National Paediatric Diabetes Audit

Notes on data analysis for unit summaries 2015-16

Document produced by the NPDA for all participating Paediatric Diabetes Units in England and Wales

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1. Introduction

This document has been prepared to aid understanding of the analysis and preparation of the data for unit results summaries. The data received by the NPDA from each submitting PDU is analysed under the same rules. This makes the NPDA a powerful tool for PDUs to benchmark against local, regional and national results. It is inevitable that there will be small differences in NPDA calculations compared to the same dataset being analysed locally as the same rules may not apply to data cleaning.

2. Inclusion criteria

For a patient to be included in the analysis they must have a valid NHS number and date of birth. Records that could not be allocated to a registered PDU, without a valid or consistent date of birth (e.g. different dates of birth for the same NHS number) or relating to people aged 25 years or older were excluded.

3. Allocation of patients to units, regions and country

A small proportion of patients may receive care from more than one PDU within the audit period. In these cases, results from these patients were attributed to the last PDU at which these patients received care. Patients were assigned to the region and country of the last PDU that they received care from, rather than their region or country of residence.

4. Data cleaning, demographics and treatment regimen

- Duplicate rows of data were removed.
- Entries submitted outside the audit cycle, i.e. the period 1st April 2015 to 31st March 2016 were removed.
- Where an individual was recorded as both male and female the most common was applied. If the inconsistency could not be resolved the gender was changed to unspecified.
- Where some records indicted the ethnic group of a patient as unspecified but another record for the same individual specified an ethnicity, this ethnicity was applied. Where an individual was recorded as having two or more ethnic groups the most specific was applied across all records (e.g. White British replaced 'not stated', Pakistani replaced 'other Asian). If the inconsistency could not be resolved the ethnicity was considered 'missing'.
- Where there were inconsistent diabetes types recorded for a patient, the more specific type of diabetes was used to replace the less specific types (eg Type 1 diabetes replaces not specified, monogenic types of diabetes (gene known) replaces monogenic types of diabetes (gene unknown). If inconsistency could not be resolved, the diabetes type was considered 'not specified'.
- Where there was inconsistency, the earliest diagnosis date provided for each patient was used, and the latest treatment regimen.
- Deprivation data was based on Indices of Multiple Deprivation (IMD), with a score calculated from the lower super output area relating to the patient's home postcode.

5. Completion of care processes and inclusion criteria

Completion of care process data only includes children and young people with Type 1 diabetes who received a complete year of care and were 12 years and older at the beginning of the audit year with the exceptions of HbA1c, Thyroid screening and BMI, which are measured at all ages. Therefore, the total number of children from each unit (i.e. the denominator) will exclude:

- Patients diagnosed after 1st April 2015.
- Patients who have transitioned or moved away during the audit year.
- Patients under 12 years on 1st April 2015 (except for HbA1c, thyroid and BMI).
- Patients who have died during the audit year.
- Those without a valid diagnosis date are excluded as the analytical team cannot be certain of the duration of diabetes.

The following criteria were used to establish whether a care process is completed:

- HbA1c - a valid HbA1c measurement within the audit period
- Body mass index – a valid height and weight measured within the audit period (height between 40 cm and 220 cm, weight between 2 kg and 200 kg, measurements taken on the same day)
- Foot examination – a date of a foot examination within the audit period
- Albuminuria – a urinary albumin level reported within the audit period
- Blood pressure – a valid systolic blood pressure recorded within the audit period (between 50 and 200).
- Eye screening – if 'Retinal Screening' indicated retinal screening was performed and the 'Retinal Screening Observation Date' was in the audit period or 'Retinal screening result' was normal or abnormal and 'Observation Date: Retinal Screening Result' was within the audit period.
- Thyroid - a numerical value greater than 0 for Thyroid function TSH within the audit period.
- Screening for coeliac or thyroid disease on diagnosis – an observation for each, within the audit period and 90 days of diagnosis. Only those diagnosed > 90 days from the end of the audit period were included within the denominator.

6. Outcome inclusion criteria: HbA1c

All children and young people with a valid HbA1c measurement more than 90 days after diagnosis were included within the outcome measure. Where more than one HbA1c was recorded for an individual the **median** value for the year was calculated and used. Where a measurement has been provided for patients who transitioned to adult services or who moved regions or PDUs during the audit period, their data was included even though they may not have completed a whole year of care.

7. Outcome inclusion criteria: microvascular disease - albuminuria and eye screening

Outcome data is shown for people aged 12 years and older where there is an indication that they have had eye screening or a valid albuminuria test.

For albuminuria to be included in the analysis as an outcome measure the measurement must be taken during the audit year and have an interpretation of the result e.g. normoalbuminuria, microalbuminuria or macroalbuminuria. The local interpretation is necessary for inclusion as different methodologies are used in different areas of the country with different cut off ranges. If only a valid measurement and date have been submitted this will be included as a care process completed but not as an outcome measure as the interpretation has not been provided.

For retinopathy screening to be included as an outcome measure, the process has to have been carried out within the audit year and a result needs to be recorded as normal or abnormal.

8. Outcome inclusion criteria: Body Mass Index (BMI)

Data on BMI is presented for all people with a height and weight in the valid ranges defined by the audit (height between 40 cm and 220 cm, weight between 2 kg and 200 kg, taken on the same day).

9. Outcome inclusion criteria: Blood pressure and Cholesterol

This section analyses data for all people aged 12 years and older with a valid systolic or diastolic blood pressure (BP) measurement. Acceptable systolic BP values were between 20 and 200 and for diastolic BP were between 15 and 150. As blood pressure varies with age and sex, data is converted to age and sex specific centiles for analysis. A blood pressure between the 91st and 98th centile is classed as 'high normal' and a blood pressure above the 98th centile is classed as 'high'.

Because of the variation of BP with age, and gender, some measurements were excluded when centiles were calculated e.g. a submitted BP of 120/30 for a 16 year old would technically be accepted as both the systolic and diastolic BP are within the accepted range.

The analysis of cholesterol measurements includes all people aged 12 years and older with a valid cholesterol measurement.

10. Differences in the denominator between the reporting of care processes and the reporting of outcomes

The cohorts used for the reporting of the care process completion and the outcomes relating to these care processes are different. This is best illustrated using the example below:

PDU X submits data on 150 children and young people. 100 of them are aged 12 and older at the start of the audit period, were not diagnosed during the audit year and did not leave the service during the audit year. Therefore the denominator for care processes (apart from HbA1c where the age rule does not apply) will be 100. For HbA1c this may not be 150 either as the patients will still need to complete a whole year of care. If 50 patients that meet the criteria listed above for albuminuria are reported then the completion rate for this care process is 50% (50/100).

For an outcome measure the audit wants to examine all results (age cut offs of 12 years and younger will apply for some outcomes) and therefore all 150 patients are looked at for valid data relating to the audit year. If there is a valid result they are included as a denominator. For albuminuria we know there are at least 50 patients with a result but there may be others where there is a result but did not complete a year of care due to transition, moving away or diagnosis within the audit year, these would be included in the denominator. If there are 10 additional patients with valid results the denominator for this outcome measure is therefore 60 (10 + 50), considerably less than that for the care process. For albuminuria an interpretation of the result is also required for it to be considered as an outcome measure. Although there may be 60 patients with a submitted value, only 30 of them have an interpretation submitted e.g. normoalbuminuria, microalbuminuria or macroalbuminuria. Potentially the denominator for the outcome measure could be greater than that used for the care process if there have been a lot of new patients or patients leaving the service where a care process has been performed as it would be included in the outcome measures.

11. Structured Education/Psychology

The analysis in this section includes children and young people of all ages receiving a complete year of care. Children and young people without a valid diagnosis date were excluded.

12. Outliers

Certain unit results are described within the report as being higher, similar to or lower than the national average based on whether they fall within or outside of 2 standard deviations from the mean. Negative outlier results are considered to represent an ‘alert’ if they fall outside of 2 standard deviations or an ‘alarm’ if they fall outside of three standard deviations, as per DoH definitions. These cut offs are visible within the funnel plots within the unit summaries.

Following the publication of the national report, negative outliers will be notified of their status by the NPDA project board and will be required to acknowledge this, with the expectation that QI initiatives can be undertaken to address the concerns.

13. Case-mix adjustment of mean HbA1c

It has been shown that HbA1c varies with age, sex, ethnicity, duration of diabetes and social deprivation. Data on HbA1c can be adjusted to take account of the case-mix (demographic characteristics) of a unit. The adjusted data on HbA1c presented was adjusted for age, sex, duration of diabetes and social deprivation based on home postcode. This means that the variation between units cannot be attributed to differences in the patient demographic characteristics.

Adjustment factors for calculating mean HbA1c by PDU, 2015/16

		Co-efficient	95 CI	p
Constant		50.57	49.76 - 51.37	<0.001
Age	Per year of age	0.92	0.86 – 0.97	<0.001
Sex	Female	-		-
	Male	-1.62	-2.02 - -1.22	<0.001
Duration	Per year of diabetes	0.69	0.64 – 0.75	<0.001
Deprivation	Most deprived	6.86	6.23 – 7.49	<0.001
	2nd most deprived	5.23	4.59 – 5.87	<0.001
	3rd most deprived	3.23	2.59 – 3.87	<0.001
	2nd least deprived	1.97	1.33 – 2.61	<0.001
	Least deprived	-	-	-
Ethnic group	White	-	-	-
	Asian	0.76	-0.21 – 1.72	0.124
	Black	5.54	4.37 – 6.71	<0.001
	Mixed	2.99	1.65 – 4.34	<0.001
	Other	0.74	-0.95 – 2.43	0.389
	Not stated	0.48	-0.10 – 1.05	0.104

The model explains 12.5% of the variation in mean HbA1c.

14. Further information

You can contact the NPDA team at npda@rcpch.ac.uk or 020 7092 6157.