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## Cohort profile: The SAIL long-term conditions e-cohort (SLTC cohort) investigating area-level changes in healthcare resource use in Wales

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### Abstract

#### Introduction

The prioritisation of acute cases of coronavirus during the pandemic caused significant disruption to non-urgent healthcare services, creating a backlog of undiagnosed and untreated individuals with long-term conditions. Previous research has explored the impact of the pandemic on long-term conditions in Wales, but not the geographic variation or underlying area-level characteristics associated with these changes.

#### Objectives

We created the SAIL long-term conditions e-cohort (SLTC cohort) within the Secure Anonymised Information Linkage (SAIL) Databank to describe changes in healthcare service use of individuals living with long-term conditions during the COVID-19 pandemic, and to facilitate future investigations into the underlying reasons for these changes.

#### Methods

Individuals were included in the cohort if they interacted with health services with a long-term condition between January 2017 and December 2022. Interactions were identified using primary and secondary care datasets within the SAIL Databank. We linked this interaction level data with individual, residence, and area-level demographic data. We calculated area-level age-sex-standardised rates of interactions, based on an individual's address at the time of interaction, for the 3 years pre-COVID-19 (2017-2019) and during-COVID-19 (2020-2022). Percentage changes in rates between these time periods were calculated, and we investigated the underlying area-level characteristics associated with these differences.

#### Results

The SLTC cohort contains 1,277,532 individuals. Age-sex standardised interaction rates varied by Welsh Index of Multiple Deprivation (WIMD) quintiles and Rural-Urban Classification. Areas in the most deprived WIMD quintile had the greatest median percentage decrease (23.5%) in primary care rates of interactions from pre- to during-COVID-19, and the least deprived overall WIMD quintile had the smallest (16.9%). Areas classified as 'Urban city & town in a sparse setting' had the greatest decrease in primary care interactions (29.7%), and 'Rural village' areas had the smallest decrease (17.1%). Secondary care rates of interactions showed less variation in rates of interactions between the two time periods.

#### Conclusion

We have created a cohort that links area-level characteristics and measures of healthcare resource use, in a study period that covers pre- and during-COVID-19, which will allow researchers to investigate geographic variation of changes in healthcare resource use over this time period and the underlying influences. This cohort can also be further linked to other area-level characteristics of interest, such as travel times to general practices, or access to green space measures.

#### Keywords

long-term conditions; healthcare utilisation; COVID-19; data linkage; geographic variation

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## Introduction

The COVID-19 pandemic caused worldwide disruption to healthcare services. While demand for healthcare surged amid pressures to treat acute cases of the virus, research has shown that attendances to general practices, hospitals and accident and emergency departments for non-COVID-19 related healthcare decreased during the COVID-19 pandemic [1, 2]. In Wales, the first case of COVID-19 was reported on 28<sup>th</sup> February 2020, leading to significant changes in healthcare delivery. Diagnosis rates of long-term conditions decreased in 2020 and 2021 compared to previous years in Wales [3] creating a potential backlog of patients living with undiagnosed, and therefore unmanaged, conditions. It has been estimated that a typical general practice – where long-term conditions are usually diagnosed and managed – serving a population of 10,000 patients may have over 400 undiagnosed long-term conditions [3].

This backlog of undiagnosed and untreated patients was reflected worldwide, with millions of people left with delayed or postponed treatments and procedures, while services were directed towards tackling COVID-19 related illnesses [4, 5].

This is a concern for individuals' worsening prognoses and subsequent presentations to healthcare settings with more severe conditions which are harder to manage and treat effectively. Delayed diagnosis not only impacts an individual's quality of life and health outcomes but also places greater strain on secondary healthcare services, as patients are more likely to require emergency or specialised care. These challenges can lead to increased healthcare costs and exacerbate pressures on already stretched systems. In order to direct resources effectively, understanding where services were most impacted can help inform strategies to target support for the worst hit communities.

The SAIL long-term conditions e-cohort (SLTC cohort) was set up to investigate how the COVID-19 pandemic impacted non-COVID-19 healthcare service use and provision in Wales, UK, with a particular focus on how this varies at the local community level. We have used Electronic Healthcare Records (EHRs), linked to residence and area-level data to create a cohort of individuals with long-term conditions, along with the characteristics of the areas in which they live. This will allow us to identify 'hot' and 'cold' spots of healthcare resource utilisation across Wales, comparing pre- and during-COVID-19 rates of healthcare service interactions. This cohort will then facilitate investigations into which communities and subgroups of the population were at the highest risk of the indirect negative effects of COVID-19. In subsequent work, we will use the cohort to examine the underlying individual, environmental, residential, and area-level characteristics associated with the greatest impact on healthcare services.

Our research, using the SLTC cohort, will provide evidence on where policies, interventions and resources could be targeted, to address the 'undiagnosed' populations of Wales, or to identify areas where long-term conditions are more prevalent.

## Methods

### Data sources/datasets

The cohort was created using data accessed and analysed within the Secure Anonymised Information Linkage (SAIL) Databank ([www.saildatabank.com](http://www.saildatabank.com)) [6–8]. The SAIL Databank is a trusted research environment, containing anonymised individual level EHRs from primary and secondary care healthcare settings, as well as demographic data, birth, and death data, among other datasets for the entire resident population of Wales over time.

The Welsh Longitudinal General Practice (WLGP) dataset [9] and the Patient Episode Database for Wales (PEDW) dataset [9] were used to identify diagnoses of long-term conditions. These contain patient records from primary care (attendances and clinical information from General Practices (GPs)) and secondary care (hospital admissions, day case activity) health services respectively. The WLGP dataset covers 86.1% of the population and 82.4% of GP practices in Wales and records are coded using Read v2 codes. The PEDW dataset contains all inpatient and day case activity undertaken in the National Health Service (NHS) Wales, and records are coded using the International Classification of Diseases version 10 (ICD-10). PEDW contains information on patients treated by the NHS, including where treatment occurs in private care facilities but is funded through the NHS. However it does not contain information on privately funded treatments in private hospitals.

The Welsh Demographic Service Dataset (WDSD) which contains information on all individuals registered to a Welsh GP [9] was used to obtain individual-level demographic data. EHRs were linked to the WDSD using Anonymised Linking Fields (ALFs).

The WDSD also contains details of residential address history. Individual addresses are replaced with a Residential Anonymous Linking Field (RALF) [10, 11], that allows for further linkage to geospatial characteristics at the household level.

RALFs are mapped to Lower Layer Super Output Areas (LSOAs) [12] which are small area statistical geographies and comprise between 400 and 1200 households and have a resident population between 1000 and 3000 persons.

The Welsh Index of Multiple Deprivation (WIMD) is the Welsh Government's official measure of relative deprivation for small areas in Wales [13]. It contains measures across the following domains: Income, Employment, Health, Education, Access to Services, Community Safety, Physical Environment, and Housing. Each of the 1909 LSOA's in Wales has domain-specific measures of deprivation and are then ranked from 1 (most deprived) to 1909 (least deprived) within each domain, and across overall deprivation. They can be further grouped into deciles and quintiles.

The Rural/Urban Classification is the UK Government's categorisation of geographic areas by population density, subdivided into six settlement types; Urban city and town, Urban city and town in a sparse setting, Rural town and fringe, Rural town and fringe in a sparse setting, Rural village and dispersed, Rural village and dispersed in a sparse setting [14].

The matching process and assignment of unique ALFs to person-based records has been previously reported [8], demonstrating high quality and enabling accurate linkage.

## Study population

The SLTC cohort is population level containing all individuals living in Wales and diagnosed with at least one of 17 long-term conditions any time up until December 2022, and a long-term condition related interaction with healthcare services between January 2017 and December 2022. These interactions could be the initial diagnosis of the long-term condition, or a subsequent interaction with health services where the long-term condition was recorded.

The time periods were selected based on data completeness and availability. The pre- and during-COVID-19 periods were designed to be of equal length to allow for comparisons. The entirety of 2020 was included in the during-COVID-19 period to account for potential behavioural and service utilisations changes prompted by awareness of the pandemic, prior to the first confirmed case in Wales.

The long-term conditions were defined using the general practice 'Quality and Outcomes Framework' [15]. The selection of conditions was informed by collaboration with NHS clinical colleagues to ensure a focus on conditions that are generally managed rather than cured, and to ensure high data quality. Records of interactions were extracted from routinely collected EHRs from the NHS, UK.

The long-term conditions included were: anxiety disorders, asthma, atrial fibrillation, coronary heart disease, chronic kidney disease, chronic obstructive pulmonary disease, dementia, depression, diabetes mellitus, epilepsy, heart failure, hypertension, inflammatory bowel disease, osteoporosis, peripheral vascular disease, rheumatoid arthritis, and stroke and transient ischaemic attack.

## Variables

Individual health records for primary care were extracted from WLGP where the Read code matched with a Read code for long-term conditions. We extracted all records recorded between 1st January 2017 and 31st December 2022. Multiple records for an individual (indicated by variable ALF) were retained. Records related to the same long-term condition with the same event date were counted as a single interaction with primary care. The list of Read codes used to define long-term conditions can be found in Supplementary Appendix 1.

Individual health records for secondary care were extracted from PEDW where the ICD-10 code matched with an ICD-10 code for long-term conditions. We extracted all records where the hospital spell had a start date between 1st January 2017 and 31st December 2022. Multiple records for an individual (indicated by variable ALF) were retained. Records related to the same long-term condition and the same hospital spell were counted as a single interaction with secondary care. The list of ICD-10 codes used to define long-term conditions can be found in Supplementary Appendix 1.

The WDSD contains variables shown in Table 1. The variables Anonymised Linking Field (ALF), Address Start Date, and Address End Date were used for data linkage with interaction level data. Individuals were linked to an address

based on the date of interaction with healthcare services falling between the address start date and address end date in WDSD. LSOA Codes were used for data linkage with area-level characteristic datasets. The WIMD dataset was used to extract area-level measures of deprivation for the cohort including: access to services and physical environment domains, as well as overall deprivation. Linkage to Office for National Statistics Rural Urban Classification data enabled area-level grouping of the cohort by rural-urban classes.

Linkage to individual level demographic data provided further information on individuals and allowed us to carry out exclusions of invalid records.

We calculated rates of healthcare interactions – age-sex standardised using the Welsh standard population (see Supplementary Appendix 2) – per 100 000 persons, for every LSOA in Wales, from 2017-2019 and 2020-2022.

We used these to calculate the percentage change in rates pre- and during-COVID-19, to identify which areas of Wales were most affected by the COVID-19 pandemic in terms of healthcare service use.

We further linked these area-level counts and rates to area-level socio-demographic and environmental datasets to understand which factors were associated with variation in the pre-during-COVID-19 changes between small areas across Wales. Median changes in age-sex standardised rates were also summarised by WIMD quintiles and Rural-Urban classifications to explore how healthcare utilisation changes varied across communities with different characteristics.

Analyses were performed using R 4.1.3, with the *dsr* package used to compute standardised rates.

## Exclusions

The following exclusions were applied for individuals within the SLTC cohort:

- Non-Welsh address at the time of interaction (Already excluded as unable to link to WDSD data).
- Interactions occurring before week of birth.
- Interactions occurring after date of death.
- Anonymised linking field status not valid.
- Sex missing, or unknown.

## Patient and public involvement

Public involvement was incorporated through the SAIL Consumer Panel. The panel provided insights into healthcare access during the COVID-19 pandemic, identifying long-term conditions as a priority for research, and highlighting regional differences in healthcare service access and use across Wales.

## Results

Records relating to 1 375 055 persons were extracted from the data, 97 501 individuals could not be linked to the WDSD, and were excluded resulting in 92.9% of individuals as linkable to individual and area-level demographic level data. A further 22 individuals were excluded as shown in Figure 1.

We linked the remaining person level EHRs with individual and area-level demographic data.

Table 1: SLTC Cohort linked datasets, variables included at both individual level and area-level

| Dataset   | Variables  | Individual/area-level  |
|---|--|--|
| Welsh Longitudinal General Practice                 | Anonymised Linking Field (ALF)<br>Event Date<br>Read Code<br>Anonymised Linking Field Status Code  | Individual<br>Individual<br>Individual<br>Individual   |
| Patient Episode Database for Wales                  | Anonymised Linking Field (ALF)<br>Spell Start Date<br>Spell End Date<br>ICD-10 Code<br>Anonymised Linking Field Status Code  | Individual<br>Individual<br>Individual<br>Individual<br>Individual   |
| Welsh Demographic Service Dataset                   | Anonymised Linking Field (ALF)<br>Address Start Date<br>Address End Date<br>Residential Anonymised Linking Field (RALF)<br>LSOA Code<br>Week of Birth<br>Date of Death<br>Sex  | Individual<br>Individual<br>Individual<br>Individual<br>Individual<br>Individual<br>Individual<br>Individual |
| Welsh Index of Multiple Deprivation                 | Lower Layer Super Output Area (LSOA) Code<br>WIMD Quintile<br>Access to Services Quintile<br>Physical Environment Quintile<br>Average travel time to pharmacy<br>Average travel time to GP<br>Proximity to accessible natural green space score<br>Ambient green space score | Area<br>Area<br>Area<br>Area<br>Area<br>Area<br>Area<br>Area   |
| Rural-Urban Classification                          | Lower Layer Super Output Area (LSOA) Code<br>Rural-Urban Classification  | Area<br>Area   |
| Office for National Statistics Population Estimates | Year<br>Mid-year Population Estimates  | Area<br>Area   |

The final number of individuals in the SLTC cohort was 1 277 532, of these 463 218 individuals entered the cohort in the first year, then 262 485 in 2018, 197 658 in 2019, 117 406 in 2020, 118 755 in 2021, and 118 010 in 2022.

The numbers of individuals at each stage are shown in Figure 1.

A total of 7 502 485 interactions with healthcare services in Wales with a record of a long-term condition between January 2017 and December 2022 were identified.

Within the SLTC cohort, 74.1% (946 679) of individuals had at least one primary care interaction, with 2 555 732 primary care interactions in total. For secondary care, 59.5% (760 704) of individuals had at least one interaction, with 4 946 753 secondary care interactions in total.

More than half of the cohort (55.1%) had interactions relating to more than one long-term condition in the 6-year timeframe. In total, 175 798 individuals in the cohort died between January 2017 and December 2022.

Across the 6 years of coverage, the most deprived areas had the greatest number of individuals with long-term conditions who interacted with healthcare services, followed by the 2nd most deprived, 3rd most deprived, 4th most deprived, then the least deprived quintile (see Table 2).

We calculated age-sex standardised rates of interactions recorded between 2017-2019 (pre-COVID-19) and between 2020-2022 (during-COVID-19) for each LSOA and compared the differences between pre- and during-COVID-19 rates by quintiles of overall WIMD, and the domain specific indicators Access to Services, and Physical Environment (Table 3a), which were selected due to their relevance to area-level factors such as access to healthcare services, proximity to green spaces, and levels of air pollution. We also compared the differences between pre- and during-COVID-19 age-sex standardised rates by Rural-Urban groups.

Both primary care and secondary care interactions decreased during-COVID-19 across all deprivation quintiles. The most deprived overall WIMD quintile had the greatest median percentage decrease (23.5%) in primary care rates of interactions from pre- to during-COVID-19, and the least deprived overall WIMD quintile had the smallest median percentage decrease (16.9%). The pattern of decreases in primary care interactions across the Access to Services domain quintiles was not linearly correlated with deprivation (from 20.6% in the 2<sup>nd</sup> most deprived and 22.3% in the 3<sup>rd</sup> most deprived). There was less variation in the percentage change of secondary care age-sex standardised

Figure 1: Cohort inclusion flow diagram

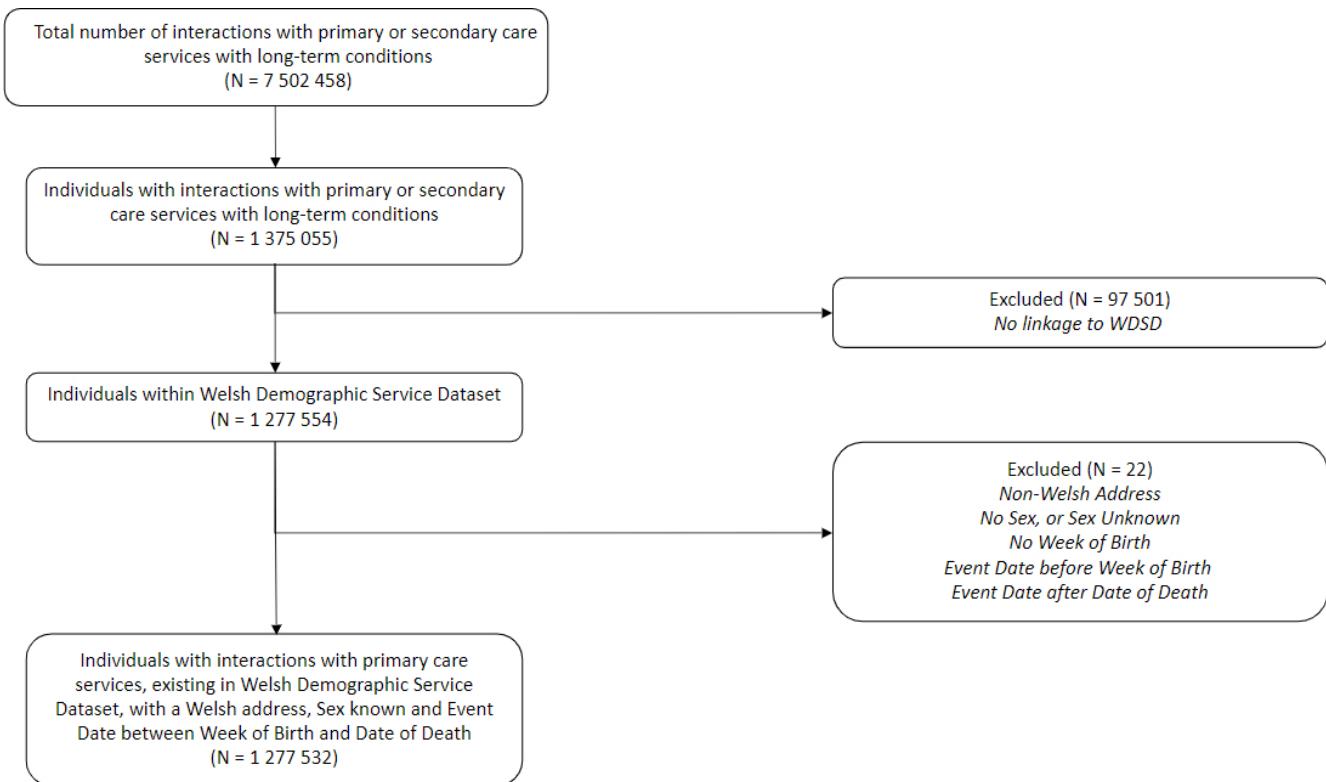


Table 2: Number of distinct individuals by WIMD deprivation quintile and Rural-Urban Classification with a long-term condition health service interaction by year of interaction

|   | Year    |         |         |         |         |         |
|---|---------|---------|---------|---------|---------|---------|
|   | 2017    | 2018    | 2019    | 2020    | 2021    | 2022    |
| <b>WIMD Quintile</b>                            |         |         |         |         |         |         |
| 1 (most deprived)                               | 104 794 | 106 010 | 106 747 | 80 719  | 85 633  | 92 542  |
| 2   | 97 808  | 98 738  | 100 624 | 75 457  | 81 143  | 90 045  |
| 3   | 92 021  | 92 544  | 93 278  | 70 199  | 76 980  | 85 517  |
| 4   | 89 406  | 90 068  | 91 083  | 69 537  | 76 318  | 83 619  |
| 5 (least deprived)                              | 84 029  | 85 058  | 86 130  | 67 647  | 73 893  | 80 546  |
| <b>Rural-Urban Classification</b>               |         |         |         |         |         |         |
| Urban city and town                             | 315 749 | 319 592 | 323 174 | 247 746 | 265 077 | 290 578 |
| Urban city and town in a sparse setting         | 9714    | 9755    | 9836    | 7546    | 8029    | 8675    |
| Rural town and fringe                           | 62 705  | 63 052  | 63 433  | 48 094  | 53 722  | 58 658  |
| Rural town and fringe in a sparse setting       | 17 053  | 17 259  | 17 420  | 12 916  | 14 041  | 15 609  |
| Rural village and dispersed                     | 27 458  | 27 827  | 28 534  | 21 540  | 24 091  | 26 308  |
| Rural village and dispersed in a sparse setting | 32 403  | 32 147  | 32 807  | 24 236  | 26 930  | 30 297  |
| <b>Total</b>                                    | 463 218 | 467 762 | 473 525 | 360 916 | 390 411 | 428 572 |

Note: Yearly counts per WIMD Quintile/Rural-Urban Classification will not sum to total yearly counts, as individuals who moved between WIMD quintiles/Rural-Urban Classifications within a year and had interactions with healthcare services in each are counted more than once.

rates, across the WIMD quintiles (between 10.9% and 14.3% decrease).

Areas classified as 'Urban city & town in a sparse setting' had the greatest decrease in primary care interactions

(29.7%) in the during-COVID-19 period compared to the pre-COVID-19 period, and 'Rural village' areas had the smallest decrease (17.1%). However, the 'Urban city & town in a sparse setting' group had the smallest decrease in secondary

Table 3: Median Percentage difference in age-sex standardised rates of primary and secondary care interactions from 2017-2019 to 2020-2022 by a) WIMD quintiles (Overall, Access to Services, and Physical Environment) - 1(most deprived) to 5(least deprived) and b) Rural-Urban Classification

(a)

| WIMD Domain          | Quintile | Median percentage difference age-sex standardised rates (pre to during-COVID-19) (%) |                |
|----------------------|----------|--|----------------|
|                      |          | Primary care   | Secondary care |
| Overall              | 1        | -23.5  | -12.3          |
|                      | 2        | -21.7  | -13.4          |
|                      | 3        | -22.4  | -13.5          |
|                      | 4        | -20.6  | -12.6          |
|                      | 5        | -16.9  | -11.2          |
| Access to Services   | 1        | -20.8  | -12.8          |
|                      | 2        | -20.6  | -13.2          |
|                      | 3        | -22.3  | -13.5          |
|                      | 4        | -20.7  | -11.3          |
|                      | 5        | -22.3  | -12.8          |
| Physical Environment | 1        | -24.1  | -10.9          |
|                      | 2        | -20.6  | -12.2          |
|                      | 3        | -21.7  | -14.3          |
|                      | 4        | -19.6  | -13.6          |
|                      | 5        | -20.9  | -11.3          |

(b)

| Rural-Urban Classification                | Median percentage difference age-sex standardised rates (pre to during-COVID-19) (%) |                |
|---|--|----------------|
|   | Primary care   | Secondary care |
| Urban city & town                         | -20.5  | -11.5          |
| Urban city & town in a sparse setting     | -29.7  | -8.4           |
| Rural town and fringe                     | -22.6  | -14.4          |
| Rural town and fringe in a sparse setting | -28.6  | -18.1          |
| Rural village                             | -17.1  | -11.4          |
| Rural village in a sparse setting         | -24.7  | -15.0          |

care age-sex standardised rates of interactions (8.4%), and the 'Rural town and fringe in a sparse setting' group had the greatest decrease (18.1%). Changes in primary and secondary care age-sex standardised rates by Rural-Urban Classification are shown in Table 3B and visualised in Figure 2.

## Discussion

We have created the SLTC cohort to: enable quantification of the variation in non-COVID-19 healthcare resource use geographically across Wales; identify the areas of Wales that experienced the greatest changes; and, facilitate understanding the underlying reasons.

We have found the biggest changes in primary care interactions occurred within the most deprived WIMD quintile and areas classified as 'Urban city & town in a sparse setting', while the biggest changes in secondary care interactions occurred within areas classified as 'Rural town and fringe in a sparse setting', but there was less variation between WIMD deprivation quintiles.

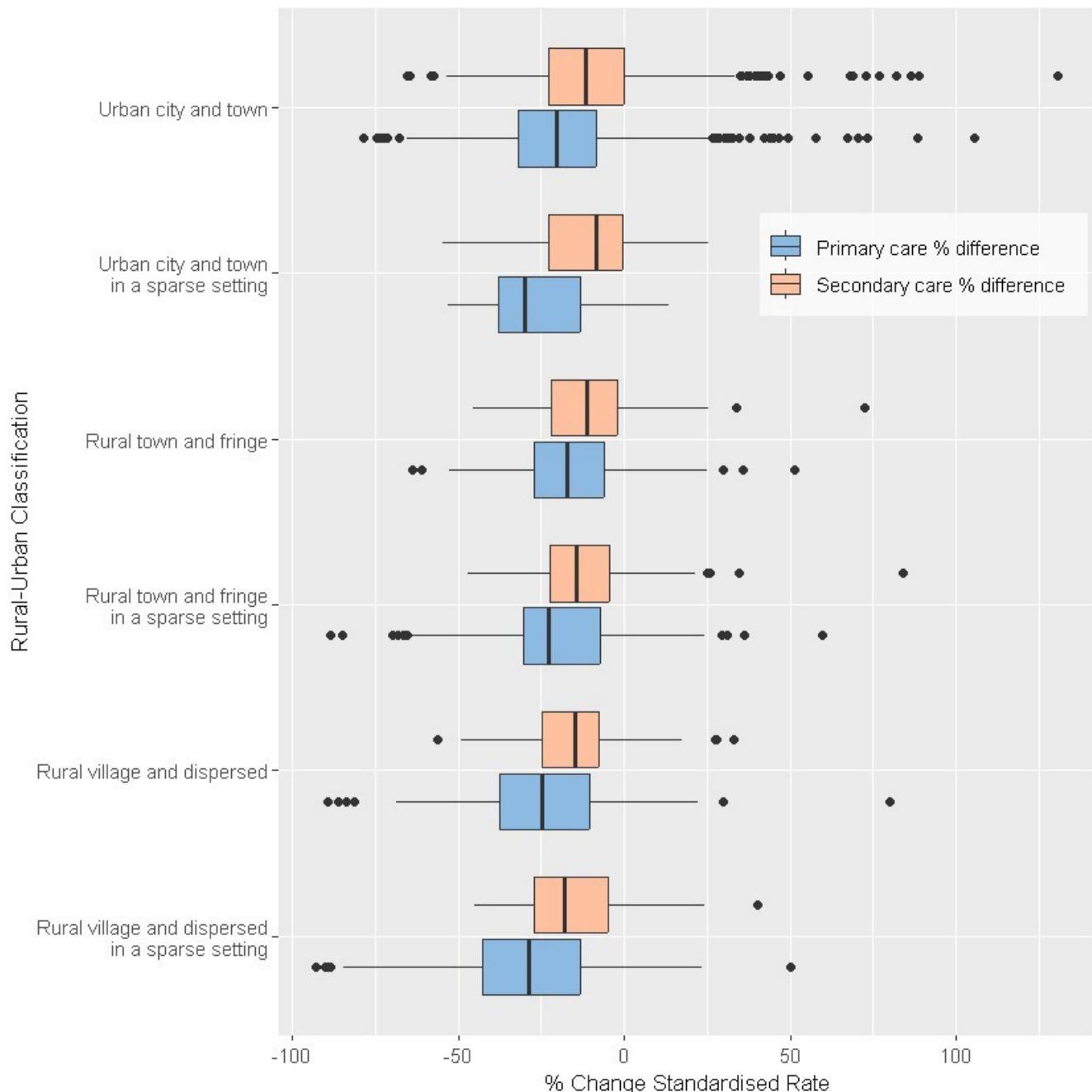
The results of this study build on the work of Moynihan et al [16], who conducted a systematic review on the impact of the COVID-19 pandemic on healthcare utilisation. While

their review highlighted trends in healthcare service utilisation, this study and cohort contribute to the existing literature by addressing a key gap, examining area-level changes in healthcare use and considering the underlying characteristics of the areas most affected. For example, we found that "Urban city & town in a sparse setting" areas experienced the greatest decrease in primary care interactions but the smallest decrease in secondary care interactions, indicating a potential shift in healthcare service utilisation from primary to secondary care. This shift is concerning, as ideally long-term conditions are mostly treated and managed in primary care. The observation that areas in the most deprived WIMD quintile experienced the greatest reduction in primary care interactions highlights a potentially disproportionate impact on these services for the most deprived populations in Wales.

In contrast to the study by Qi et al [3] which focused on diagnosis rates and found limited differences across deprivation levels, this study examined both initial diagnoses and ongoing management. While deprivation may not have significantly impacted the initial diagnosis of long-term conditions, it is likely to have influenced access to follow-up care.

These findings have implications for ongoing healthcare catch-up initiatives and provide useful insight for preparedness for potential future health crises, emphasising the importance

Figure 2: Primary and secondary care % change in age-sex standardised rates by Rural-Urban Classification



of ensuring equitable access to primary care services during times of disruption.

Future work will use the SLTC cohort to apply spatial auto-correlation methods and identify clustering of similar values of age-sex standardised rates. Geospatial analyses will enable a better understanding of the local relationships between area-level socio-demographic and environmental factors (such as distances to general practices, proximity to greenspace, Enhanced Vegetation Index (EVI)) and various healthcare resource use outcome measures. We aim to investigate which area-level characteristics had the greatest impact on the effects of the pandemic on healthcare service use. There is also potential for the cohort to be used to investigate condition-specific changes in healthcare-service use, to explore whether individuals with

specific conditions were disproportionately impacted by the pandemic.

### Strengths and limitations

The main strength of the SLTC cohort is the use of longitudinal nationwide healthcare interaction records, demographic and area-level characteristic data with population-scale coverage in Wales. The use of anonymised linked datasets within SAIL Databank, a secure repository of large-scale datasets regarding the population of Wales, allows us to consider the geospatial characteristics associated with variation in healthcare resource use at a small area-level.

A further strength is the investigation of both primary care and secondary care interactions, which will help us to

understand how individuals living in different parts of Wales have changed which services they use more or less frequently during-COVID-19.

This cohort has complete population coverage for secondary care and demographic records, while primary care records cover 86.1% of the population. This provides a more representative sample of the population of Wales compared to other types of cohorts, so studies using the SLTC can inform public health strategies aimed at improving the health of the whole population, and relieve pressures on the National Health Service.

This study included healthcare interactions for individuals diagnosed with a broad range of long-term conditions. These conditions defined using the Quality and Outcomes Framework criteria were selected for comparison with previous work [3] investigating temporal trends in diagnosis rates. A limitation of using these selected conditions is that the variation in healthcare use across areas may not be representative of other healthcare conditions (e.g. cancer).

The data used to create the SLTC cohort is routinely recorded administrative data and while it is highly valuable, it does not fully capture human behaviour. We therefore cannot account for individuals' decisions not to attend primary care appointments or go to hospital for emergency or planned treatment nor understand the reasons why. As the study period of the SLTC cohort spans the peak of the COVID-19 pandemic, there may be further underlying reasons – such as fear of contracting the virus - why individuals may have avoided using healthcare services, and therefore not appear in routine data. It doesn't necessarily imply the services were not available to them.

We are currently limited to statistical geographies when creating small area estimates of clustering. In rural areas where the statistical geographies are larger, we may not be able to detect intra-small area variations in disease distribution. Area-level measures of deprivation are used to make inferences about individuals' socio-economic status, which would inevitably vary within small areas. This ecological fallacy of area-level characteristics limits the conclusions that can be drawn at an individual level; however, the purpose of this study is to help direct scarce resources to the area's most in need rather than identify individual persons most affected.

A limitation of this study is that it does not account for the effects of specific lockdown periods on healthcare utilisation. This decision reflects the study's primary focus on overall changes in service use patterns across pre- and during-COVID-19 periods, rather than a time-series analysis. Future studies could utilise this cohort to explore these temporal trends and underlying causes in greater detail.

## Data availability statement

Anonymised individual-level data was extracted and linked within the SAIL Databank. Aggregated outcome data was requested out of the secure e-research platform and linked to area-level datasets.

Applications to access data within the SAIL Databank can be submitted here <https://saildatabank.com/data/apply-to-work-with-the-data/>, and will be reviewed by an independent Information Governance Review Panel.

## Conflict of interest

None declared.

## Ethics statement

This research was conducted within the Secure Anonymised Information Linkage (SAIL) Databank, with the permission and approval of the SAIL Independent Information Governance Review Panel (IGRP) project number 1542.

The cohort was created using anonymised data within the SAIL Databank, which is exempt from requiring individual patient consent.

## Acknowledgements

This study makes use of anonymised data held in the Secure Anonymised Information Linkage (SAIL) Databank. We would like to acknowledge all the data providers who make anonymised data available for research.

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## Supplementary Appendices

Supplementary Appendix 1: clinical\_code\_lists.docx – lists of clinical codes used for primary care (Read codes) and secondary care (ICD-10 codes)

| Condition           | ICD-10 code | ICD-10 code description   |
|---------------------|-------------|---|
| Anxiety Disorders   | F41         | Other anxiety disorders   |
| Anxiety Disorders   | F40         | Phobic anxiety disorders  |
| Asthma              | J46         | Status asthmaticus  |
| Asthma              | J45         | Asthma  |
| Atrial Fibrillation | I802        | Phlebitis and thrombophlebitis of other deep vessels of lower extremities                                 |
| Atrial Fibrillation | I48         | Atrial fibrillation and flutter   |
| Atrial Fibrillation | I801        | Phlebitis and thrombophlebitis of femoral vein  |
| Atrial Fibrillation | I26         | Pulmonary embolism  |
| Atrial Fibrillation | I803        | Phlebitis and thrombophlebitis of lower extremities, unspecified  |
| CHD                 | I250        | Atherosclerotic cardiovascular disease, so described  |
| CHD                 | I253        | Aneurysm of heart   |
| CHD                 | I255        | Ischaemic cardiomyopathy  |
| CHD                 | I251        | Atherosclerotic heart disease   |
| CHD                 | I254        | Coronary artery aneurysm  |
| CHD                 | I256        | Silent myocardial ischaemia   |
| CHD                 | I258        | Other forms of chronic ischaemic heart disease  |
| CHD                 | I259        | Chronic ischaemic heart disease, unspecified  |
| CKD                 | Z940        | Kidney transplant status  |
| CKD                 | Z49         | Care involving dialysis   |
| CKD                 | Y841        | Kidney dialysis   |
| CKD                 | T861        | Kidney transplant failure and rejection   |
| CKD                 | N19         | Unspecified kidney failure  |
| CKD                 | N181        | Chronic kidney disease, stage 1   |
| CKD                 | N185        | Chronic kidney disease, stage 5   |
| CKD                 | N184        | Chronic kidney disease, stage 4   |
| CKD                 | N183        | Chronic kidney disease, stage 3   |
| CKD                 | N03         | Chronic nephritic syndrome  |
| CKD                 | N189        | Chronic kidney disease, unspecified   |
| CKD                 | N25         | Disorders resulting from impaired renal tubular function  |
| CKD                 | Z992        | Dependence on renal dialysis  |
| CKD                 | N074        | Hereditary nephropathy, not elsewhere classified ; Diffuse endocapillary proliferative glomerulonephritis |
| CKD                 | N072        | Hereditary nephropathy, not elsewhere classified ; Diffuse membranous glomerulonephritis                  |
| CKD                 | N10         | Acute tubulo-interstitial nephritis   |
| CKD                 | N053        | Unspecified nephritic syndrome ; Diffuse mesangial proliferative glomerulonephritis                       |
| CKD                 | N073        | Hereditary nephropathy, not elsewhere classified ; Diffuse mesangial proliferative glomerulonephritis     |
| CKD                 | N182        | Chronic kidney disease, stage 2   |
| CKD                 | N01         | Rapidly progressive nephritic syndrome  |
| CKD                 | N056        | Unspecified nephritic syndrome ; Dense deposit disease  |
| CKD                 | N054        | Unspecified nephritic syndrome ; Diffuse endocapillary proliferative glomerulonephritis                   |
| CKD                 | N052        | Unspecified nephritic syndrome ; Diffuse membranous glomerulonephritis                                    |
| CKD                 | N00         | Acute nephritic syndrome  |
| CKD                 | N17         | Acute renal failure   |
| CKD                 | N055        | Unspecified nephritic syndrome ; Diffuse mesangiocapillary glomerulonephritis                             |

Continued

## Supplementary Appendix 1: Continued

| Condition         | ICD-10 code | ICD-10 code description   |
|-------------------|-------------|---|
| COPD              | J42         | Unspecified chronic bronchitis  |
| COPD              | J43         | Emphysema   |
| COPD              | J440        | Other chronic obstructive pulmonary disease   |
| COPD              | J41         | Simple and mucopurulent chronic bronchitis  |
| COPD              | J40         | Bronchitis, not specified as acute or chronic                                       |
| COPD              | J410        | Simple and mucopurulent chronic bronchitis  |
| COPD              | J44         | Other chronic obstructive pulmonary disease   |
| Dementia          | F024A       | Dementia in human immunodef virus [HIV] disease                                     |
| Dementia          | 333.4       | Huntingdon's  |
| Dementia          | 46.19       | Creutzfeld Jacob  |
| Dementia          | F019        | Vascular dementia, unspecified  |
| Dementia          | F013        | Mixed cortical and subcortical vascular dementia                                    |
| Dementia          | 331.1       | Frontotemporal dementia   |
| Dementia          | F01         | Vascular dementia   |
| Dementia          | F012        | Subcortical vascular dementia   |
| Dementia          | F011        | Multi-infarct dementia  |
| Dementia          | F018        | Other vascular dementia   |
| Dementia          | F010        | Vascular dementia of acute onset  |
| Dementia          | F028A       | Dementia in other specified diseases classified elsewhere                           |
| Dementia          | 290.3       | Senile dementia with delirium   |
| Dementia          | I67.3       | Binswanger's disease  |
| Dementia          | F051        | Delirium superimposed on dementia   |
| Dementia          | F021A       | Dementia in Creutzfeldt-Jakob disease   |
| Dementia          | F02         | Dementia in other diseases classified elsewhere                                     |
| Dementia          | 290.2       | Senile dementia with delusional features  |
| Dementia          | F020A       | Dementia in Pick's disease  |
| Dementia          | F023A       | Dementia in Parkinson's disease   |
| Dementia          | F03X        | Unspecified dementia  |
| Dementia          | 290.1x      | Presenile dementia  |
| Dementia          | 290.4       | Vascular dementia   |
| Dementia          | 290         | Senile dementia, uncomplicated  |
| Dementia          | F022A       | Dementia in Huntington's disease  |
| Depression        | F332        | Recurrent depressive disorder, current episode severe without psychotic symptoms    |
| Depression        | F330        | Recurrent depressive disorder, current episode mild                                 |
| Depression        | F334        | Recurrent depressive disorder, currently in remission                               |
| Depression        | F338        | Other recurrent depressive disorders  |
| Depression        | F339        | Recurrent depressive disorder, unspecified  |
| Depression        | F333        | Recurrent depressive disorder, current episode severe with psychotic symptoms       |
| Depression        | F381        | Other recurrent mood [affective] disorders  |
| Depression        | F341        | Dysthymia   |
| Depression        | F331        | Recurrent depressive disorder, current episode moderate                             |
| Depression        | F321        | Moderate depressive episode   |
| Depression        | F322        | Severe depressive episode without psychotic symptoms                                |
| Depression        | F323        | Severe depressive episode with psychotic symptoms                                   |
| Depression        | F329        | Depressive episode, unspecified   |
| Depression        | F328        | Other depressive episodes   |
| Depression        | F320        | Mild depressive episode   |
| Diabetes Mellitus | E10         | Insulin-dependent diabetes mellitus   |
| Diabetes Mellitus | E11         | Non-insulin-dependent diabetes mellitus   |
| Diabetes Mellitus | E12         | Malnutrition-related diabetes mellitus  |
| Diabetes Mellitus | O242        | Diabetes mellitus in pregnancy: Pre-existing malnutrition-related diabetes mellitus |
| Epilepsy          | G41         | Status epilepticus  |
| Epilepsy          | G40         | Epilepsy  |

Continued

## Supplementary Appendix 1: Continued

| Condition                  | ICD-10 code | ICD-10 code description   |
|----------------------------|-------------|---|
| Heart Failure              | I130        | Hypertensive heart and renal disease with (congestive) heart failure                        |
| Heart Failure              | I500        | Congestive heart failure  |
| Heart Failure              | I110        | Hypertensive heart disease with (congestive) heart failure                                  |
| Heart Failure              | I501        | Left ventricular heart failure  |
| Heart Failure              | I322        | Hypertensive heart and renal disease with both (congestive) heart failure and renal failure |
| Heart Failure              | I509        | Heart failure, unspecified  |
| Hypertension               | I10         | Essential (primary) hypertension  |
| Hypertension               | I11         | Hypertensive heart disease  |
| Hypertension               | I12         | Hypertensive renal disease  |
| Hypertension               | I13         | Hypertensive heart and renal disease  |
| Hypertension               | I15         | Secondary hypertension  |
| Inflammatory Bowel Disease | K50         | Crohn's disease [regional enteritis]  |
| Inflammatory Bowel Disease | M075        | Arthropathy in ulcerative colitis   |
| Inflammatory Bowel Disease | K519        | Ulcerative colitis, unspecified   |
| Inflammatory Bowel Disease | K518        | Other ulcerative colitis  |
| Inflammatory Bowel Disease | K515        | Left sided colitis  |
| Inflammatory Bowel Disease | K513        | Ulcerative (chronic) rectosigmoiditis   |
| Inflammatory Bowel Disease | M074        | Arthropathy in Crohn's disease [regional enteritis]   |
| Inflammatory Bowel Disease | K512        | Ulcerative (chronic) proctitis  |
| Inflammatory Bowel Disease | K510        | Ulcerative (chronic) pancolitis   |
| Osteoporosis               | M82         | Osteoporosis in diseases classified elsewhere   |
| Osteoporosis               | M80         | Osteoporosis with pathological fracture   |
| Osteoporosis               | M81         | Osteoporosis without pathological fracture  |
| PVD                        | I731        | Thromboangiitis obliterans [Buerger]  |
| PVD                        | I745        | Embolism and thrombosis of iliac artery   |
| PVD                        | I744        | Embolism and thrombosis of arteries of extremities, unspecified                             |
| PVD                        | I743        | Embolism and thrombosis of arteries of lower extremities                                    |
| PVD                        | I739        | Peripheral vascular disease, unspecified  |
| PVD                        | I738        | Other specified peripheral vascular diseases  |
| Rheumatoid Arthritis       | M053        | Rheumatoid arthritis with involvement of other organs and systems                           |
| Rheumatoid Arthritis       | M062        | Rheumatoid bursitis   |
| Rheumatoid Arthritis       | M060        | Seronegative rheumatoid arthritis   |
| Rheumatoid Arthritis       | M068        | Other specified rheumatoid arthritis  |
| Rheumatoid Arthritis       | M061        | Adult-onset Still's disease   |
| Rheumatoid Arthritis       | M059        | Seropositive rheumatoid arthritis, unspecified  |
| Rheumatoid Arthritis       | M063        | Rheumatoid nodule   |
| Rheumatoid Arthritis       | M069        | Rheumatoid arthritis, unspecified   |
| Rheumatoid Arthritis       | M083        | Juvenile polyarthritis (seronegative)   |
| Rheumatoid Arthritis       | M080        | Juvenile rheumatoid arthritis   |
| Rheumatoid Arthritis       | M058        | Other seropositive rheumatoid arthritis   |
| Rheumatoid Arthritis       | M052        | Rheumatoid vasculitis   |
| Rheumatoid Arthritis       | I528        | Rheumatoid carditis   |
| Rheumatoid Arthritis       | M084        | Pauciarticular juvenile arthritis   |
| Rheumatoid Arthritis       | J990        | Rheumatoid lung disease   |
| Rheumatoid Arthritis       | M051        | Rheumatoid lung disease   |
| Rheumatoid Arthritis       | M050        | Felty's syndrome  |
| Rheumatoid Arthritis       | M082        | Juvenile arthritis with systemic onset  |
| Stroke & TIA               | G452        | Multiple and bilateral precerebral artery syndromes   |
| Stroke & TIA               | G454        | Transient global amnesia  |
| Stroke & TIA               | G453        | Amaurosis fugax   |
| Stroke & TIA               | G463        | Brain stem stroke syndrome  |
| Stroke & TIA               | I631        | Cerebral infarction due to embolism of precerebral arteries                                 |
| Stroke & TIA               | G464        | Cerebellar stroke syndrome  |
| Stroke & TIA               | 1660        | Occlusion and stenosis of cerebral arteries, not resulting in cerebral infarction           |

Continued

## Supplementary Appendix 1: Continued

| Condition    | ICD-10 code | ICD-10 code description  |
|--------------|-------------|--|
| Stroke & TIA | G460        | Middle cerebral artery syndrome  |
| Stroke & TIA | G468        | Other vascular syndromes of brain in cerebrovascular diseases                        |
| Stroke & TIA | G462        | Posterior cerebral artery syndrome   |
| Stroke & TIA | G461        | Anterior cerebral artery syndrome  |
| Stroke & TIA | G467        | Other lacunar syndromes  |
| Stroke & TIA | I630        | Cerebral infarction due to thrombosis of precerebral arteries                        |
| Stroke & TIA | I633        | Cerebral infarction due to thrombosis of cerebral arteries                           |
| Stroke & TIA | G466        | Pure sensory lacunar syndrome  |
| Stroke & TIA | G450        | Vertebo-basilar artery syndrome  |
| Stroke & TIA | I635        | Cerebral infarction due to unspecified occlusion or stenosis of cerebral arteries    |
| Stroke & TIA | I638        | Other cerebral infarction  |
| Stroke & TIA | I639        | Cerebral infarction, unspecified   |
| Stroke & TIA | I632        | Cerebral infarction due to unspecified occlusion or stenosis of precerebral arteries |
| Stroke & TIA | I64         | Stroke, not specified as haemorrhage or infarction                                   |
| Stroke & TIA | I650        | Occlusion and stenosis of precerebral arteries, not resulting in cerebral infarction |
| Stroke & TIA | G458        | Other transient cerebral ischaemic attacks and related syndromes                     |
| Stroke & TIA | I65         | Occlusion and stenosis of precerebral arteries, not resulting in cerebral infarction |
| Stroke & TIA | I693        | Sequelae of cerebral infarction  |
| Stroke & TIA | I69.4       | Sequelae of stroke, not specified as haemorrhage or infarction                       |
| Stroke & TIA | I694        | Sequelae of stroke, not specified as haemorrhage or infarction                       |
| Stroke & TIA | I634        | Cerebral infarction due to embolism of cerebral arteries                             |
| Stroke & TIA | G465        | Pure motor lacunar syndrome  |
| Stroke & TIA | G451        | Carotid artery syndrome (hemispheric)  |
| Stroke & TIA | G459        | Transient cerebral ischaemic attack, unspecified                                     |
| Stroke & TIA | I66         | Occlusion and stenosis of cerebral arteries, not resulting in cerebral infarction    |

| Condition         | Read code | Read code description                           |
|-------------------|-----------|---|
| Anxiety Disorders | Eu41z     | [X]Anxiety disorder, unspecified                |
| Anxiety Disorders | Eu41y     | [X]Other specified anxiety disorders            |
| Anxiety Disorders | Eu412     | [X]Mixed anxiety and depressive disorder        |
| Anxiety Disorders | Eu411     | [X]Generalized anxiety disorder                 |
| Anxiety Disorders | Eu410     | [X]Panic disorder [episodic paroxysmal anxiety] |
| Anxiety Disorders | E2029     | Fear of crowds                                  |
| Anxiety Disorders | E20y2     | Other occupational neurosis                     |
| Anxiety Disorders | Eu402     | [X]Specific (isolated) phobias                  |
| Anxiety Disorders | Eu40y     | [X]Other phobic anxiety disorders               |
| Anxiety Disorders | Eu341     | [X]Depressive neurosis                          |
| Anxiety Disorders | ZV112     | [V]Personal history of neurosis                 |
| Anxiety Disorders | Z4L1.     | Anxiety counselling                             |
| Anxiety Disorders | Z481.     | Phobia counselling                              |
| Anxiety Disorders | Eu41.     | [X]Other anxiety disorders                      |
| Anxiety Disorders | Eu400     | [X]Agoraphobia                                  |
| Anxiety Disorders | Eu401     | [X]Social phobias                               |
| Anxiety Disorders | E20y3     | Psychasthenic neurosis                          |
| Anxiety Disorders | E20y.     | Other neurotic disorders                        |
| Anxiety Disorders | E20y1     | Writer's cramp neurosis                         |
| Anxiety Disorders | E20yz     | Other neurotic disorder NOS                     |
| Anxiety Disorders | E20z.     | Neurotic disorder NOS                           |
| Anxiety Disorders | Eu403     | [X]Needle phobia                                |
| Anxiety Disorders | Eu40z     | [X]Phobic anxiety disorder, unspecified         |
| Anxiety Disorders | Eu40.     | [X]Phobic anxiety disorders                     |

Continued

## Supplementary Appendix 1: Continued

| Condition         | Read code | Read code description                         |
|-------------------|-----------|---|
| Anxiety Disorders | E202z     | Phobic disorder NOS                           |
| Anxiety Disorders | E202E     | Fear of pregnancy                             |
| Anxiety Disorders | E202D     | Fear of death                                 |
| Anxiety Disorders | E202C     | Dental phobia                                 |
| Anxiety Disorders | E202B     | Cancer phobia                                 |
| Anxiety Disorders | E202A     | Fear of flying                                |
| Anxiety Disorders | E20..     | Neurotic disorders                            |
| Anxiety Disorders | Eu413     | [X]Other mixed anxiety disorders              |
| Anxiety Disorders | E2027     | Animal phobia                                 |
| Anxiety Disorders | E2026     | Acrophobia                                    |
| Anxiety Disorders | E2025     | Social phobia, fear of public washing         |
| Anxiety Disorders | E2024     | Social phobia, fear of public speaking        |
| Anxiety Disorders | E2023     | Social phobia, fear of eating in public       |
| Anxiety Disorders | E2022     | Agoraphobia without mention of panic attacks  |
| Anxiety Disorders | E200z     | Anxiety state NOS                             |
| Anxiety Disorders | E2020     | Phobia unspecified                            |
| Anxiety Disorders | E201B     | Compensation neurosis                         |
| Anxiety Disorders | E200.     | Anxiety states                                |
| Anxiety Disorders | E2005     | Recurrent anxiety                             |
| Anxiety Disorders | E2004     | Chronic anxiety                               |
| Anxiety Disorders | E2002     | Generalized anxiety disorder                  |
| Anxiety Disorders | E2000     | Anxiety state unspecified                     |
| Anxiety Disorders | E2028     | Claustrophobia                                |
| Anxiety Disorders | E2021     | Agoraphobia with panic attacks                |
| Anxiety Disorders | 1Bb..     | Specific fear                                 |
| Anxiety Disorders | 8G94.     | Anxiety management training                   |
| Anxiety Disorders | 8G52.     | Antiphobic therapy                            |
| Anxiety Disorders | 286..     | Poor insight into neurotic condition          |
| Anxiety Disorders | 285..     | Neurotic condition, insight present           |
| Anxiety Disorders | 225K.     | O/E - fearful mood                            |
| Anxiety Disorders | 9N54.     | Encounter for fear                            |
| Anxiety Disorders | 225J.     | O/E - panic attack                            |
| Anxiety Disorders | 8HHp.     | Referral for guided self-help for anxiety     |
| Anxiety Disorders | 1B1H.     | Fear  |
| Anxiety Disorders | 146G.     | H/O: agoraphobia                              |
| Anxiety Disorders | 1466.     | H/O: anxiety state                            |
| Anxiety Disorders | E202.     | Phobic disorders                              |
| Anxiety Disorders | E2003     | Anxiety with depression                       |
| Anxiety Disorders | E2001     | Panic disorder                                |
| Anxiety Disorders | 1B1V.     | C/O - panic attack                            |
| Asthma            | 14B4.     | H/O: asthma                                   |
| Asthma            | 173A.     | Exercise induced asthma                       |
| Asthma            | 173c.     | Occupational asthma                           |
| Asthma            | 173d.     | Work aggravated asthma                        |
| Asthma            | 1780.     | Aspirin induced asthma                        |
| Asthma            | H332.     | Mixed asthma                                  |
| Asthma            | 1O2..     | Asthma confirmed                              |
| Asthma            | 21262     | Asthma resolved                               |
| Asthma            | 212G.     | Asthma resolved                               |
| Asthma            | H330z     | Extrinsic asthma NOS                          |
| Asthma            | H3310     | Intrinsic asthma without status asthmaticus   |
| Asthma            | H331z     | Intrinsic asthma NOS                          |
| Asthma            | H333.     | Acute exacerbation of asthma                  |
| Asthma            | H3301     | Extrinsic asthma with status asthmaticus      |
| Asthma            | H335.     | Chronic asthma with fixed airflow obstruction |
| Asthma            | H3120     | Chronic asthmatic bronchitis                  |

Continued

## Supplementary Appendix 1: Continued

| Condition           | Read code | Read code description  |
|---------------------|-----------|--|
| Asthma              | H33z2     | Late-onset asthma  |
| Asthma              | H33..     | Asthma   |
| Asthma              | H330..    | Extrinsic (atopic) asthma                                    |
| Asthma              | H331..    | Intrinsic asthma   |
| Asthma              | H334..    | Brittle asthma   |
| Asthma              | H3311     | Intrinsic asthma with status asthmaticus                     |
| Asthma              | H33z..    | Asthma unspecified   |
| Asthma              | H33z0     | Status asthmaticus NOS                                       |
| Asthma              | H33z1     | Asthma attack  |
| Asthma              | H33zz     | Asthma NOS   |
| Asthma              | H3300     | Extrinsic asthma without status asthmaticus                  |
| Atrial Fibrillation | G5731     | Atrial flutter   |
| Atrial Fibrillation | 3273..    | ECG: atrial flutter  |
| Atrial Fibrillation | G573z     | Atrial fibrillation and flutter NOS                          |
| Atrial Fibrillation | G573..    | Atrial fibrillation and flutter                              |
| Atrial Fibrillation | 3272..    | ECG: atrial fibrillation                                     |
| Atrial Fibrillation | G5733     | Non-rheumatic atrial fibrillation                            |
| Atrial Fibrillation | G5732     | Paroxysmal atrial fibrillation                               |
| Atrial Fibrillation | G5734     | Permanent atrial fibrillation                                |
| Atrial Fibrillation | G5730     | Atrial fibrillation  |
| Atrial Fibrillation | G5735     | Persistent atrial fibrillation                               |
| Atrial Fibrillation | 9hF1..    | Excepted from atrial fibrillation qual indic: Inform dissent |
| Atrial Fibrillation | 662S..    | Atrial fibrillation monitoring                               |
| Atrial Fibrillation | 9Os4..    | Atrial fibrillation monitoring telephone invite              |
| Atrial Fibrillation | 9Os3..    | Atrial fibrillation monitoring verbal invite                 |
| Atrial Fibrillation | 9Os2..    | Atrial fibrillation monitoring third letter                  |
| Atrial Fibrillation | 9Os1..    | Atrial fibrillation monitoring second letter                 |
| Atrial Fibrillation | 9Os..     | Atrial fibrillation monitoring administration                |
| Atrial Fibrillation | 9hF..     | Exception reporting: atrial fibrillation quality indicators  |
| Atrial Fibrillation | 6A9..     | Atrial fibrillation annual review                            |
| Atrial Fibrillation | 212R..    | Atrial fibrillation resolved                                 |
| Atrial Fibrillation | 14AR..    | History of atrial flutter                                    |
| Atrial Fibrillation | 14AN..    | H/O: atrial fibrillation                                     |
| Atrial Fibrillation | 9Os0..    | Atrial fibrillation monitoring first letter                  |
| CHD                 | 14AL..    | H/O: Treatment for ischaemic heart disease                   |
| CHD                 | G344..    | Silent myocardial ischaemia                                  |
| CHD                 | 6A4..     | Coronary heart disease review                                |
| CHD                 | 8H2V..    | Admit ischaemic heart disease emergency                      |
| CHD                 | G31y2     | Subendocardial ischaemia                                     |
| CHD                 | G31..     | Other acute and subacute ischaemic heart disease             |
| CHD                 | G343..    | Ischaemic cardiomyopathy                                     |
| CHD                 | G34..     | Other chronic ischaemic heart disease                        |
| CHD                 | G31yz     | Other acute and subacute ischaemic heart disease NOS         |
| CHD                 | G31y..    | Other acute and subacute ischaemic heart disease             |
| CHD                 | G31y3     | Transient myocardial ischaemia                               |
| CHD                 | 6A2..     | Coronary heart disease annual review                         |
| CHD                 | 8B3k..    | Coronary heart disease medication review                     |
| CHD                 | G3y..     | Other specified ischaemic heart disease                      |
| CHD                 | G34z0     | Asymptomatic coronary heart disease                          |
| CHD                 | G34y1     | Chronic myocardial ischaemia                                 |
| CHD                 | G34yz     | Other specified chronic ischaemic heart disease NOS          |
| CHD                 | G3z..     | Ischaemic heart disease NOS                                  |
| CHD                 | Gyu3..    | [X]Ischaemic heart diseases                                  |
| CHD                 | G34z..    | Other chronic ischaemic heart disease NOS                    |
| CHD                 | Gyu32     | [X]Other forms of acute ischaemic heart disease              |
| CHD                 | G34y..    | Other specified chronic ischaemic heart disease              |

Continued

## Supplementary Appendix 1: Continued

| Condition | Read code | Read code description  |
|-----------|-----------|--|
| CHD       | G3...     | Ischaemic heart disease                                      |
| CHD       | G3110     | Myocardial infarction aborted                                |
| CHD       | G340.     | Coronary atherosclerosis                                     |
| CHD       | Gyu33     | [X]Other forms of chronic ischaemic heart disease            |
| CKD       | Ua1IM     | Chronic peritoneal dialysis                                  |
| CKD       | X018T     | Angioplasty of arteriovenous fistula                         |
| CKD       | TA22y     | Failure of sterile precautions during other perfusion        |
| CKD       | X018U     | Thrombolysis of arteriovenous fistula                        |
| CKD       | X018V     | Thrombolysis of arteriovenous graft                          |
| CKD       | X01AI     | Continuous haemodialysis                                     |
| CKD       | X018Y     | Embolectomy of arteriovenous fistula                         |
| CKD       | 7L1Cz     | Placement other apparatus- compensate for renal failure NOS  |
| CKD       | 7L1Bz     | Placement ambulatory apparatus- compensate renal failure NOS |
| CKD       | 7L1C.     | Placement other apparatus for compensation for renal failure |
| CKD       | 7L1C0     | Insertion of temporary peritoneal dialysis catheter          |
| CKD       | 7L1Cy     | Placement other apparatus- compensate for renal failure OS   |
| CKD       | TA22.     | Failure of sterile precautions during perfusion              |
| CKD       | U6122     | [X]Failure sterile precautions dur kidney dialys/other perf  |
| CKD       | 7A614     | Ligation of acquired arteriovenous fistula                   |
| CKD       | 7L1B0     | Insertion of chronic ambulatory peritoneal dialysis catheter |
| CKD       | 14S2.     | H/O: kidney recipient  |
| CKD       | 7A600     | Insertion of arteriovenous prosthesis                        |
| CKD       | 7A603     | Removal of infected arteriovenous shunt                      |
| CKD       | TA420     | Mech failure of instrument &/or apparatus during kidney dial |
| CKD       | 7L1B1     | Removal of chronic ambulatory peritoneal dialysis catheter   |
| CKD       | 7A60z     | Arteriovenous shunt NOS                                      |
| CKD       | 7A6E2     | Declotting of thigh vein loop                                |
| CKD       | 7L1By     | Placement ambulatory apparatus- compensate renal failure OS  |
| CKD       | Ua1IN     | Stab peritoneal dialysis                                     |
| CKD       | TA22z     | Failure of sterile precautions during perfusion NOS          |
| CKD       | 7A60y     | Other specified arteriovenous shunt                          |
| CKD       | 8877.     | Ultrafiltration  |
| CKD       | Xaa6o     | Infection of dialysis arteriovenous fistula                  |
| CKD       | Xaa7F     | Infection of dialysis arteriovenous shunt                    |
| CKD       | Xaa7H     | Haemorrhage of dialysis arteriovenous graft                  |
| CKD       | Xaa7I     | Haemorrhage of dialysis arteriovenous fistula                |
| CKD       | Xaa7J     | Haemorrhage of dialysis arteriovenous shunt                  |
| CKD       | X018Z     | Embolectomy of arteriovenous graft                           |
| CKD       | Xaa7K     | Rupture of dialysis arteriovenous graft                      |
| CKD       | XaZkw     | Aneurysm of vein of transplanted kidney                      |
| CKD       | XaZcU     | Aneurysm of dialysis arteriovenous fistula                   |
| CKD       | XaZcX     | Aneurysm of needle site of dialysis arteriovenous fistula    |
| CKD       | XaZcd     | Aneurysm of anastomotic site of dialysis AV fistula          |
| CKD       | XaZdk     | Thrombus in peritoneal dialysis catheter                     |
| CKD       | Xaa5T     | Infection of dialysis vascular access                        |
| CKD       | Xaa5U     | Haemorrhage of dialysis vascular access                      |
| CKD       | 8882.     | Intestinal dialysis  |
| CKD       | G760.     | Acquired arteriovenous fistula                               |
| CKD       | TA02z     | Accid cut,puncture,perf,h'ge - perfusion NOS                 |
| CKD       | X40bz     | Renewal of chronic ambulatory peritoneal dialysis catheter   |
| CKD       | Xaa5j     | Occlusion of dialysis arteriovenous shunt                    |
| CKD       | Xaa6n     | Infection of dialysis arteriovenous graft                    |
| CKD       | Xaa5W     | Stenosis of dialysis arteriovenous graft                     |
| CKD       | Xaa5e     | Thrombosis of dialysis arteriovenous graft                   |
| CKD       | Xaa5f     | Thrombosis of dialysis arteriovenous fistula                 |

Continued

## Supplementary Appendix 1: Continued

| Condition | Read code | Read code description  |
|-----------|-----------|--|
| CKD       | Xaa5g     | Thrombosis of dialysis arteriovenous shunt                   |
| CKD       | Xaa5h     | Occlusion of dialysis arteriovenous graft                    |
| CKD       | Xaa5i     | Occlusion of dialysis arteriovenous fistula                  |
| CKD       | Xaa5X     | Stenosis of dialysis arteriovenous shunt                     |
| CKD       | 7A602     | Attention to arteriovenous shunt                             |
| CKD       | X018e     | Removal of stent from arteriovenous fistula                  |
| CKD       | X018g     | Adjustment of arteriovenous fistula stent                    |
| CKD       | X01AG     | Intermittent haemodialysis with sequential ultrafiltration   |
| CKD       | X018j     | Banding of arteriovenous fistula                             |
| CKD       | X018o     | Exploration of arteriovenous graft                           |
| CKD       | 7B00.     | Renal transplant   |
| CKD       | X01AF     | Intermittent haemodialysis                                   |
| CKD       | X30Lw     | Long-term disorder of dialysis                               |
| CKD       | X30Ls     | First use syndrome of dialysis                               |
| CKD       | X30Lt     | Anaphylactoid reaction to dialysis                           |
| CKD       | X30Lu     | Hyperchloraemic acidosis associated with dialysis            |
| CKD       | X30Lv     | Hard water syndrome  |
| CKD       | X018a     | Procedure on intraluminal device of arteriovenous fistula    |
| CKD       | X018d     | Removal of intraluminal device from arteriovenous fistula    |
| CKD       | X01AJ     | Continuous arteriovenous haemodialysis                       |
| CKD       | X01AK     | Continuous venovenous haemodialysis                          |
| CKD       | X01AL     | Haemofiltration  |
| CKD       | X01AH     | Intermittent haemodialysis with continuous ultrafiltration   |
| CKD       | X01AM     | Intermittent haemofiltration                                 |
| CKD       | X018c     | Insertion of stent into arteriovenous fistula                |
| CKD       | X01AN     | Continuous haemofiltration                                   |
| CKD       | X01AP     | Continuous venovenous haemofiltration                        |
| CKD       | X01AQ     | Haemodiafiltration   |
| CKD       | X01AR     | Intermittent haemodiafiltration                              |
| CKD       | X018f     | Adjustment of intraluminal device of arteriovenous fistula   |
| CKD       | X018b     | Insertion of intraluminal device into arteriovenous fistula  |
| CKD       | X01AO     | Continuous arteriovenous haemofiltration                     |
| CKD       | X30Lx     | Beta-2 microglobulin amyloidosis                             |
| CKD       | X30M2     | Aluminium-related osteomalacia                               |
| CKD       | 7L1A0     | (Renal dialysis) or (Thomas intravascular dialysis shunt)    |
| CKD       | 7B002     | Cadaveric renal transplant                                   |
| CKD       | 7B00y     | Other specified transplantation of kidney                    |
| CKD       | 7B00z     | Transplantation of kidney NOS                                |
| CKD       | X30Lr     | Dialysis disequilibrium                                      |
| CKD       | 7L1A.     | Compensation for renal failure (& dialysis)                  |
| CKD       | 7B001     | Live donor renal transplant                                  |
| CKD       | 7L1A2     | Haemodialysis NEC  |
| CKD       | 7L1Ay     | Other specified compensation for renal failure               |
| CKD       | 7L1Az     | Compensation for renal failure NOS                           |
| CKD       | 7L1B.     | Chronic ambulatory peritoneal dialysis catheter procedure ++ |
| CKD       | 7L1A1     | Peritoneal dialysis  |
| CKD       | X30Lp     | Disorder associated with dialysis                            |
| CKD       | X30Ly     | Beta-2 microglobulin arthropathy                             |
| CKD       | X30Lz     | Matrix stone formation of dialysis                           |
| CKD       | X30M0     | Aluminium intoxication                                       |
| CKD       | X30M1     | Aluminium bone disease                                       |
| CKD       | X30Lq     | Acute disorder of haemodialysis                              |
| CKD       | X30J3     | End stage renal failure with renal transplant                |
| CKD       | X30J0     | End stage renal failure                                      |
| CKD       | X01AU     | Continuous venovenous haemodiafiltration                     |
| CKD       | X01AY     | Plasma filtration  |

Continued

## Supplementary Appendix 1: Continued

| Condition | Read code | Read code description                                       |
|-----------|-----------|---|
| CKD       | X30D2     | Xenograft renal transplant                                  |
| CKD       | X30J1     | End stage renal failure, untreated by RRT                   |
| CKD       | X01AS     | Continuous haemodiafiltration                               |
| CKD       | X30J2     | End stage renal failure on dialysis                         |
| CKD       | X01AT     | Continuous arteriovenous haemodiafiltration                 |
| CKD       | XaZe2     | Rupture of artery of transplanted kidney                    |
| CKD       | X30MK     | Poor drainage of peritoneal dialysis catheter               |
| CKD       | X30ML     | Extrusion of peritoneal dialysis catheter cuff              |
| CKD       | X30MM     | Misplacement of acute peritoneal dialysis catheter          |
| CKD       | X30MN     | Renal transplant disorder                                   |
| CKD       | X30MO     | Primary non-function of renal transplant                    |
| CKD       | XaZe3     | Rupture of vein of transplanted kidney                      |
| CKD       | X30MP     | Renal transplant rejection                                  |
| CKD       | XaMKM     | Allotransplantation of kidney from cadaver NEC              |
| CKD       | XaC2Z     | [X] Peritoneal dialysis associated peritonitis              |
| CKD       | XaE9T     | Donor renal transplantation                                 |
| CKD       | XaLiG     | Thrombectomy of arteriovenous fistula                       |
| CKD       | XaLiH     | Creation of graft fistula for dialysis                      |
| CKD       | X30MX     | Chronic rejection of renal transplant                       |
| CKD       | X40c5     | Intermittent peritoneal dialysis                            |
| CKD       | X40c2     | Flushing of chronic ambulatory peritoneal dialysis catheter |
| CKD       | X40c3     | Continuous ambulatory peritoneal dialysis                   |
| CKD       | X40c4     | Continuous cycling peritoneal dialysis                      |
| CKD       | X30MQ     | Hyperacute rejection of renal transplant                    |
| CKD       | X30MF     | Loss of solute clearance                                    |
| CKD       | X30MJ     | Omental wrapping around peritoneal dialysis catheter        |
| CKD       | X30M4     | Polyserositis syndrome of dialysis                          |
| CKD       | X30M6     | Adynamic bone disease                                       |
| CKD       | X30M7     | Disorders associated with peritoneal dialysis               |
| CKD       | X30M8     | Pain during inflow of dialysate                             |
| CKD       | X30M9     | Pain during outflow of dialysate                            |
| CKD       | X30ME     | Loss of ultrafiltration                                     |
| CKD       | X30M5     | Underdialysis   |
| CKD       | XaM1o     | Allotransplantation of kidney from cadaver, heart-beating   |
| CKD       | Xa0Ex     | Peritoneal dialysis-associated peritonitis                  |
| CKD       | Xa0FB     | Percutaneous balloon angioplasty of arteriovenous fistula   |
| CKD       | Xa0Gm     | Percutaneous embolectomy of arteriovenous fistula           |
| CKD       | Xa0H7     | Percutaneous thrombolysis of arteriovenous fistula          |
| CKD       | Xa0HK     | Unexplained episode of renal transplant dysfunction         |
| CKD       | XaM1p     | Allotransplantation kidney from cadaver, heart non-beating  |
| CKD       | Xa0HL     | Pre-existing disease in renal transplant                    |
| CKD       | Xa0x1     | Removal of arteriovenous shunt                              |
| CKD       | Xa1dw     | Transplant kidney   |
| CKD       | Xa24l     | Acquired renal arteriovenous fistula                        |
| CKD       | Xa3x6     | Kidney replacement  |
| CKD       | Xa402     | Extracorporeal kidney                                       |
| CKD       | Xa0ol     | Procedure related to surgical arteriovenous connection      |
| CKD       | XE2u6     | Chronic ambulatory peritoneal dialysis catheter procedure   |
| CKD       | XaM2A     | Automated peritoneal dialysis                               |
| CKD       | XaMMt     | Peritoneal dialysis NEC                                     |
| CKD       | XaBrA     | Haemodialysis procedure                                     |
| CKD       | X40c6     | Tidal peritoneal dialysis                                   |
| CKD       | XaOmL     | Ligation of arteriovenous dialysis fistula                  |
| CKD       | XE0kD     | Renal dialysis (& haemodialysis)                            |
| CKD       | XaOoH     | Ligation of arteriovenous dialysis graft                    |
| CKD       | XaZWa     | Urological complication of renal transplant                 |

Continued

## Supplementary Appendix 1: Continued

| Condition | Read code | Read code description  |
|-----------|-----------|--|
| CKD       | XaZYx     | Vascular complication of renal transplant                    |
| CKD       | XaMtq     | Extracorporeal albumin haemodialysis                         |
| CKD       | Xa9zl     | Dependence on renal dialysis                                 |
| CKD       | X40c7     | Night-time intermittent peritoneal dialysis                  |
| CKD       | XaREO     | Continuous ambulatory peritoneal dialysis associated perit   |
| CKD       | X40c1     | Aspiration chronic ambulatory peritoneal dialysis catheter   |
| CKD       | X30Mg     | Transplant glomerulopathy                                    |
| CKD       | X30MH     | Obstruction of peritoneal dialysis catheter                  |
| CKD       | X30Mh     | Transplant glomerulopathy - early form                       |
| CKD       | X30MI     | Migration of peritoneal dialysis catheter                    |
| CKD       | Xa8S7     | Haemodialysis  |
| CKD       | X40c0     | Adjustment chronic ambulatory peritoneal dialysis catheter   |
| CKD       | X30Mc     | Failed renal transplant                                      |
| CKD       | XE0Fj     | Repair of acquired arteriovenous fistula                     |
| CKD       | XE0Jf     | Compensation for renal failure                               |
| CKD       | XE0Jg     | Renal dialysis   |
| CKD       | XE21r     | Mechanical failure of apparatus during kidney dialysis       |
| CKD       | ZV560     | [V]Aftercare involving extracorporeal dialysis               |
| CKD       | XE0Fh     | Creation of arteriovenous fistula NEC                        |
| CKD       | X30MG     | Disorder of peritoneal dialysis catheter                     |
| CKD       | XaZe7     | Stenosis of vein of transplanted kidney                      |
| CKD       | XaZl0     | Aneurysm of artery of transplanted kidney                    |
| CKD       | XaaEx     | Stenosis of arterial side of dialysis arteriovenous shunt    |
| CKD       | X30M3     | Aluminium-related fracturing osteodystrophy                  |
| CKD       | XaZlv     | Thrombosis of dialysis vascular access                       |
| CKD       | X30Md     | Perfusion injury of renal transplant                         |
| CKD       | XaZmp     | Anaphylactoid reaction due to haemodialysis                  |
| CKD       | Xaa2Q     | Thrombosis of vein of transplanted kidney                    |
| CKD       | Xaa5S     | Occlusion of dialysis vascular access                        |
| CKD       | XaaEy     | Stenosis of venous side of dialysis arteriovenous shunt      |
| CKD       | X30Mi     | Transplant glomerulopathy - late form                        |
| CKD       | X30MD     | Peritoneal dialysis catheter tunnel infection                |
| CKD       | Xaa2O     | Thrombosis of artery of transplanted kidney                  |
| CKD       | X30MC     | Peritoneal dialysis catheter exit site infection             |
| CKD       | XaZlu     | Stenosis of dialysis vascular access                         |
| CKD       | X30MZ     | Chronic rejection of renal transplant - grade II             |
| CKD       | X30MS     | Very mild acute rejection of renal transplant                |
| CKD       | X30MT     | Acute rejection of renal transplant                          |
| CKD       | X30MU     | Acute rejection of renal transplant - grade I                |
| CKD       | TA020     | Accid cut,puncture,perf,h'ge - kidney dialysis               |
| CKD       | X30MV     | Acute rejection of renal transplant - grade II               |
| CKD       | XaZc8     | Ruptured aneurysm of dialysis vascular access                |
| CKD       | X30MY     | Chronic rejection of renal transplant - grade 1              |
| CKD       | X30Ma     | Chronic rejection of renal transplant - grade III            |
| CKD       | X30MR     | Accelerated rejection of renal transplant                    |
| CKD       | X30NN     | Perirenal and periureteric post-transplant lymphocele        |
| CKD       | X30MW     | Acute rejection of renal transplant - grade III              |
| CKD       | X30Mb     | Acute-on-chronic rejection of renal transplant               |
| CKD       | ZV420     | [V]Kidney transplanted                                       |
| CKD       | ZV451     | [V]Renal dialysis status                                     |
| CKD       | ZV56.     | [V]Aftercare involving intermittent dialysis                 |
| CKD       | ZV561     | [V]Preparatory care for dialysis                             |
| CKD       | ZV56y     | [V]Other specified aftercare involving intermittent dialysis |
| CKD       | X30MB     | Bloodstained peritoneal dialysis effluent                    |
| CKD       | ZV56z     | [V]Unspecified aftercare involving intermittent dialysis     |

Continued

## Supplementary Appendix 1: Continued

| Condition | Read code | Read code description  |
|-----------|-----------|--|
| CKD       | TA220     | Failure of sterile precautions during kidney dialysis        |
| CKD       | XaZcQ     | Aneurysm of superficialised artery of dialysis AV fistula    |
| CKD       | TB11.     | Kidney dialysis with complication, without blame             |
| CKD       | X018M     | Creation of Cimino fistula                                   |
| CKD       | X018N     | Creation brachiocephalic fistula                             |
| CKD       | X018n     | Exploration of arteriovenous fistula                         |
| CKD       | ZVu3G     | [X]Other dialysis  |
| COPD      | H3...     | Chronic obstructive pulmonary disease                        |
| COPD      | H3110     | Purulent chronic bronchitis                                  |
| COPD      | H322.     | Centrilobular emphysema                                      |
| COPD      | H3120     | Chronic asthmatic bronchitis                                 |
| COPD      | H31yz     | Other chronic bronchitis NOS                                 |
| COPD      | 14B3.     | History of chronic obstructive pulmonary disease             |
| COPD      | H310.     | Simple chronic bronchitis                                    |
| COPD      | H310z     | Simple chronic bronchitis NOS                                |
| COPD      | H3111     | Fetid chronic bronchitis                                     |
| COPD      | H3123     | Bronchiolitis obliterans                                     |
| COPD      | H3100     | Chronic catarrhal bronchitis                                 |
| COPD      | H321.     | Panlobular emphysema   |
| COPD      | H31y.     | Other chronic bronchitis                                     |
| COPD      | H31z.     | Chronic bronchitis NOS                                       |
| COPD      | H31y1     | Chronic tracheobronchitis                                    |
| COPD      | H313.     | Mixed simple and mucopurulent chronic bronchitis             |
| COPD      | H320z     | Chronic bullous emphysema NOS                                |
| COPD      | H312z     | Obstructive chronic bronchitis NOS                           |
| COPD      | H3200     | Segmental bullous emphysema                                  |
| COPD      | H3201     | Zonal bullous emphysema                                      |
| COPD      | H3202     | Giant bullous emphysema                                      |
| COPD      | H3203     | Bullous emphysema with collapse                              |
| COPD      | H320.     | Chronic bullous emphysema                                    |
| COPD      | H312.     | Obstructive chronic bronchitis                               |
| COPD      | H311.     | Mucopurulent chronic bronchitis                              |
| COPD      | Hyu31     | [X]Other specified chronic obstructive pulmonary disease     |
| COPD      | H3y..     | Other specified chronic obstructive airways disease          |
| COPD      | H39..     | Very severe chronic obstructive pulmonary disease            |
| COPD      | H32y0     | Acute vesicular emphysema                                    |
| COPD      | H311z     | Mucopurulent chronic bronchitis NOS                          |
| COPD      | H32y2     | MacLeod's unilateral emphysema                               |
| COPD      | H32yz     | Other emphysema NOS  |
| COPD      | H32z.     | Emphysema NOS  |
| COPD      | H36..     | Mild chronic obstructive pulmonary disease                   |
| COPD      | H37..     | Moderate chronic obstructive pulmonary disease               |
| COPD      | H38..     | Severe chronic obstructive pulmonary disease                 |
| COPD      | H32y.     | Other emphysema  |
| COPD      | Hyu30     | [X]Other emphysema   |
| COPD      | H32y1     | Atrophic (senile) emphysema                                  |
| COPD      | H3121     | Emphysematous bronchitis                                     |
| COPD      | H3122     | Acute exacerbation of chronic obstructive airways disease    |
| COPD      | H31..     | Chronic bronchitis   |
| COPD      | H5832     | Eosinophilic bronchitis                                      |
| COPD      | H4640     | Chronic emphysema due to chemical fumes                      |
| COPD      | H3y0.     | Chronic obstruct pulmonary dis with acute lower resp infectn |
| COPD      | H3y1.     | Chron obstrct pulmonary dis wth acute exacerbation, unspec   |
| COPD      | H3z..     | Chronic obstructive airways disease NOS                      |
| COPD      | H4641     | Obliterative bronchiolitis due to chemical fumes             |
| COPD      | H3A..     | End stage chronic obstructive airways disease                |

Continued

## Supplementary Appendix 1: Continued

| Condition  | Read code | Read code description  |
|------------|-----------|--|
| COPD       | H32..     | Emphysema  |
| Dementia   | Eu01..    | [X]Vascular dementia   |
| Dementia   | Eu013     | [X]Mixed cortical and subcortical vascular dementia          |
| Dementia   | Eu011     | [X]Multi-infarct dementia                                    |
| Dementia   | E001z     | Presenile dementia NOS                                       |
| Dementia   | E041..    | Dementia in conditions EC                                    |
| Dementia   | 1461..    | H/O: dementia  |
| Dementia   | 9hD0..    | Excepted from dementia quality indicators: Patient unsuitabl |
| Dementia   | 8CMZ..    | Dementia care plan   |
| Dementia   | 6AB..     | Dementia annual review                                       |
| Dementia   | 66h..     | Dementia monitoring  |
| Dementia   | E00y..    | Other senile and presenile organic psychoses                 |
| Dementia   | 9hD1..    | Excepted from dementia quality indicators: Informed dissent  |
| Dementia   | Eu010..   | [X]Vascular dementia of acute onset                          |
| Dementia   | Eu000..   | [X]Dementia in Alzheimer's disease with early onset          |
| Dementia   | E00z..    | Senile or presenile psychoses NOS                            |
| Dementia   | E004z..   | Arteriosclerotic dementia NOS                                |
| Dementia   | E0042..   | Arteriosclerotic dementia with paranoia                      |
| Dementia   | E0041..   | Arteriosclerotic dementia with delirium                      |
| Dementia   | Eu00z..   | [X]Dementia in Alzheimer's disease, unspecified              |
| Dementia   | E0040..   | Uncomplicated arteriosclerotic dementia                      |
| Dementia   | E002z..   | Senile dementia with depressive or paranoid features NOS     |
| Dementia   | E002..    | Senile dementia with depressive or paranoid features         |
| Dementia   | Eu001..   | [X]Dementia in Alzheimer's disease with late onset           |
| Dementia   | Eu002..   | [X]Dementia in Alzheimer's dis, atypical or mixed type       |
| Dementia   | Eu00..    | [X]Dementia in Alzheimer's disease                           |
| Dementia   | E003..    | Senile dementia with delirium                                |
| Dementia   | 9hD..     | Exception reporting: dementia quality indicators             |
| Dementia   | 9Ou4..    | Dementia monitoring verbal invite                            |
| Dementia   | 9Ou3..    | Dementia monitoring third letter                             |
| Dementia   | 9Ou2..    | Dementia monitoring second letter                            |
| Dementia   | Eu012..   | [X]Subcortical vascular dementia                             |
| Dementia   | Eu01z..   | [X]Vascular dementia, unspecified                            |
| Dementia   | E0043..   | Arteriosclerotic dementia with depression                    |
| Dementia   | ZS7C5..   | Language disorder of dementia                                |
| Dementia   | F110..    | Alzheimer's disease  |
| Dementia   | F1101..   | Alzheimer's disease with late onset                          |
| Dementia   | F1100..   | Alzheimer's disease with early onset                         |
| Dementia   | Eu041..   | [X]Delirium superimposed on dementia                         |
| Dementia   | Eu02z..   | [X] Unspecified dementia                                     |
| Dementia   | Fyu30..   | [X]Other Alzheimer's disease                                 |
| Dementia   | 9Ou5..    | Dementia monitoring telephone invite                         |
| Dementia   | E004..    | Arteriosclerotic dementia                                    |
| Dementia   | E0021..   | Senile dementia with depression                              |
| Dementia   | E0013..   | Presenile dementia with depression                           |
| Dementia   | E00..     | Senile/presenile dementia                                    |
| Dementia   | 9Ou1..    | Dementia monitoring first letter                             |
| Dementia   | E0020..   | Senile dementia with paranoia                                |
| Dementia   | E000..    | Uncomplicated senile dementia                                |
| Dementia   | E001..    | Presenile dementia   |
| Dementia   | E0012..   | Presenile dementia with paranoia                             |
| Dementia   | E0011..   | Presenile dementia with delirium                             |
| Dementia   | E0010..   | Uncomplicated presenile dementia                             |
| Dementia   | 9Ou..     | Dementia monitoring administration                           |
| Dementia   | Eu01y..   | [X]Other vascular dementia                                   |
| Depression | E1121..   | Single major depressive episode, mild                        |

Continued

## Supplementary Appendix 1: Continued

| Condition  | Read code | Read code description  |
|------------|-----------|--|
| Depression | E1120     | Single major depressive episode, unspecified                 |
| Depression | E1131     | Recurrent major depressive episodes, mild                    |
| Depression | E113.     | Recurrent major depressive episode                           |
| Depression | Eu32.     | [X]Depressive episode  |
| Depression | Eu251     | [X]Schizoaffective disorder, depressive type                 |
| Depression | E2003     | Anxiety with depression                                      |
| Depression | 9Ov1.     | Depression monitoring second letter                          |
| Depression | E130.     | Reactive depressive psychosis                                |
| Depression | Eu322     | [X]Severe depressive episode without psychotic symptoms      |
| Depression | E0043     | Arteriosclerotic dementia with depression                    |
| Depression | E0021     | Senile dementia with depression                              |
| Depression | E0013     | Presenile dementia with depression                           |
| Depression | Eu323     | [X]Severe depressive episode with psychotic symptoms         |
| Depression | 1465.     | H/O: depression  |
| Depression | 8HHq.     | Referral for guided self-help for depression                 |
| Depression | 8CAa.     | Patient given advice about management of depression          |
| Depression | E112.     | Single major depressive episode                              |
| Depression | E1122     | Single major depressive episode, moderate                    |
| Depression | 9Ov2.     | Depression monitoring third letter                           |
| Depression | 9Ov0.     | Depression monitoring first letter                           |
| Depression | 9Ov3.     | Depression monitoring verbal invite                          |
| Depression | 9Ov4.     | Depression monitoring telephone invite                       |
| Depression | 9Ov..     | Depression monitoring administration                         |
| Depression | 9kQ..     | On full dose long term treatment depression - enh serv admin |
| Depression | 9k4..     | Depression - enhanced services administration                |
| Depression | E1123     | Single major depressive episode, severe, without psychosis   |
| Depression | 9k40.     | Depression - enhanced service completed                      |
| Depression | 9H92.     | Depression interim review                                    |
| Depression | E1125     | Single major depressive episode, partial or unspec remission |
| Depression | E1130     | Recurrent major depressive episodes, unspecified             |
| Depression | E112z     | Single major depressive episode NOS                          |
| Depression | Eu33z     | [X]Recurrent depressive disorder, unspecified                |
| Depression | E1126     | Single major depressive episode, in full remission           |
| Depression | E1124     | Single major depressive episode, severe, with psychosis      |
| Depression | Eu333     | [X]Recurrent depress disorder cur epi severe with psyc symp  |
| Depression | 9HA0.     | On depression register                                       |
| Depression | 8BK0.     | Depression management programme                              |
| Depression | Eu334     | [X]Recurrent depressive disorder, currently in remission     |
| Depression | Eu341     | [X]Depressive neurosis                                       |
| Depression | Eu204     | [X]Post-schizophrenic depression                             |
| Depression | E1133     | Recurrent major depressive episodes, severe, no psychosis    |
| Depression | E1134     | Recurrent major depressive episodes, severe, with psychosis  |
| Depression | E1135     | Recurrent major depressive episodes,partial/unspec remission |
| Depression | E1136     | Recurrent major depressive episodes, in full remission       |
| Depression | 212S.     | Depression resolved  |
| Depression | E1137     | Recurrent depression   |
| Depression | E118.     | Seasonal affective disorder                                  |
| Depression | E11..     | Depressive psychoses   |
| Depression | E11y2     | Atypical depressive disorder                                 |
| Depression | E11z2     | Masked depression  |
| Depression | E135.     | Agitated depression  |
| Depression | E291.     | Prolonged depressive reaction                                |
| Depression | E2B1.     | Chronic depression   |
| Depression | E2B..     | Depressive disorder NEC                                      |
| Depression | E113z     | Recurrent major depressive episode NOS                       |
| Depression | Eu33y     | [X]Other recurrent depressive disorders                      |

Continued

## Supplementary Appendix 1: Continued

| Condition         | Read code | Read code description  |
|-------------------|-----------|--|
| Depression        | Eu332     | [X]Recurr depress disorder cur epi severe without psyc sympt |
| Depression        | 9H91.     | Depression medication review                                 |
| Depression        | Eu33.     | [X]Recurrent depressive disorder                             |
| Depression        | Eu32z     | [X]Depressive episode, unspecified                           |
| Depression        | Eu32y     | [X]Other depressive episodes                                 |
| Depression        | 9H90.     | Depression annual review                                     |
| Depression        | Eu328     | [X]Major depression, severe with psychotic symptoms          |
| Depression        | Eu320     | [X]Mild depressive episode                                   |
| Depression        | Eu412     | [X]Mixed anxiety and depressive disorder                     |
| Depression        | Eu321     | [X]Moderate depressive episode                               |
| Depression        | Eu325     | [X]Major depression, mild                                    |
| Depression        | Eu326     | [X]Major depression, moderately severe                       |
| Depression        | Eu327     | [X]Major depression, severe without psychotic symptoms       |
| Depression        | Eu329     | [X]Single major depr ep, severe with psych, psych in remiss  |
| Depression        | E1132     | Recurrent major depressive episodes, moderate                |
| Depression        | Eu32A     | [X]Recurr major depr ep, severe with psych, psych in remiss  |
| Depression        | Eu330     | [X]Recurrent depressive disorder, current episode mild       |
| Depression        | Eu331     | [X]Recurrent depressive disorder, current episode moderate   |
| Depression        | Eu324     | [X]Mild depression   |
| Diabetes Mellitus | C1082     | Type I diabetes mellitus with neurological complications     |
| Diabetes Mellitus | C1085     | Type I diabetes mellitus with ulcer                          |
| Diabetes Mellitus | C1084     | Unstable type I diabetes mellitus                            |
| Diabetes Mellitus | C108H     | Type I diabetes mellitus with arthropathy                    |
| Diabetes Mellitus | C108F     | Type I diabetes mellitus with diabetic cataract              |
| Diabetes Mellitus | C108D     | Type I diabetes mellitus with nephropathy                    |
| Diabetes Mellitus | C10E0     | Type 1 diabetes mellitus with renal complications            |
| Diabetes Mellitus | C108A     | Type I diabetes mellitus without complication                |
| Diabetes Mellitus | C10EH     | Type 1 diabetes mellitus with arthropathy                    |
| Diabetes Mellitus | C1080     | Type I diabetes mellitus with renal complications            |
| Diabetes Mellitus | C10E8     | Type 1 diabetes mellitus - poor control                      |
| Diabetes Mellitus | C108E     | Type I diabetes mellitus with hypoglycaemic coma             |
| Diabetes Mellitus | C10E6     | Type 1 diabetes mellitus with gangrene                       |
| Diabetes Mellitus | C108.     | Type 1 diabetes mellitus                                     |
| Diabetes Mellitus | C1089     | Type I diabetes mellitus maturity onset                      |
| Diabetes Mellitus | C1087     | Type I diabetes mellitus with retinopathy                    |
| Diabetes Mellitus | C10E2     | Type 1 diabetes mellitus with neurological complications     |
| Diabetes Mellitus | C109B     | Type II diabetes mellitus with polyneuropathy                |
| Diabetes Mellitus | C10E1     | Type 1 diabetes mellitus with ophthalmic complications       |
| Diabetes Mellitus | C1088     | Type I diabetes mellitus - poor control                      |
| Diabetes Mellitus | C109.     | Type 2 diabetes mellitus                                     |
| Diabetes Mellitus | C1091     | Type II diabetes mellitus with ophthalmic complications      |
| Diabetes Mellitus | C10EL     | Type 1 diabetes mellitus with persistent microalbuminuria    |
| Diabetes Mellitus | C10EK     | Type 1 diabetes mellitus with persistent proteinuria         |
| Diabetes Mellitus | C10EJ     | Type 1 diabetes mellitus with neuropathic arthropathy        |
| Diabetes Mellitus | C10EF     | Type 1 diabetes mellitus with diabetic cataract              |
| Diabetes Mellitus | C1092     | Type II diabetes mellitus with neurological complications    |
| Diabetes Mellitus | C10EE     | Type 1 diabetes mellitus with hypoglycaemic coma             |
| Diabetes Mellitus | C10ED     | Type 1 diabetes mellitus with nephropathy                    |
| Diabetes Mellitus | C10EQ     | Type 1 diabetes mellitus with gastroparesis                  |
| Diabetes Mellitus | C1090     | Type II diabetes mellitus with renal complications           |
| Diabetes Mellitus | C1095     | Type II diabetes mellitus with gangrene                      |
| Diabetes Mellitus | C1096     | Type II diabetes mellitus with retinopathy                   |
| Diabetes Mellitus | C10EB     | Type 1 diabetes mellitus with mononeuropathy                 |
| Diabetes Mellitus | C1094     | Type II diabetes mellitus with ulcer                         |
| Diabetes Mellitus | C1097     | Type II diabetes mellitus - poor control                     |
| Diabetes Mellitus | C109E     | Type II diabetes mellitus with diabetic cataract             |

Continued

## Supplementary Appendix 1: Continued

| Condition         | Read code | Read code description  |
|-------------------|-----------|--|
| Diabetes Mellitus | C109F     | Type II diabetes mellitus with peripheral angiopathy         |
| Diabetes Mellitus | C109A     | Type II diabetes mellitus with mononeuropathy                |
| Diabetes Mellitus | C109C     | Type II diabetes mellitus with nephropathy                   |
| Diabetes Mellitus | C109D     | Type II diabetes mellitus with hypoglycaemic coma            |
| Diabetes Mellitus | C108J     | Type I diabetes mellitus with neuropathic arthropathy        |
| Diabetes Mellitus | C10E9     | Type 1 diabetes mellitus maturity onset                      |
| Diabetes Mellitus | C10E7     | Type 1 diabetes mellitus with retinopathy                    |
| Diabetes Mellitus | C109K     | Hyperosmolar non-ketotic state in type 2 diabetes mellitus   |
| Diabetes Mellitus | C10E5     | Type 1 diabetes mellitus with ulcer                          |
| Diabetes Mellitus | C10E3     | Type 1 diabetes mellitus with multiple complications         |
| Diabetes Mellitus | C10F1     | Type 2 diabetes mellitus with ophthalmic complications       |
| Diabetes Mellitus | C10E.     | Type 1 diabetes mellitus                                     |
| Diabetes Mellitus | C109J     | Insulin treated Type 2 diabetes mellitus                     |
| Diabetes Mellitus | C109G     | Type II diabetes mellitus with arthropathy                   |
| Diabetes Mellitus | C109H     | Type II diabetes mellitus with neuropathic arthropathy       |
| Diabetes Mellitus | C10F0     | Type 2 diabetes mellitus with renal complications            |
| Diabetes Mellitus | C10F.     | Type 2 diabetes mellitus                                     |
| Diabetes Mellitus | C10EP     | Type 1 diabetes mellitus with exudative maculopathy          |
| Diabetes Mellitus | C10EA     | Type 1 diabetes mellitus without complication                |
| Diabetes Mellitus | C10EN     | Type 1 diabetes mellitus with ketoacidotic coma              |
| Diabetes Mellitus | C10F5     | Type 2 diabetes mellitus with gangrene                       |
| Diabetes Mellitus | C10EG     | Type 1 diabetes mellitus with peripheral angiopathy          |
| Diabetes Mellitus | C10EC     | Type 1 diabetes mellitus with polyneuropathy                 |
| Diabetes Mellitus | C10FM     | Type 2 diabetes mellitus with persistent microalbuminuria    |
| Diabetes Mellitus | C10EM     | Type 1 diabetes mellitus with ketoacidosis                   |
| Diabetes Mellitus | C10E4     | Unstable type 1 diabetes mellitus                            |
| Diabetes Mellitus | C10FG     | Type 2 diabetes mellitus with arthropathy                    |
| Diabetes Mellitus | C10FH     | Type 2 diabetes mellitus with neuropathic arthropathy        |
| Diabetes Mellitus | C10FQ     | Type 2 diabetes mellitus with exudative maculopathy          |
| Diabetes Mellitus | C10FC     | Type 2 diabetes mellitus with nephropathy                    |
| Diabetes Mellitus | C10F4     | Type 2 diabetes mellitus with ulcer                          |
| Diabetes Mellitus | C10F7     | Type 2 diabetes mellitus - poor control                      |
| Diabetes Mellitus | C10FN     | Type 2 diabetes mellitus with ketoacidosis                   |
| Diabetes Mellitus | C10FP     | Type 2 diabetes mellitus with ketoacidotic coma              |
| Diabetes Mellitus | C10FK     | Hyperosmolar non-ketotic state in type 2 diabetes mellitus   |
| Diabetes Mellitus | C10F6     | Type 2 diabetes mellitus with retinopathy                    |
| Diabetes Mellitus | C10F3     | Type 2 diabetes mellitus with multiple complications         |
| Diabetes Mellitus | C10FL     | Type 2 diabetes mellitus with persistent proteinuria         |
| Diabetes Mellitus | C10FJ     | Insulin treated Type 2 diabetes mellitus                     |
| Diabetes Mellitus | C10FF     | Type 2 diabetes mellitus with peripheral angiopathy          |
| Diabetes Mellitus | C10FR     | Type 2 diabetes mellitus with gastroparesis                  |
| Diabetes Mellitus | C10FE     | Type 2 diabetes mellitus with diabetic cataract              |
| Diabetes Mellitus | C10FB     | Type 2 diabetes mellitus with polyneuropathy                 |
| Diabetes Mellitus | C10FA     | Type 2 diabetes mellitus with mononeuropathy                 |
| Diabetes Mellitus | C10F9     | Type 2 diabetes mellitus without complication                |
| Diabetes Mellitus | C10F2     | Type 2 diabetes mellitus with neurological complications     |
| Diabetes Mellitus | C10FD     | Type 2 diabetes mellitus with hypoglycaemic coma             |
| Epilepsy          | 6674.     | Epilepsy associated problems                                 |
| Epilepsy          | F2553     | Visceral reflex epilepsy                                     |
| Epilepsy          | F259.     | Early infant epileptic encephalopathy wth suppression bursts |
| Epilepsy          | 1B1W.     | Transient epileptic amnesia                                  |
| Epilepsy          | 1O30.     | Epilepsy confirmed   |
| Epilepsy          | 9Of3.     | Epilepsy monitoring verbal invite                            |
| Epilepsy          | 21260     | Epilepsy resolved  |
| Epilepsy          | 6110.     | Contraceptive advice for patients with epilepsy              |
| Epilepsy          | F256.     | Infantile spasms   |

Continued

## Supplementary Appendix 1: Continued

| Condition | Read code | Read code description                                    |
|-----------|-----------|--|
| Epilepsy  | F250y     | Other specified generalised nonconvulsive epilepsy       |
| Epilepsy  | Eu052     | [X]Schizophrenia-like psychosis in epilepsy              |
| Epilepsy  | Eu05y     | [X]Epileptic psychosis NOS                               |
| Epilepsy  | 212J.     | Epilepsy resolved  |
| Epilepsy  | F2550     | Jacksonian, focal or motor epilepsy                      |
| Epilepsy  | 667D.     | Epilepsy control poor                                    |
| Epilepsy  | 667F.     | Seizure free >12 months                                  |
| Epilepsy  | 667G.     | Epilepsy restricts employment                            |
| Epilepsy  | 667H.     | Epilepsy prevents employment                             |
| Epilepsy  | 667J.     | Epilepsy impairs education                               |
| Epilepsy  | F253.     | Grand mal status   |
| Epilepsy  | 667K.     | Epilepsy limits activities                               |
| Epilepsy  | 667E.     | Epilepsy care arrangement                                |
| Epilepsy  | 667..     | Epilepsy monitoring                                      |
| Epilepsy  | F1321     | Progressive myoclonic epilepsy                           |
| Epilepsy  | F2500     | Petit mal (minor) epilepsy                               |
| Epilepsy  | F2510     | Grand mal (major) epilepsy                               |
| Epilepsy  | F2511     | Neonatal myoclonic epilepsy                              |
| Epilepsy  | 667L.     | Epilepsy does not limit activities                       |
| Epilepsy  | Eu060     | [X]Limbic epilepsy personality                           |
| Epilepsy  | 667W.     | Emergency epilepsy treatment since last appointment      |
| Epilepsy  | 67IJ0     | Pre-conception advice for patients with epilepsy         |
| Epilepsy  | 667V.     | Many seizures a day                                      |
| Epilepsy  | 667S.     | 1 to 7 seizures a week                                   |
| Epilepsy  | 667R.     | 2 to 4 seizures a month                                  |
| Epilepsy  | Eu803     | [X]Acquired aphasia with epilepsy [Landau - Kleffner]    |
| Epilepsy  | 667Q.     | 1 to 12 seizures a year                                  |
| Epilepsy  | 667T.     | Daily seizures   |
| Epilepsy  | 9Of6.     | Epilepsy monitoring call second letter                   |
| Epilepsy  | 9Of5.     | Epilepsy monitoring call first letter                    |
| Epilepsy  | 9Of4.     | Epilepsy monitoring telephone invite                     |
| Epilepsy  | 8BIF.     | Epilepsy medication review                               |
| Epilepsy  | 667P.     | No seizures on treatment                                 |
| Epilepsy  | 667X.     | No epilepsy drug side effects                            |
| Epilepsy  | F25G.     | Severe myoclonic epilepsy in infancy                     |
| Epilepsy  | F1322     | Myoclonic encephalopathy                                 |
| Epilepsy  | 9Of7.     | Epilepsy monitoring call third letter                    |
| Epilepsy  | F1422     | Dyssynergia cerebellaris myoclonica                      |
| Epilepsy  | F2501     | Pykno-epilepsy   |
| Epilepsy  | 667Z.     | Epilepsy monitoring NOS                                  |
| Epilepsy  | F2502     | Epileptic seizures - atonic                              |
| Epilepsy  | F2504     | Juvenile absence epilepsy                                |
| Epilepsy  | F2505     | Lennox-Gastaut syndrome                                  |
| Epilepsy  | F250.     | Generalised nonconvulsive epilepsy                       |
| Epilepsy  | F25z.     | Epilepsy NOS   |
| Epilepsy  | 667N.     | Epilepsy severity  |
| Epilepsy  | 67AF.     | Pregnancy advice for patients with epilepsy              |
| Epilepsy  | F2503     | Epileptic seizures - akinetic                            |
| Epilepsy  | 667M.     | Epilepsy management plan given                           |
| Epilepsy  | F2515     | Tonic-clonic epilepsy                                    |
| Epilepsy  | F255z     | Partial epilepsy without impairment of consciousness NOS |
| Epilepsy  | F251.     | Generalised convulsive epilepsy                          |
| Epilepsy  | F251z     | Generalised convulsive epilepsy NOS                      |
| Epilepsy  | F252.     | Petit mal status   |
| Epilepsy  | 667C.     | Epilepsy control good                                    |
| Epilepsy  | F2540     | Temporal lobe epilepsy                                   |

Continued

## Supplementary Appendix 1: Continued

| Condition     | Read code | Read code description  |
|---------------|-----------|--|
| Epilepsy      | F2542     | Psychosensory epilepsy                                       |
| Epilepsy      | F251y     | Other specified generalised convulsive epilepsy              |
| Epilepsy      | F2560     | Hypsarrhythmia   |
| Epilepsy      | F25y1     | Gelastic epilepsy  |
| Epilepsy      | F25y2     | Loco-rlt(foc)(part)idiop epilep&epilptic syn seiz locl onset |
| Epilepsy      | F2541     | Psychomotor epilepsy   |
| Epilepsy      | F2514     | Epileptic seizures - tonic                                   |
| Epilepsy      | F2545     | Complex partial epileptic seizure                            |
| Epilepsy      | F254.     | Partial epilepsy with impairment of consciousness            |
| Epilepsy      | F254z     | Partial epilepsy with impairment of consciousness NOS        |
| Epilepsy      | F2551     | Sensory induced epilepsy                                     |
| Epilepsy      | F2552     | Somatosensory epilepsy                                       |
| Epilepsy      | F2513     | Epileptic seizures - myoclonic                               |
| Epilepsy      | F2554     | Visual reflex epilepsy                                       |
| Epilepsy      | F2556     | Simple partial epileptic seizure                             |
| Epilepsy      | F255.     | Partial epilepsy without impairment of consciousness         |
| Epilepsy      | F255y     | Partial epilepsy without impairment of consciousness OS      |
| Epilepsy      | F2544     | Epileptic automatism   |
| Epilepsy      | F2543     | Limbic system epilepsy                                       |
| Epilepsy      | F2512     | Epileptic seizures - clonic                                  |
| Epilepsy      | F2555     | Unilateral epilepsy  |
| Epilepsy      | F25y3     | Complex partial status epilepticus                           |
| Epilepsy      | F25C.     | Drug-induced epilepsy  |
| Epilepsy      | F25D.     | Menstrual epilepsy   |
| Epilepsy      | F25E.     | Stress-induced epilepsy                                      |
| Epilepsy      | F25..     | Epilepsy   |
| Epilepsy      | F25F.     | Photosensitive epilepsy                                      |
| Epilepsy      | F25y4     | Benign Rolandic epilepsy                                     |
| Epilepsy      | F25B.     | Alcohol-induced epilepsy                                     |
| Epilepsy      | 6677.     | Epilepsy drug side effects                                   |
| Epilepsy      | 6678.     | Epilepsy treatment changed                                   |
| Epilepsy      | 6679.     | Epilepsy treatment started                                   |
| Epilepsy      | 667A.     | Epilepsy treatment stopped                                   |
| Epilepsy      | 667B.     | Nocturnal epilepsy   |
| Epilepsy      | 1473.     | H/O: epilepsy  |
| Epilepsy      | F25A.     | Juvenile myoclonic epilepsy                                  |
| Epilepsy      | F250z     | Generalised nonconvulsive epilepsy NOS                       |
| Epilepsy      | F25y5     | Panayiotopoulos syndrome                                     |
| Epilepsy      | F25yz     | Other forms of epilepsy NOS                                  |
| Epilepsy      | Fyu50     | [X]Other generalized epilepsy and epileptic syndromes        |
| Epilepsy      | Fyu51     | [X]Other epilepsy  |
| Epilepsy      | F25X.     | Status epilepticus, unspecified                              |
| Epilepsy      | Fyu52     | [X]Other status epilepticus                                  |
| Epilepsy      | F25y.     | Other forms of epilepsy                                      |
| Epilepsy      | F25y0     | Cursive (running) epilepsy                                   |
| Epilepsy      | F2561     | Salaam attacks   |
| Epilepsy      | F256z     | Infantile spasms NOS   |
| Epilepsy      | F257.     | Kojevnikov's epilepsy  |
| Epilepsy      | F258.     | Post-ictal state   |
| Epilepsy      | Fyu59     | [X]Status epilepticus, unspecified                           |
| Heart Failure | 9Or..     | Heart failure monitoring administration                      |
| Heart Failure | G1yz1     | Rheumatic left ventricular failure                           |
| Heart Failure | G400.     | Acute cor pulmonale  |
| Heart Failure | 9On2.     | Left ventricular dysfunction monitoring third letter         |
| Heart Failure | 9hH1.     | Excepted heart failure quality indicators: Informed dissent  |
| Heart Failure | 9h11.     | Excepted from LVD quality indicators: Patient unsuitable     |

Continued

## Supplementary Appendix 1: Continued

| Condition     | Read code | Read code description  |
|---------------|-----------|--|
| Heart Failure | 662h.     | New York Heart Association classification - class III        |
| Heart Failure | 9h12.     | Excepted from LVD quality indicators: Informed dissent       |
| Heart Failure | 9hH0.     | Excepted heart failure quality indicators: Patient unsuitabl |
| Heart Failure | 9hH..     | Exception reporting: heart failure quality indicators        |
| Heart Failure | G41z.     | Chronic cor pulmonale  |
| Heart Failure | 9N2p.     | Seen by community heart failure nurse                        |
| Heart Failure | 9N6T.     | Referred by heart failure nurse specialist                   |
| Heart Failure | 9On0.     | Left ventricular dysfunction monitoring first letter         |
| Heart Failure | 9On1.     | Left ventricular dysfunction monitoring second letter        |
| Heart Failure | 9h1..     | Exception reporting: LVD quality indicators                  |
| Heart Failure | 9Or5.     | Heart failure monitoring third letter                        |
| Heart Failure | 662i.     | New York Heart Association classification - class IV         |
| Heart Failure | 661M5     | Heart failure self-management plan agreed                    |
| Heart Failure | 662p.     | Heart failure 6 month review                                 |
| Heart Failure | 662T.     | Congestive heart failure monitoring                          |
| Heart Failure | 388D.     | New York Heart Assoc classification heart failure symptoms   |
| Heart Failure | 101..     | Heart failure confirmed                                      |
| Heart Failure | 14AM.     | H/O: Heart failure in last year                              |
| Heart Failure | 9On3.     | Left ventricular dysfunction monitoring verbal invite        |
| Heart Failure | 14A6.     | H/O: heart failure   |
| Heart Failure | 9Or3.     | Heart failure monitoring first letter                        |
| Heart Failure | 9On4.     | Left ventricular dysfunction monitoring telephone invite     |
| Heart Failure | 9On..     | Left ventricular dysfunction monitoring administration       |
| Heart Failure | 9Or0.     | Heart failure review completed                               |
| Heart Failure | 9Or1.     | Heart failure monitoring telephone invite                    |
| Heart Failure | 9Or2.     | Heart failure monitoring verbal invite                       |
| Heart Failure | 9Or4.     | Heart failure monitoring second letter                       |
| Heart Failure | G58z.     | Heart failure NOS  |
| Heart Failure | G5800     | Acute congestive heart failure                               |
| Heart Failure | G584.     | Right ventricular failure                                    |
| Heart Failure | 662f.     | New York Heart Association classification - class I          |
| Heart Failure | 662W.     | Heart failure annual review                                  |
| Heart Failure | G5yyA     | Left ventricular diastolic dysfunction                       |
| Heart Failure | G5yy9     | Left ventricular systolic dysfunction                        |
| Heart Failure | 8CeC.     | Preferred place of care for next exacerbation heart failure  |
| Heart Failure | G234.     | Hyperten heart&renal dis+both(congestv)heart and renal fail  |
| Heart Failure | 679X.     | Heart failure education                                      |
| Heart Failure | 8HBE.     | Heart failure follow-up                                      |
| Heart Failure | 8H2S.     | Admit heart failure emergency                                |
| Heart Failure | 8CL3.     | Heart failure care plan discussed with patient               |
| Heart Failure | 8B29.     | Cardiac failure therapy                                      |
| Heart Failure | 8CMK.     | Has heart failure management plan                            |
| Heart Failure | 8Hz.      | Referral to heart failure exercise programme                 |
| Heart Failure | 8CMW8     | Heart failure clinical pathway                               |
| Heart Failure | 679W1     | Education about deteriorating heart failure                  |
| Heart Failure | 8Hk0.     | Referred to heart failure education group                    |
| Heart Failure | G2101     | Malignant hypertensive heart disease with CCF                |
| Heart Failure | G2111     | Benign hypertensive heart disease with CCF                   |
| Heart Failure | G21z1     | Hypertensive heart disease NOS with CCF                      |
| Heart Failure | G232.     | Hypertensive heart&renal dis wth (congestive) heart failure  |
| Heart Failure | G5540     | Congestive cardiomyopathy                                    |
| Heart Failure | 662g.     | New York Heart Association classification - class II         |
| Heart Failure | G58..     | Heart failure  |
| Heart Failure | G582.     | Acute heart failure  |
| Heart Failure | G580.     | Congestive heart failure                                     |
| Heart Failure | G581.     | Left ventricular failure                                     |

Continued

## Supplementary Appendix 1: Continued

| Condition     | Read code | Read code description  |
|---------------|-----------|--|
| Heart Failure | ZRad.     | New York Heart Assoc classification heart failure symptoms   |
| Heart Failure | G5810     | Acute left ventricular failure                               |
| Heart Failure | G5801     | Chronic congestive heart failure                             |
| Heart Failure | G5802     | Decompensated cardiac failure                                |
| Heart Failure | G5803     | Compensated cardiac failure                                  |
| Heart Failure | G5804     | Congestive heart failure due to valvular disease             |
| Heart Failure | G580.     | Right ventricular failure                                    |
| Hypertension  | G241z     | Secondary benign hypertension NOS                            |
| Hypertension  | G24z.     | Secondary hypertension NOS                                   |
| Hypertension  | G2400     | Secondary malignant renovascular hypertension                |
| Hypertension  | G24z0     | Secondary renovascular hypertension NOS                      |
| Hypertension  | G24z1     | Hypertension secondary to drug                               |
| Hypertension  | G24zz     | Secondary hypertension NOS                                   |
| Hypertension  | Gyu21     | [X]Hypertension secondary to other renal disorders           |
| Hypertension  | G240.     | Secondary malignant hypertension                             |
| Hypertension  | L1220     | Other pre-existing hypertension in preg/childb/puerp unspec  |
| Hypertension  | L1282     | Pre-exist 2ndry hypertens comp preg childbth and puerperium  |
| Hypertension  | L127z     | Pre-eclampsia or eclampsia + pre-existing hypertension NOS   |
| Hypertension  | L128.     | Pre-exist hypertension compl preg childbirth and puerperium  |
| Hypertension  | L1280     | Pre-exist hyperten heart dis compl preg childbth+puerperium  |
| Hypertension  | TJC7.     | Adverse reaction to other antihypertensives                  |
| Hypertension  | L122z     | Other pre-existing hypertension in preg/childb/puerp NOS     |
| Hypertension  | TJC7z     | Adverse reaction to antihypertensives NOS                    |
| Hypertension  | 61462     | Hypertension induced by oral contraceptive pill              |
| Hypertension  | G24..     | Secondary hypertension                                       |
| Hypertension  | L127.     | Pre-eclampsia or eclampsia with pre-existing hypertension    |
| Hypertension  | G2410     | Secondary benign renovascular hypertension                   |
| Hypertension  | L1221     | Other pre-existing hypertension in preg/childb/puerp - deliv |
| Hypertension  | U60C5     | [X]Oth antihyperten drug caus advers eff in therap use, NEC  |
| Hypertension  | L1223     | Other pre-exist hypertension in preg/childb/puerp-not deliv  |
| Hypertension  | G672.     | Hypertensive encephalopathy                                  |
| Hypertension  | L122.     | Other pre-existing hypertension in preg/childbirth/puerp     |
| Hypertension  | Gyu2.     | [X]Hypertensive diseases                                     |
| Hypertension  | G2z..     | Hypertensive disease NOS                                     |
| Hypertension  | G20z.     | Essential hypertension NOS                                   |
| Hypertension  | G241.     | Secondary benign hypertension                                |
| Hypertension  | G234.     | Hyperten heart&renal dis+both(congestv)heart and renal fail  |
| Hypertension  | G240z     | Secondary malignant hypertension NOS                         |
| Hypertension  | G244.     | Hypertension secondary to endocrine disorders                |
| Hypertension  | G2y..     | Other specified hypertensive disease                         |
| Hypertension  | G232.     | Hypertensive heart&renal dis wth (congestive) heart failure  |
| Hypertension  | G2...     | Hypertensive disease   |
| Hypertension  | G2111     | Benign hypertensive heart disease with CCF                   |
| Hypertension  | G21z0     | Hypertensive heart disease NOS without CCF                   |
| Hypertension  | G21z1     | Hypertensive heart disease NOS with CCF                      |
| Hypertension  | G22z.     | Hypertensive renal disease NOS                               |
| Hypertension  | G2101     | Malignant hypertensive heart disease with CCF                |
| Hypertension  | 662F.     | Hypertension treatm. started                                 |
| Hypertension  | G233.     | Hypertensive heart and renal disease with renal failure      |
| Hypertension  | G231.     | Benign hypertensive heart and renal disease                  |
| Hypertension  | G230.     | Malignant hypertensive heart and renal disease               |
| Hypertension  | G23..     | Hypertensive heart and renal disease                         |
| Hypertension  | G222.     | Hypertensive renal disease with renal failure                |
| Hypertension  | G221.     | Benign hypertensive renal disease                            |
| Hypertension  | G220.     | Malignant hypertensive renal disease                         |
| Hypertension  | G200.     | Malignant essential hypertension                             |

Continued

## Supplementary Appendix 1: Continued

| Condition                  | Read code | Read code description                                 |
|----------------------------|-----------|---|
| Hypertension               | 8B26.     | Antihypertensive therapy                              |
| Hypertension               | G22..     | Hypertensive renal disease                            |
| Hypertension               | G201.     | Benign essential hypertension                         |
| Hypertension               | G202.     | Systolic hypertension                                 |
| Hypertension               | G21z.     | Hypertensive heart disease NOS                        |
| Hypertension               | G203.     | Diastolic hypertension                                |
| Hypertension               | G210.     | Malignant hypertensive heart disease                  |
| Hypertension               | G2100     | Malignant hypertensive heart disease without CCF      |
| Hypertension               | G211.     | Benign hypertensive heart disease                     |
| Hypertension               | G2110     | Benign hypertensive heart disease without CCF         |
| Hypertension               | G21..     | Hypertensive heart disease                            |
| Hypertension               | G21zz     | Hypertensive heart disease NOS                        |
| Hypertension               | 662c.     | Hypertension six month review                         |
| Hypertension               | 662d.     | Hypertension annual review                            |
| Hypertension               | 662r.     | Trial withdrawal of antihypertensive therapy          |
| Hypertension               | 7Q01.     | High cost hypertension drugs                          |
| Hypertension               | 8BL0.     | Patient on maximal tolerated antihypertensive therapy |
| Hypertension               | 662b.     | Moderate hypertension control                         |
| Hypertension               | 8I3N.     | Hypertension treatment refused                        |
| Hypertension               | F4042     | Blind hypertensive eye                                |
| Hypertension               | F4213     | Hypertensive retinopathy                              |
| Hypertension               | G23z.     | Hypertensive heart and renal disease NOS              |
| Hypertension               | 14A2.     | H/O: hypertension                                     |
| Hypertension               | 21261     | Hypertension resolved                                 |
| Hypertension               | 212K.     | Hypertension resolved                                 |
| Hypertension               | 662O.     | On treatment for hypertension                         |
| Hypertension               | 9O19.     | Hypertens.monitor deleted                             |
| Hypertension               | 6627.     | Good hypertension control                             |
| Hypertension               | 6628.     | Poor hypertension control                             |
| Hypertension               | 662G.     | Hypertensive treatm.changed                           |
| Hypertension               | G20..     | Essential hypertension                                |
| Hypertension               | 6624.     | Borderline hyperten:yearly obs                        |
| Inflammatory Bowel Disease | J4...     | Inflammatory bowel disease                            |
| Inflammatory Bowel Disease | ZR3S.     | CDAI - Crohn's disease activity index                 |
| Inflammatory Bowel Disease | ZR3S.     | Crohn's disease activity index                        |
| Inflammatory Bowel Disease | N0453     | Juvenile arthritis in Crohn's disease                 |
| Inflammatory Bowel Disease | N0311     | Arthropathy in Crohn's disease                        |
| Inflammatory Bowel Disease | Jyu40     | [X]Other Crohn's disease                              |
| Inflammatory Bowel Disease | J40z.     | Crohn's disease NOS                                   |
| Inflammatory Bowel Disease | J4005     | Exacerbation of Crohn's disease of small intestine    |
| Inflammatory Bowel Disease | J401z     | Crohn's colitis                                       |
| Inflammatory Bowel Disease | J40..     | Crohn's disease                                       |
| Inflammatory Bowel Disease | J4002     | Crohn's disease of the terminal ileum                 |
| Inflammatory Bowel Disease | J4003     | Crohn's disease of the ileum unspecified              |
| Inflammatory Bowel Disease | J401z     | Crohn's disease of the large bowel NOS                |
| Inflammatory Bowel Disease | J4012     | Exacerbation of Crohn's disease of large intestine    |
| Inflammatory Bowel Disease | J400z     | Crohn's disease of the small bowel NOS                |
| Inflammatory Bowel Disease | J4004     | Crohn's disease of the ileum NOS                      |
| Inflammatory Bowel Disease | J40..     | Regional enteritis - Crohn's disease                  |
| Inflammatory Bowel Disease | J41..     | Ulcerative colitis and/or proctitis                   |
| Inflammatory Bowel Disease | N0454     | Juvenile arthritis in ulcerative colitis              |
| Inflammatory Bowel Disease | N0310     | Arthropathy in ulcerative colitis                     |
| Inflammatory Bowel Disease | Jyu41     | [X]Other ulcerative colitis                           |
| Inflammatory Bowel Disease | J41z.     | Idiopathic proctocolitis NOS                          |
| Inflammatory Bowel Disease | J41yz     | Other idiopathic proctocolitis NOS                    |
| Inflammatory Bowel Disease | J41y.     | Other idiopathic proctocolitis                        |

Continued

## Supplementary Appendix 1: Continued

| Condition                  | Read code | Read code description                                      |
|----------------------------|-----------|--|
| Inflammatory Bowel Disease | J412.     | Ulcerative (chronic) ileocolitis                           |
| Inflammatory Bowel Disease | J410z     | Ulcerative proctocolitis NOS                               |
| Inflammatory Bowel Disease | J08z9     | Orofacial Crohn's disease                                  |
| Inflammatory Bowel Disease | J4104     | Exacerbation of ulcerative colitis                         |
| Inflammatory Bowel Disease | J4103     | Ulcerative proctitis                                       |
| Inflammatory Bowel Disease | J4101     | Ulcerative colitis   |
| Inflammatory Bowel Disease | J4100     | Ulcerative ileocolitis                                     |
| Inflammatory Bowel Disease | J410.     | Ulcerative proctocolitis                                   |
| Inflammatory Bowel Disease | J41..     | Idiopathic proctocolitis                                   |
| Inflammatory Bowel Disease | 14C4.     | H/O: ulcerative colitis                                    |
| Inflammatory Bowel Disease | J411.     | Ulcerative (chronic) enterocolitis                         |
| Osteoporosis               | N331M     | Fragility fracture due to unspecified osteoporosis         |
| Osteoporosis               | NyuB8     | [X]Unspecified osteoporosis with pathological fracture     |
| Osteoporosis               | NyuB2     | [X]Osteoporosis in other disorders classified elsewhere    |
| Osteoporosis               | NyuB1     | [X]Other osteoporosis                                      |
| Osteoporosis               | N3312     | Postoophorectomy osteoporosis with pathological fracture   |
| Osteoporosis               | NyuB0     | [X]Other osteoporosis with pathological fracture           |
| Osteoporosis               | N330A     | Osteoporosis in endocrine disorders                        |
| Osteoporosis               | N331K     | Collapse of thoracic vertebra due to osteoporosis          |
| Osteoporosis               | N331J     | Collapse of lumbar vertebra due to osteoporosis            |
| Osteoporosis               | N331H     | Collapse of cervical vertebra due to osteoporosis          |
| Osteoporosis               | N331B     | Postmenopausal osteoporosis with pathological fracture     |
| Osteoporosis               | N331L     | Collapse of vertebra due to osteoporosis NOS               |
| Osteoporosis               | N3746     | Osteoporotic kyphosis                                      |
| Osteoporosis               | N3318     | Osteoporosis + pathological fracture lumbar vertebrae      |
| Osteoporosis               | N3316     | Idiopathic osteoporosis with pathological fracture         |
| Osteoporosis               | N3315     | Drug-induced osteoporosis with pathological fracture       |
| Osteoporosis               | N3314     | Postsurgical malabsorption osteoporosis with path fracture |
| Osteoporosis               | N331A     | Osteoporosis + pathological fracture cervical vertebrae    |
| Osteoporosis               | N3313     | Osteoporosis of disuse with pathological fracture          |
| Osteoporosis               | N3319     | Osteoporosis + pathological fracture thoracic vertebrae    |
| Osteoporosis               | N330.     | Osteoporosis   |
| Osteoporosis               | N330D     | Osteoporosis due to corticosteroids                        |
| Osteoporosis               | N330C     | Osteoporosis localized to spine                            |
| Osteoporosis               | N330B     | Vertebral osteoporosis                                     |
| Osteoporosis               | N330z     | Osteoporosis NOS   |
| Osteoporosis               | N3307     | Postsurgical malabsorption osteoporosis                    |
| Osteoporosis               | N3306     | Postoophorectomy osteoporosis                              |
| Osteoporosis               | N3305     | Drug-induced osteoporosis                                  |
| Osteoporosis               | N3304     | Disuse osteoporosis  |
| Osteoporosis               | N3303     | Idiopathic osteoporosis                                    |
| Osteoporosis               | 9kj0.     | Bone sparing drug treatment offered for osteoporosis - ESA |
| Osteoporosis               | N3302     | Postmenopausal osteoporosis                                |
| Osteoporosis               | N3300     | Osteoporosis, unspecified                                  |
| Osteoporosis               | 9Od..     | Osteoporosis monitoring administration                     |
| Osteoporosis               | 9Od9.     | Osteoporosis monitoring check done                         |
| Osteoporosis               | 9Od8.     | Osteoporosis monitoring deleted                            |
| Osteoporosis               | 9Od7.     | Osteoporosis monitoring telephone invitation               |
| Osteoporosis               | N3301     | Senile osteoporosis  |
| Osteoporosis               | N331N     | Fragility fracture   |
| Osteoporosis               | 9Od4.     | Osteoporosis monitoring second letter                      |
| Osteoporosis               | 9Od3.     | Osteoporosis monitoring first letter                       |
| Osteoporosis               | 9Od2.     | Osteoporosis monitoring default                            |
| Osteoporosis               | 9Od0.     | Attends osteoporosis monitoring                            |
| Osteoporosis               | 9Od6.     | Osteoporosis monitoring verbal invitation                  |
| Osteoporosis               | 9kj..     | Osteoporosis - enhanced services administration            |

Continued

## Supplementary Appendix 1: Continued

| Condition    | Read code | Read code description  |
|--------------|-----------|--|
| Osteoporosis | 9Od5.     | Osteoporosis monitoring third letter                         |
| Osteoporosis | 58EV.     | Femoral neck DEXA scan result osteoporotic                   |
| Osteoporosis | 58EM.     | Lumbar DXA scan result osteoporotic                          |
| Osteoporosis | 58EG.     | Hip DXA scan result osteoporotic                             |
| Osteoporosis | 14GB.     | History of osteoporosis                                      |
| Osteoporosis | 66a..     | Osteoporosis monitoring                                      |
| PVD          | C1070     | Diabetes mellitus, juvenile +peripheral circulatory disorder |
| PVD          | C107.     | Diabetes mellitus with peripheral circulatory disorder       |
| PVD          | A3A0F     | Gas gangrene-foot  |
| PVD          | 7A49.     | Reconstruction of femoral artery or popliteal artery         |
| PVD          | 2G63.     | Ischaemic toe  |
| PVD          | 14F7.     | H/O: arterial lower limb ulcer                               |
| PVD          | 7A4A3     | Open embolectomy popliteal artery                            |
| PVD          | G74y3     | Embolism and thrombosis of the iliac artery unspecified      |
| PVD          | 7A4A2     | Open embolectomy of femoral artery                           |
| PVD          | 14NB.     | H/O: Peripheral vascular disease procedure                   |
| PVD          | G73zz     | Peripheral vascular disease NOS                              |
| PVD          | 7A41C     | Bypass leg artery by aorta/deep femoral art anastomosis NEC  |
| PVD          | 7A41B     | Bypass leg artery by aorta/com femoral art anastomosis NEC   |
| PVD          | 7A419     | Bypass common iliac artery by aorta/com iliac art anast NEC  |
| PVD          | 7A416     | Emerg bypass leg artery by aorta/com fem art anastomosis NEC |
| PVD          | G740.     | Aortoiliac obstruction                                       |
| PVD          | 7A414     | Emerg bypass comm iliac art by aorta/com iliac art anast NEC |
| PVD          | 7A4A.     | Other open operations on femoral artery or popliteal artery  |
| PVD          | C1071     | Diabetes mellitus, adult, + peripheral circulatory disorder  |
| PVD          | G73y6     | Acroparaesthesia - unspecified                               |
| PVD          | G73y2     | Acrocyanosis   |
| PVD          | G73y1     | Peripheral angiopathic disease EC NOS                        |
| PVD          | G73y0     | Diabetic peripheral angiopathy                               |
| PVD          | G73y.     | Other specified peripheral vascular disease                  |
| PVD          | G73y4     | Acroparaesthesia - Schultze's type                           |
| PVD          | C1074     | NIDDM with peripheral circulatory disorder                   |
| PVD          | 7A47.     | Other emergency bypass of femoral artery or popliteal artery |
| PVD          | 7A48.     | Other bypass of femoral artery or popliteal artery           |
| PVD          | 7A431     | Open embolectomy of iliac artery                             |
| PVD          | 7A43.     | Other open operations on iliac artery                        |
| PVD          | C1073     | IDDM with peripheral circulatory disorder                    |
| PVD          | 7A421     | Endarterectomy of iliac artery NEC                           |
| PVD          | 7A42.     | Reconstruction of iliac artery                               |
| PVD          | 7A413     | Bypass iliac artery by femoral/femoral art anastomosis NEC   |
| PVD          | 7A412     | Emerg bypass iliac artery by femoral/femoral art anast NEC   |
| PVD          | 7A123     | Bypass bifurcation aorta by anastom aorta to iliac artery    |
| PVD          | 7A420     | Endarterectomy and patch repair of iliac artery              |
| PVD          | 7A430     | Repair of iliac artery NEC                                   |
| PVD          | 7A410     | Emerg bypass iliac art by iliac/femoral art anastomosis NEC  |
| PVD          | 7A120     | Emerg bypass bifurc aorta by anast aorta to femoral artery   |
| PVD          | M2714     | Mixed venous and arterial leg ulcer                          |
| PVD          | M2710     | Ischaemic ulcer diabetic foot                                |
| PVD          | M271.     | Ischaemic leg ulcer  |
| PVD          | Gyu74     | [X]Other specified peripheral vascular diseases              |
| PVD          | G742z     | Peripheral arterial embolism and thrombosis NOS              |
| PVD          | M2713     | Arterial leg ulcer   |
| PVD          | G7426     | Embolism and thrombosis of the anterior tibial artery        |
| PVD          | 7A41.     | Other bypass of iliac artery                                 |
| PVD          | 7A12.     | Other bypass of bifurcation of aorta                         |
| PVD          | 7A102     | Axillo-bifemoral bypass graft                                |

Continued

## Supplementary Appendix 1: Continued

| Condition | Read code | Read code description  |
|-----------|-----------|--|
| PVD       | 7A101     | Bypass aorta by anastomosis axillary to femoral artery NEC   |
| PVD       | G7427     | Embolism and thrombosis of the dorsalis pedis artery         |
| PVD       | 7A100     | Emerg aortic bypass by anastomosis axillary to femoral art   |
| PVD       | G74y2     | Embolism and/or thrombosis of the external iliac artery      |
| PVD       | G74y1     | Embolism and/or thrombosis of the internal iliac artery      |
| PVD       | G74y0     | Embolism and/or thrombosis of the common iliac artery        |
| PVD       | G7429     | Embolism and thrombosis of a leg artery NOS                  |
| PVD       | 7A103     | Axillo-unifemoral PTFE bypass graft                          |
| PVD       | R0542     | [D]Gangrene of toe in diabetic                               |
| PVD       | 7A192     | Open embolectomy of bifurcation of aorta                     |
| PVD       | 7A12z     | Other bypass of bifurcation of aorta NOS                     |
| PVD       | 7A411     | Bypass iliac artery by iliac/femoral artery anastomosis NEC  |
| PVD       | 7A41F     | Ilio-femoral prosthetic cross over graft                     |
| PVD       | 7A44z     | Transluminal operation on iliac artery NOS                   |
| PVD       | 7A44y     | Other specified transluminal operation on iliac artery       |
| PVD       | 7A444     | Percutaneous transluminal insertion of iliac artery stent    |
| PVD       | 7A443     | Insertion of iliac artery stent                              |
| PVD       | R0543     | [D]Widespread diabetic foot gangrene                         |
| PVD       | 7A41y     | Other specified other bypass of iliac artery                 |
| PVD       | 7A433     | Open insertion of iliac artery stent                         |
| PVD       | 7A42z     | Reconstruction of iliac artery NOS                           |
| PVD       | 7A42y     | Other specified reconstruction of iliac artery               |
| PVD       | 7A41z     | Other bypass of iliac artery NOS                             |
| PVD       | 7A440     | Percutaneous transluminal angioplasty of iliac artery        |
| PVD       | 7A12y     | Other specified other bypass of bifurcation of aorta         |
| PVD       | G7425     | Embolism and thrombosis of the popliteal artery              |
| PVD       | G7424     | Embolism and thrombosis of the femoral artery                |
| PVD       | 7A441     | Percutaneous transluminal embolectomy of iliac artery        |
| PVD       | G733.     | Ischaemic foot   |
| PVD       | 7A47B     | Emerg bypass pop art by pop/peron art anast c vein graft NEC |
| PVD       | 7A493     | Endarterectomy of popliteal artery NEC                       |
| PVD       | 7A47C     | Emerg bypass femoral artery by fem/fem art anastomosis NEC   |
| PVD       | 7A47y     | Other emergency bypass of femoral or popliteal artery OS     |
| PVD       | 7A47z     | Other emergency bypass of femoral or popliteal artery NOS    |
| PVD       | 7A480     | Bypass femoral artery by fem/pop art anast c prosthesis NEC  |
| PVD       | 7A481     | Bypass popliteal artery by pop/pop a anast c prosthesis NEC  |
| PVD       | G73y7     | Erythrocyanosis  |
| PVD       | 7A482     | Bypass femoral artery by fem/pop art anast c vein graft NEC  |
| PVD       | 7A47D     | Emerg bypass popliteal artery by pop/fem art anastomosis NEC |
| PVD       | 7A4B3     | Percutaneous transluminal embolectomy of popliteal artery    |
| PVD       | 7A4B4     | Percutaneous transluminal embolisation of femoral artery     |
| PVD       | 7A4B5     | Percutaneous transluminal embolisation of popliteal artery   |
| PVD       | 7A4B8     | Percut translum thrombolysis femoral graft streptokinase     |
| PVD       | 7A4B9     | Percutaneous transluminal insertion of stent femoral artery  |
| PVD       | 7A50.     | Revision of reconstruction of artery                         |
| PVD       | 7A494     | Profundoplasty femoral artery & patch repair deep fem artery |
| PVD       | 7A483     | Bypass popliteal artery by pop/pop a anast c vein graft NEC  |
| PVD       | 7A477     | Emerg bypass pop art by pop/tib art anast c vein graft NEC   |
| PVD       | 7A486     | Bypass femoral artery by fem/tib art anast c vein graft NEC  |
| PVD       | 7A487     | Bypass popliteal artery by pop/tib a anast c vein graft NEC  |
| PVD       | 7A488     | Bypass femoral artery by fem/peron a anast c prosthesis NEC  |
| PVD       | 7A48A     | Bypass femoral artery by fem/peron a anast c vein graft NEC  |
| PVD       | 7A48B     | Bypass popliteal art by pop/peron art anast c vein graft NEC |
| PVD       | 7A48C     | Bypass femoral artery by femoral/femoral art anastomosis NEC |
| PVD       | 7A48D     | Bypass popliteal artery by pop/fem artery anastomosis NEC    |
| PVD       | 7A48E     | Femoro-femoral prosthetic cross over graft                   |

Continued

## Supplementary Appendix 1: Continued

| Condition            | Read code | Read code description  |
|----------------------|-----------|--|
| PVD                  | 7A476     | Emerg bypass femoral art by fem/tib a anast c vein graft NEC |
| PVD                  | 7A48y     | Other bypass of femoral artery or popliteal artery OS        |
| PVD                  | 7A490     | Endarterectomy and patch repair of femoral artery            |
| PVD                  | 7A491     | Endarterectomy and patch repair of popliteal artery          |
| PVD                  | 7A492     | Endarterectomy of femoral artery NEC                         |
| PVD                  | 7A485     | Bypass popliteal artery by pop/tib a anast c prosthesis NEC  |
| PVD                  | 7A484     | Bypass femoral artery by fem/tib art anast c prosthesis NEC  |
| PVD                  | 7A472     | Emerg bypass femoral art by fem/pop a anast c vein graft NEC |
| PVD                  | 7A473     | Emerg bypass pop art by pop/pop art anast c vein graft NEC   |
| PVD                  | 7A474     | Emerg bypass femoral art by fem/tib art anast c prosth NEC   |
| PVD                  | 7A48z     | Other bypass of femoral artery or popliteal artery NOS       |
| PVD                  | 7A500     | Revision of reconstruction involving aorta                   |
| PVD                  | 7A4B1     | Percutaneous transluminal angioplasty of popliteal artery    |
| PVD                  | 7A4A0     | Repair of femoral artery NEC                                 |
| PVD                  | 7A471     | Emerg bypass popliteal art by pop/pop art anast c prosth NEC |
| PVD                  | G7320     | Gangrene of toe  |
| PVD                  | G732.     | Peripheral gangrene  |
| PVD                  | G731z     | Thromboangiitis obliterans NOS                               |
| PVD                  | G7310     | Buerger's disease  |
| PVD                  | 7A470     | Emerg bypass femoral art by fem/pop art anast c prosth NEC   |
| PVD                  | 7A502     | Revision of reconstruction involving femoral artery          |
| PVD                  | G731.     | Thromboangiitis obliterans                                   |
| PVD                  | G700.     | Aorto-iliac disease  |
| PVD                  | C108G     | Insulin dependent diab mell with peripheral angiopathy       |
| PVD                  | C107z     | Diabetes mellitus NOS with peripheral circulatory disorder   |
| PVD                  | G702z     | Extremity artery atheroma NOS                                |
| PVD                  | G7321     | Gangrene of foot   |
| PVD                  | G73z.     | Peripheral vascular disease NOS                              |
| PVD                  | G73yz     | Other specified peripheral vascular disease NOS              |
| PVD                  | G73y8     | Erythromelalgia  |
| PVD                  | G702.     | Extremity artery atheroma                                    |
| PVD                  | 7A4B0     | Percutaneous transluminal angioplasty of femoral artery      |
| PVD                  | 7A503     | Revision of reconstruction of popliteal artery               |
| PVD                  | G73..     | Other peripheral vascular disease                            |
| PVD                  | G73y5     | Acroparaesthesia - Nothnagel's type                          |
| PVD                  | G73z0     | Intermittent claudication                                    |
| PVD                  | R0550     | [D]Failure of peripheral circulation                         |
| PVD                  | 7A501     | Revision of reconstruction involving iliac artery            |
| PVD                  | 7A121     | Bypass bifurc aorta by anastom aorta to femoral artery NEC   |
| PVD                  | 7A495     | Profundoplasty and patch repair of popliteal artery          |
| PVD                  | 7A4Ay     | Other open operation on femoral or popliteal artery OS       |
| PVD                  | 7A496     | Profundoplasty of femoral artery NEC                         |
| PVD                  | 7A498     | Reconstruction of femoral artery with vein graft             |
| PVD                  | 7A499     | Reconstruction of popliteal artery with vein graft           |
| PVD                  | 7A49y     | Reconstruction of femoral or popliteal artery OS             |
| PVD                  | 7A4B2     | Percutaneous transluminal embolectomy of femoral artery      |
| PVD                  | 7A49z     | Reconstruction of femoral or popliteal artery NOS            |
| PVD                  | 7A4A1     | Repair of popliteal artery NEC                               |
| PVD                  | 7A4A7     | Repair of femoral artery with temporary silastic shunt       |
| PVD                  | 7A4A8     | Repair of popliteal artery with temporary silastic shunt     |
| PVD                  | 7A497     | Profundoplasty of popliteal artery NEC                       |
| Rheumatoid Arthritis | N0422     | Rheumatoid nodule  |
| Rheumatoid Arthritis | N042z     | Rheumatoid arthropathy + visceral/systemic involvement NOS   |
| Rheumatoid Arthritis | N040F     | Rheumatoid arthritis of ankle                                |
| Rheumatoid Arthritis | N040R     | Rheumatoid nodule  |
| Rheumatoid Arthritis | N0405     | Rheumatoid arthritis of elbow                                |

Continued

## Supplementary Appendix 1: Continued

| Condition            | Read code | Read code description  |
|----------------------|-----------|--|
| Rheumatoid Arthritis | N005.     | Adult Still's Disease  |
| Rheumatoid Arthritis | N040.     | Rheumatoid arthritis   |
| Rheumatoid Arthritis | N0400     | Rheumatoid arthritis of cervical spine                       |
| Rheumatoid Arthritis | N0401     | Other rheumatoid arthritis of spine                          |
| Rheumatoid Arthritis | H570.     | Rheumatoid lung  |
| Rheumatoid Arthritis | N0421     | Rheumatoid lung disease                                      |
| Rheumatoid Arthritis | N040H     | Rheumatoid arthritis of talonavicular joint                  |
| Rheumatoid Arthritis | N040J     | Rheumatoid arthritis of other tarsal joint                   |
| Rheumatoid Arthritis | N040K     | Rheumatoid arthritis of 1st MTP joint                        |
| Rheumatoid Arthritis | N040N     | Rheumatoid vasculitis  |
| Rheumatoid Arthritis | N042.     | Other rheumatoid arthropathy + visceral/systemic involvement |
| Rheumatoid Arthritis | N040P     | Seronegative rheumatoid arthritis                            |
| Rheumatoid Arthritis | N040S     | Rheumatoid arthritis - multiple joint                        |
| Rheumatoid Arthritis | N040G     | Rheumatoid arthritis of subtalar joint                       |
| Rheumatoid Arthritis | N040T     | Flare of rheumatoid arthritis                                |
| Rheumatoid Arthritis | N041.     | Felty's syndrome   |
| Rheumatoid Arthritis | N040Q     | Rheumatoid bursitis  |
| Rheumatoid Arthritis | N0402     | Rheumatoid arthritis of shoulder                             |
| Rheumatoid Arthritis | F3964     | Myopathy due to rheumatoid arthritis                         |
| Rheumatoid Arthritis | G5y8.     | Rheumatoid myocarditis                                       |
| Rheumatoid Arthritis | 14G1.     | H/O: rheumatoid arthritis                                    |
| Rheumatoid Arthritis | Nyu1G     | [X]Seropositive rheumatoid arthritis, unspecified            |
| Rheumatoid Arthritis | N0406     | Rheumatoid arthritis of distal radio-ulnar joint             |
| Rheumatoid Arthritis | Nyu12     | [X]Other specified rheumatoid arthritis                      |
| Rheumatoid Arthritis | N04y2     | Adult-onset Still's disease                                  |
| Rheumatoid Arthritis | N04y0     | Fibrosing alveolitis associated with rheumatoid arthritis    |
| Rheumatoid Arthritis | N04y0     | Caplan's syndrome  |
| Rheumatoid Arthritis | N04y0     | Rheumatoid lung  |
| Rheumatoid Arthritis | Nyu11     | [X]Other seropositive rheumatoid arthritis                   |
| Rheumatoid Arthritis | F3712     | Polyneuropathy in rheumatoid arthritis                       |
| Rheumatoid Arthritis | N047.     | Seropositive erosive rheumatoid arthritis                    |
| Rheumatoid Arthritis | N0407     | Rheumatoid arthritis of wrist                                |
| Rheumatoid Arthritis | N0408     | Rheumatoid arthritis of MCP joint                            |
| Rheumatoid Arthritis | N0409     | Rheumatoid arthritis of PIP joint of finger                  |
| Rheumatoid Arthritis | 66H..     | Rheumatoid arthrit. monitoring                               |
| Rheumatoid Arthritis | N040A     | Rheumatoid arthritis of DIP joint of finger                  |
| Rheumatoid Arthritis | N040D     | Rheumatoid arthritis of knee                                 |
| Rheumatoid Arthritis | N04X.     | "Seropositive rheumatoid arthritis, unspecified"             |
| Rheumatoid Arthritis | G5yA.     | Rheumatoid carditis  |
| Rheumatoid Arthritis | 2G27.     | O/E-hands-rheumatoid spindling                               |
| Rheumatoid Arthritis | N040B     | Rheumatoid arthritis of hip                                  |
| Stroke & TIA         | Z7CE7     | Transient global amnesia                                     |
| Stroke & TIA         | ZV125     | [V]Personal history of stroke                                |
| Stroke & TIA         | G66..     | Stroke unspecified   |
| Stroke & TIA         | G66..     | Stroke and cerebrovascular accident unspecified              |
| Stroke & TIA         | G65..     | Transient cerebral ischaemia                                 |
| Stroke & TIA         | G64z1     | Wallenberg syndrome  |
| Stroke & TIA         | 14AB.     | H/O: TIA   |
| Stroke & TIA         | G641.     | Cerebral embolism  |
| Stroke & TIA         | G64..     | Cerebral arterial occlusion                                  |
| Stroke & TIA         | 14A7.     | H/O: CVA/stroke  |
| Stroke & TIA         | ZV12D     | [V]Personal history of transient ischaemic attack            |
| Stroke & TIA         | G65zz     | Transient cerebral ischaemia NOS                             |
| Stroke & TIA         | G65z.     | Transient cerebral ischaemia NOS                             |
| Stroke & TIA         | G65z1     | Intermittent cerebral ischaemia                              |
| Stroke & TIA         | G664.     | Cerebellar stroke syndrome                                   |

Continued

## Supplementary Appendix 1: Continued

| Condition    | Read code | Read code description  |
|--------------|-----------|--|
| Stroke & TIA | G64z.     | Cerebral infarction NOS                                      |
| Stroke & TIA | G656.     | Vertebrobasilar insufficiency                                |
| Stroke & TIA | G655.     | Transient global amnesia                                     |
| Stroke & TIA | G650.     | Insufficiency - basilar artery                               |
| Stroke & TIA | Fyu55     | [X]Other transnt cerebral ischaemic attacks+related syndroms |
| Stroke & TIA | F4236     | Amaurosis fugax  |
| Stroke & TIA | 8CRB.     | Transient ischaemic attack clinical management plan          |
| Stroke & TIA | G65y.     | Other transient cerebral ischaemia                           |
| Stroke & TIA | 1B1S.     | Transient global amnesia                                     |
| Stroke & TIA | G657.     | Carotid territory transient ischaemic attack                 |
| Stroke & TIA | Gyu6C     | [X]Sequelae of stroke,not specfd as h'morrhage or infarction |
| Stroke & TIA | G68X.     | Sequelae of stroke,not specfd as h'morrhage or infarction    |
| Stroke & TIA | G668.     | Right sided CVA  |
| Stroke & TIA | G667.     | Left sided CVA   |
| Stroke & TIA | G666.     | Pure sensory lacunar syndrome                                |
| Stroke & TIA | G665.     | Pure motor lacunar syndrome                                  |
| Stroke & TIA | 14AB0     | H/O amaurosis fugax  |
| Stroke & TIA | G663.     | Brain stem stroke syndrome                                   |
| Stroke & TIA | Fyu56     | [X]Other lacunar syndromes                                   |
| Stroke & TIA | 9h2..     | Exception reporting: stroke quality indicators               |
| Stroke & TIA | 9h22.     | Excepted from stroke quality indicators: Informed dissent    |
| Stroke & TIA | 9h21.     | Excepted from stroke quality indicators: Patient unsuitable  |
| Stroke & TIA | 8IEC.     | Ref multidisciplinary stroke function improvement declined   |
| Stroke & TIA | 8HHM.     | Ref to multidisciplinary stroke function improvement service |
| Stroke & TIA | G64z0     | Brainstem infarction   |
| Stroke & TIA | 7P242     | Delivery of rehabilitation for stroke                        |
| Stroke & TIA | Gyu6G     | [X]Cereb infarct due unsp occlus/stenos precerebr arteries   |
| Stroke & TIA | 662M1     | Stroke 6 month review  |
| Stroke & TIA | 661N7     | Stroke self-management plan review                           |
| Stroke & TIA | 661M7     | Stroke self-management plan agreed                           |
| Stroke & TIA | 1M4..     | Central post-stroke pain                                     |
| Stroke & TIA | 14AK.     | H/O: Stroke in last year                                     |
| Stroke & TIA | 662M2     | Stroke initial post discharge review                         |
| Stroke & TIA | 662M.     | Stroke monitoring  |
| Stroke & TIA | Gyu63     | [X]Cerebrl infarct due/unspcf occlusn or sten/cerebrl artrs  |
| Stroke & TIA | G6X..     | Cerebrl infarctn due/unspcf occlusn or sten/cerebrl artrs    |
| Stroke & TIA | G6W..     | Cereb infarct due unsp occlus/stenos precerebr arteries      |
| Stroke & TIA | G683.     | Sequelae of cerebral infarction                              |
| Stroke & TIA | G64z4     | Infarction of basal ganglia                                  |
| Stroke & TIA | G64z3     | Right sided cerebral infarction                              |
| Stroke & TIA | Gyu64     | [X]Other cerebral infarction                                 |
| Stroke & TIA | G64z2     | Left sided cerebral infarction                               |
| Stroke & TIA | L440.     | CVA - cerebrovascular accident in the puerperium             |
| Stroke & TIA | G640.     | Cerebral thrombosis  |
| Stroke & TIA | G6400     | Cerebral infarction due to thrombosis of cerebral arteries   |
| Stroke & TIA | G63y1     | Cerebral infarction due to embolism of precerebral arteries  |
| Stroke & TIA | G63y0     | Cerebral infarct due to thrombosis of precerebral arteries   |
| Stroke & TIA | G63..     | Infarction - precerebral                                     |
| Stroke & TIA | 662e.     | Stroke/CVA annual review                                     |
| Stroke & TIA | G6410     | Cerebral infarction due to embolism of cerebral arteries     |

Supplementary Appendix 2: welsh\_standard\_populations.docx – population of Wales grouped by age groups and gender (used as standard population)

| Age group | Gender | Population estimate (2018) |
|-----------|--------|----------------------------|
| 0-19      | Female | 342523                     |
| 0-19      | Male   | 361517                     |
| 20-29     | Female | 198754                     |
| 20-29     | Male   | 212900                     |
| 30-39     | Female | 186826                     |
| 30-39     | Male   | 185025                     |
| 40-49     | Female | 191784                     |
| 40-49     | Male   | 183742                     |
| 50-59     | Female | 222449                     |
| 50-59     | Male   | 211466                     |
| 60-69     | Female | 191600                     |
| 60-69     | Male   | 182235                     |
| 70-79     | Female | 155561                     |
| 70-79     | Male   | 141790                     |
| 80+       | Female | 101825                     |
| 80+       | Male   | 68634                      |
| Age group | Gender | Population estimate (2020) |
| 0-19      | Female | 341354                     |
| 0-19      | Male   | 360423                     |
| 20-29     | Female | 199339                     |
| 20-29     | Male   | 215332                     |
| 30-39     | Female | 192237                     |
| 30-39     | Male   | 190308                     |
| 40-49     | Female | 186136                     |
| 40-49     | Male   | 179259                     |
| 50-59     | Female | 225673                     |
| 50-59     | Male   | 213519                     |
| 60-69     | Female | 194142                     |
| 60-69     | Male   | 183229                     |
| 70-79     | Female | 163436                     |
| 70-79     | Male   | 149473                     |
| 80+       | Female | 103745                     |
| 80+       | Male   | 71981                      |

