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| **Diabetes Foot Care Activity Profiles**  **January 2023**  **Technical Document** |
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This technical document accompanies the January 2023 update to the NCVIN diabetes foot care activity profiles. It details the methodology used in calculating the indicators included in the profiles. It is intended to be iteratively updated as frequently asked questions are collated and methodological changes are made.

Any queries, please contact: ncvin-ohid@dhsc.gov.uk

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**Glossary of abbreviations:**

HES – Hospital Episode Statistics

NDA – National Diabetes Audit

QOF – Quality Outcomes Framework

**Note on directly standardised rates:**

Several of the indicators used in the Diabetic Footcare Profiles are presented as directly standardised rates (DSRs). These offer a single, easily interpreted, summary figure for each study population which has been adjusted to take into account its age and ethnicity structure. Such summary figures are calculated using age standardisation methods. For further details on direct standardisation methodology and interpretation of the statistics (including their associated confidence intervals) we recommend reading the Association of Public Health Observatories technical briefing ‘*Commonly used public health statistics and their confidence intervals*’ available here:

<https://fingertips.phe.org.uk/documents/APHO%20Tech%20Briefing%203%20Common%20PH%20Stats%20and%20CIs.pdf>

# Methodological Changes (since the last release in December 2021)

The following changes have been made since the last release of the diabetes foot care activity profiles (December 2021):

* **2021 CCG Changes**

Profiles for, now non-existent, CCGs are no longer produced where these CCGs have merged to form new commissioning regions. As two of data inputs for the Foot Care Profiles (the National Diabetes Audit and the Quality and Outcome Framework) only publish data for currently active CCGs we have not been able to provide backdated analysis for these new CCGs at present. The affected CCGs are as follows:

* + Bedfordshire, Luton and Milton Keynes CCG: M1J4Y (this includes the merged Bedfordshire CCG, Luton CCG, Milton Keynes CCG)
  + Hampshire, Southampton and Isle of Wight CCG: D9Y0V (this includes the merged Fareham and Gosport CCG, Isle of Wight CCG, North Hampshire CCG, South Eastern Hampshire CCG, Southampton CCG, West Hampshire CCG)
  + Frimley CCG: D4U1Y (this includes the merged East Berkshire CCG, North East Hampshire and Farnham CCG, Surrey Heath CCG)
  + North East London CCG: A3A8R (this includes the merged Barking and Dagenham CCG, City and Hackney CCG, Havering CCG, Newham CCG, Redbridge CCG, Tower Hamlets CCG, Waltham Forest CCG)
  + North West London CCG: W2U3Z (this includes the merged Brent CCG, Central London (Westminster) CCG, Ealing CCG, Hammersmith and Fulham CCG, Harrow CCG, Hillingdon CCG, Hounslow CCG, West London CCG)
  + Shropshire, Telford and Wrekin CCG: M2L0M (this includes the merged Shropshire CCG, Telford and Wrekin CCG)
  + Black Country and West Birmingham CCG: D2P2L (this includes the merged Dudley CCG, Sandwell and West Birmingham CCG, Walsall CCG, Wolverhampton CCG)
  + Coventry and Warwickshire CCG: B2M3M (this includes the merged Coventry and Rugby CCG, South Warwickshire CCG, Warwickshire North CCG)
  + Kirklees CCG: X2C4Y (this includes the merged Greater Huddersfield CCG, North Kirklees CCG)
* **At-risk populations**

In the December 2021 profiles, in order to enable direct standardisation, demographic information regarding patients with diabetes was taken from the 2019/20 National Diabetes Audit and used to stratify the sum of the three-year QOF registered populations with diabetes in order to infer the at-risk population by age and ethnicity. This year, we applied the 2020/21 NDA proportions to the three-year (2018/19-2020/21) QOF data when updating the at-risk population. At-risk populations are only calculated for the geographies available in the most recent QOF release used.

# Indicator 1: Total spells in hospital for diabetic foot disease

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| Definition | This indicator provides a count of hospital spells, where the spell has been identified as containing episodes of care valid for classification as ‘predominantly inpatient management of diabetes related foot disease’. |
| Data Source | HES |
| Numerator | Count of spells (SUSSPELLID) |
| Denominator | N/A |
| Basic Methodology | Finished consultant episodes of care within the specified three year period, which meet the criteria for diabetic foot disease, are identified (the full technical definition of a diabetic foot disease episode is given below).  A count of spells containing these episodes is made  Counts of spells are aggregated by the CCG of responsibility |
| Data cleaning | Patients under 18 were removed as this indicator is also used to produce rates and the denominator for this purpose (QOF DM Register) does not include patients under 18.  Patients with no STARTAGE assigned were removed (excepting patients from Nottingham University Hospitals Trust in 16/17 as detailed on page 2).  Patients with no CCG assigned (coded ‘59999’) were removed.  Patient classification was restricted to one of the following values:  1 = Ordinary admission  2 = Day case admission  5 = Mothers and babies using only delivery facilities  Patients who were the responsibility of a commissioning hub were removed.  Where patients had been coded as belonging to a CCG that has since merged with other they were assigned to the current CCG.  Spells were assigned to a financial year based on the FYEAR field of the admission episode. |
| Unit | Spells |
| Age | 18+ |
| Sex | Persons |
| Year | Financial years aggregated to three-year periods. E.g. 2018/19, 2019/20, 2020/21. |
| Benchmarking Method | N/A |
| Benchmarking significance level | N/A |
| Confidence interval methodology | N/A |
| Further information/ caveats | Please see the tables below for a full technical definition of an episode of diabetic foot disease. |

The two tables below illustrate the criteria by which *episodes of care* have been identified as ‘predominantly for inpatient management of diabetes related foot disease’:

## Table 1: Criteria by which episodes of care are identified as foot disease based on clinical procedures:

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| --- | --- | --- | --- | --- |
| Criteria | Procedure | Any Procedure Code | Other codes required | Notes |
| 1 | Debridement of a foot/leg wound | S57.1 | At least one procedure code of: Z50.4, Z50.5, Z50.6 or Z50.7  **AND**  At least one diagnosis code of: E10, E11, E12, E13 or E14 | The subsequent coding of Z50.4, Z50.5, Z50.6 or Z50.7 identifies a foot, leg, toe or ankle.  The diagnosis coding of E10-E14 here indicates that this is a patient with diabetes |
| 2 | Amputations | X09.1, X09.2, X09.3, X09.4, X09.5, X09.8, X09.9, X10.1, X10.2, X10.3, X10.4, X10.8, X10.9, X11.1, X11.2, X11.8, X11.9, X12.1, X12.2, X12.3, X12.4, X12.5, X12.8, X12.9. | At least one diagnosis code of: E10, E11, E12, E13 or E14 | The diagnosis coding of E10-E14 here indicates that this is a patient with diabetes. |

## Table 2: Criteria by which episodes of care are identified based in clinical diagnosis coding:

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| --- | --- | --- | --- | --- |
| Criteria | Primary diagnosis | Primary diagnosis codes | Other diagnosis codes required | Notes |
| 1 | Diabetes mellitus with peripheral circulatory complications | E10.5, E11.5, E12.5, E13.5, E14.5 | None |  |
| 2 | Ulcer of the lower limb | L97 | At least one of: E10, E11, E12, E13, E14 | The subsequent coding of E10-E14 here indicates that this is a diabetic foot ulcer. |
| 3 | Decubitus Ulcer | L89 | At least one of: E10, E11, E12, E13, E14 | The subsequent coding of E10-E14 here indicates that this is an episode of care for a patient with diabetes. |
| 4 | Cellulitis | L03.0, L03.1 | At least one of: E10, E11, E12, E13, E14 | The subsequent coding of E10-E14 here indicates that this is an episode of care for a patient with diabetes. |
| 5 | Osteomyelitis | M86.0, M86.1, M86.2, M86.3, M86.4, M86.5, M86.6, M86.8, M86.9 | At least one of: E10, E11, E12, E13, E14  **AND**  At least one of: L97, L89, L03.0, L03.1, R02 | The subsequent coding of E10-E14 here indicates that this is an episode of care for a patient with diabetes. Also having the subsequent coding of a diabetic foot condition ensures this is osteomyelitis of the foot/leg. |
| 6 | Gangrene | R02 | At least one of: E10, E11, E12, E13, E14 | The subsequent coding of E10-E14 here indicates that this is a diabetic foot ulcer. |
| 7 | Atherosclerosis | I70.2 | At least one of: E10, E11, E12, E13, E14  **AND**  At least One of: L97, L89, L03.0, L03.1, R02 | The subsequent coding of E10-E14 here indicates that this is an episode of care for a patient with diabetes.  Also having the subsequent coding of a diabetic foot condition ensures this is atherosclerosis of the foot/leg. |
| 8 | Bacteraemia/ septicaemia/ septic shock/ sepsis syndrome | A40.0, A40.1, A40.2, A40.3, A40.8, A40.9, A41.0, A41.1, A41.2, A41.3. A41.4, A41.5, A41.8, A41.9, A49.9 | At least one of: E10, E11, E12, E13, E14  **AND**  L97 | The subsequent coding of E10-E14 here indicates that this is an episode of care for a patient with diabetes.  Also having the subsequent coding of a diabetic foot ulcer ensures this is infection related to that ulcer. |

# Indicator 2: Total spells in hospital for diabetic foot disease, per 10,000 population-years

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| Definition | This indicator provides a count of hospital spells, where the spell has been identified as containing an episode of care classified as ‘predominantly inpatient management of diabetes related foot disease’. This figure has been divided by the sum of the registered population with diabetes for the corresponding time-period and multiplied by 10,000. |
| Data Source | HES, QOF, NDA |
| Numerator | Count of spells – as per indicator 1 above |
| Denominator | Three year sums of the QOF registered population with diabetes\* see note below |
| Basic Methodology | The count of spells identified in indicator 1 is divided by the sum of the at-risk population with diabetes and multiplied by 10,000. |
| Data cleaning | Please see the ‘data cleaning’ metadata for indicator 1. |
| Unit | Spells per 10,000 person-years at risk |
| Age | 18+ |
| Sex | Persons |
| Year | Financial years aggregated to three-year periods. E.g. 2018/19, 2019/20, 2020/21. |
| Benchmarking Method | **Between areas:** confidence intervals overlapping reference value’s CIs.  **Between periods:** comparisons were made between the 2012/13 – 2014/15 period and the most recent period by calculating rate ratios and constructing a confidence interval around the ratio of two rates using the delta method. Statistical significance is assessed by the confidence intervals crossing 1. |
| Benchmarking significance level | 95% |
| Confidence interval methodology | **Denominator:** please note the denominator used in this indicator is a sum of 3 years of registered population with diabetes. It is likely that the majority of patients summed together over three years will include many of the same individuals (excepting new diagnoses and deaths). Therefore, a more accurate interpretation of the denominator would be seeing it as a proxy measure for person years. Presenting this indicator as a rate allows comparison to other areas but if a real-word number of spells is required by the end user we recommend using indicator 1.  **Between areas:** confidence intervals are constructed using Byar's method. This method is described in detail in APHO Technical Briefing 3: Commonly used public health statistics and their confidence intervals.  Eayres D. Technical Briefing 3: Commonly used public health statistics and their confidence intervals. York: APHO; 2008.  **Between time periods**: Bland (2000) describes a methodology for calculating a confidence interval for the rate ratio using a technique called the 'delta method' Kirkwood and Sterne (1998) also describe a similar methodology.  The 'delta method' in this case is based on a consideration of the logarithm of the rate ratio and deriving the mean and variance of this  using information about the distributional characteristics of the numerator and denominator considered separately.  The formula used in constructing the CIs around the ratio *approximates* the formula given for the ratio of two relative risks, as demonstrated on Page 157 of Kirkwood and Sterne.  Bland, M. Introduction to Medical Statistics. Third Edition. Oxford University Press, 2000  Kirkwood B. R., Sterne J.A., Essential Medical Statistics, Blackwell, 1988 |
| Further information/ caveats | N/A |

# Indicator 3: Number of major amputation procedures

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| Definition | This indicator provides a count of the number major amputation procedures undertaken, by CCG of responsibility. |
| Data Source | HES |
| Numerator | Count of major amputation procedures |
| Denominator | N/A |
| Basic Methodology | Episodes of care within the specified three year period, which meet the criteria for major diabetic lower-limb amputation, are identified.  The full technical definition of a diabetic lower limb procedure is follows:     * At least one diagnosis code (in any position) of:   + E10, E11, E12, E13 or E14 * A procedure code (in any position) of:   + X09 Amputation of leg   + X09.1 Hindquarter amputation   + X09.2 Disarticulation of hip   + X09.3 Amputation of leg above knee   + X09.4 Amputation of leg through knee   + X09.5 Amputation of leg below knee   + X09.8 Other specified amputation of leg   + X09.9 Unspecified amputation of leg   A sum of major amputation procedures is aggregated by the CCG of responsibility and forms this indicator. |
| Data cleaning | Patients under 18 were removed as this indicator is also used to produce rates per 10,000 patients with diabetes and the denominator for this purpose (QOF DM Register) does not include patients under 18.  Patients with no STARTAGE assigned were removed (except patients from NUH Trust as detailed on page 2).  Patients with no CCG assigned, coded ‘59999’ were removed.  CLASSPAT must = 1, 2 or 5  Patients who were the responsibility of a commissioning hub were removed.  Where patients had been coded as belonging to a CCG that has since merged with another (e.g. Newcastle and Gateshead, Manchester) they were assigned to the current CCG.  Spells were assigned to a financial year based on the FYEAR field of the admission episode. Note: in some cases, the actual amputation procedure may have taken place in a different financial year if the operation episode took place later in the spell. |
| Unit | Major amputation procedures |
| Age | 18+ |
| Sex | Persons |
| Year | Financial years aggregated to three-year periods. E.g. 2018/19, 2019/20, 2020/21. |
| Benchmarking Method | N/A |
| Benchmarking significance level | N/A |
| Confidence interval methodology | N/A |
| Further information/ caveats | N/A |

# Indicator 4: Directly-standardised rate of major amputation procedures

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| Definition | This indicator provides a directly age and ethnicity standardised rate of major amputations per 10,000 population-years. |
| Data Source | HES, QOF, NDA |
| Numerator | Count of amputation procedures |
| Denominator | QOF registered population with diabetes stratified by ethnicity and age, as inferred by applying proportions from the local CCG’s NDA registration data.  Please note: the denominator used in this indicator is a sum of 3 years of registered population with diabetes. It is likely that the majority of patients summed together over three years will be the same individuals (excepting new diagnoses and deaths). Therefore, a more accurate interpretation of the denominator would be seeing it as a proxy measure for person-years at risk. |
| Basic Methodology | The sum of major amputation procedures by CCG (from indicator 5) is stratified by age (<65, 65-79, 80+) and ethnicity (white/non-white) based on the patient’s HES record.  Registration data from the national diabetes audit 2018/19 is used to identify the proportions of white/non-white diabetic patients and diabetic patients aged <65, 65-79 and 80+ for each CCG.  These proportions are applied to the CCG’s QOF registered population with diabetes to infer the age and ethnicity stratified at-risk populations.  Category-specific rates of amputation are then calculated for each CCG.  These category specific rates are weighted against a standard population (see below). The weighted category specific rates are summed to form a DSR for each CCG. |
| Data cleaning | See indicator 5 |
| Unit | Major amputations |
| Age | 18+ |
| Sex | Persons |
| Year | Financial years aggregated to three-year periods. E.g. 2018/19, 2019/20, 2020/21. |
| Standard Population | An important consideration in the choice of a standard population is that the population should “not be considered abnormal or unnatural relative to the populations under study”. In our case this means the population should be representative of the population with diabetes in England. Therefore, data from the 2015/16 National Diabetes Audit was used to infer a standard population.  The National Diabetes Audit (NDA) is an audit of the (mostly) primary care records of the registered population with diabetes. The audit collects information on the demographic characteristics of these patients. In 2015/16 81.4% of all GP practices in England took part in the audit – this equates to a collation of demographic information on 2,646,701 patients with diabetes from primary care records (information on 74,591 additional patients was also taken from secondary care records). For comparison, the entire registered population with diabetes in the Quality Outcomes Framework in 2015/16 was 3,033,529 patients. As such, the NDA offers a large, reliable, improving sample to make statistical inferences from regarding the characteristics of the English population with diabetes. The proportion of NDA registrations by age and ethnicity were calculated from the NDA. A hypothetical total population of 3,000,000 was used as a basis for creating our standard population. The resulting standard population, used for weighting, is as follows:  NCVIN DM Standard Population   |  |  |  |  | | --- | --- | --- | --- | |  | White | Non-White | Total | | <65 | 1,033,396 | 410,891 | 1,444,288 | | 65-79 | 948,789 | 168,575 | 1,117,364 | | 80+ | 390,873 | 47,475 | 438,349 | | Total | 2,373,059 | 626,941 | 3,000,000 | |
| Benchmarking Method | Comparisons were made between the national rate and CCG rate by assessing overlapping confidence intervals.  Comparisons were made between the 2012/13 – 2014/15 period and the most recent period. This was done by calculating a standardised rate ratio and constructing a confidence interval around it. |
| Benchmarking significance level | 95% |
| Confidence interval methodology | **DSRs**: Dobson & Byar's methods  **Standardised rate ratios:** Confidence intervals of the rate ratio were computed according to the method proposed by Tiwari, Clegg and Zou (Statistical Methods in Medical Research 15: 547–569) with the analysis being carried out in R (version 4.0.2). |
| Further information/ caveats | Clinical advice was sought on which demographic factors would be relevant to control for in the standardisation analysis. It was suggested that, in particular, efforts should be made to standardise for ethnicity and age. The reasons for standardising for ethnicity were twofold:   1. Data from the 2015/16 NDA suggests there is considerable variation in the distribution of ethnicity between the registered population with diabetes at a CCG level. 2. The risk of adverse end outcomes of diabetes (including amputation) differ by ethnicity. A summary of some of the literature consulted before performing the analysis is detailed below:    1. There are UK data reporting that the relative risk of amputation was three times lower in black men (but not women) in London - risk reduction was reduced to two times lower after adjustment for smoking[[1]](#footnote-1).    2. The risk of amputation in South Asians was found to be four times lower than in Europeans in Manchester and South Lancs[[2]](#footnote-2).    3. A paper from New Zealand confirms the low incidence of amputation in East and South Asians when compared to Europeans.[[3]](#footnote-3)    4. A paper from 2005 found “South Asians with diabetes in the U.K. have about one-third the risk of foot ulcers of Europeans. The lower levels of PAD, neuropathy, insulin usage, and foot deformities of the Asians account for approximately half of this reduced foot ulcer risk. Lower   neuropathy is the main contributor to the reduced African-Caribbean ulcer rate, particularly in men”[[4]](#footnote-4)   * 1. Findings from the National Diabetes Foot Care Audit Report 2014-2016 suggest that after 12 weeks patients with Black or Asian ethnicity are more likely to be alive and ulcer-free than those with White ethnicity.[[5]](#footnote-5)   The use of ethnicity data from HES is not common practice. Therefore, to inform the use of HES ethnicity data for this analysis a scoping literature review was conducted and the findings suggested a white/ non-white dichotomy would be robust for the purposed of this analysis. A summary of the key findings are below:   * The completeness of HES ethnicity coding has improved over time – from around 70% in 2001 to 91% in 2011. * There are limited studies on the accuracy of HES ethnicity coding, but those that have addressed the question have found that: * Patients coded as white in HES also self-identify (or are identified in other data sources elsewhere) as white (98% concordance). * For those coded as non-white in HES there is considerably more discrepancy with self-reported ethnicity (and self-reported or primary care data sources). However, in general when there is a discrepancy patients have their ethnicity assigned to another non-white group. Meaning if the categorisation of HES data used is white/non-white then this would not be an issue. * Estimating practice ethnicity using hospital attendance data is in closer agreement with practice recording of self-reported ethnicity than using census methods. * Of those with multiple HES inpatient records 94% have consistently identical ethnicities assigned to them over time.[[6]](#footnote-6)[[7]](#footnote-7)[[8]](#footnote-8)[[9]](#footnote-9)[[10]](#footnote-10)[[11]](#footnote-11)   Furthermore, an analysis of ethnicity in HES data for major amputations in people with diabetes found no evidence of biases at CCG level that would be expected to be present if significant miscoding of ethnicity was present in those data.  In each three-year period a small number of HES records did not have a valid ethnicity code assigned to the major amputation spell. In these cases, patient’s past HES records (Inpatient and Outpatient and A&E) were searched for episodes where a valid ethnicity code had been assigned. The most recent, valid ethnicity code was then assigned to the patient. Where we were still unable to identify a valid ethnicity code for a patient their ethnicity was imputed based on the known distribution of white/non-white diabetic patients in that CCG. This applied to just 0.4% of patients having a minor amputation and 0.2% having a major amputation in the most recent time period. |

# Indicator 5: Number of minor amputation procedures

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| Definition | This indicator provides a count of the number of minor amputation procedures, by CCG of responsibility |
| Data Source | HES |
| Numerator | Count minor of amputation procedures |
| Denominator | N/A |
| Basic Methodology | Episodes of care within the specified three year period, which meet the criteria for minor diabetic lower-limb amputation, are identified.  The full technical definition of a minor diabetic lower limb procedure is follows:     * At least one diagnosis code (in any position) of:   + E10, E11, E12, E13 or E14 * A procedure code (in any position) of   + X10 Amputation of foot   + X10.1 Amputation of foot through ankle   + X10.2 Disarticulation of tarsal bones   + X10.3 Disarticulation of metatarsal bones   + X10.4 Amputation through metatarsal bones   + X10.8 Other specified amputation of foot   + X10.9 Unspecified amputation of foot   + X11 Amputation of toe   + X11.1 Amputation of great toe   + X11.2 Amputation of phalanx of toe   + X11.8 Other specified amputation of toe   + X11.9 Unspecified amputation of toe   A sum of minor amputation procedures is aggregated by the CCG of responsibility and forms this indicator. |
| Data cleaning | Patients under 18 were removed as this indicator is also used to produce rates where the denominator for this purpose (QOF DM Register) does not include patients under 18.  Patients with no STARTAGE assigned were removed (except patients from NUH Trust as detailed on page 2).  Patients with no CCG assigned, coded ‘59999’ were removed.  CLASSPAT must = 1, 2 or 5  Patients who were the responsibility of a commissioning hub were removed.  Where patients had been coded as belonging to a CCG that has since merged with another (e.g. Newcastle and Gateshead, Manchester) they were assigned to the current CCG.  Spells were assigned to a financial year based on the FYEAR field of the admission episode. Note: in some cases, the actual amputation procedure may have taken place in a different financial year if the operation episode took place later in the spell. |
| Unit | Minor amputation procedures |
| Age | 18+ |
| Sex | Persons |
| Year | Financial years aggregated to three-year periods. E.g. 2018/19, 2019/20, 2020/21. |
| Benchmarking Method | N/A |
| Benchmarking significance level | N/A |
| Confidence interval methodology | N/A |
| Further information/ caveats | N/A |

# Indicator 6: Directly-standardised rate of minor amputation procedures

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| --- | --- |
| Definition | This indicator provides a directly age and ethnicity standardised rate of minor amputations per 10,000 population years. |
| Data Source | HES, QOF, NDA |
| Numerator | Count of amputation procedures |
| Denominator | QOF registered population with diabetes  Please note: the denominator used in this indicator is a sum of 3 years of registered population with diabetes. It is likely that the majority of patients summed together over three years will be the same individuals (excepting new diagnoses and deaths). Therefore, a more accurate interpretation of the denominator would be seeing it as a proxy measure for person-years. |
| Basic Methodology | The sum of minor amputation procedures by CCG (from indicator 8) is stratified by age (<65, 65-79, 80+) and ethnicity (white/non-white) based on the patient’s HES record.  Registration data from the national diabetes audit 2015/16 is used to identify the proportions of white/non-white diabetic patients and diabetic patients aged >65, 65-79 and 80+ for each CCG.  These proportions are applied to the CCG’s QOF registered population with diabetes to infer the age and ethnicity stratified at-risk populations.  Category-specific rates of amputation are then calculated for each CCG.  These category specific rates are weighted against a standard population (see below). The weighted category specific rates are summed to form a DSR for each CCG. |
| Data cleaning | See indicator 5 |
| Unit | Minor Amputations |
| Age | 18+ |
| Sex | Persons |
| Year | Financial years aggregated to three-year periods. E.g. 2018/19, 2019/20, 2020/21. |
| Standard Population | An important consideration in the choice of a standard population is that the population should “not be considered abnormal or unnatural relative to the populations under study”. In our case this means the population should be representative of the population with diabetes in England. Therefore, data from the 2015/16 National Diabetes Audit was used to infer a standard population.  The National Diabetes Audit (NDA) is an audit of the (mostly) primary care records of registered patients with diabetes. The audit collects information on the demographic characteristics of these patients. In 2015/16 81.4% of all GP practices in England took part in the audit – this equates to a collation of demographic information on 2,646,701 patients with diabetes from primary care records (information on 74,591 additional patients was also taken from secondary care records). For comparison, the entire registered population with diabetes in the Quality Outcomes Framework in 2015/16 was 3,033,529 patients. As such, the NDA offers a large, reliable, improving sample to make statistical inferences from regarding the characteristics of the English population with diabetes. The proportion of NDA registrations by age and ethnicity were calculated from the NDA. A hypothetical total population of 3,000,000 was used as a basis for creating our standard population. The resulting standard population, used for weighting, is as follows:  NCVIN DM Standard Population   |  |  |  |  | | --- | --- | --- | --- | |  | White | Non-White | Total | | <65 | 1,033,396 | 410,891 | 1,444,288 | | 65-79 | 948,789 | 168,575 | 1,117,364 | | 80+ | 390,873 | 47,475 | 438,349 | | Total | 2,373,059 | 626,941 | 3,000,000 | |
| Benchmarking Method | Comparisons were made between the national rate and CCG rate by assessing overlapping confidence intervals.  Comparisons were made between the 2012/13 – 2014/15 period and the most recent period. This was done by calculating a standardised rate ratio and constructing a confidence interval around it. |
| Benchmarking significance level | 95% |
| Confidence interval methodology | **DSRs:** Dobson & Byar's methods  **Standardised rate ratios:** Confidence intervals of the rate ratio were computed according to the method proposed by Tiwari, Clegg and Zou (Statistical Methods in Medical Research 15: 547–569) with the analysis being carried out in R (version 4.0.2). |
| Further information/ caveats | Clinical advice was sought on which demographic factors would be relevant to control for in the standardisation analysis. It was suggested that, in particular, efforts should be made to standardise for ethnicity and age. The reasons for standardising for ethnicity were twofold:   1. Data from the 2015/16 NDA suggests there is considerable variation in the distribution of ethnicity between the registered population with diabetes at a CCG level. 2. The risk of adverse end outcomes of diabetes (including amputation) differ by ethnicity. A summary of some of the literature consulted before performing the analysis is detailed below:    1. There are UK data reporting that the relative risk of amputation was three times lower in black men (but not women) in London - risk reduction was reduced to two times lower after adjustment for smoking[[12]](#footnote-12).    2. The risk of amputation in South Asians was found to be four times lower than in Europeans in Manchester and South Lancs[[13]](#footnote-13).    3. A paper from New Zealand confirms the low incidence of amputation in East and South Asians when compared to Europeans.[[14]](#footnote-14)    4. A paper from 2005 found “South Asians with diabetes in the U.K. have about one-third the risk of foot ulcers of Europeans. The lower levels of PAD, neuropathy, insulin usage, and foot deformities of the Asians account for approximately half of this reduced foot ulcer risk. Lower   neuropathy is the main contributor to the reduced African-Caribbean ulcer rate, particularly in men”[[15]](#footnote-15)   * 1. Findings from the National Diabetes Foot Care Audit Report 2014-2016 suggest that after 12 weeks patients with Black or Asian ethnicity are more likely to be alive and ulcer-free than those with White ethnicity.[[16]](#footnote-16)   The use of ethnicity data from HES is not common practice. Therefore, to inform the use of HES ethnicity data for this analysis a scoping literature review was conducted and the findings suggested a white/ non-white dichotomy would be robust for the purposed of this analysis. A summary of the key findings are below:   * The completeness of HES ethnicity coding has improved over time – from around 70% in 2001 to 91% in 2011. * There are limited studies on the accuracy of HES ethnicity coding, but those that have addressed the question have found that: * Patients coded as white in HES also self-identify (or are identified in other data sources elsewhere) as white (98% concordance). * For those coded as non-white in HES there is considerably more discrepancy with self-reported ethnicity (and self-reported or primary care data sources). However, in general when there is a discrepancy patients have their ethnicity assigned to another non-white group. Meaning if the categorisation of HES data used is white/non-white then this would not be an issue. * Estimating practice ethnicity using hospital attendance data is in closer agreement with practice recording of self-reported ethnicity than using census methods. * Of those with multiple HES inpatient records 94% have consistently identical ethnicities assigned to them over time.[[17]](#footnote-17)[[18]](#footnote-18)[[19]](#footnote-19)[[20]](#footnote-20)[[21]](#footnote-21)[[22]](#footnote-22)   Furthermore, an analysis of ethnicity in HES data for major amputations in people with diabetes found no evidence of biases at CCG level that would be expected to be present if significant miscoding of ethnicity was present in that data.  In each three-year period a small number of HES records did not have a valid ethnicity code assigned to the major amputation spell. In these cases, patient’s past HES records (Inpatient and Outpatient and A&E) were searched for episodes where a valid ethnicity code had been assigned. The most recent, valid ethnicity code was then assigned to the patient. Where we were still unable to identify a valid ethnicity code for a patient their ethnicity was imputed based on the known distribution of white/non-white diabetic patients in that CCG. This applied to just 0.4% of patients having a minor amputation and 0.2% having a major amputation in the most recent time period. |

# Annex 1: Methodological Changes (between November 2020 and December 2021 – taken from last year’s technical document)

The following changes have been made since the last release of the diabetes foot care activity profiles (November 2021):

* **2020 CCG Changes**

Profiles for, now non-existent, CCGs are no longer produced where these CCGs have merged to form new commissioning regions. As two of data inputs for the Foot Care Profiles (the National Diabetes Audit and the Quality and Outcome Framework) only publish data for currently active CCGs we have not been able to provide backdated analysis for these new CCGs at present. The affected CCGs are as follows:

* + NHS County Durham CCG: 84H (this includes the merged Durham Dales, Easington and Sedgfield CCG and North Durham CCG)
  + NHS Tees Valley CCG: 16C (this includes the merged Darlington CCG, Hartlepool and Stockton-on-Tees CCG and South Tees CCG)
  + NHS North Yorkshire CCG: 42D (this includes the merged Hambleton, Richmondshire and Whitby CCG, Scarborough and Ryedale CCG and Harrogate and Rural District CCG)
  + NHS Bradford District and Craven CCG: 36J (this includes the merged Airedale, Wharfedale and Craven CCG, Bradford City CCG and Bradford Districts CCG)
  + NHS Cheshire CCG: 27D (this includes the merged Eastern Cheshire CCG, South Cheshire CCG, Vale Royal CCG and West Cheshire CCG)
  + NHS Herefordshire and Worcestershire CCG: 18C (this includes the merged Herefordshire CCG, Redditch and Bromsgrove CCG, South Worcestershire CCG and Wyre Forest CCG)
  + NHS Northamptonshire CCG: 78H (this includes the merged Corby CCG and Nene CCG)
  + NHS Nottingham and Nottinghamshire CCG: 52R (this includes the merged Mansfield and Ashfield CCG, Newark and Sherwood CCG, Nottingham City CCG, Nottingham North and East CCG, Nottingham West CCG and Rushcliffe CCG)
  + NHS Lincolnshire CCG: 71E (this includes the merged Lincolnshire East CCG, Lincolnshire West CCG, South Lincolnshire CCG and South West Lincolnshire CCG)
  + NHS Norfolk & Waveney CCG: 26A (this includes the merged Great Yarmouth and Waveney CCG, North Norfolk CCG, West Norfolk CCG, South Norfolk CCG and Norwich CCG)
  + NHS South East London CCG: 72Q (this includes the merged NHS Bexley CCG, NHS Bromley CCG, NHS Greenwich CCG, NHS Lambeth CCG, NHS Lewisham CCG and NHS Southwark CCG)
  + NHS South West London CCG: 36L (this includes the merged NHS Croydon CCG, NHS Kingston CCG, NHS Richmond CCG, NHS Merton CCG, NHS Sutton CCG and NHS Wandsworth CCG)
  + NHS North Central London CCG: 93C (this includes the merged NHS Barnet CCG, NHS Camden CCG, NHS Enfield CCG, NHS Haringey CCG and NHS Islington CCG)
  + NHS Kent and Medway CCG: 91Q (this includes the merged Ashford CCG, Canterbury and Coastal CCG, Dartford, Gravesham and Swanley CCG, Medway CCG, South Kent Coast CCG, Swale CCG, Thanet CCG and West Kent CCG)
  + NHS Surrey Heartlands CCG: 92A (this includes the merged Guildford and Waverley CCG, North West Surrey CCG, Surrey Downs CCG and East Surrey CCG)
  + NHS West Sussex CCG: 70F (this includes the merged Coastal West Sussex CCG, Crawley CCG and Horsham and Mid Sussex CCG)
  + NHS East Sussex CCG: 97R (this includes the merged Hastings and Rother CCG, High Weald Lewes Havens CCG and Eastbourne Hailsham and Seaford CCG)
  + NHS Bath and North East Somerset, Swindon and Wiltshire CCG: 92G (this includes the merged Bath and North East Somerset CCG, Swindon CCG and Wiltshire CCG)
* **At-risk populations**

In the November 2020 profiles, in order to enable direct standardisation, demographic information regarding patients with diabetes was taken from the 2018/19 National Diabetes Audit and used to stratify the sum of the three-year QOF registered populations with diabetes in order to infer the at-risk population by age and ethnicity. This year, we applied the 2019/20 NDA proportions to the three-year (2017/18-2019/20) QOF data when updating the at-risk population. At-risk populations are only calculated for the geographies available in the most recent QOF release used.

1. Leggetter S et al Arch Int Med 2002; 162: 73-8 [↑](#footnote-ref-1)
2. Chaturvedi N Diabetic Med 2002; 19: 99-104 [↑](#footnote-ref-2)
3. Robinson TE et al Diabet Med 2016; 33: 55-61 [↑](#footnote-ref-3)
4. Abbott, et al. 2005 Foot Ulcer Risk Is Lower in South-Asian and African-Caribbean Compared With European Diabetic Patients in the U.K.Diabetes Care 28:1869–1875. [↑](#footnote-ref-4)
5. The Healthcare Quality Improvement Partnership. 2017. National Diabetes Audit - National Diabetes Foot Care Audit Report

   2014-2016 [↑](#footnote-ref-5)
6. Saunders CL, Abel GA, El Turabi A, et al. Accuracy of routinely recorded ethnic group information compared with self-reported ethnicity: evidence from the English Cancer Patient Experience survey. BMJ Open 2013;3: e002882. doi:10.1136/ bmjopen-2013-002882 [↑](#footnote-ref-6)
7. The Health and Social Care Information Centre, 2011. How good is HES ethnic coding and where do the problems lie? [↑](#footnote-ref-7)
8. Mathur, et al. 2013. Completeness and usability of ethnicity data in UK-based primary care and hospital databases . Journal of Public Health | Vol. 36, No. 4, pp. 684–692 | doi:10.1093/pubmed/fdt116 [↑](#footnote-ref-8)
9. JACK et al. 2006. Ethnicity coding in a regional cancer registry and in Hospital Episode Statistics. BMC Public Health [↑](#footnote-ref-9)
10. Mindell et al. 2007. Using routine data to measure ethnic differentials in access to coronary revascularization. Journal of Public Health | Vol. 30, No. 1, pp. 45 –53 | doi:10.1093/pubmed/fdm077 [↑](#footnote-ref-10)
11. Hull, SA. et al. 2009. Hospital data may be more accurate than census data in estimating the ethnic composition of general practice populations. Informatics in Primary Care 2009;17:67–78 [↑](#footnote-ref-11)
12. Leggetter S et al Arch Int Med 2002; 162: 73-8 [↑](#footnote-ref-12)
13. Chaturvedi N Diabetic Med 2002; 19: 99-104 [↑](#footnote-ref-13)
14. Robinson TE et al Diabet Med 2016; 33: 55-61 [↑](#footnote-ref-14)
15. Abbott, et al. 2005 Foot Ulcer Risk Is Lower in South-Asian and African-Caribbean Compared With European Diabetic Patients in the U.K.Diabetes Care 28:1869–1875. [↑](#footnote-ref-15)
16. The Healthcare Quality Improvement Partnership. 2017. National Diabetes Audit - National Diabetes Foot Care Audit Report

    2014-2016 [↑](#footnote-ref-16)
17. Saunders CL, Abel GA, El Turabi A, et al. Accuracy of routinely recorded ethnic group information compared with self-reported ethnicity: evidence from the English Cancer Patient Experience survey. BMJ Open 2013;3: e002882. doi:10.1136/ bmjopen-2013-002882 [↑](#footnote-ref-17)
18. The Health and Social Care Information Centre, 2011. How good is HES ethnic coding and where do the problems lie? [↑](#footnote-ref-18)
19. Mathur, et al. 2013. Completeness and usability of ethnicity data in UK-based primary care and hospital databases . Journal of Public Health | Vol. 36, No. 4, pp. 684–692 | doi:10.1093/pubmed/fdt116 [↑](#footnote-ref-19)
20. JACK et al. 2006. Ethnicity coding in a regional cancer registry and in Hospital Episode Statistics. BMC Public Health [↑](#footnote-ref-20)
21. Mindell et al. 2007. Using routine data to measure ethnic differentials in access to coronary revascularization. Journal of Public Health | Vol. 30, No. 1, pp. 45 –53 | doi:10.1093/pubmed/fdm077 [↑](#footnote-ref-21)
22. Hull, SA. et al. 2009. Hospital data may be more accurate than census data in estimating the ethnic composition of general practice populations. Informatics in Primary Care 2009;17:67–78 [↑](#footnote-ref-22)