	6380	12.2%	435	0.2%	–	–
7–9	83,935	21.6%	917,660	19.7%	975	1.9%	35	0.0%	–	–
10+	118,385	30.4%	889,215	19.1%	480	0.9%	5	0.0%	–	–
Creatinine measurements[a]										
0	31,460	8.1%	83,785	1.8%	22,065	42.3%	107,740	57.0%	–	–
1–3	79,030	20.3%	1,313,035	28.2%	20,235	38.8%	80,035	42.3%	–	–
4–6	76,310	19.6%	1,261,200	27.1%	7940	15.2%	1245	0.7%	–	–
7–9	78,600	20.2%	956,765	20.6%	1350	2.6%	150	0.1%	–	–
10+	123,740	31.8%	1,035,595	22.3%	600	1.1%	5	0.0%	–	–
Albumin measurements[a]										
0	69,050	17.7%	525,690	11.3%	34,590	66.3%	16,3615	86.5%	–	–
1–3	115,005	29.6%	1,623,370	34.9%	13,980	26.8%	27,940	14.8%	–	–
4–6	91,235	23.4%	1,202,020	25.8%	2980	5.7%	1410	0.7%	–	–
7–9	66,865	17.2%	799,505	17.2%	435	0.8%	155	0.1%	–	–
10+	46,990	12.1%	499,790	10.7%	205	0.4%	5	0.0%	–	–
Follow up										
Median (IQR), years	12.0 (7–14.4)		8.0 (4.0–12.0)		4.0 (3.0–8.0)		3.0 (1.0–5.0)		2.2 (1.2–2.2)	

[a]Number of audit data collection periods which contain at least one measurement.

manage their data submissions; also a change in specifics of the information governance rules at the time may have introduced bias. Both these issues were addressed by the new data extraction and information governance arrangements introduced in 2017.

The fact that the data collated for each audit period until 2017 included only the latest recorded measurement in the period means that in the past some detail of the variation in clinical measures has not been captured. The breadth of the data collected is more limited than many research cohorts but recent additions, such as the inclusion of drug data and identification of people with learning difficulties and severe mental illness, mean that the cohort will have the scope to address a wider range of questions in the future.

5 | USING THE NDA DATA FOR SECONDARY ANALYSES

Researchers can apply to obtain a data extract from the NDA using the NHS Digital Data Access Request Service (DARS). Data that have already been subject to an NDA audit publication can be requested. Further details of the DARS process and the requirements that applicants need to meet can be found at https://digital.nhs.uk/services/data-access-reque

st-service-dars. This process can also be used to apply for linked data on hospital activity in England from Hospital Episode Statistics and death registrations in England and Wales registered with the Office for National Statistics. Linked data on hospital activity in Wales recorded in Patient Episode Database for Wales can be applied for via NHS Wales Informatic Service (see http://www.infoandstats.wales.nhs.uk/page.cfm?orgid=869&pid=40977 for further details).

Any data on counts of people reported from the NDA must be rounded to the nearest five for publication to protect confidentiality.

6 | FURTHER DETAILS

The NDA is managed by NHS Digital in partnership with Diabetes UK. It is one of more than 30 National Clinical Audits commissioned by the Healthcare Quality Improvement Partnership on behalf of NHS England and the Welsh Government. NHS Digital and NHS England and NHS Improvement are data controllers for the NDA.

CONFLICT OF INTEREST

NS has consulted for Amgen, AstraZeneca, BoehringerIngelheim, Eli Lilly, Merck Sharp & Dohme, Novartis, Novo Nordisk, Pfizer,and Sanofi, and received grant support from Boehringer Ingelheim outside thesubmitted work. JV is National Clinical Director for Diabetesand Obesity at NHS England & NHS Improvement. EWG and SHW do not have any conflicts of interest. All authors are members of the National Diabetes Audit Research Advisory Group.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

How to cite this article: Holman N, Knighton P, Wild SH, et al. Cohort profile: National Diabetes Audit for England and Wales. *Diabet Med*. 2021;38:e14616. https://doi.org/10.1111/dme.14616