# Diabetic eye disease: A UK Incidence and Prevalence Study

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Year of publication: 2017

## Notes on version

There are a number of slight differences between this report and the British Medical Journal paper ‘Population trends in the 10-year incidence and prevalence of diabetic retinopathy in the UK: a cohort study in the Clinical Practice Research Datalink 2004–2014’ (<http://bmjopen.bmj.com/content/7/2/e014444>).

These differences are as follows:

1. The report includes information on the crude incidence and prevalence of diabetic retinopathy in key population subgroups. The paper presents age-standardized incidence and prevalences. These figures are standardized against the mid-2014 UK population estimates from the Office for National Statistics - and thus take account for the age structure of the UK population (Figure 1 and table 2 in the paper).
2. Severe diabetic retinopathy in the report includes codes for severe pre-proliferative retinopathy. In the paper, severe retinopathy is defined as proliferative retinopathy - and thus the severe DR population is slightly smaller in the paper compared to the report.
3. Risk of developing retinopathy is presented as crude hazard ratios in the report- stratified by gender, age, ethnic group, calendar year, geographical region, and deprivation. (Tables 13 and 14). In the paper, the risk of developing retinopathy is presented as an adjusted hazard ratio, which takes account of age, gender, ethnic group, deprivation, geographic region, and additionally, duration of diabetes) This is figure 2 in the paper.

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## Background

Diabetic retinopathy (DR) is the most common form of eye disease amongst individuals with diabetes mellitus. (1) Though diabetic retinopathy is thought to be one of the leading causes of visual impairment and blindness in the UK. UK wide population-based measures of incidence and prevalence have not been determined, with previous research generally limited to estimates based on regional screening programmes or small general practices samples.(2–4) In the UK, within 20 years of diagnosis nearly all people with type 1 and almost two thirds of people with type 2 diabetes (60%) have some degree of retinopathy.(5)

Ethnic and gender differences in the risk of diabetes and subsequent visual impairment have been established both in the UK and worldwide.(6–11) In the UK, the risk of developing type two diabetes has been shown to be 2-6 times higher in South Asian communities compared to the White British population.(12,13)

If untreated, diabetic retinopathy leads to blindness, and is one of the most common causes of sight loss in people of working age.(1) Compared to the general population, the risk of developing cataracts or glaucoma is doubled amongst individuals with diabetic retinopathy.(14)

Since 2004 it has been a requirement of the UK Quality and Outcomes Framework (QOF) that patients with diabetes should be screened annually for diabetic retinopathy, and that screening should be recorded by general practitioners in patient records. QOF indicators are known to have been well recorded by GPs and so we anticipate results of screening will have been recorded with a high degree of accuracy.(15,16) Having a more complete understanding of the burden of disease due to diabetic retinopathy in the UK will help improve future service planning and provision.

## Aim

To estimate the incidence and prevalence of diabetic retinopathy in the United Kingdom. We will use nationally representative date from the Clinical Practice Research Datalink (CPRD) to measure how common this condition occurs in the UK population. We will also look to see whether diabetic retinopathy is more or less common in specific groups of people; specifically we will look at whether incidence and prevalence varies with age, sex, geographical location, ethnicity and socio-economic status. Furthermore we will estimate the time it takes to develop visual impairment following onset of diabetic retinopathy.

## Study Type

This is a descriptive study. Measures of overall and annual prevalence and incidence of diabetic retinopathy will be calculated. Furthermore incidence of visual impairment will be calculated within patients with diagnosed diabetic retinopathy.

## Methodology

### Description of the data source

The Clinical Practice Research Datalink (CPRD, formerly GPRD) was initially set up in 1987 as a commercial data bank by the company VAMP (Value Added Medical Products). Now run by the Medicines and Health Care products Regulatory Agency (MHRA), the CPRD is the largest primary care database in the UK, representing over 8% of the UK population.

The CPRD currently contains longitudinal primary care records for approximately 13.5 million patients, of whom 5.5 million are currently active.(17) Continuous observational data has been collected in most practices for over six years yielding over 30 million patient years of observation. Patients contributing to the CPRD are registered with one of 650 practices which all use the Vision clinical software system. General practitioners and practice staff record data onto their clinical systems and send anonymized patient data every 6 weeks to the CPRD. These data are then appended to the continually growing database which contains information on diagnoses, symptoms, referrals, test results, medications, consultations, demographics, and lifestyle factors. Around fifty percent of English practices contributing to the CPRD also allow linkage to other data sources such as the Hospital Episode Statistics for England, and the Office for National Statistics (ONS) Mortality Data.

For research purposes, individual patient data is anonymised, with identifying information such as NHS number, name, date of birth, address, and postcode removed. In addition to these demographic data, researchers can access coded data pertaining to diagnoses, symptoms and processes of care. Coded data are entered according to the Read clinical coding system- a hierarchical system of medical coding used across UK primary care.

The Clinical Practice Research Datalink is well suited to investigate the national prevalence and incidence of diabetic retinopathy due to its representativeness of the UK population with respect to gender, age and ethnic group, and large number of contributing practices and patients- which will enable a more granular and detailed description of trends over time and between demographic subgroups.(17,18)

### Identification of diabetic retinopathy

Clinical terms to identify diagnoses of diabetic retinopathy were agreed upon via consultation between the research team and clinicians at Moorfields eye hospital. All diagnoses of diabetic retinopathy was identified by searching for the following Read clinical terms in the CPRD. Diabetic retinopathy was classified as severe if the codes pertained to laser therapy, advanced retinopathy, preproliferative or proliferative retinopathy.

A summary of the clinical terms used to identify diabetic retinopathy is shown in Table 1. The full list of Read codes can be found in the appendix. Onset of diabetic retinopathy was defined as the first ever diagnostic code entered onto the patient recoded. Patients with a diagnosis for severe retinopathy at any time were included in a sub-analysis of patients with advanced disease, with onset defined as the earliest ever code of severe DR on the patient record.

Table 1. Search terms for Diabetic Retinopathy

|  |
| --- |
| Keywords for identifying diabetic retinopathy in the CPRD |
| \*RETINAL\* **and**  or \*SCR\* or \*ARTERIES\* or \*EXUDATE\* or \*MICROANEURYSMS\* or \*PHOTOGRAPHY\* or \*ABNORMALITY\* |
| \*O/E\* **and** \*RETINA\* or \*FUNDUS\* or \*PHOTOCOAGULATION\* or \*MACULAR\* or \*VITREOUS\* |
| \*LASER” **and** \*RETINA\* |
| \*RETINOPATHY\* or \*FUNDOSCOPY\* or \*MACULOPATHY\* or \*RED REFLEX\* or \*SEEN BY OP\* or \*RETINAL SCR\* or \*RETINOSCOPY\* or \*SLIT LAMP\* or \*DIABETIC EYE\* or \*EYE FUNDUS\* or \*EXAMINATION OF RETINA\* or \*RETINA AND OTHER PARTS OF EYE OPERATIONS\* or \*VITRECTOMY\* |
| Keywords excluded (to remove obstetric terms related to “fundus”) |
| \*TERM SIZE\* or \*WEEK SIZE\* or \*OBSTETRIC\* |

### Identification of diabetes mellitus

For the purposes of this study, diabetic status was determined via the use of classification algorithms developed by the UK Biobank study for use in electronic health records.(19) The UK Biobank is a prospective cohort study investigating genetic, lifestyle and environmental risk factors for major chronic diseases such as cancer, diabetes, heart disease, and stroke. A key objective of the Biobank program is to improve the identification and classification of diabetes in routine medical records. The algorithms developed for the Biobank study are the most current iteration of a diagnostic toolkit designed to counteract the most common diagnostic errors .

The algorithms for classification of diabetes follow the general principles for outcomes adjudication as defined by the Biobank study; namely to:

a) Use a staged approach to ascertain, confirm, and sub-classify disease

b) Avoid false positive cases, but tolerate some false negative cases

c) Be geographically generalizable, scalable, cost-effective, and future proof

#### Flowchart 1: Assigning initial diabetes classification

The first of the three Biobank algorithms provided an initial diabetes classification for each patients based on diagnostic Read codes alone. Patients with type 1 or type 2 diabetes were classified using a hierarchical method starting with definite codes and stepping down to probable codes and then possible codes. Patients whose only diabetes codes were for subtype specific were classified separately. A summary of the read codes used to typify diabetes mellitus is shown in table 2. A full list of Read codes can be found in the appendix. he codes listed include codes which confirm diagnoses of diabetes and also refute diagnoses (such as diabetes resolved/ceased) depending on their temporal ordering in the patient record.

Table 2. Categorization of Read codes for Diabetes Mellitus

|  |  |  |  |
| --- | --- | --- | --- |
|  | Type 1 Diabetes | Type 2 Diabetes | Other |
| Definite | Type 1 DM: C10E  Not contradicted/ceased/superseded | Type 2 DM: C10F  Not contradicted/ceased/superseded | Gestational L180  Genetic C10c-C10D  Other/Secondary  C10G-J, L-N, C11y0  Insulin resistance: C10K, C1098, C10F8  Ceased: 21263, 212H |
| Probable | IDDM: C108  Adult onset: C1073  Gestational: L1805  Not contradicted/ceased/superseded | NIDDM: C109  Gestational: L1806  Gestational: L180X  Not contradicted/ceased/superseded |
| Possible | Diabetes mellitus, adult onset:  C10z1 C10y0 C110  Not contradicted/ceased/superseded | Diabetes mellitus, adult onset: C10%, C112 (z), L180x  Not contradicted/ceased/superseded |

#### Flowchart 2: Improving classification of type 1 diabetes

The second algorithm further refined the classification of patients initially identified as having type 1 diabetes by utilizing supporting information which allowed patients to retain their classification as having type 1 diabetes, or to be reclassified as having either type 2 diabetes or gestational diabetes. Supporting information including prescriptions of diabetic medications (insulin, metformin, and other antidiabetic drugs), pregnancy, hospitalizations, body mass index, age, gender, and ethnicity are used to detect potential errors in the classification of type 1 diabetes.

#### Flowchart 3: Improving classification of type 2 diabetes

The third algorithm further refined the classification of patients initially identified as having type 2 diabetes by utilizing supporting information which allowed patients to retain their classification as having type 2 diabetes, or to be reclassified as having type 1 diabetes, polycystic ovary syndrome, gestational diabetes, or not diabetes.

### Calculating prevalence and incidence of T1DM, T2DM, and diabetic retinopathy

A prospective cohort study was conducted to examine the prevalence and incidence of diabetes mellitus and diabetic retinopathy in all patients aged 12 and over in the whole of the CPRD. The prevalence and incidence of diabetic retinopathy were also examined separately for indidividuals with type 1 diabetes and type 2 diabetes.

#### Prevalence analysis

For the study of diabetes and retinopathy prevalence, the outcome was all individuals with a diagnostic code at the midpoint of each calendar year from January 2004 to January 2015. Point prevalence was calculated by dividing the number of individuals with any one of a) Type 1 diabetes b) Type 2 diabetes c) Diabetic Retinopathy d) Severe diabetic retinopathy by the number of patients in the CPRD aged 12 years and over on July 1st of each year.

#### Incidence analysis

For the study of disease incidence, the outcome was first diagnosis of diabetes or diabetic retinopathy between January 2004 and January 2015. Individuals with a first diagnosis prior to 1994 were excluded from the analysis. Incidence was calculated by dividing the number of newly diagnosed patients aged 12 and over by the number of person-years of follow-up of all eligible patients aged 12 and over contributing to the CPRD.

Crude incidence rates of diabetes and diabetic retinopathy per 10,000 person years of follow-up time were calculated for all patients in the CPRD. For the analysis, the start of follow-up was defined as the latest of practice up to standard date or 12 months after the patients current registration date.

Follow-up time ended at the date of first diagnosis of diabetes or diabetic retinopathy. For patients not diagnosed with the outcome of interest, follow-up time was censored at the earliest of date of transferring out of the practice, date of latest data collection, death, or December 31st 2014. To examine trends over time, Cox proportional hazards regression using time since first registration as the timescale was used to evaluate the risk of diabetic retinopathy in all patients between January 2004 and December 2014 stratified by age band, gender, calendar year, region, deprivation, and ethnic group.

Age was grouped into bands spanning ages 25-24, 25-34, 45-54, 55-64, and 75 and older. Ethnicity was grouped into the five categories of the 2011 census, namely, White, South Asian, Black African/Caribbean, Mixed, and Other. Patients with missing ethnicity, or with codes which were unusable were collapsed into a category of unknown ethnicity. The full list of codes and their categorization can be found in the appendix.

Deprivation was classified using the Index of Multiple Deprivation (IMD).(20) IMD scores are assigned to small geographic locations known as “Lower Layer Super Output Areas” (LSOA), which cover populations of approximately 1,500 people, allowing for exploration of small scale geographic differences in deprivation. Each LSOA has an IMD score which is made of up several domains including income, employment, health and disability, education, barriers to housing and services, crime, and living environment. Each patient in the CPRD was assigned a deprivation score relating to the deprivation value of their general practice.

### Calculating time to of visual impairment amongst individuals with diabetic retinopathy

Within our population with diabetic retinopathy, the time between onset of retinopathy and visual impairment was examined for the whole population and by gender, ethnic group, age group, and deprivation. The analysis was conducted separately for patients with diabetic retinopathy only and for patients with both diabetic retinopathy and a diagnosis for major eye disease defined as glaucoma, cataract, or macular degeneration. The Read codes for eye disease are listed in detail in the appendix

Cox proportional hazards regression was used to estimate the median number of years to developing subsequent visual impairment. Visual impairment codes were selected from a pre-defined list created and checked by the CALIBER study group , who create shareable codeslists for use in studies using routine electronic healthcare databses ([www.caliberresearch.org](http://www.caliberresearch.org)). The codes are summarized below in Table 3, and listed in detail in the appendix.

Table 3. Categorization of Read codes for visual impairment

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Visual Impairment Category | | |  |  |  |  |  |  |  |  |  |
| Severely sight impaired | 2B79 | 2B6A | 2B6Q | 2B7A | 2B7T | 2B6R | 2B7R | 2B6B | 2B6S | 2B7P | 2B7B |
| (VA worse than 3/60) | 2B7C | 2B7V | 2B6P | 2B6V | 2B69 | 2B6C | 2B7S | 2B7Q | 2B6T |  |  |
| Reduced visual acuity (VA 6/12 to 6/36) | 2B6G | 2B7J | 2B76 | 2B64 | 2B6J | 2B6H | 2B7K | 2B6K | 2B7H | 2B77 | 2B75 |
| Sight impaired (VA 3/60 to 6/60) | 2B7W | 2B6E | 2B6X | 2B6L | 2B7L | 2B68 | 2B78 | 2B7E | 2B7X | 2B6W |  |

For patients with diabetic retinopathy alone, time to visual impairment was calculated from their first retinopathy diagnosis. For patients with co-morbid eye disease, time to visual impairment was calculated from the most recent diagnosis for retinopathy, glaucoma, cataracts, or macular degeneration.

## Findings

### Number of patients with diabetes and diabetic retinopathy

From a total of 10,207,366 patients in the CPRD with research quality data, 7,707,475 were eligible for inclusion in the study. Amongst all patients aged 12 and over on December 31st 2014, the prevalence of type 1 diabetes was 0.4% (CI95% 0.39%-0.40%). The prevalence of type 2 diabetes was 4.39% (CI95% 4.38%-4.40%). The prevalence of diabetic retinopathy was 1.87% (CI95% 1.86%-1.88%) while the prevalence of severe diabetic retinopathy was 0.18% (CI85% 0.17%-0.18%).

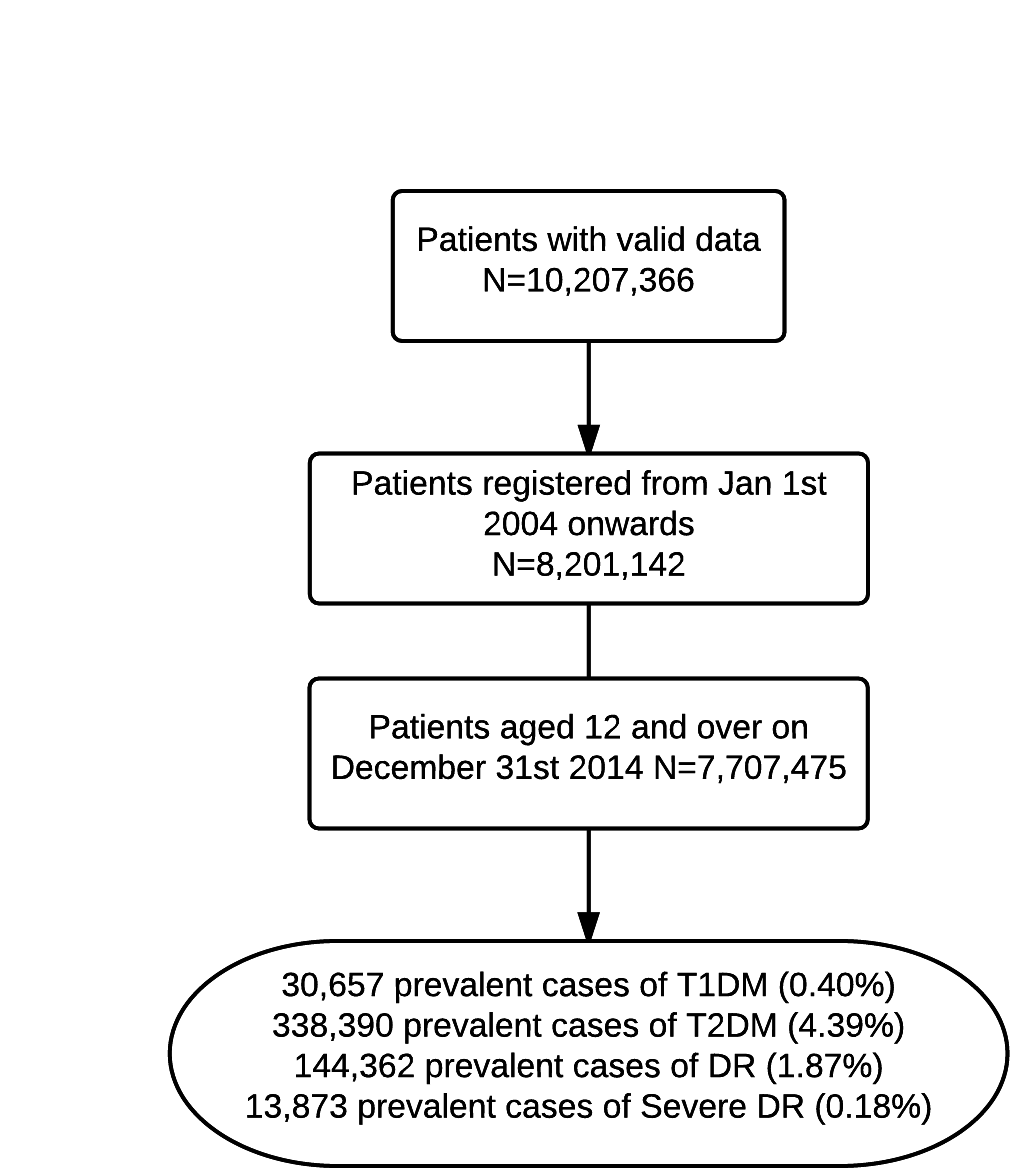


Figure 1. Derivation of study population from the CPRD

The earliest ever diagnostic Read code for each patient identified as having diabetic retinopathy is shown in table 4.

Table 4. Diagnostic Read codes for all retinopathy identified in the CPRD

|  |  |  |
| --- | --- | --- |
| **First diagnosis of any diabetic retinopathy** | **No.** | **%** |
| Diabetic retinopathy | 32,175 | 22.30 |
| Background diabetic retinopathy | 29,732 | 20.60 |
| O/E - right eye background diabetic retinopathy | 13,993 | 9.70 |
| O/E - left eye background diabetic retinopathy | 13,363 | 9.30 |
| Fundoscopy abnormal | 5,721 | 4.00 |
| Anterior vitrectomy | 5,629 | 3.90 |
| Diabetic maculopathy | 4,552 | 3.20 |
| O/E - retinal haemorrhages | 4,102 | 2.80 |
| Unspecified background retinopathy | 3,500 | 2.40 |
| Non proliferative diabetic retinopathy | 3,069 | 2.10 |
| Hypertensive retinopathy | 3,015 | 2.10 |
| O/E - vitreous haemorrhages | 2,835 | 2.00 |
| Central serous retinopathy | 2,696 | 1.90 |
| O/E - retinal pigmentation | 2,039 | 1.40 |
| Pars plana vitrectomy | 1,666 | 1.20 |
| Proliferative diabetic retinopathy | 1,131 | 0.80 |
| O/E - left eye diabetic maculopathy | 1,059 | 0.70 |
| O/E - right eye diabetic maculopathy | 1,031 | 0.70 |
| Type 2 diabetes mellitus with retinopathy | 830 | 0.60 |
| Retinal microaneurysms NOS | 783 | 0.50 |
| Retinal laser therapy | 722 | 0.50 |
| Diabetic retinopathy NOS | 677 | 0.50 |
| Preproliferative diabetic retinopathy | 604 | 0.40 |
| Retinopathy of prematurity | 594 | 0.40 |
| O/E - diabetic maculopathy present both eyes | 592 | 0.40 |
| O/E - No retinal laser photocoagulation scars | 538 | 0.40 |
| Other background retinopathy | 491 | 0.30 |
| Retina and other parts of eye operations | 443 | 0.30 |
| Retinal abnormality - diabetes related | 433 | 0.30 |
| Maculopathy | 398 | 0.30 |
| O/E - retinal microaneurysms | 382 | 0.30 |
| Laser photocoagulation of retina for detachment | 339 | 0.20 |
| O/E - right eye preproliferative diabetic retinopathy | 337 | 0.20 |
| Laser therapy - retinal lesion | 332 | 0.20 |
| O/E - left eye preproliferative diabetic retinopathy | 305 | 0.20 |
| Panretinal laser photocoagulation to lesion of retina | 300 | 0.20 |
| O/E - referable retinopathy | 292 | 0.20 |
| O/E - right eye clinically significant macular oedema | 259 | 0.20 |
| O/E - retinal exudates | 254 | 0.20 |
| Retinal exudate or deposit | 250 | 0.20 |
| O/E - right eye proliferative diabetic retinopathy | 210 | 0.10 |
| Type 1 diabetes mellitus with retinopathy | 201 | 0.10 |
| O/E - left eye proliferative diabetic retinopathy | 179 | 0.10 |
| Vitrectomy using pars plana approach | 171 | 0.10 |
| O/E - retinal A-V nipping | 170 | 0.10 |
| Vitrectomy using anterior approach | 168 | 0.10 |
| O/E - left eye clinically significant macular oedema | 164 | 0.10 |
| Advanced diabetic maculopathy | 162 | 0.10 |
| Focal laser photocoagulation of retina | 130 | 0.10 |
| Other proliferative retinopathy | 128 | 0.10 |
| Retinal abnormality - non-diabetes | 128 | 0.10 |
| Other background retinopathy NOS | 118 | 0.10 |
| Laser destruction of lesion of retina | 101 | 0.10 |
| Exudative retinopathy | 95 | 0.10 |
| O/E - retinal vessel narrowing | 92 | 0.10 |
| Insulin dependent diabetes mellitus with retinopathy | 77 | 0.10 |
| O/E- non-referable retinopathy | 63 | <0.10 |
| O/E - Laser photocoagulation scars | 47 | <0.10 |
| Panretinal laser photocoagulation to lesion of retina NEC | 46 | <0.10 |
| Type 2 diabetes mellitus with exudative maculopathy | 46 | <0.10 |
| Proliferative retinopathy NOS | 45 | <0.10 |
| O/E - right eye stable treated prolif diabetic retinopathy | 41 | <0.10 |
| Solar retinopathy | 40 | <0.10 |
| Proliferative retinopathy due to sickle cell disease | 38 | <0.10 |
| Non-insulin-dependent diabetes mellitus with retinopathy | 30 | <0.10 |
| Type II diabetes mellitus with retinopathy | 29 | <0.10 |
| Atherosclerotic retinopathy | 21 | <0.10 |
| O/E - retinal vascular prolif. | 20 | <0.10 |
| O/E - sight threatening diabetic retinopathy | 20 | <0.10 |
| High risk non proliferative diabetic retinopathy | 14 | <0.10 |
| Type 1 diabetes mellitus with exudative maculopathy | 14 | <0.10 |
| Atheroscleritic retinopathy | 12 | <0.10 |
| Type I diabetes mellitus with retinopathy | 11 | <0.10 |
| Venostasis retinopathy | 11 | <0.10 |
| Arterosclerotic retinopathy | 9 | <0.10 |
| Renal retinopathy | 9 | <0.10 |
| High risk proliferative diabetic retinopathy | 8 | <0.10 |
| Retinal arteries silverwire | 7 | <0.10 |
| O/E - left eye stable treated prolif diabetic retinopathy | 6 | <0.10 |
| Other intraretinal microvascular abnormality | 5 | <0.10 |
| Other specified other proliferative retinopathy | 5 | <0.10 |
| Pseudoretinitis pigmentosa | \*\* | <0.10 |
| Impaired vision due to diabetic retinopathy | \*\* | <0.10 |
| [X]Other proliferative retinopathy | \*\* | <0.10 |
| Total | 144,362 | 100.00 |

\*\*cells with fewer than 5 individuals cannot be included due to concerns over patient anonymity

The earliest ever diagnostic Read code for the subset of patients identified as having severe diabetic retinopathy is shown in table 5.

Table 5. Diagnostic Read codes for severe retinopathy identified in the CPRD

|  |  |  |
| --- | --- | --- |
| **First diagnosis of severe diabetic retinopathy** | **No.** | **%** |
| Proliferative diabetic retinopathy | 3,455 | 24.90 |
| Preproliferative diabetic retinopathy | 2,046 | 14.70 |
| O/E - right eye preproliferative diabetic retinopathy | 1,411 | 10.20 |
| O/E - left eye preproliferative diabetic retinopathy | 1,321 | 9.50 |
| Retinal laser therapy | 1,062 | 7.70 |
| O/E - right eye proliferative diabetic retinopathy | 688 | 5.00 |
| Panretinal laser photocoagulation to lesion of retina | 615 | 4.40 |
| O/E - left eye proliferative diabetic retinopathy | 614 | 4.40 |
| Laser therapy - retinal lesion | 610 | 4.40 |
| Laser photocoagulation of retina for detachment | 479 | 3.50 |
| Advanced diabetic maculopathy | 374 | 2.70 |
| Focal laser photocoagulation of retina | 315 | 2.30 |
| Other proliferative retinopathy | 264 | 1.90 |
| Laser destruction of lesion of retina | 242 | 1.70 |
| Proliferative retinopathy NOS | 106 | 0.80 |
| Panretinal laser photocoagulation to lesion of retina NEC | 94 | 0.70 |
| O/E - Laser photocoagulation scars | 86 | 0.60 |
| Proliferative retinopathy due to sickle cell disease | 42 | 0.30 |
| High risk non proliferative diabetic retinopathy | 23 | 0.20 |
| High risk proliferative diabetic retinopathy | 16 | 0.10 |
| Other specified other proliferative retinopathy | 8 | 0.10 |
| [X]Other proliferative retinopathy | \*\* | <0.10 |
| Total | 13,873 | 100.00 |

\*\*cells with fewer than 5 individuals cannot be included due to concerns over patient anonymity

### Results of prevalence analysis

#### Study Populations

The breakdown of each of the study populations by gender, ethnic group and deprivation quintile is presented in table 6. Compared to the general CPRD population, both diabetic populations have a higher proportion of males. Additionally, the population with type 2 diabetes has a higher proportion of individuals of South Asian and Black African/Carbbean ethnicity and individuals in the least affluent quintiles compared to the general CPRD population. The population with type 1 diabetes has a greater proportion of individuals of White ethnicity, and a similar distribution of deprivation as the general CPRD population.

Table 6. Demographic characteristics of the CPRD population 2004-2014

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Population** | **CPRD** | |  | **T2DM** |  | **T1DM** |  |
|  | **N** | | **%** | **N** | **%** | **N** | **%** |
| **Denominator (12+)** | **7,707,475 7,557,272** | | **100%** | **338,390** | **100%** | **30,657** | **100%** |
| **Gender** |  | |  |  |  |  |  |
| **Male** | 3,790,664 | | 49.18% | 187,141 | 55.30% | 17,761 | 57.93% |
| **Female** | 3,916,811 | | 50.82% | 151,249 | 44.70% | 12,896 | 42.07% |
|  |  | |  |  |  |  |  |
| **Ethnic Group** |  | |  |  |  |  |  |
| **White** | 4,006,927 | | 51.99%% | 205,168 | 60.63% | 19,810 | 64.62% |
| **South Asian** | 223,090 | | 2.89% | 15,840 | 4.68% | 453 | 1.48% |
| **Black** | 142,070 | | 1.84% | 7,186 | 2.12% | 373 | 1.22% |
| **Other** | 109,402 | | 1.42% | 3,891 | 1.15% | 254 | 0.83% |
| **Mixed** | 50,363 | | 0.65% | 1,095 | 0.32% | 152 | 0.50% |
| **Unknown** | 3,175,623 | | 41.20% | 105,210 | 31.09% | 9,615 | 31.36% |
|  |  | |  |  |  |  |  |
| **IMD Quintile** | |  |  |  |  |  |  |
| **1 (most affluent)** | 1,338,388 | | 17.36% | 52,280 | 15.45% | 5,280 | 17.22% |
| **2** | 1,496,051 | | 19.41% | 61,008 | 18.03% | 5,934 | 19.36% |
| **3** | 1,621,330 | | 21.04% | 71,982 | 21.27% | 6,517 | 21.26% |
| **4** | 1,723,122 | | 22.36% | 79,130 | 23.38% | 6,910 | 22.54% |
| **5 (least affluent)** | 1,470,726 | | 19.08% | 72,094 | 21.31% | 5,833 | 19.03% |

The gender breakdown of the whole CPRD population in 2014 is similar to that over the whole study period. The proportion of males and those of South Asian ethnicity with type 1 or type 2 diabetes is increased in 2014 compared to the whole study period.

Table 7. Demographic characteristics of the CPRD population 2014

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Population** | **CPRD** | |  | **T2DM** |  | **T1DM** |  |
|  | **N** | | **%** | **N** | **%** | **N** | **%** |
| **Denominator (12+)** | **3,207,886** | | **100%** | **160,415** | **100%** | **13,788** | **100%** |
| **Gender** |  | |  |  |  |  |  |
| **Male** | 1,528,040 | | 49.32**%** | 90,141 | 56.19**%** | 8,002 | 58.04**%** |
| **Female** | 1,625,846 | | 50.68**%** | 70,274 | 43.81**%** | 5,786 | 41.96**%** |
|  |  | |  |  |  |  |  |
| **Ethnic Group** |  | |  |  |  |  |  |
| **White** | 1,749,939 | | 54.55**%** | 95,157 | 59.32**%** | 9,001 | 65.28**%** |
| **South Asian** | 94,210 | | 2.94**%** | 8,234 | 5.13**%** | 212 | 1.54**%** |
| **Black** | 60,576 | | 1.89**%** | 3,747 | 2.34**%** | 155 | 1.12**%** |
| **Other** | 42,292 | | 1.32**%** | 1,903 | 1.19**%** | 115 | 0.83**%** |
| **Mixed** | 18,184 | | 0.57**%** | 524 | 0.33**%** | 65 | 0.47**%** |
| **Unknown** | 1,242,685 | | 38.74**%** | 50,855 | 31.70**%** | 4,240 | 30.75**%** |
|  |  | |  |  |  |  |  |
|  | |  |  |  |  |  |  |
| **1 (most affluent)** | 627,041 | | 19.73**%** | 26,408 | 16.58**%** | 2,710 | 19.80**%** |
| **2** | 672,597 | | 21.17**%** | 31,378 | 19.70**%** | 2,824 | 20.63**%** |
| **3** | 607,787 | | 19.13**%** | 31,801 | 19.96**%** | 2,708 | 19.79**%** |
| **4** | 696,504 | | 21.92**%** | 36,785 | 23.09**%** | 3,015 | 22.03**%** |
| **5 (least affluent)** | 573,630 | | 18.05**%** | 32,918 | 20.67**%** | 2,430 | 17.75**%** |

#### Overall Prevalence of diabetic retinopathy

During the study period there were a total of 144,362 prevalent cases of diabetic retinopathy giving an overall prevalence of 1.87% in the entire CPRD population, 28.31% in the population with type 2 diabetes and 48.43% in the population with type 1 diabetes. In both the CPRD and T2DM populations, the prevalence of diabetic retinopathy is higher amongst males and those of South Asian ethnicity. Amongst those with Type 1 diabetes, prevalence is highest in the White ethnic group compared to all other ethnic groups and slightly higher for females compared to males. In all study populations, the prevalence of diabetic retinopathy increases with deprivation.

***Table 8. Overall prevalence of Diabetic Retinopathy in the CPRD 2004-2014***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diabetic Retinopathy | | CPRD | | | | T2DM | | T1DM | |
| Denominator (12+) | | **7,707,475** | | **100.00%** | | **338,390** | **100%** | **30,657** | **100%** |
|  | | N with DR | | % with DR | | N with DR | % with DR | N with DR | % with DR |
| Prevalent DR | | 144,362 | | 1.87% | | 95,807 | 28.31% | 14,846 | 48.43% |
|  | |  | |  | |  |  |  |  |
| Gender | |  | |  | |  |  |  |  |
| Male | | 80,148 | | 2.11% | | 54,309 | 29.02% | 8,579 | 48.30% |
| Female | | 64,214 | | 1.64% | | 41,498 | 27.44% | 6,267 | 48.60% |
|  | |  | |  | |  |  |  |  |
| Ethnic Group | |  | |  | |  |  |  |  |
| White | | 91,447 | | 2.28% | | 60,781 | 29.62% | 9,953 | 50.24% |
| South Asian | | 5,727 | | 2.57% | | 4,743 | 29.94% | 184 | 40.62% |
| Black | | 2,684 | | 1.89% | | 2,074 | 28.86% | 124 | 33.24% |
| Other | | 1,461 | | 1.34% | | 1,085 | 27.88% | 93 | 36.61% |
| Mixed | | 491 | | 0.97% | | 322 | 29.41% | 51 | 33.55% |
| Unknown | | 42,552 | | 1.34% | | 26,802 | 25.47% | 4,441 | 46.19% |
|  | |  | |  | |  |  |  |  |
| IMD Quintile |  | |  | |  | |  |  |  |
| 1 (most affluent) | | 23,915 | | 1.79% | | 14,669 | 15.45% | 2,714 | 18.4% |
| 2 | | 27,123 | | 1.81% | | 17,601 | 18.53% | 2,869 | 19.45% |
| 3 | | 29,494 | | 1.82% | | 19,170 | 20.18% | 3,104 | 21.05% |
| 4 | | 33,143 | | 1.92% | | 22,850 | 24.06% | 3,281 | 22.25% |
| 5 (least affluent) | | 29,410 | | 2.0% | | 20,685 | 21.78% | 2,779 | 18.84% |

In 2014, there were a total of 76,637 prevalent cases of diabetic retinopathy, giving an overall prevalence of 2.39% in the entire CPRD population, 30.65 in the population with type 2 diabetes and 55% in the population with type 1 diabetes. Differences by gender ethnic group, and deprivation quintile remain apparent.

Table 9. Overall prevalence of Diabetic Retinopathy in the CPRD 2014

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diabetic Retinopathy | | CPRD | | | | T2DM | | T1DM | |
| Denominator (12+) | | **3,207,886** | | **100%** | | **160,415** | **100%** | **13,788** | **100%** |
| Prevalent DR | | 73,637 | | 2.39% | | 49,166 | 30.65% | 7,583 | 55.0% |
|  | |  | |  | |  |  |  |  |
| Gender | |  | |  | |  |  |  |  |
| Male | | 41,492 | | 2.62% | | 28,299 | 31.39% | 4,393 | 54.90% |
| Female | | 32,145 | | 1.98% | | 20,867 | 29.69% | 3,190 | 55.13 |
|  | |  | |  | |  |  |  |  |
| Ethnic Group | |  | |  | |  |  |  |  |
| White | | 45,726 | | 2.61% | | 30,253 | 31.79% | 5,028 | 55.86% |
| South Asian | | 3,088 | | 3.28% | | 2,545 | 30.91% | 94 | 44.34% |
| Black | | 1,526 | | 2.52% | | 1,190 | 31.76% | 59 | 38.06% |
| Other | | 808 | | 1.91% | | 605 | 31.79% | 47 | 40.87% |
| Mixed | | 236 | | 1.30% | | 156 | 29.77% | 22 | 33.85% |
| Unknown | | 22,253 | | 1.79% | | 14,417 | 28.35% | 2,333 | 55.02% |
|  | |  | |  | |  |  |  |  |
| IMD Quintile |  | |  | |  | |  |  |  |
| 1 (most affluent) | | 12,435 | | 1.98% | | 7,354 | 27.85% | 1,504 | 55.50% |
| 2 | | 14,662 | | 2.18% | | 9,780 | 31.17% | 1,558 | 55.17% |
| 3 | | 14,969 | | 2.46% | | 9,910 | 31.16% | 1,541 | 56.91% |
| 4 | | 17,344 | | 2.49% | | 12,144 | 33.01% | 1,688 | 55.99% |
| 5 (least affluent) | | 13,420 | | 2.34% | | 9,456 | 28.73% | 1,233 | 50.74% |

#### Overall Prevalence of severe diabetic retinopathy

During the study period there were a total of 13,873 prevalent cases of severe diabetic retinopathy giving an overall prevalence of 0.18% in the entire CPRD population, 2.41% in the population with type 2 diabetes and 10.25% in the population with type 1 diabetes. In all study populations the prevalence of severe diabetic retinopathy is raised in Males compared to Females. In the CPRD and T2DM populations, prevalanece is highest in the South Asian population, while in the T1DM population, prevalence is highest in the White population. In all study populations, the prevalence of diabetic retinopathy increases with deprivation until quintile 4.

***Table 10. Overall prevalence of severe Diabetic Retinopathy in the CPRD 2004-2014***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Severe Retinopathy Retinopathy | | CPRD | | | | | T2DM | | | | T1DM | | | |
|  | | N with DR | | % with DR | | | N with DR | | % with DR | | N with DR | | % with DR | |
| Denominator (12+) | | **7,707,475** | | | **100.00%** | | | **338,390** | | **100%** | | **30,657** | | **100%** |
| Prevalent Severe DR | | 13,873 | | 0.18% | | | 8,158 | | 2.41% | | 3,142 | | 10.25% | |
|  | |  | |  | | |  | |  | |  | |  | |
| Gender | |  | |  | | |  | |  | |  | |  | |
| Male | | 8,207 | | 0.22% | | | 4,981 | | 2.66% | | 1,890 | | 10.64% | |
| Female | | 5,666 | | 0.14% | | | 3,177 | | 2.10% | | 1,252 | | 9.71% | |
|  | |  | |  | | |  | |  | |  | |  | |
| Ethnic Group | |  | |  | | |  | |  | |  | |  | |
| White | | 8,688 | | 0.22% | | | 4,932 | | 2.40% | | 2,185 | | 11.03% | |
| South Asian | | 679 | | 0.30% | | | 559 | | 3.53% | | 34 | | 7.51% | |
| Black | | 336 | | 0.24% | | | 244 | | 3.40% | | 24 | | 6.43% | |
| Other | | 137 | | 0.13% | | | 97 | | 2.49% | | 16 | | 6.30% | |
| Mixed | | 57 | | 0.11% | | | 40 | | 3.65% | | 9 | | 5.92% | |
| Unknown | | 3,976 | | 0.13% | | | 2,286 | | 2.17% | | 874 | | 9.09% | |
|  | |  | |  | | |  | |  | |  | |  | |
| IMD Quintile |  | |  | | |  | | |  | |  | |  | |
| 1 (most affluent) | | 2,078 | | 0.16% | | | 1,007 | | 12.51% | | 524 | | 16.8% | |
| 2 | | 2,520 | | 0.17% | | | 1,459 | | 18.12% | | 591 | | 18.95% | |
| 3 | | 2,778 | | 0.17% | | | 1,599 | | 19.86% | | 659 | | 21.13% | |
| 4 | | 3,435 | | 0.20% | | | 2,071 | | 25.72% | | 751 | | 24.08% | |
| 5 (least affluent) | | 2,910 | | 0.20% | | | 1,916 | | 23.80% | | 594 | | 19.04% | |

In 2014 there were a total of 6,929 prevalent cases of severe diabetic retinopathy, giving an overall prevalence of 0.22% in the entire CPRD population, 2.41% in the population with type 2 diabetes and 12.45% in the population with type 1 diabetes. Differences in prevalence by gender, ethnic group, and deprivation quintile mirror those found in the entire study population from 2004-2014.

Table 11. Overall prevalence of severe Diabetic Retinopathy in the CPRD 2014

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Severe Retinopathy Retinopathy | | CPRD | | | | | T2DM | | | | T1DM | | | |
|  | | N with DR | | % with DR | | | N with DR | | % with DR | | N with DR | | % with DR | |
| Denominator (12+) | | **3,207,886** | | | **100%** | | | **160,415** | | **100%** | | **13,788** | | **100%** |
| Prevalent Severe DR | | 6,929 | | 0.22% | | | 3,868 | | 2.41% | | 1,717 | | 12.45% | |
|  | |  | |  | | |  | |  | |  | |  | |
| Gender | |  | |  | | |  | |  | |  | |  | |
| Male | | 4,185 | | 0.26% | | | 2,439 | | 2.71% | | 1,025 | | 12.81% | |
| Female | | 2,744 | | 0.17% | | | 1,429 | | 2.03% | | 692 | | 11.96% | |
|  | |  | |  | | |  | |  | |  | |  | |
| Ethnic Group | |  | |  | | |  | |  | |  | |  | |
| White | | 4,183 | | 0.24% | | | 2,197 | | 2.31% | | 1,175 | | 13.05% | |
| South Asian | | 365 | | 0.39% | | | 293 | | 3.56% | | 12 | | 5.66% | |
| Black | | 184 | | 0.30% | | | 134 | | 3.58%  3.2.36 | | 12 | | 7.74% | |
| Other | | 66 | | 0.16% | | | 45 | | 2.36% | | 7 | | 6.09% | |
| Mixed | | 32 | | 0.18% | | | 24 | | 4.58% | | 5 | | 7.69% | |
| Unknown | | 2,099 | | 0.17% | | | 1,175 | | 2.31% | | 506 | | 11.93% | |
|  | |  | |  | | |  | |  | |  | |  | |
| IMD Quintile |  | |  | | |  | | |  | |  | |  | |
| 1 (most affluent) | | 1,093 | | 0.17% | | | 472 | | 1.79% | | 313 | | 11.55% | |
| 2 | | 1,344 | | 0.20% | | | 752 | | 2.40% | | 351 | | 12.43% | |
| 3 | | 1,323 | | 0.22% | | | 727 | | 2.29% | | 349 | | 12.89% | |
| 4 | | 1,729 | | 0.25% | | | 1,009 | | 2.74% | | 404 | | 13.40% | |
| 5 (least affluent) | | 1,333 | | 0.23% | | | 831 | | 2.52% | | 287 | | 11.81% | |

#### Prevalence of diabetes and retinopathy in the total CPRD population

##### Overall

The prevalence of diabetic retinopathy alongside that of type 1 and type 2 diabetes in the whole CPRD population over the period 2004 to 2014 is displayed below. The prevalence of type 1 diabetes in the entire CPRD population aged 12 and over is 0.4% while the prevalence of type 2 diabetes is 4.39%. The prevalence of diabetic retinopathy is 1.87% while the prevalence of severe diabetic retinopathy is 0.18%

Figure 2. Prevalence of diabetes and retinopathy in the CPRD

The prevalence of diabetic retinopathy appears to rise in tandem with the rising prevalence of type 2 diabetes. The prevalence of severe diabetic retinopathy and type 1 diabetes remain largely static over the study period.

Figure 3. Prevalence of diabetes and retinopathy in the CPRD 2004-2014

##### By Gender

The overall prevalence of both diabetes and diabetic retinopathy is consistently higher in males compared to females.

Figure 4. Prevalence of diabetes and retinopathy in the CPRD by gender

When examined separately by gender, the prevalence of both type 1 and type 2 diabetes and diabetic retinopathy is lower for women in all years compared to men, with the gap widening from 2009 onwards. The same trend holds true for both overall retinopathy and severe retinopathy.

Figure 5. Prevalence of all retinopathy in the CPRD 2004-2014 by gender

Figure 6. Prevalence of severe retinopathy in the CPRD 2004-2014 by gender

Figure 7. Prevalence of type 2 diabetes in the CPRD 2004-2014 by gender

Figure 8. Prevalence of type 1 diabetes in the CPRD 2004-2014 by gender

##### By Age group

After splitting the population into ten year age bands, there is a clear trend towards increasing prevalence both over time and with increasing age. The increase in prevalence of retinopathy over time is most pronounced for individuals aged 55 and over. The same trend is apparent for severe diabetic retinopathy.Examining trends in the prevalence of type 2 diabetes by age group and time period, there is a slight increase in prevalence over time, which is most pronounced in the oldest age groups.

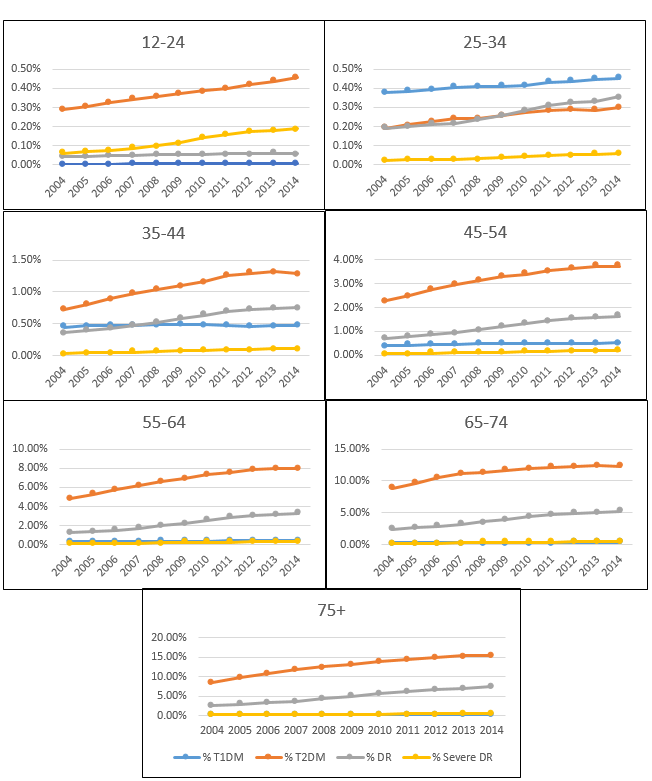
******

Figure 9. Prevalence of diabetes melltus and retinopathy in the CPRD 2004-2014 by age group

##### By Ethnic Group

By ethnic group, the prevalence of type 2 diabetes and retinopathy is highest in the South Asian group while prevalence of type 1 diabetes is highest in the White group.

Figure 10. Prevalence of diabetes mellitus and retinopathy in the CPRD by ethnic group

Over time, the prevalence of retinopathy and severe retinopathy increased. Prevalence of both forms of retinopathy was consistently highest for the South Asian population, followed by the Black African/Caribbean and White populations, for whom prevalence overlapped from 2008 onwards. Prevalence was lowest for those of Mixed or unknown ethnicity.

As with retinopathy, the prevalence of type 2 diabetes is highest for the South Asian group followed by the Black African/Caribbean group and the White group. Prevalence increases over time in all groups, most notably for the White and unknown ethnic groups. Prevalence of type 1 diabetes remains stable over time for most ethnic groups, rising slightly in recent years for the White,Other, and Mixed ethnic groups.

Figure 11. Prevalence of all retinopathy in the CPRD 2004-2014 by ethnic group

Figure 12. Prevalence of severe retinopathy in the CPRD 2004-2014 by ethnic group

Figure 13. Prevalence of type 2 diabetes in the CPRD 2004-2014 by ethnic group

Figure 14. Prevalence of type 1 diabetes in the CPRD 2004-2014 by ethnic group

##### By Index of Multiple Deprivation Quintile

The prevalence of type two diabetes and retinopathy showed a clear trend with increasing deprivation. No relationship between deprivation and the prevalence of type 1 diabetes or severe retinopathy is evident.

Figure 15. Prevalence of diabetes and retinopathy in the CPRD by deprivation quintile

Figure 16. Prevalence of all retinopathy in the CPRD 2004-2014 by deprivation quintile

Figure 17. Prevalence of severe retinopathy in the CPRD 2004-2014 by deprivation quintile

Figure 18. Prevalence of type 2 diabetes in the CPRD 2004-2014 by deprivation quintile

Figure 19. Prevalence of type 1 diabetes in the CPRD 2004-2014 by deprivation quintile

##### By Geographic Region

By geographic region the prevalence of type 2 diabetes and retinopathy were both highest in Wales, followed by the North West of England. The prevalence of severe diabetic retinopathy was highest in the North East of England while the prevalence of type 1 diabetes was highest in Scotland.

Figure 20. Prevalence of diabetes and retinopathy in the CPRD by region

Over time, the prevalence of retinopathy increases at variable rates depending on region. While the annual change is low in Northern Ireland, the annual change is higher in regions such as Scotland and the North East of England.

For severe diabetic retinopathy the annual increases are more modest overall, except for in areas such as the North East of England, the East Midlands, and the South West of England, where increases over time are steeper.

Figure 21. Prevalence of retinopathy in the CPRD 2004-2014 by region

Figure 22. Prevalence of severe retinopathy in the CPRD 2004-2014 by region

#### Prevalence of retinopathy in patients with Type 2 diabetes

##### By Gender

The overall prevalence of all retinopathy and severe retinopathy is higher in males compared to females with type 2 diabetes.

Figure 23. Prevalence of retinopathy in the T2DM population by gender

Over time, the prevalence of both retinopathy and severe retinopathy rise at a slightly higher rate for men compared to women, increasing the gap between genders over time.

Figure 24. Prevalence of retinopathy in the T2DM population 2004-2014 by gender

##### By Age Group

In the population with type 2 diabetes, the prevalence of both retinopathy and severe retinopathy increases with age and over calendar period, particulary for individuals aged 25 and over. The rate of increase is highest in the oldest group of those aged 75 and over.

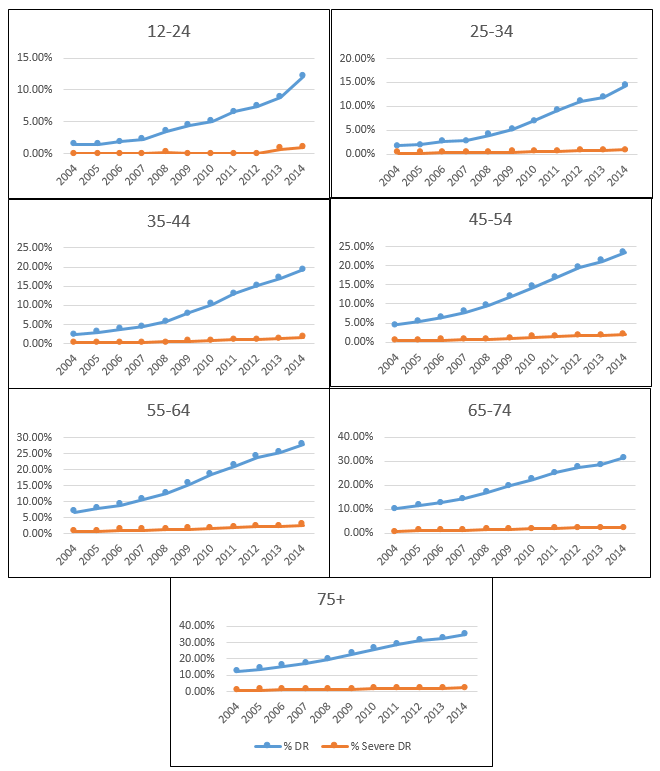


Figure 25. Prevalence of retinopathy in the T2DM population 2004-2014 by age group

##### By Ethnic Group

Amongst individuals with type 2 diabetes, though the overall prevalence of retinopathy is comparable between ethnic groups, differences in the progression over time are apparent.

Figure 26. Prevalence of retinopathy in the T2DM population by ethnic group

Until 2010, the prevalence of retinopathy is highest in the South Asian population. After this time, the prevalence overlaps between the South Asian, White, Black African/Caribbean, and Mixed ethic groups. The prevalence is lowest for those with unknown ethnicity in all years. The same trends are apparent for those with severe diabetic retinopathy, with the increase over time more modest.

Figure 27. Prevalence of all retinopathy in the T2DM population 2004-2014 by ethnic group

Figure 28. Prevalence of severe retinopathy in the T2DM population 2004-2014 by ethnic group

##### By Index of Multiple Deprivation Quintile

The overall prevalence of diabetic retinopathy is equivalent between deprivation quintiles. The prevalence of severe retinopathy incraeses slightly with increasing deprivation.

Figure 29. Prevalence of retinopathy in the T2DM population by deprivation quintile

Amongst individuals with type two diabetes, there is an overlap between deprivation groups with respect to the prevalence of both retinopathy and severe retinopathy, with no clear trend apparent.

Figure 30. Prevalence of all retinopathy in the T2DM population 2004-2014 by deprivation quintile

Figure 31. Prevalence of severe retinopathy in the T2DM population 2004-2014 by deprivation quintile

##### By Geographic Region

By geographic region, variability in the prevalence of retinopathy and severe retinopathy is evident. Overall prevalence of retinopathy is highest in Scotland and lowest in Northern Ireland. The prevalence of severe retinopathy is highest in the North East of England and lowest in the South East of England.

Figure 32. Prevalence of retinopathy in the T2DM population by region

Prevalence of both retinopathy and severe retinopathy increases over time in all regions, with the rate of change higher in some regions such as the North East of England, the East Midlands and Scotland than in other regions such as Ireland and the East of England.

Figure 33. Prevalence of retinopathy in the T2DM population 2004-2014 by region

Figure 34. Prevalence of severe retinopathy in the T2DM population 2004-2014 by region

#### Prevalence of retinopathy in patients with Type 1 diabetes

##### By Gender

Amongst individuals with type 1 diabetes the prevalence of retinopathy is comparable between females and males.

Figure 35. Prevalence of retinopathy in the T1DM population by gender

Over time, the prevalence of all retinopathy is similar between males and females while the prevalence of severe retinopathy is higher for males compared to females in all years except 2004.

Figure 36. Prevalence of retinopathy in the T1DM population 2004-2014 by gender

##### By Age Group

By age group, the prevalence of retinopathy differes significantly for those aged 16-44, but overlaps for those aged 45 and over, particularly from 2010 onwards. In most years, the prevalence of severe retinopathy increases by age group until age 65 and then drops again for those in the highest age group of age 75 and older.

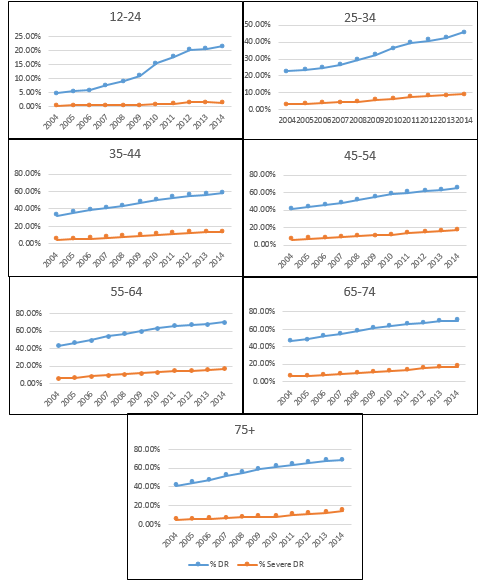


Figure 37. Prevalence of retinopathy in the T1DM population 2004-2014 by age group

##### By Ethnic Group

The overall prevalence of both types of retinopathy is highest in the White population. All retinopathy is lowest in the Black African/Caribbean group while severe retinopathy is lowest in the Mixed group.

Figure 38. Prevalence of diabetic retinopathy in the T1DM population by ethnic group

Over time, there is a trend towards raised and equivalent prevalence of retinopathy in the White and Unknown ethnic groups. Prevalence for all other ethnic groups is lower. In most years the prevalence of retinopathy is lowest for the Black African/Population, though this difference dissapears after 2012. The prevalence of severe retinopathy is highest in the Mixed group from 2004-2012 and lowest in the Black African/Caribbean group from 2004-2010 after which time it is lowest in the Other ethnic group.

Figure 39. Prevalence of all diabetic retinopathy in the T1DM population 2004-2014 by ethnic group

Figure 40. Prevalence of severe diabetic retinopathy in the T1DM population 2004-2014 by ethnic group

##### By Index of Multiple Deprivation Quintile

In the population with type 1 diabetes, the prevalence of diabetic retinopathy is highest in the most affluent quintile and lowest in the fourth quintile.

Figure 41. Prevalence of diabetic retinopathy in the T1DM population by deprivation quintile

The prevalence of retinopathy is highest in the least deprived quintile in all years until 2013, after which the prevalence becomes equivalent in all groups except the most deprived quintile, for whom prevalence is lower.

Prevalence of severe retinopathy is highest in the 2nd least deprived quintile in most years, with prevalence largely equivalent between all other groups until 2014, where there is a trend towards decreasing prevalence as deprivation increases.

Figure 42. Prevalence of all diabetic retinopathy in the T1DM population 2004-2014 by deprivation quintile

Figure 43. Prevalence of severe diabetic retinopathy in the T1DM population 2004-2014 by deprivation quintile

##### By Geographic Region

In the population with type 1 diabetes, the prevalence of retinopathy is largely equivalent between regions, with the prevalence of all diabetic retinopathy highest in Scotland and the prevalence of severe retinopathy highest in Wales.

Figure 44. Prevalence of retinopathy in the T1DM population by region

Figure 45. Prevalence of retinopathy in the T1DM population 2004-2014 by region

A similar trend is apperent for the prevalence of severe diabetic retinopathy, with one outlier in the East Midlands for 2014, due to small population size in the CPRD.

Figure 46. Prevalence of severe diabetic retinopathy in the T1DM population by region

### Results of incidence analysis

In the CPRD, a total of 86,522 incident cases of diabetic retinopathy occured over the study period of January 2004 to December 2014. Of these cases, 5,536 were incident cases of severe diabetic retinopathy.

#### Incidence of diabetic retinopathy in the total CPRD population

The crude incidence rate of diabetic retinopathy is 21.60 per 10,000 person years of follow-up. The crude incidence rate of severe diabetic retinopathy is 1.38 per 10,000 person years of follow-up. Hazard ratios resulting from Cox proportional-hazards regression show that the risk of developing retinopathy is reduced in females compared to males by 29% (Hazard ratio 0.71, CI95% 0.70-0.72) for all retinopathy and by 37% for severe retinopathy (HR 0.63, CI95% 0.60-0.67).

Relative to the youngest age group, the risk of deveoping diabetic retinopathy increases with each age group, with risk 24 times higher in those aged 75 and over compared to those aged 12-24 (HR 24.04, CI95% 22.86-25.28). Risk increases by age are more moderate for severe retinopathy, with risk peaking in those aged 65-74 instead of for those aged 75 and over (HR 14.40, CI95% 12.10-17.13).

By calendar yaer, risk of all retinopathy peaks in 2009 (HR 1.80, CI95% 1.74-1.85), after which point the risk decreases in each year till 2014. Risk of severe retinopathy peaks in 2007, (HR 1.14 CI95% 1.02-1.27) with a continuous reduction in risk thereafter.

By region, risk of all retinopathy is lowest in Northern Ireland and highest in the North East of England and Scotland. Risk of severe retinopathy is highest in the North East and South East of England and significantly reduced in all other regions.

By deprivation, risk of diabetic retinopathy is increased in all deprivation quintiles relative to the most affluent group, with risk increased by 31% in the least affluent group relative to the most affluent group (HR 1.31, CI95% 1.28-1.34). Risk of severe retinopathy is also higher in all deprivation quintiles relative to the most affluent group- and equivalent for those in the 2nd and 5th quintiles.

Table 12. Incidence of Diabetic Retinopathy in the CPRD



#### Incidence of diabetic retinopathy in patients with Type 2 diabetes

Amongst patients with type 2 diabetes, hazard ratios show that the risk of developing retinopathy is reduced in females compared to males by 8% (Hazard ratio 0.92, CI95% 0.91-0.93) for all retinopathy and by 20% for severe retinopathy (HR 0.80, CI95% 0.75-0.86). Relative to the youngest age group, the risk of deveoping diabetic retinopathy increases with each age group, with risk 2.8 times higher in those aged 75 and over compared to those aged 12-24 (HR 2.83, CI95% 2.33-3.45). Risk increases by age are slightly larger for severe retinopathy, with risk peaking in those aged 45-54 instead of for those aged 75 and over (HR 4.60, CI95% 1.72-12.29).

By calendar time, risk of all retinopathy peaks in 2011 (HR 2.70 CI95% 2.60-2.81), after which point the risk decreases in each year till 2014. Risk of severe retinopathy peaks in 2007, (HR 1.34 CI95% 1.17-1.53) with a continuous reduction in risk thereafter. By 2014, the risk of severe retinopathy is reduced by 50% compared to the start of follow-up in 2004 (HR 0.50 CI95% 0.40-0.63).

By region, risk of all retinopathy is lowest in Northern Ireland and highest in the North East of England and Scotland. Risk of severe retinopathy is comparable between most regions with notable reductions in the North West, East and South East of England, and Northern Ireland. By deprivation, risk of diabetic retinopathy is increased in most deprivation quintiles relative to the most affluent group, with risk increased by 14% in the quintile 4 relative to the most affluent group (HR 1.14, CI95% 1.12-1.17). Differences in risk of severe retinopathy are more pronounced, with risk increased by 65% in quintile 4 relative to the most affluent group (HR 1.65, CI95% 1.47-1.84).

Table 13. Incidence of Diabetic Retinopathy in the population with type 2 diabetes



#### Incidence of diabetic retinopathy in patients with Type 1 diabetes

Amongst individuals with type 1 diabetes, the crude incidence rate of diabetic retinopathy is double that of individuals with type 2 diabetes at 642.71 events per 10,000 person years. The crude incidence rate of severe diabetic retinopathy is almost five times higher in the T1DM population compared to the T2DM population at 86.89 events per 10,000 person years.

Hazard ratios resulting from Cox proportional-hazards regression show that the risk of developing retinopathy is comparable between males and females. Relative to the youngest age group, the risk of deveoping diabetic retinopathy increases until age group 45-54, with risk 1.85 times higher in those aged 45-54 and over compared to those aged 12-24 (HR 1.85 CI95% 1.71-2.01). Risk increases by age are slightly larger for those with severe retinopathy, with risk peaking in those aged 25-34 and declining thereafter (HR 2.79 CI95% 2.23-3.49).

By calendar time, risk of all retinopathy peaks in 2009 (HR 1.64 CI95% 1.47-1.83), after which point the risk decreases in each year till 2014. Risk of severe retinopathy does not vary significantly between 2004-2012, and reduces thereafter. By 2014, the risk of severe retinopathy is reduced by 72% compared to the start of follow-up in 2004 (HR 0.28 CI95% 0.17-0.47).

By region, risk of all retinopathy is comparable between most regions with notable reductions in Northern Ireland and Scotland. No significant variations in the risk of severe retinopathy by region is evident, with weak evidence for an increase in Wales relative to the rest of the UK (HR 1.77 CI95% 1.10-3.10). By deprivation, risk of both overall and severe diabetic retinopathy is comparable between the least affluent and most affluent quintiles.

Table 14. Incidence of Diabetic Retinopathy in the population with type one diabetes******

### Time to visual impairment amongst those with diabetic retinopathy

From the 144,736 prevalent cases of diabetic retinopathy in the CPRD, 4,358 individuals whose first visual impairment diagnosis was prior to their first diagnosis of diabetic retinopathy or major eye disease were removed from the dataset, leaving a final study sample of 139,173 individuals with diabetic retinopathy, with or without co-morbid eye disease. Within the study sample, 6,585 individuals had diagnosis of visual impairment subsequent to their retinopathy or eye disease diagnosis.

For patients with both diabetic retinopathy and major eye disease, the first recorded diagnosis of eye disease is tabulated below. The most common co-morbid eye disease was cataract, followed by glaucoma and macular degeneration.

Table 15. Breakdown of major eye disease categories for patients with diabetic retinopathy

|  |  |  |
| --- | --- | --- |
| **Eye disease category** | **N** | **%** |
| Cataract | 26871 | 68.2 |
| Glaucoma | 7137 | 18.1 |
| Macular degeneration | 2212 | 5.6 |
| Age related macular degeneration | 3173 | 8.1 |
| Total | 39390 | 100 |

The analysis was conducted separately for the 98,823 patients with diabetic retinpathy alone and the 39,390 patients with diabetic retinopathy plus co-morbid glucoma, cataracts, or macular degeneration. In all subgroup analyses, the time to visual impairment is shorter for individuals with more than one eye disease than for those with retinopathy alone. The median time to visual impairment is 4.74 years for patients with retinopathy alone (range 0-47.6 years) and 4.03 years for those with retinopathy and co-morbid eye disease (range 0-28.6 years).

By diabetic status, visual impairment occurs approximately two years earlier in the population with type 2 diabetes compared to the population with type 1 diabetes. By gender, time to visual impairment is comparable for those with retinopathy alone, and shorter for males amongst those with retinopathy and co-morbid eye disease. By ethnic group, time to visual impairment is shortest for the Black African/Caribbean group and longest for the White/Unknown group amongst those with retinopathy alone. Amongst those with co-morbid eye disease, the trend is reversed. By deprivation quintile, time to visual impairment decreases as deprivation increases amongst those with retinopathy alone. In the population with co-morbid eye disease, no consistent trend is apparent.

Table 16. Time to visual impairment amongst people with Diabetic Retinopathy

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## Discussion

According to the Office for National Statistics, the size of the UK population at the midpoint of 2014 was 64.6 million people.(21) Given that the CPRD is representative of the UK population structure, we estimate that the absolute number of people with any form of diabetic retinopathy in the UK is approximately 1.5 million and that the absolute number of people with severe diabetic retinopathy is around 140,000.

### Main findings

Over the study period of 2004-2014, the average prevalence of DR is 48.3% in T1DM and 28.3% in T2DM. In 2014, prevalence of diabetic retinopathy is 54.6% in T1DM and 30.0% in T2DM rising to 68% and 35% respectively in the oldest age group.

The overall prevalence of diabetic retinopathy found in the CPRD is comparable to that of smaller, regional contemporaneous studies. A 2015 study of the Welsh National Diabetic Retinopathy Screening Service has reported that the prevalence of diabetic retinopathy is 56% in those with type 1 diabetes and 30.3% in those with type 2 diabetes.(4) These figures tally closely with the respective figures of 48.4% and 28.3% from our study. Similarities extend to severe diabetic retinopathy also; the same study reports prevalences of 11.2% in those with type 1 diabetes and 2.9% in those with type 2 diabetes. Our study has found the prevalence to be 10.3% and 2.4% respectively

The differences in prevalence by gender and ethnic group found here confirm those of recent smaller UK based studies. In 2012, Sivaprasad et al. reported reduced odds of prevalent retinopathy in women compared to men (OR 0.93 CI95% 0.90-0.97) and raised odds in South Asian and Black African/Caribbean groups compared to White (South Asian OR 1.10 CI95% 1.02-1.18, Black OR 1.79, CI95% 1.70-1.89) amongst individuals with diabetes in the UK. (7)

The overall prevelance of DR has been increasing steadily over the last 10 years in parallel to that of T2DM. Increases in prevalence of DR are likely to be related to increasing prevalence of T2DM and potentially increased ascertainment through nationwide screening programs.

In the general CPRD population, several inequalities by socio-demographic group are apparent, with prevalence of diabetic retinopathy highest in the South Asian population and in the least affluent quintile. Within the T2DM population, differences by ethnicity and IMD are small, reaching equivalency in later years. This suggests that the overall increase in DR prevalence is driven by the increasing prevalence of T2DM. The pattern differs for incident DR, with risk of new events significantly raised for ethnic minority groups compared to White.

Turning to patients with type 1 diabetes, the prevalence of both T1DM and retinopathy within T1DM relatively stable over time. This is to be expected as the prevalence and incidence of T1DM is not subject to large increases due to an increasingly obesogenic environment, as is the case with the current epidemic of type 2 diabetes. Within this group, the patterns of incidence are similar to those of prevalence, with no apparent differences by ethnic group or deprivation.

Median time to visual impairment was found to be shorter for those with both diabetic retinopathy and major eye disease compared to those with diabetic retinopathy alone (4.03 years vs. 4.75 years). In the group with retinopathy alone we can be fairly confident that the subsequent visual impairment is due to the presence of retinopathy and the progression of diabetes. In those with multiple eye diseases, we can infer that diabetic retinopathy contributed to the visual impairment, but it is impossible to attribute cause to retinopathy alone due to the overlapping disease processes at work.

### Strengths of the study

This study made use of high levels of ethnicity recording and linkage with ONS to describe patterns by ethnicity and IMD. This study consitutes the largest ever sample size to examine trends in the burden of diabetes and diabetic retinopathy in the UK. This allowed for sufficient power to detect relationships between populations stratified by gender, ethnic group, geographic region and deprivation, which is often unfeasible in smaller studies where population sizes do not allow for such granular comparisons.

At the time of publication, this is the only national study to examine ethnicity and IMD in relation to the prevalence and incidence of diabetic retinopathy.

The advantage of routine electronic health databases is that they are regularly updated and can be used to provide timely information on the demographic makeup of the general population and on areas of growing healthcare need.

The data in the CPRD are prospectively collected and, as a result, the data are not subject to recall bias (the presence of a disease outcome affects the reporting of exposure status) or observer bias (the knowledge of the patient’s disease status influences ascertainment or recording of exposure).

### Limitations

The primary purpose of the clinical data held in the CPRD is for patient care, rather than research. By its nature it only includes information gathered at consultation and is thus routinely collected rather than researcher-led. As a result, the completeness and accuracy of data are subject to temporal changes in coding practices, health priorities and population need. Anything not reported to the general practitioner is necessarily not recorded. The absence of a code does not necessarily mean that an individual is free from that condition, but must also be interpreted as being unknown.

In addition to incomplete data, a further potential problem with routinely electronic health records is incorrect coding stemming from errors in the way data is entered. A wide range of studies have found the validity of diagnoses and process of care measures in CPRD to be high.(22–24) Combined with the fact that the CPRD data are subject to ongoing internal quality checks and that concerns with data quality are fed back to the general practices, researchers can be reassured that errors which do occur in the database are kept to a minimum.

This study relied solely on the coded diagnoses of diabetes, retinopathy, eye disease, and visual impairment. We did not have access to data from other sources such as retinal photography or practitioner letters, which could have been used to validate the diagnoses. As the recording all of these codes is incentivised under the Quality and Outcomes Framework, it is likely that the quality and accuracy of these coded data was high.

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## Appendix

### Read codes for Diabetes Mellitus

| **medcode** | **readcode** | **readterm** | **category** |
| --- | --- | --- | --- |
| 28622 | 2126300 | Diabetes resolved | Diabetes ceased |
| 18766 | 212H.00 | Diabetes resolved | Diabetes ceased |
| 711 | C10..00 | Diabetes mellitus | Vague codes |
| 38986 | C100.00 | Diabetes mellitus with no mention of complication | Vague codes |
| 24490 | C100000 | Diabetes mellitus, juvenile type, no mention of complication | Possible T1 codes |
| 1038 | C100011 | Insulin dependent diabetes mellitus | Possible T1 codes |
| 14803 | C100100 | Diabetes mellitus, adult onset, no mention of complication | Possible T2 codes |
| 14889 | C100111 | Maturity onset diabetes | Possible T2 codes |
| 506 | C100112 | Non-insulin dependent diabetes mellitus | Possible T2 codes |
| 50972 | C100z00 | Diabetes mellitus NOS with no mention of complication | Vague codes |
| 1682 | C101.00 | Diabetes mellitus with ketoacidosis | Vague codes |
| 53200 | C101000 | Diabetes mellitus, juvenile type, with ketoacidosis | Possible T1 codes |
| 54856 | C101100 | Diabetes mellitus, adult onset, with ketoacidosis | Vague codes |
| 38617 | C101y00 | Other specified diabetes mellitus with ketoacidosis | Vague codes |
| 42505 | C101z00 | Diabetes mellitus NOS with ketoacidosis | Vague codes |
| 21482 | C102.00 | Diabetes mellitus with hyperosmolar coma | Vague codes |
| 40023 | C102000 | Diabetes mellitus, juvenile type, with hyperosmolar coma | Possible T1 codes |
| 43139 | C102100 | Diabetes mellitus, adult onset, with hyperosmolar coma | Possible T2 codes |
| 72345 | C102z00 | Diabetes mellitus NOS with hyperosmolar coma | Vague codes |
| 15690 | C103.00 | Diabetes mellitus with ketoacidotic coma | Vague codes |
| 42567 | C103000 | Diabetes mellitus, juvenile type, with ketoacidotic coma | Possible T1 codes |
| 68843 | C103100 | Diabetes mellitus, adult onset, with ketoacidotic coma | Possible T2 codes |
| 59288 | C103y00 | Other specified diabetes mellitus with coma | Vague codes |
| 65062 | C103z00 | Diabetes mellitus NOS with ketoacidotic coma | Vague codes |
| 16502 | C104.00 | Diabetes mellitus with renal manifestation | Vague codes |
| 2475 | C104.11 | Diabetic nephropathy | Vague codes |
| 93922 | C104000 | Diabetes mellitus, juvenile type, with renal manifestation | Possible T1 codes |
| 35105 | C104100 | Diabetes mellitus, adult onset, with renal manifestation | Possible T2 codes |
| 13279 | C104y00 | Other specified diabetes mellitus with renal complications | Vague codes |
| 35107 | C104z00 | Diabetes mellitis with nephropathy NOS | Vague codes |
| 33254 | C105.00 | Diabetes mellitus with ophthalmic manifestation | Vague codes |
| 69748 | C105000 | Diabetes mellitus, juvenile type, + ophthalmic manifestation | Possible T1 codes |
| 41389 | C105100 | Diabetes mellitus, adult onset, + ophthalmic manifestation | Possible T2 codes |
| 47377 | C105y00 | Other specified diabetes mellitus with ophthalmic complicatn | Vague codes |
| 34283 | C105z00 | Diabetes mellitus NOS with ophthalmic manifestation | Vague codes |
| 16230 | C106.00 | Diabetes mellitus with neurological manifestation | Vague codes |
| 59903 | C106.11 | Diabetic amyotrophy | Vague codes |
| 7795 | C106.12 | Diabetes mellitus with neuropathy | Vague codes |
| 16491 | C106.13 | Diabetes mellitus with polyneuropathy | Vague codes |
| 67853 | C106000 | Diabetes mellitus, juvenile, + neurological manifestation | Possible T1 codes |
| 39317 | C106100 | Diabetes mellitus, adult onset, + neurological manifestation | Possible T2 codes |
| 61523 | C106y00 | Other specified diabetes mellitus with neurological comps | Vague codes |
| 22573 | C106z00 | Diabetes mellitus NOS with neurological manifestation | Vague codes |
| 35399 | C107.00 | Diabetes mellitus with peripheral circulatory disorder | Vague codes |
| 32403 | C107.11 | Diabetes mellitus with gangrene | Vague codes |
| 32556 | C107.12 | Diabetes with gangrene | Vague codes |
| 70448 | C107000 | Diabetes mellitus, juvenile +peripheral circulatory disorder | Possible T1 codes |
| 63357 | C107100 | Diabetes mellitus, adult, + peripheral circulatory disorder | Possible T2 codes |
| 33807 | C107200 | Diabetes mellitus, adult with gangrene | Possible T2 codes |
| 69124 | C107300 | IDDM with peripheral circulatory disorder | Probable T1 codes |
| 56803 | C107400 | NIDDM with peripheral circulatory disorder | Probable T2 codes |
| 65025 | C107z00 | Diabetes mellitus NOS with peripheral circulatory disorder | Vague codes |
| 1647 | C108.00 | Insulin dependent diabetes mellitus | Probable T1 codes |
| 18505 | C108.11 | IDDM-Insulin dependent diabetes mellitus | Probable T1 codes |
| 17858 | C108.12 | Type 1 diabetes mellitus | Probable T1 codes |
| 24423 | C108.13 | Type I diabetes mellitus | Probable T1 codes |
| 46963 | C108000 | Insulin-dependent diabetes mellitus with renal complications | Probable T1 codes |
| 61344 | C108011 | Type I diabetes mellitus with renal complications | Probable T1 codes |
| 21983 | C108012 | Type 1 diabetes mellitus with renal complications | Probable T1 codes |
| 49276 | C108100 | Insulin-dependent diabetes mellitus with ophthalmic comps | Probable T1 codes |
| 52283 | C108200 | Insulin-dependent diabetes mellitus with neurological comps | Probable T1 codes |
| 49146 | C108211 | Type I diabetes mellitus with neurological complications | Probable T1 codes |
| 61829 | C108212 | Type 1 diabetes mellitus with neurological complications | Probable T1 codes |
| 52104 | C108300 | Insulin dependent diabetes mellitus with multiple complicatn | Probable T1 codes |
| 26855 | C108400 | Unstable insulin dependant diabetes mellitus | Probable T1 codes |
| 60107 | C108411 | Unstable type I diabetes mellitus | Probable T1 codes |
| 97474 | C108412 | Unstable type 1 diabetes mellitus | Probable T1 codes |
| 44443 | C108500 | Insulin dependent diabetes mellitus with ulcer | Probable T1 codes |
| 51957 | C108511 | Type I diabetes mellitus with ulcer | Probable T1 codes |
| 68390 | C108512 | Type 1 diabetes mellitus with ulcer | Probable T1 codes |
| 60499 | C108600 | Insulin dependent diabetes mellitus with gangrene | Probable T1 codes |
| 6509 | C108700 | Insulin dependent diabetes mellitus with retinopathy | Probable T1 codes |
| 38161 | C108711 | Type I diabetes mellitus with retinopathy | Probable T1 codes |
| 41049 | C108712 | Type 1 diabetes mellitus with retinopathy | Probable T1 codes |
| 6791 | C108800 | Insulin dependant diabetes mellitus - poor control | Probable T1 codes |
| 46850 | C108811 | Type I diabetes mellitus - poor control | Probable T1 codes |
| 45914 | C108812 | Type 1 diabetes mellitus - poor control | Probable T1 codes |
| 31310 | C108900 | Insulin dependant diabetes maturity onset | Probable T1 codes |
| 63017 | C108911 | Type I diabetes mellitus maturity onset | Probable T1 codes |
| 97446 | C108912 | Type 1 diabetes mellitus maturity onset | Probable T1 codes |
| 56448 | C108A00 | Insulin-dependent diabetes without complication | Probable T1 codes |
| 95992 | C108A11 | Type I diabetes mellitus without complication | Probable T1 codes |
| 24694 | C108B00 | Insulin dependent diabetes mellitus with mononeuropathy | Probable T1 codes |
| 99231 | C108B11 | Type I diabetes mellitus with mononeuropathy | Probable T1 codes |
| 41716 | C108C00 | Insulin dependent diabetes mellitus with polyneuropathy | Probable T1 codes |
| 57621 | C108D00 | Insulin dependent diabetes mellitus with nephropathy | Probable T1 codes |
| 66872 | C108D11 | Type I diabetes mellitus with nephropathy | Probable T1 codes |
| 44440 | C108E00 | Insulin dependent diabetes mellitus with hypoglycaemic coma | Probable T1 codes |
| 42729 | C108E11 | Type I diabetes mellitus with hypoglycaemic coma | Probable T1 codes |
| 70766 | C108E12 | Type 1 diabetes mellitus with hypoglycaemic coma | Probable T1 codes |
| 44260 | C108F00 | Insulin dependent diabetes mellitus with diabetic cataract | Probable T1 codes |
| 17545 | C108F11 | Type I diabetes mellitus with diabetic cataract | Probable T1 codes |
| 64446 | C108G00 | Insulin dependent diab mell with peripheral angiopathy | Probable T1 codes |
| 65616 | C108H00 | Insulin dependent diabetes mellitus with arthropathy | Probable T1 codes |
| 62352 | C108H11 | Type I diabetes mellitus with arthropathy | Probable T1 codes |
| 39809 | C108J00 | Insulin dependent diab mell with neuropathic arthropathy | Probable T1 codes |
| 60208 | C108J11 | Type I diabetes mellitus with neuropathic arthropathy | Probable T1 codes |
| 18230 | C108J12 | Type 1 diabetes mellitus with neuropathic arthropathy | Probable T1 codes |
| 46290 | C108y00 | Other specified diabetes mellitus with multiple comps | Vague codes |
| 64449 | C108z00 | Unspecified diabetes mellitus with multiple complications | Vague codes |
| 4513 | C109.00 | Non-insulin dependent diabetes mellitus | Probable T2 codes |
| 5884 | C109.11 | NIDDM - Non-insulin dependent diabetes mellitus | Probable T2 codes |
| 17859 | C109.12 | Type 2 diabetes mellitus | Probable T2 codes |
| 18219 | C109.13 | Type II diabetes mellitus | Probable T2 codes |
| 52303 | C109000 | Non-insulin-dependent diabetes mellitus with renal comps | Probable T2 codes |
| 50225 | C109011 | Type II diabetes mellitus with renal complications | Probable T2 codes |
| 18209 | C109012 | Type 2 diabetes mellitus with renal complications | Probable T2 codes |
| 50429 | C109100 | Non-insulin-dependent diabetes mellitus with ophthalm comps | Probable T2 codes |
| 59725 | C109111 | Type II diabetes mellitus with ophthalmic complications | Probable T2 codes |
| 70316 | C109112 | Type 2 diabetes mellitus with ophthalmic complications | Probable T2 codes |
| 55842 | C109200 | Non-insulin-dependent diabetes mellitus with neuro comps | Probable T2 codes |
| 67905 | C109211 | Type II diabetes mellitus with neurological complications | Probable T2 codes |
| 45919 | C109212 | Type 2 diabetes mellitus with neurological complications | Probable T2 codes |
| 62146 | C109300 | Non-insulin-dependent diabetes mellitus with multiple comps | Probable T2 codes |
| 34912 | C109400 | Non-insulin dependent diabetes mellitus with ulcer | Probable T2 codes |
| 55075 | C109411 | Type II diabetes mellitus with ulcer | Probable T2 codes |
| 65704 | C109412 | Type 2 diabetes mellitus with ulcer | Probable T2 codes |
| 40401 | C109500 | Non-insulin dependent diabetes mellitus with gangrene | Probable T2 codes |
| 62107 | C109511 | Type II diabetes mellitus with gangrene | Probable T2 codes |
| 46150 | C109512 | Type 2 diabetes mellitus with gangrene | Probable T2 codes |
| 17262 | C109600 | Non-insulin-dependent diabetes mellitus with retinopathy | Probable T2 codes |
| 58604 | C109611 | Type II diabetes mellitus with retinopathy | Probable T2 codes |
| 42762 | C109612 | Type 2 diabetes mellitus with retinopathy | Probable T2 codes |
| 8403 | C109700 | Non-insulin dependant diabetes mellitus - poor control | Probable T2 codes |
| 24458 | C109711 | Type II diabetes mellitus - poor control | Probable T2 codes |
| 45913 | C109712 | Type 2 diabetes mellitus - poor control | Probable T2 codes |
| 39406 | C109800 | Reaven's syndrome | Not diabetes |
| 29979 | C109900 | Non-insulin-dependent diabetes mellitus without complication | Probable T2 codes |
| 72320 | C109A00 | Non-insulin dependent diabetes mellitus with mononeuropathy | Probable T2 codes |
| 50813 | C109A11 | Type II diabetes mellitus with mononeuropathy | Probable T2 codes |
| 45467 | C109B00 | Non-insulin dependent diabetes mellitus with polyneuropathy | Probable T2 codes |
| 47409 | C109B11 | Type II diabetes mellitus with polyneuropathy | Probable T2 codes |
| 59365 | C109C00 | Non-insulin dependent diabetes mellitus with nephropathy | Probable T2 codes |
| 64571 | C109C11 | Type II diabetes mellitus with nephropathy | Probable T2 codes |
| 24836 | C109C12 | Type 2 diabetes mellitus with nephropathy | Probable T2 codes |
| 43785 | C109D00 | Non-insulin dependent diabetes mellitus with hypoglyca coma | Probable T2 codes |
| 56268 | C109D11 | Type II diabetes mellitus with hypoglycaemic coma | Probable T2 codes |
| 61071 | C109D12 | Type 2 diabetes mellitus with hypoglycaemic coma | Probable T2 codes |
| 69278 | C109E00 | Non-insulin depend diabetes mellitus with diabetic cataract | Probable T2 codes |
| 48192 | C109E11 | Type II diabetes mellitus with diabetic cataract | Probable T2 codes |
| 44779 | C109E12 | Type 2 diabetes mellitus with diabetic cataract | Probable T2 codes |
| 54212 | C109F00 | Non-insulin-dependent d m with peripheral angiopath | Probable T2 codes |
| 54899 | C109F11 | Type II diabetes mellitus with peripheral angiopathy | Probable T2 codes |
| 60699 | C109F12 | Type 2 diabetes mellitus with peripheral angiopathy | Probable T2 codes |
| 24693 | C109G00 | Non-insulin dependent diabetes mellitus with arthropathy | Probable T2 codes |
| 18143 | C109G11 | Type II diabetes mellitus with arthropathy | Probable T2 codes |
| 49869 | C109G12 | Type 2 diabetes mellitus with arthropathy | Probable T2 codes |
| 40962 | C109H00 | Non-insulin dependent d m with neuropathic arthropathy | Probable T2 codes |
| 47816 | C109H11 | Type II diabetes mellitus with neuropathic arthropathy | Probable T2 codes |
| 66965 | C109H12 | Type 2 diabetes mellitus with neuropathic arthropathy | Probable T2 codes |
| 18278 | C109J00 | Insulin treated Type 2 diabetes mellitus | Probable T2 codes |
| 37648 | C109J11 | Insulin treated non-insulin dependent diabetes mellitus | Probable T2 codes |
| 18264 | C109J12 | Insulin treated Type II diabetes mellitus | Probable T2 codes |
| 36633 | C109K00 | Hyperosmolar non-ketotic state in type 2 diabetes mellitus | Probable T2 codes |
| 52236 | C10A.00 | Malnutrition-related diabetes mellitus | Secondary / Other types |
| 66675 | C10A000 | Malnutrition-related diabetes mellitus with coma | Secondary / Other types |
| 33969 | C10A100 | Malnutrition-related diabetes mellitus with ketoacidosis | Secondary / Other types |
| 100347 | C10A500 | Malnutritn-relat diabetes melitus wth periph circul complctn | Secondary / Other types |
| 11551 | C10B.00 | Diabetes mellitus induced by steroids | Secondary / Other types |
| 26108 | C10B000 | Steroid induced diabetes mellitus without complication | Secondary / Other types |
| 43453 | C10C.00 | Diabetes mellitus autosomal dominant | Genetic |
| 46624 | C10C.11 | Maturity onset diabetes in youth | Genetic |
| 98392 | C10C.12 | Maturity onset diabetes in youth type 1 | Genetic |
| 36695 | C10D.00 | Diabetes mellitus autosomal dominant type 2 | Genetic |
| 59991 | C10D.11 | Maturity onset diabetes in youth type 2 | Genetic |
| 1549 | C10E.00 | Type 1 diabetes mellitus | Definite T1 codes |
| 12455 | C10E.11 | Type I diabetes mellitus | Definite T1 codes |
| 51261 | C10E.12 | Insulin dependent diabetes mellitus | Definite T1 codes |
| 47582 | C10E000 | Type 1 diabetes mellitus with renal complications | Definite T1 codes |
| 47649 | C10E100 | Type 1 diabetes mellitus with ophthalmic complications | Definite T1 codes |
| 99311 | C10E111 | Type I diabetes mellitus with ophthalmic complications | Definite T1 codes |
| 98071 | C10E112 | Insulin-dependent diabetes mellitus with ophthalmic comps | Definite T1 codes |
| 42831 | C10E200 | Type 1 diabetes mellitus with neurological complications | Definite T1 codes |
| 47650 | C10E300 | Type 1 diabetes mellitus with multiple complications | Definite T1 codes |
| 91942 | C10E311 | Type I diabetes mellitus with multiple complications | Definite T1 codes |
| 45276 | C10E312 | Insulin dependent diabetes mellitus with multiple complicat | Definite T1 codes |
| 43921 | C10E400 | Unstable type 1 diabetes mellitus | Definite T1 codes |
| 49949 | C10E411 | Unstable type I diabetes mellitus | Definite T1 codes |
| 54600 | C10E412 | Unstable insulin dependent diabetes mellitus | Definite T1 codes |
| 18683 | C10E500 | Type 1 diabetes mellitus with ulcer | Definite T1 codes |
| 93878 | C10E511 | Type I diabetes mellitus with ulcer | Definite T1 codes |
| 98704 | C10E512 | Insulin dependent diabetes mellitus with ulcer | Definite T1 codes |
| 69993 | C10E600 | Type 1 diabetes mellitus with gangrene | Definite T1 codes |
| 18387 | C10E700 | Type 1 diabetes mellitus with retinopathy | Definite T1 codes |
| 95343 | C10E711 | Type I diabetes mellitus with retinopathy | Definite T1 codes |
| 93875 | C10E712 | Insulin dependent diabetes mellitus with retinopathy | Definite T1 codes |
| 35288 | C10E800 | Type 1 diabetes mellitus - poor control | Definite T1 codes |
| 72702 | C10E812 | Insulin dependent diabetes mellitus - poor control | Definite T1 codes |
| 40682 | C10E900 | Type 1 diabetes mellitus maturity onset | Definite T1 codes |
| 96235 | C10E911 | Type I diabetes mellitus maturity onset | Definite T1 codes |
| 97849 | C10E912 | Insulin dependent diabetes maturity onset | Definite T1 codes |
| 69676 | C10EA00 | Type 1 diabetes mellitus without complication | Definite T1 codes |
| 62613 | C10EA11 | Type I diabetes mellitus without complication | Definite T1 codes |
| 99719 | C10EA12 | Insulin-dependent diabetes without complication | Definite T1 codes |
| 68105 | C10EB00 | Type 1 diabetes mellitus with mononeuropathy | Definite T1 codes |
| 46301 | C10EC00 | Type 1 diabetes mellitus with polyneuropathy | Definite T1 codes |
| 91943 | C10EC11 | Type I diabetes mellitus with polyneuropathy | Definite T1 codes |
| 101311 | C10EC12 | Insulin dependent diabetes mellitus with polyneuropathy | Definite T1 codes |
| 10418 | C10ED00 | Type 1 diabetes mellitus with nephropathy | Definite T1 codes |
| 39070 | C10EE00 | Type 1 diabetes mellitus with hypoglycaemic coma | Definite T1 codes |
| 99716 | C10EE12 | Insulin dependent diabetes mellitus with hypoglycaemic coma | Definite T1 codes |
| 49554 | C10EF00 | Type 1 diabetes mellitus with diabetic cataract | Definite T1 codes |
| 100770 | C10EF12 | Insulin dependent diabetes mellitus with diabetic cataract | Definite T1 codes |
| 93468 | C10EG00 | Type 1 diabetes mellitus with peripheral angiopathy | Definite T1 codes |
| 18642 | C10EH00 | Type 1 diabetes mellitus with arthropathy | Definite T1 codes |
| 54008 | C10EJ00 | Type 1 diabetes mellitus with neuropathic arthropathy | Definite T1 codes |
| 30323 | C10EK00 | Type 1 diabetes mellitus with persistent proteinuria | Definite T1 codes |
| 30294 | C10EL00 | Type 1 diabetes mellitus with persistent microalbuminuria | Definite T1 codes |
| 10692 | C10EM00 | Type 1 diabetes mellitus with ketoacidosis | Definite T1 codes |
| 62209 | C10EM11 | Type I diabetes mellitus with ketoacidosis | Definite T1 codes |
| 40837 | C10EN00 | Type 1 diabetes mellitus with ketoacidotic coma | Definite T1 codes |
| 66145 | C10EN11 | Type I diabetes mellitus with ketoacidotic coma | Definite T1 codes |
| 22871 | C10EP00 | Type 1 diabetes mellitus with exudative maculopathy | Definite T1 codes |
| 97894 | C10EP11 | Type I diabetes mellitus with exudative maculopathy | Definite T1 codes |
| 55239 | C10EQ00 | Type 1 diabetes mellitus with gastroparesis | Definite T1 codes |
| 95636 | C10ER00 | Latent autoimmune diabetes mellitus in adult | Secondary / Other types |
| 758 | C10F.00 | Type 2 diabetes mellitus | Definite T2 codes |
| 22884 | C10F.11 | Type II diabetes mellitus | Definite T2 codes |
| 18777 | C10F000 | Type 2 diabetes mellitus with renal complications | Definite T2 codes |
| 57278 | C10F011 | Type II diabetes mellitus with renal complications | Definite T2 codes |
| 47321 | C10F100 | Type 2 diabetes mellitus with ophthalmic complications | Definite T2 codes |
| 100964 | C10F111 | Type II diabetes mellitus with ophthalmic complications | Definite T2 codes |
| 34268 | C10F200 | Type 2 diabetes mellitus with neurological complications | Definite T2 codes |
| 98616 | C10F211 | Type II diabetes mellitus with neurological complications | Definite T2 codes |
| 65267 | C10F300 | Type 2 diabetes mellitus with multiple complications | Definite T2 codes |
| 43227 | C10F311 | Type II diabetes mellitus with multiple complications | Definite T2 codes |
| 49074 | C10F400 | Type 2 diabetes mellitus with ulcer | Definite T2 codes |
| 91646 | C10F411 | Type II diabetes mellitus with ulcer | Definite T2 codes |
| 12736 | C10F500 | Type 2 diabetes mellitus with gangrene | Definite T2 codes |
| 18496 | C10F600 | Type 2 diabetes mellitus with retinopathy | Definite T2 codes |
| 49655 | C10F611 | Type II diabetes mellitus with retinopathy | Definite T2 codes |
| 25627 | C10F700 | Type 2 diabetes mellitus - poor control | Definite T2 codes |
| 47315 | C10F711 | Type II diabetes mellitus - poor control | Definite T2 codes |
| 54773 | C10F800 | Reaven's syndrome | Not diabetes |
| 39481 | C10F811 | Metabolic syndrome X | Not diabetes |
| 47954 | C10F900 | Type 2 diabetes mellitus without complication | Definite T2 codes |
| 53392 | C10F911 | Type II diabetes mellitus without complication | Definite T2 codes |
| 62674 | C10FA00 | Type 2 diabetes mellitus with mononeuropathy | Definite T2 codes |
| 95351 | C10FA11 | Type II diabetes mellitus with mononeuropathy | Definite T2 codes |
| 18425 | C10FB00 | Type 2 diabetes mellitus with polyneuropathy | Definite T2 codes |
| 50527 | C10FB11 | Type II diabetes mellitus with polyneuropathy | Definite T2 codes |
| 12640 | C10FC00 | Type 2 diabetes mellitus with nephropathy | Definite T2 codes |
| 46917 | C10FD00 | Type 2 diabetes mellitus with hypoglycaemic coma | Definite T2 codes |
| 98723 | C10FD11 | Type II diabetes mellitus with hypoglycaemic coma | Definite T2 codes |
| 44982 | C10FE00 | Type 2 diabetes mellitus with diabetic cataract | Definite T2 codes |
| 93727 | C10FE11 | Type II diabetes mellitus with diabetic cataract | Definite T2 codes |
| 37806 | C10FF00 | Type 2 diabetes mellitus with peripheral angiopathy | Definite T2 codes |
| 59253 | C10FG00 | Type 2 diabetes mellitus with arthropathy | Definite T2 codes |
| 35385 | C10FH00 | Type 2 diabetes mellitus with neuropathic arthropathy | Definite T2 codes |
| 1407 | C10FJ00 | Insulin treated Type 2 diabetes mellitus | Definite T2 codes |
| 64668 | C10FJ11 | Insulin treated Type II diabetes mellitus | Definite T2 codes |
| 34450 | C10FK00 | Hyperosmolar non-ketotic state in type 2 diabetes mellitus | Definite T2 codes |
| 26054 | C10FL00 | Type 2 diabetes mellitus with persistent proteinuria | Definite T2 codes |
| 60796 | C10FL11 | Type II diabetes mellitus with persistent proteinuria | Definite T2 codes |
| 18390 | C10FM00 | Type 2 diabetes mellitus with persistent microalbuminuria | Definite T2 codes |
| 85991 | C10FM11 | Type II diabetes mellitus with persistent microalbuminuria | Definite T2 codes |
| 32627 | C10FN00 | Type 2 diabetes mellitus with ketoacidosis | Definite T2 codes |
| 51756 | C10FP00 | Type 2 diabetes mellitus with ketoacidotic coma | Definite T2 codes |
| 25591 | C10FQ00 | Type 2 diabetes mellitus with exudative maculopathy | Definite T2 codes |
| 63690 | C10FR00 | Type 2 diabetes mellitus with gastroparesis | Definite T2 codes |
| 95539 | C10FS00 | Maternally inherited diabetes mellitus | Genetic |
| 51697 | C10G.00 | Secondary pancreatic diabetes mellitus | Secondary / Other types |
| 96506 | C10G000 | Secondary pancreatic diabetes mellitus without complication | Secondary / Other types |
| 61122 | C10H.00 | Diabetes mellitus induced by non-steroid drugs | Secondary / Other types |
| 67212 | C10H000 | DM induced by non-steroid drugs without complication | Secondary / Other types |
| 68517 | C10J.00 | Insulin autoimmune syndrome | Secondary / Other types |
| 37957 | C10K.00 | Type A insulin resistance | Not diabetes |
| 56885 | C10K000 | Type A insulin resistance without complication | Not diabetes |
| 43857 | C10M.00 | Lipoatrophic diabetes mellitus | Secondary / Other types |
| 22487 | C10N.00 | Secondary diabetes mellitus | Secondary / Other types |
| 94383 | C10N000 | Secondary diabetes mellitus without complication | Secondary / Other types |
| 93380 | C10N100 | Cystic fibrosis related diabetes mellitus | Secondary / Other types |
| 33343 | C10y.00 | Diabetes mellitus with other specified manifestation | Vague codes |
| 63371 | C10y100 | Diabetes mellitus, adult, + other specified manifestation | Probable T2 codes |
| 10098 | C10yy00 | Other specified diabetes mellitus with other spec comps | Vague codes |
| 70821 | C10yz00 | Diabetes mellitus NOS with other specified manifestation | Vague codes |
| 45491 | C10z.00 | Diabetes mellitus with unspecified complication | Vague codes |
| 68792 | C10z000 | Diabetes mellitus, juvenile type, + unspecified complication | Possible T1 codes |
| 63762 | C10z100 | Diabetes mellitus, adult onset, + unspecified complication | Probable T2 codes |
| 64283 | C10zy00 | Other specified diabetes mellitus with unspecified comps | Vague codes |
| 64357 | C10zz00 | Diabetes mellitus NOS with unspecified complication | Vague codes |
| 2472 | C110.00 | Hypoglycaemic coma | Possible T1 codes |
| 53630 | C110.11 | Insulin coma | Possible T1 codes |
| 61520 | C110000 | Iatrogenic hyperinsulinism | Secondary / Other types |
| 72882 | C110100 | Self-induced hyperinsulinism | Probable T1 codes |
| 51371 | C110z00 | Hypoglycaemic coma NOS | Possible T1 codes |
| 1410 | C112.00 | Hypoglycaemia unspecified | Possible T2 codes |
| 4563 | C112000 | Reactive hypoglycaemia NOS | Possible T2 codes |
| 24405 | C112100 | Spontaneous hypoglycaemia NOS | Possible T2 codes |
| 20368 | C112z00 | Hypoglycaemia unspecified NOS | Possible T2 codes |
| 11359 | L180.00 | Diabetes mellitus during pregnancy/childbirth/puerperium | Probable Gestational diabetes |
| 67635 | L180000 | Diabetes mellitus - unspec whether in pregnancy/puerperium | Probable Gestational diabetes |
| 34639 | L180100 | Diabetes mellitus during pregnancy - baby delivered | Probable Gestational diabetes |
| 49559 | L180300 | Diabetes mellitus during pregnancy - baby not yet delivered | Probable Gestational diabetes |
| 96823 | L180400 | Diabetes mellitus in pueperium - baby previously delivered | Probable T1 codes |
| 50960 | L180500 | Pre-existing diabetes mellitus, insulin-dependent | Probable T1 codes |
| 50609 | L180600 | Pre-existing diabetes mellitus, non-insulin-dependent | Probable T2 codes |
| 10278 | L180800 | Diabetes mellitus arising in pregnancy | Probable Gestational diabetes |
| 8446 | L180811 | Gestational diabetes mellitus | Probable Gestational diabetes |
| 2664 | L180900 | Gestational diabetes mellitus | Probable Gestational diabetes |
| 55431 | L180X00 | Pre-existing diabetes mellitus, unspecified | Vague codes |
| 64384 | L180z00 | Diabetes mellitus in pregnancy/childbirth/puerperium NOS | Probable Gestational diabetes |

### Read codes for Diabetic Retinopathy diagnosis

|  |  |  |  |
| --- | --- | --- | --- |
| medcode | readcode | readterm | severe |
| 52041 | 2BBl.00 | O/E - left eye stable treated prolif diabetic retinopathy | 0 |
| 52630 | 2BBo.00 | O/E - sight threatening diabetic retinopathy | 0 |
| 19533 | 2BBY.00 | O/E - referable retinopathy | 0 |
| 3837 | F420400 | Diabetic maculopathy | 0 |
| 47328 | 2BBk.00 | O/E - right eye stable treated prolif diabetic retinopathy | 0 |
| 101881 | 2BBr.00 | Impaired vision due to diabetic retinopathy | 0 |
| 3914 | 2BB9.00 | O/E - retinal pigmentation | 0 |
| 9339 | F421.00 | Other background retinopathy | 0 |
| 10882 | F421400 | Exudative retinopathy | 0 |
| 48751 | 2BB3.00 | O/E - retinal A-V nipping | 0 |
| 42762 | C109612 | Type 2 diabetes mellitus with retinopathy | 0 |
| 35659 | 2BB7.00 | O/E - retinal vascular prolif. | 0 |
| 38161 | C108711 | Type I diabetes mellitus with retinopathy | 0 |
| 72424 | 7270B00 | Vitrectomy using anterior approach | 0 |
| 9835 | 2BBL.00 | O/E - diabetic maculopathy present both eyes | 0 |
| 39457 | F421C00 | Other intraretinal microvascular abnormality | 0 |
| 55026 | 7270B11 | Anterior vitrectomy | 0 |
| 11053 | F421800 | Retinal microaneurysms NOS | 0 |
| 18387 | C10E700 | Type 1 diabetes mellitus with retinopathy | 0 |
| 4514 | 7270011 | Anterior vitrectomy | 0 |
| 13102 | 2BBW.00 | O/E - right eye diabetic maculopathy | 0 |
| 13108 | 2BBX.00 | O/E - left eye diabetic maculopathy | 0 |
| 36119 | F421111 | Arterosclerotic retinopathy | 0 |
| 93875 | C10E712 | Insulin dependent diabetes mellitus with retinopathy | 0 |
| 8595 | F42y600 | Retinal exudate or deposit | 0 |
| 102242 | 2BBs.00 | Retinal arteries silverwire | 0 |
| 17916 | F422011 | Retinopathy of prematurity | 0 |
| 22871 | C10EP00 | Type 1 diabetes mellitus with exudative maculopathy | 0 |
| 1411 | 3128100 | Fundoscopy abnormal | 0 |
| 11626 | F420z00 | Diabetic retinopathy NOS | 0 |
| 34455 | F421112 | Atheroscleritic retinopathy | 0 |
| 66964 | F426500 | Pseudoretinitis pigmentosa | 0 |
| 2254 | F424100 | Central serous retinopathy | 0 |
| 36867 | 2BBa.00 | O/E- non-referable retinopathy | 0 |
| 11129 | 2BBQ.00 | O/E - left eye background diabetic retinopathy | 0 |
| 88368 | 7270411 | Vitrectomy using pars plana approach | 0 |
| 6509 | C108700 | Insulin dependent diabetes mellitus with retinopathy | 0 |
| 45876 | F421200 | Renal retinopathy | 0 |
| 8742 | 2BB5.00 | O/E - retinal haemorrhages | 0 |
| 17262 | C109600 | Non-insulin-dependent diabetes mellitus with retinopathy | 0 |
| 13107 | 2BBn.00 | O/E - left eye clinically significant macular oedema | 0 |
| 104263 | F425900 | Maculopathy | 0 |
| 58604 | C109611 | Type II diabetes mellitus with retinopathy | 0 |
| 41049 | C108712 | Type 1 diabetes mellitus with retinopathy | 0 |
| 1323 | F420.00 | Diabetic retinopathy | 0 |
| 40982 | F421z00 | Other background retinopathy NOS | 0 |
| 50656 | 2BBc.00 | O/E - No retinal laser photocoagulation scars | 0 |
| 36855 | 2BBG.00 | Retinal abnormality - non-diabetes | 0 |
| 3822 | 2BB8.00 | O/E - vitreous haemorrhages | 0 |
| 49655 | C10F611 | Type II diabetes mellitus with retinopathy | 0 |
| 11433 | 2BBP.00 | O/E - right eye background diabetic retinopathy | 0 |
| 17293 | 727..00 | Retina and other parts of eye operations | 0 |
| 69662 | F421G00 | Venostasis retinopathy | 0 |
| 7069 | F420000 | Background diabetic retinopathy | 0 |
| 1438 | F421000 | Unspecified background retinopathy | 0 |
| 97894 | C10EP11 | Type I diabetes mellitus with exudative maculopathy | 0 |
| 13106 | 2BB6.00 | O/E - retinal exudates | 0 |
| 22967 | 2BBF.00 | Retinal abnormality - diabetes related | 0 |
| 25888 | 2BBm.00 | O/E - right eye clinically significant macular oedema | 0 |
| 25591 | C10FQ00 | Type 2 diabetes mellitus with exudative maculopathy | 0 |
| 18496 | C10F600 | Type 2 diabetes mellitus with retinopathy | 0 |
| 31829 | F433100 | Solar retinopathy | 0 |
| 41229 | F421100 | Atherosclerotic retinopathy | 0 |
| 19532 | 2BB4.00 | O/E - retinal microaneurysms | 0 |
| 95343 | C10E711 | Type I diabetes mellitus with retinopathy | 0 |
| 11858 | 7270400 | Pars plana vitrectomy | 0 |
| 6702 | F421300 | Hypertensive retinopathy | 0 |
| 45145 | 2BB2.00 | O/E - retinal vessel narrowing | 0 |
| 27022 | 5B42.00 | Laser therapy - retinal lesion | 1 |
| 86068 | 7272800 | Panretinal laser photocoagulation to lesion of retina | 1 |
| 13097 | 2BBT.00 | O/E - right eye proliferative diabetic retinopathy | 1 |
| 100979 | 7272900 | Focal laser photocoagulation of retina | 1 |
| 11874 | F422100 | Proliferative retinopathy due to sickle cell disease | 1 |
| 96926 | FyuF700 | [X]Other proliferative retinopathy | 1 |
| 6836 | 7271100 | Laser photocoagulation of retina for detachment | 1 |
| 11912 | 5B4..11 | Retinal laser therapy | 1 |
| 30477 | F420700 | High risk proliferative diabetic retinopathy | 1 |
| 9318 | 7272300 | Laser destruction of lesion of retina | 1 |
| 36035 | F422y00 | Other specified other proliferative retinopathy | 1 |
| 18775 | 2BBO.00 | O/E - Laser photocoagulation scars | 1 |
| 10099 | F420300 | Advanced diabetic maculopathy | 1 |
| 2986 | F420200 | Preproliferative diabetic retinopathy | 1 |
| 13103 | 2BBS.00 | O/E - left eye preproliferative diabetic retinopathy | 1 |
| 13099 | 2BBR.00 | O/E - right eye preproliferative diabetic retinopathy | 1 |
| 46068 | 7272500 | Panretinal laser photocoagulation to lesion of retina NEC | 1 |
| 10755 | F420600 | Non proliferative diabetic retinopathy | 1 |
| 13101 | 2BBV.00 | O/E - left eye proliferative diabetic retinopathy | 1 |
| 38096 | F422z00 | Proliferative retinopathy NOS | 1 |
| 3286 | F420100 | Proliferative diabetic retinopathy | 1 |
| 65463 | F420800 | High risk non proliferative diabetic retinopathy | 1 |
| 7890 | F422.00 | Other proliferative retinopathy | 1 |

### Read codes for Eye disease

|  |  |  |
| --- | --- | --- |
| medcode | readcode | categorycode |
| 2762 | F4250 | Macular degeneration |
| 10343 | F4251 | Macular degeneration |
| 4410 | F4H20 | Macular degeneration |
| 6350 | F425 | Macular degeneration |
| 57600 | F427G | Macular degeneration |
| 26205 | F4252 | Macular degeneration |
| 57319 | F4255 | Age-related macular degeneration |
| 12125 | F4256 | Age-related macular degeneration |
| 38393 | F4254 | Age-related macular degeneration |
| 4424 | F4257 | Age-related macular degeneration |
| 8518 | 2BBH | Age-related macular degeneration |
| 2789 | F4253 | Age-related macular degeneration |
| 16751 | 22EE | Cataract |
| 6317 | F46z | Cataract |
| 9931 | 2BT1 | Cataract |
| 1622 | 22E5 | Cataract |
| 22022 | F4618 | Cataract |
| 47566 | F4610 | Cataract |
| 7793 | F4607 | Cataract |
| 10010 | F461 | Cataract |
| 296 | F46 | Cataract |
| 6547 | 2BT0 | Cataract |
| 7257 | F4605 | Cataract |
| 703 | F466 | Cataract |
| 20230 | F4H14 | Glaucoma |
| 4581 | F4511 | Glaucoma |
| 41804 | F454z | Glaucoma |
| 68633 | F4544 | Glaucoma |
| 65079 | 72590 | Glaucoma |
| 88142 | 7259y | Glaucoma |
| 28505 | F45y | Glaucoma |
| 70195 | FyuG0 | Glaucoma |
| 35748 | F4502 | Glaucoma |
| 22528 | F4565 | Glaucoma |
| 44295 | F45yz | Glaucoma |
| 9469 | F4512 | Glaucoma |
| 8971 | F450 | Glaucoma |
| 10070 | F4501 | Glaucoma |
| 37876 | F4561 | Glaucoma |
| 65193 | F45y1 | Glaucoma |
| 41794 | F4563 | Glaucoma |
| 53521 | F456z | Glaucoma |
| 28189 | F451z | Glaucoma |
| 41854 | F454 | Glaucoma |
| 26870 | F4562 | Glaucoma |
| 20520 | F4520 | Glaucoma |
| 68094 | F4531 | Glaucoma |
| 35446 | F4523 | Glaucoma |
| 48132 | F453z | Glaucoma |
| 54262 | F455 | Glaucoma |
| 8001 | F45z | Glaucoma |
| 67413 | F4524 | Glaucoma |
| 44817 | F4521 | Glaucoma |
| 98647 | FyuG1 | Glaucoma |
| 88595 | 72592 | Glaucoma |
| 96707 | F4542 | Glaucoma |
| 39120 | F452z | Glaucoma |
| 12251 | F4513 | Glaucoma |
| 93967 | 72594 | Glaucoma |
| 35528 | F453 | Glaucoma |
| 8132 | F45y2 | Glaucoma |
| 18743 | F4551 | Glaucoma |
| 63660 | F45y0 | Glaucoma |
| 34354 | F455z | Glaucoma |
| 67341 | F4541 | Glaucoma |
| 42447 | F4510 | Glaucoma |
| 24860 | F4500 | Glaucoma |
| 69195 | F4540 | Glaucoma |
| 52888 | FyuG | Glaucoma |
| 11059 | 7275 | Glaucoma |
| 89934 | 72591 | Glaucoma |
| 22805 | F4560 | Glaucoma |
| 53127 | F456 | Glaucoma |
| 91442 | 72593 | Glaucoma |
| 1798 | F451 | Glaucoma |
| 2074 | F45 | Glaucoma |
| 9260 | F450z | Glaucoma |
| 44798 | F4550 | Glaucoma |
| 48479 | F4564 | Glaucoma |
| 11058 | F4566 | Glaucoma |
| 58645 | F4514 | Glaucoma |
| 64851 | F4543 | Glaucoma |
| 46069 | 7259 | Glaucoma |
| 2823 | F452 | Glaucoma |
| 36737 | F4503 | Glaucoma |
| 72394 | F4515 | Glaucoma |
| 28536 | F4522 | Glaucoma |
| 29764 | F4421 | Glaucoma |
| 95852 | 7259z | Glaucoma |

### Read codes for Visual Impairment

|  |  |  |
| --- | --- | --- |
| medcode | readcode | categorycode |
| 23027 | 2B75 | Reduced visual acuity (VA 6/12 to 6/36) |
| 38169 | 2B7G | Reduced visual acuity (VA 6/12 to 6/36) |
| 41055 | 2B6J | Reduced visual acuity (VA 6/12 to 6/36) |
| 26723 | 2B66 | Reduced visual acuity (VA 6/12 to 6/36) |
| 56814 | 2B7K | Reduced visual acuity (VA 6/12 to 6/36) |
| 23025 | 2B74 | Reduced visual acuity (VA 6/12 to 6/36) |
| 41059 | 2B6G | Reduced visual acuity (VA 6/12 to 6/36) |
| 23026 | 2B77 | Reduced visual acuity (VA 6/12 to 6/36) |
| 26726 | 2B76 | Reduced visual acuity (VA 6/12 to 6/36) |
| 23022 | 2B67 | Reduced visual acuity (VA 6/12 to 6/36) |
| 59260 | 2B6b | Reduced visual acuity (VA 6/12 to 6/36) |
| 59261 | 2B7b | Reduced visual acuity (VA 6/12 to 6/36) |
| 23021 | 2B64 | Reduced visual acuity (VA 6/12 to 6/36) |
| 20446 | 2B65 | Reduced visual acuity (VA 6/12 to 6/36) |
| 47913 | 2B7J | Reduced visual acuity (VA 6/12 to 6/36) |
| 40879 | 2B7H | Reduced visual acuity (VA 6/12 to 6/36) |
| 49306 | 2B6K | Reduced visual acuity (VA 6/12 to 6/36) |
| 41057 | 2B6H | Reduced visual acuity (VA 6/12 to 6/36) |
| 49283 | 2B7Q | Severely sight impaired (VA worse than 3/60) |
| 35515 | 2B79 | Severely sight impaired (VA worse than 3/60) |
| 45030 | 2B6C | Severely sight impaired (VA worse than 3/60) |
| 48983 | 2B6P | Severely sight impaired (VA worse than 3/60) |
| 47158 | 2B6Q | Severely sight impaired (VA worse than 3/60) |
| 45786 | 2B6T | Severely sight impaired (VA worse than 3/60) |
| 3852 | 2B7A | Severely sight impaired (VA worse than 3/60) |
| 33016 | 2B7B | Severely sight impaired (VA worse than 3/60) |
| 33015 | 2B69 | Severely sight impaired (VA worse than 3/60) |
| 47911 | 2B6V | Severely sight impaired (VA worse than 3/60) |
| 41060 | 2B6R | Severely sight impaired (VA worse than 3/60) |
| 38167 | 2B7A | Severely sight impaired (VA worse than 3/60) |
| 60032 | 2B7V | Severely sight impaired (VA worse than 3/60) |
| 47912 | 2B7T | Severely sight impaired (VA worse than 3/60) |
| 54514 | 2B7R | Severely sight impaired (VA worse than 3/60) |
| 33017 | 2B7C | Severely sight impaired (VA worse than 3/60) |
| 26722 | 2B6A | Severely sight impaired (VA worse than 3/60) |
| 10388 | 2B6A | Severely sight impaired (VA worse than 3/60) |
| 50925 | 2B7P | Severely sight impaired (VA worse than 3/60) |
| 33014 | 2B6B | Severely sight impaired (VA worse than 3/60) |
| 54513 | 2B7S | Severely sight impaired (VA worse than 3/60) |
| 51274 | 2B6S | Severely sight impaired (VA worse than 3/60) |
| 65569 | 2B7X | Sight impaired (VA 3/60 to 6/60) |
| 39170 | 2B7E | Sight impaired (VA 3/60 to 6/60) |
| 47910 | 2B6E | Sight impaired (VA 3/60 to 6/60) |
| 66391 | 2B6X | Sight impaired (VA 3/60 to 6/60) |
| 23028 | 2B78 | Sight impaired (VA 3/60 to 6/60) |
| 33013 | 2B68 | Sight impaired (VA 3/60 to 6/60) |
| 38168 | 2B7W | Sight impaired (VA 3/60 to 6/60) |
| 41063 | 2B7L | Sight impaired (VA 3/60 to 6/60) |
| 38166 | 2B6W | Sight impaired (VA 3/60 to 6/60) |
| 40877 | 2B6L | Sight impaired (VA 3/60 to 6/60) |

### Read codes for Ethnicity

Table reproduced from http://www.clininf.eu/ethnicity.html

|  |  |  |  |
| --- | --- | --- | --- |
| **Grouping of the 9S and 9i ethnic codes to the '16+1' format and the five category classifications** | | | |
| **Five category** | **16 category framework** | **9i… Ethnic category hierarchy** | **9S.. Ethnic group hierarchy** |
| 1. White | 1. British or Mixed British | **9i0** British or mixed British | **9S1** White, **9S10** White British, **9S14** Other white British ethnic grp |
| 2. Irish | **9i1** Irish | **9S11** White Irish, **9SA9** Irish NMO, **9SI** Irish traveller |
| 3. Other White | **9i2** Other White | **9S12** Other white ethnic group |
| **9i20** English |  |
| **9i21** Scottish | **9S13** White Scottish |
| **9i22** Welsh, **9i26** Cypriot part unsp, **9i27** Greek, **9i28** Greek Cypriot, **9i29** Turkish, **9i2A** Turkish Cypriot, **9i2B** Italian, **9i2C** Irish Traveller, **9i2D** Traveller, **9i2E** Gypsy/Romany, **9i2F** Polish, **9i2H**Commonwealth of (Russian), **9i2J** Kosovan, **9i2K** Albanian Serbian, **9i2P** Oth repub Yugoslav, **9i2R** Oth White/unsp/Mix Eur,**9i2S** Oth mixed White, **9i2T** Other White or White unspecified. |  |
| 2. Mixed | 4. White + Black Caribbean | **9i3** White & Black Caribbean | **9SB5** Black Caribbean and White |
| 5. White + Black African | **9i4** White and Black African | **9SB6** Black African and White |
| 6. White + Asian | **9i5** White & Asian | **9SB2** Other ethnic, Asian/White orig |
| 7. Other mixed | **9i6** Other Mixed | **9SB** Other ethnic, mixed origin , **9SB3** Other ethnic, mixed white orig, **9SB4** Other ethnic, other mixed orig,**9S52** Other Black - Black/Asian orig. |
| **9i60** Black & Asian, **9i61** Black & Chinese |  |
| **9i62** Black and White | **9SB1** Other ethnic, Black/White orig, **9S51** Other Black – Black/White orig |
| **9i63** Chinese & White, **9i64** Asian & Chinese |  |
| 3. Asian or Asian British | 8. Indian or British Indian | **9i7** Indian/British Indians | **9S6** Indian |
| 9. Pakistani or British Pakistani | **9i8** Pakistani/Brit Pakists | **9S7** Pakistani |
| 10. Bangladeshi or British Bangladeshi | **9i9** Bangladeshi/Brit Bangl | **9S8** Bangladeshi |
| 11. Other Asian | **9iA** Other Asian | **9SH** Other Asian ethnic group, **9SA8** Other Asian NMO, **9SA7** Indian sub-continent NMO |
| **9iA3** East African Asian | **9SA6** E Afric Asian/Indo-Carib NMO |
| **9iA4** Sri Lankan, **9iA5** Tamil, **9iA6** Sinhalese, **9iA7** Carib Asian,**9iA8** Briti Asian, **9iA9** Mixed Asian |  |
| 4. Other Black | 12. Caribbean | **9iB** Caribbean | **9S2** Black Caribbean |
| 13. African | **9iC** African | **9S3** Black African, **9S44**Black - other African country,**9SA5** Other African countries NMO |
| 14 Other Black | **9iD** Other Black | **9S4** Black, other, non-mixed origin, |
| **9S42** Black Caribbean/W.I./Guyana, |
| **9S43** Black N African/Arab/Iranian, |
| **9S45** Black E Afric Asia/Indo-Caribb, |
| **9SG** Other black ethnic group, **9S47** Black - other Asian, **9S48** Black Black - other, **9S5** Black - other, mixed, **9SA3** Caribbean I./W.I./Guyana NMO |
| **9iD0** Somali, **9iD1** Nigerian |  |
| **9iD2** Black British | **9S41** Black British |
| 5. Other ethnic groups | 15. Chinese | **9iE** Chinese | **9S9** Chinese |
| 16. Other | **9iF** Other | **9SJ** Other ethnic group, **9SA**Other ethnic non-mixed NMO, **9SA2** Brit. ethnic minor. unsp NMO, **9SAA**Greek/Greek Cypriot NMO,**9SAB** Turkish/Turkish Cypriot NMO |
| **9SAC** Other European NMO,**9SAD** Other ethnic NEC NMO |
| **9iF0** Vietnamese | **9SC** Vietnamese |
| **9iF1** Japanese, **9iF2** Filipino, **9iF3** Malaysian, **9iF9** Arab |  |
| **9iFA** North African | **9SA4** N African Arab/Iranian NMO |
| **9iFB** ME ex Isr/Iran/Arab, **9iFD** Iranian, **9iFE** Kurdish, **9iFG** Latin American, **9iFH** South/Central American, **9iFJ** Multi-ethnic islands: Mauritian or Seychellois or Maldivian or St Helena, **9iFK** Any other - ethn categ |  |
| 6. Not stated | 17. (16+1) | **9iG** Ethn cat not stated | **9S** Ethnic groups census,**9SD** Ethnic group - patient refused, **9SE** Ethnic group not recorded, **9SZ** Ethnic groups census NOS |
| Not stated |

### Results of the diabetes adjudication algorithms

#### Flowchart 1: Assigning initial diabetic classification

From a total of 13,685,136 acceptable patients, 515,504 had at least one diagnostic Read code for diabetes. At the end of Flowchart 1, which assigns each patient an initial diabetic type based on Read codes alone, 46,135 patients were classified as having type 1 diabetes (8.4%) and 444,824 were classified as having type 2 diabetes (82.3%).

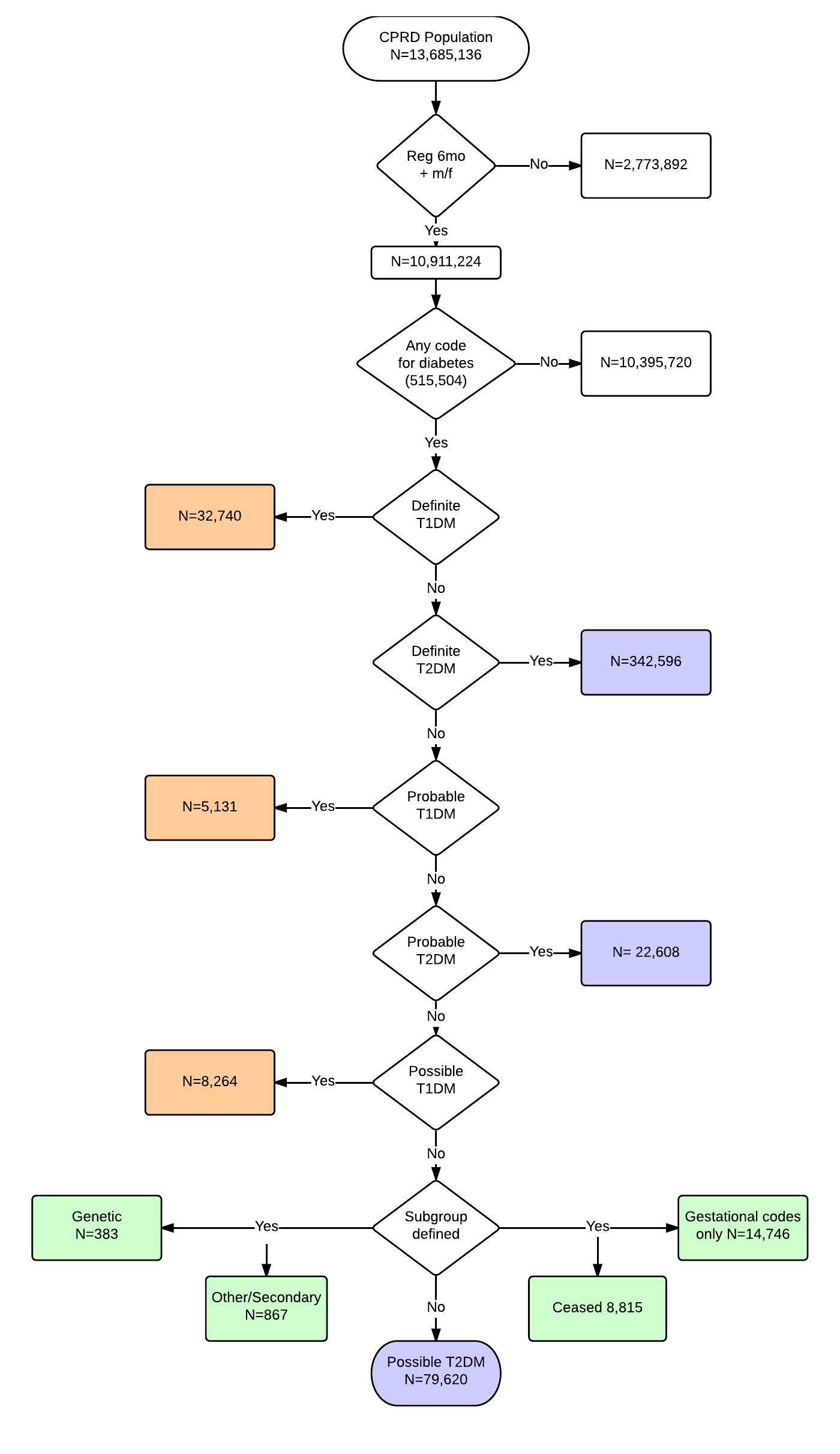


Figure 1. Results from Flowchart 1: Initial Sort and Classification

#### Flowchart 2: Improving Classification of type 1 diabetes

A total of 46,135 patients initially classified as having type 1 diabetes were entered into Flowchart 2. 85.0% of the initial cohort remained as type 1 diabetics at the end of the flowchart (n=39,231). 6,904 (15.0%) were re-classified as having probable 2 diabetes.

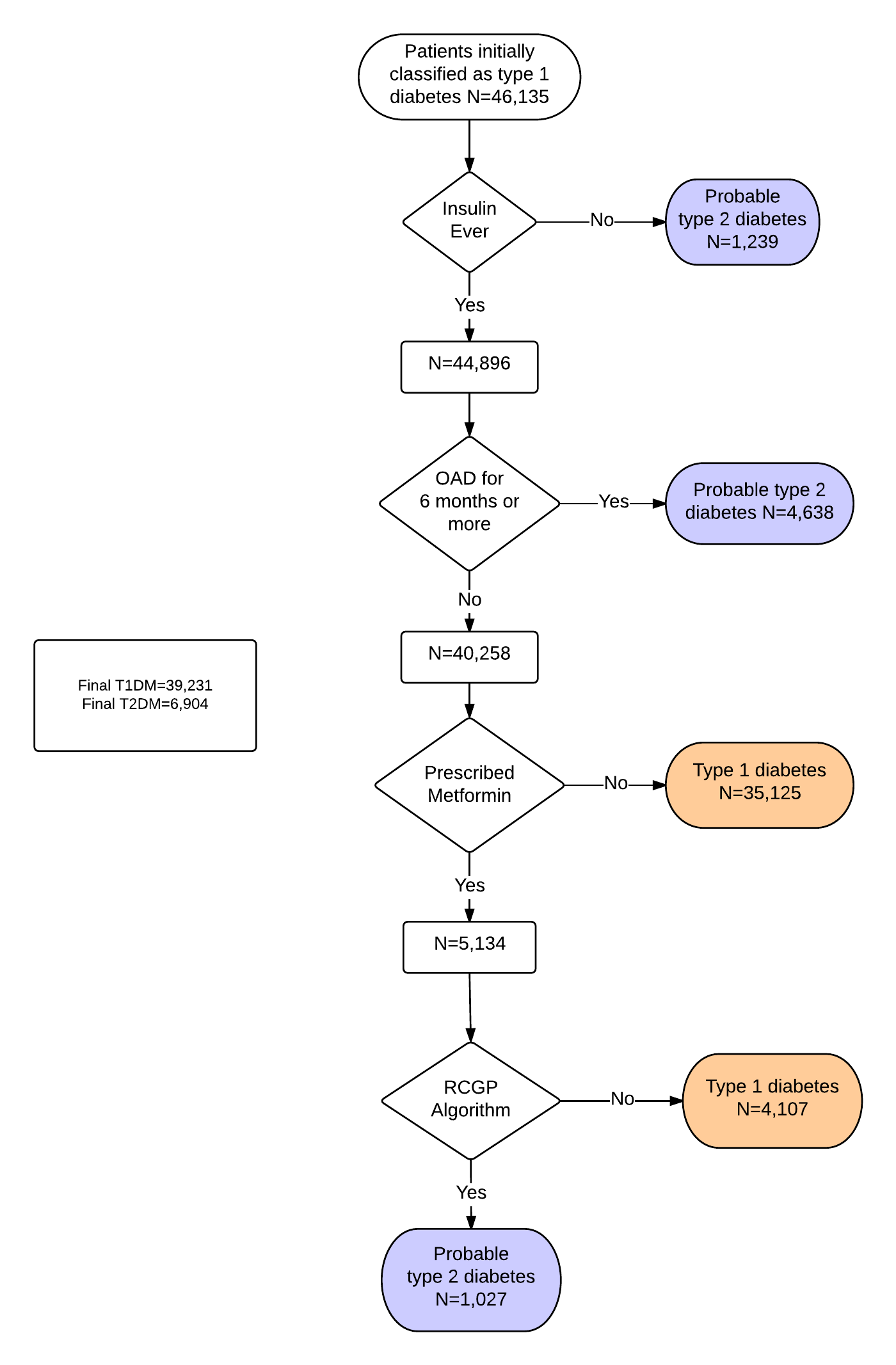


Figure 2. Results from Flowchart 2: Improving classification of type 1 diabetes

#### Flowchart 3: Improving Classification of type 2 diabetes

A total of 444,824 patients initially classified as having type 2 diabetes were entered into Flowchart 3. 89.9% of the initial cohort remained as type 2 diabetics at the end (n=400,070). 3,951 (0.9%) were re-classified as having probable type 1 diabetes.

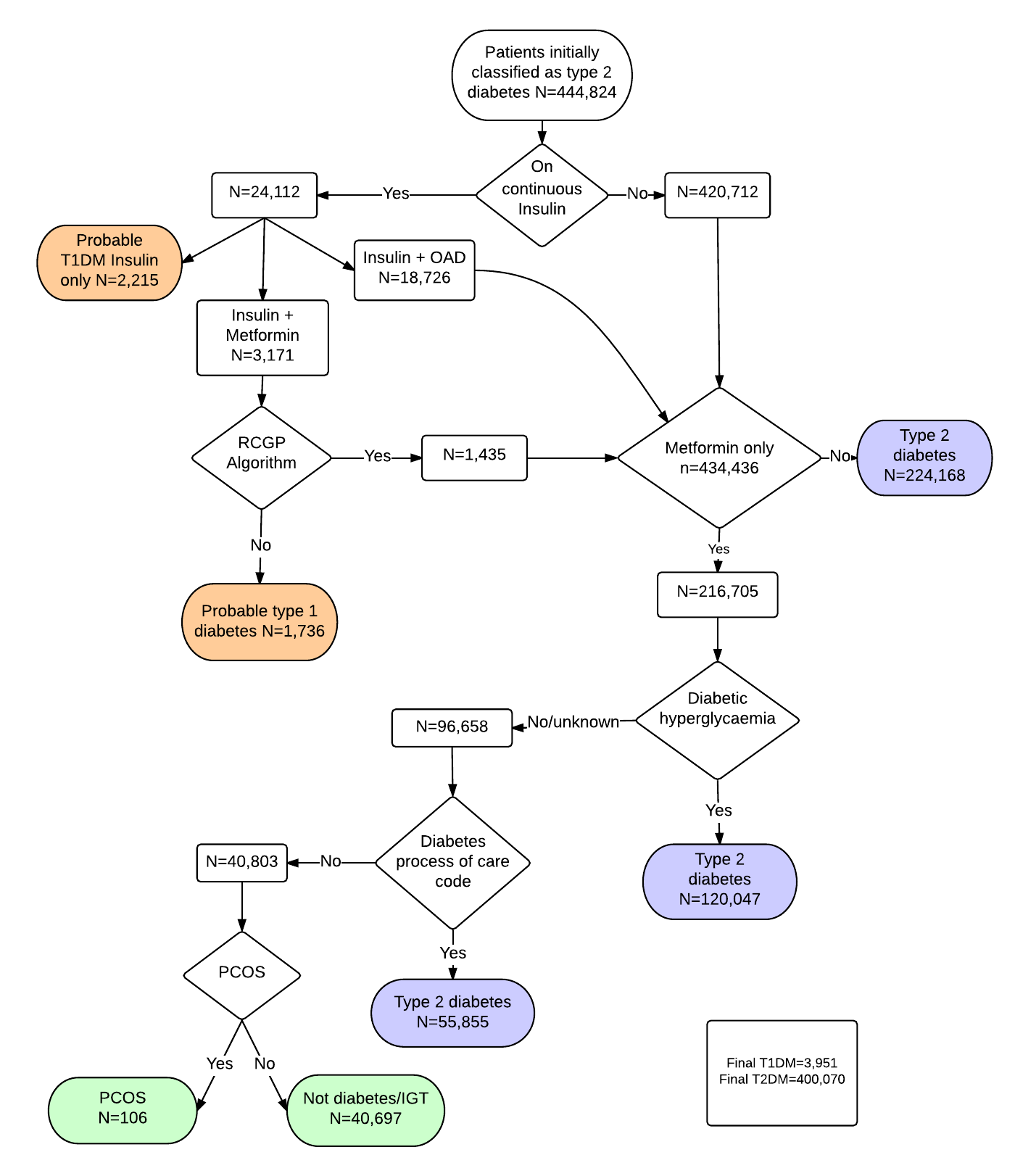


Figure 3. Results from Flowchart 3: Improving classification of type 2 diabetes