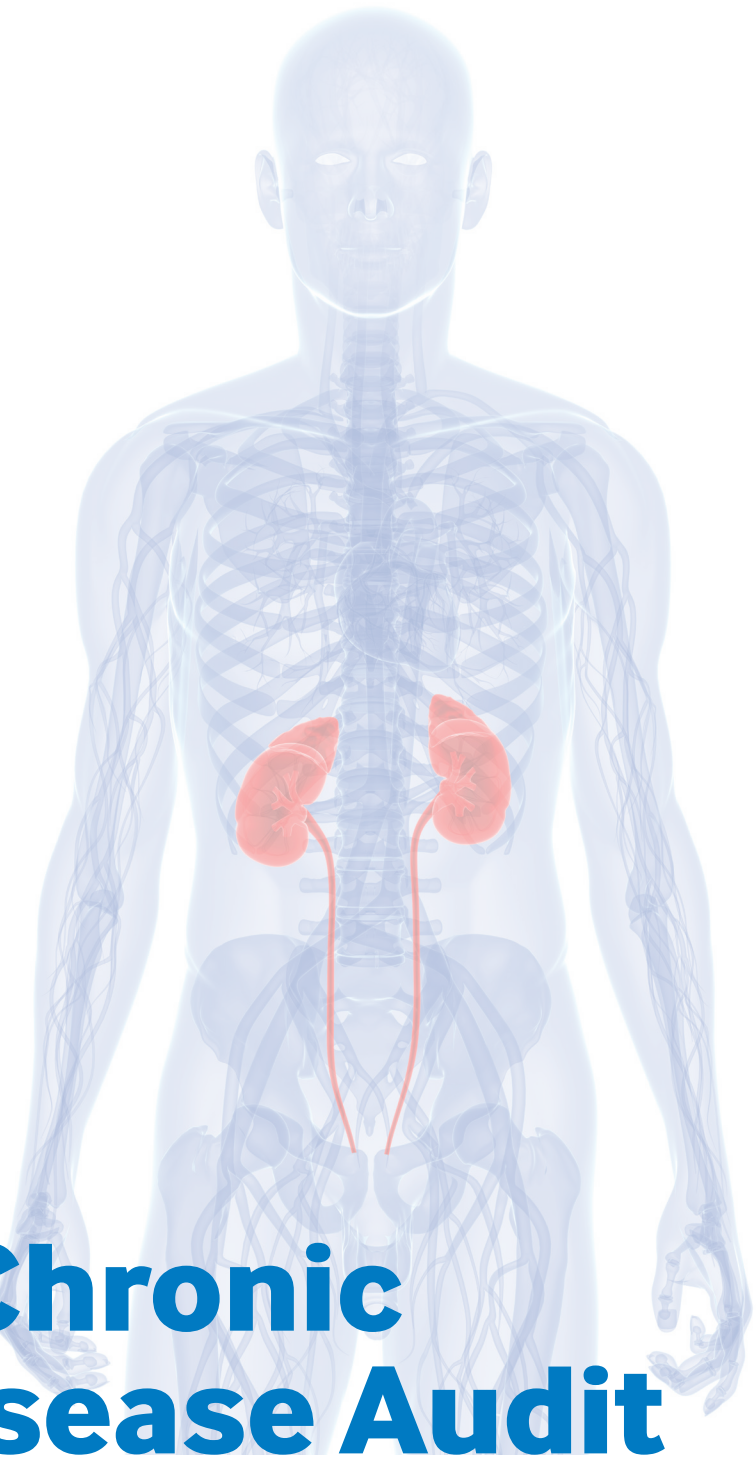
National CKDAudit

A quality improvement programme for chronic kidney disease



National Chronic Kidney Disease Audit

// National Report (Part 1) January 2017

Commissioned by: HQIP Healthcare Quality Improvement Partnership

Delivered by: Queen Mary University of London; London School of Hygiene & Tropical Medicine; UCL; Informatica Systems

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// Foreword by Fiona Loud

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The general public are not well aware of what the kidneys do and yet prevention and early detection of kidney disease can help to improve our outcomes as part of an integrated approach to vascular care. At the BKPA, we saw the first ever national audit into chronic kidney disease (CKD) practice as an important opportunity to improve kidney care and were both a supportive stakeholder in the original application for funding and an active participant throughout.

For patients, identifying and then actively managing at risk people with CKD represents value for money. Early intervention can and will avoid far costlier interventions and increased mortality once disease has advanced. The burden of advanced kidney disease on patients and their families as well as on our healthcare system is disproportionate and, while we direct much of what we do as a charity to those with kidney failure, we are absolutely committed to the early identification and prevention of deterioration of kidney disease.

Historically there has been debate about the usefulness of identifying CKD and informing patients of their diagnosis. None of this has helped people who do have CKD and would benefit from treatment and advice about what they can do now to reduce their risk of complications later. There are some really important findings from this audit – the huge variation in identifying risk of kidney disease in those with diabetes and the even greater variation in checking for CKD in those with high blood pressure. This is despite the fact that diabetes and high blood pressure are the commonest causes of kidney disease.

As patients we need primary care and rely on our doctors to look out for us; we hope that the audit will give further weight and encourage general practice to increase urine tests for those at risk. We see this as a simple intervention to avoid deterioration, recommended by NICE as best practice, to target care where needed. Wherever you live in the country there should be the same opportunity to receive the right tests, advice and treatments.

A further reason to look out for and accurately diagnose those with CKD is avoiding the harm of acute kidney injury. If people are very unwell, knowing that they have kidney disease will be a very important prompt to review medications and watch out for sudden decline in kidney function. We were also concerned to see such a low uptake of the pneumonia vaccine at just 23.5%, which we hope will be significantly increased in future.

Finally, any audit is all about improvement and, while we hope that it will be possible for the full potential and follow-up to this important work to be delivered, I commend its findings. Focus, with individual practice feedback, and the support of the system, can and does make a meaningful improvement to looking after people with chronic kidney disease.

// Foreword by Dr Richard Fluck

Former National Clinical Director (Renal), NHS England and Chair, Think Kidneys, UK Renal Registry

This report on the national audit of the management of chronic kidney disease (CKD) in primary care is timely and welcome. Much has changed in the professional understanding of kidney disease since the Renal National Service Framework was published over a decade ago. The driver to that publication was the desire to improve the care of people with end stage renal disease but the second part of the NSF recognised the need to improve care for everyone with CKD. NICE first published guidelines in 2008 and the adoption of using estimating equations to derive glomerular filtration rate from serum creatinine and the simplification of urinary protein excretion testing highlighted a simple truth – most of CKD management is carried out in primary care. This audit has been designed to examine practice in this key area. It has examined how well primary care diagnose and recognise CKD, looked at variation in treatment patterns and developed systems to support improvement.

Chronic kidney disease is important. Returning to the NSF, it was recognised that progressive CKD was often not diagnosed in a timely way. The consequence of late presentation and late referral to specialists reduced the options to slow down the progression of kidney disease and also to prepare that person and their family for the possibility of kidney failure. Such late presentation occurred in about 1 in 3 people starting dialysis over a decade ago and is now less than 1 in 5. That improvement is down principally to the skills of primary care in understanding the need to detect and manage CKD.

That is an important risk yet is dwarfed by the risk that CKD brings to an individual. CKD is harmful – it can result in premature mortality and can complicate other illness. There is significantly higher risks of cardiovascular disease and CKD is a powerful non-traditional risk factor. This has been recognised in the Cardiovascular Disease Outcomes Strategy published in 2013 by the Department of Health. Markers of kidney disease form part of the NHS Health Check. The Joint British Societies recommendations on the prevention of Cardiovascular Disease (JBS3) published a risk calculator in 2014 that included CKD in the calculation of overall risk.

The third element of risk that CKD brings is the increased vulnerability to acute kidney injury (AKI). AKI is a serious health issue across the globe and in England is associated with over 100,000 deaths. A national project, Think Kidneys, has been established by NHS England and working with professionals and stakeholders to address this issue. One aspect that is now clear – CKD is a risk factor for AKI and AKI can result in or accelerate CKD.

There is a recognition that CKD is harmful, that progress has been made and yet that progress is patchy with variation across the country at primary care level. So this audit is important because it is not only attempting to measure what is happening but why it is happening and therefore how can outcomes for individuals be improved in a systematic way. It has been designed to measure at the level of an individual practice and across the country and to provide support to improve care.

This has not been an easy journey for the project team or the many practices that have taken part – this has been a very complicated project. It has, however, produced the largest sample of patients with CKD in primary care globally. It has provided insights into processes of care and it has tested how data may be collected and analysed on a large scale. The existing data will be used in further research and analysis, both within England and Wales, to maximise the benefit of this work. The challenge, as this project comes to a close, is to translate these findings into a sustainable plan to improve care for people with chronic kidney disease.

//Contents

// Executive summary

Chronic Kidney Disease (CKD) is a long-term irreversible deterioration in the function of the kidneys often found in patients who also have diabetes and high blood pressure. It affects approximately 5.5% of adults and is more common in older people. CKD is an important condition because it can contribute to cardiovascular disease (CVD) and predispose to sudden worsening of kidney function (known as acute kidney injury) at times when patients are unwell for other reasons. Although only a small number of cases progress to end stage renal disease requiring dialysis (or a kidney transplant if possible), this is very difficult for individual patients and their families, and very costly for the health economy.

CKD is often without symptoms until the very advanced stages and is only picked up by performing tests on blood and urine. The management of CKD is based on identifying patients at high risk, regular monitoring of their kidney function, avoidance of treatments that may further damage their kidneys and taking appropriate steps to protect their general health. This audit was designed to help GPs achieve these four goals.

Patients with CKD can be identified by testing blood and urine:

- The ability of the kidneys to clean the blood can be assessed by measuring the blood levels of a waste produced called creatinine. The creatinine level can be used to estimate the rate that the kidneys are filtering blood (giving an "estimated glomerular filtration rate" or eGFR).
- Kidney damage can also be detected by measuring any leakage of a protein (albumin) into the urine using a test called the albumin to creatinine ratio (or ACR).

To accurately diagnose CKD and improve health outcomes, it is important that of both tests are performed as recommended by NICE.

Patients identified with CKD should then be coded accurately in the electronic patient record (using "Read codes"). **Accurate coding facilitates appropriate follow up and management by activating electronic alerts in GP computer systems to support safer prescribing.**

CKD can have widespread health implications. Having identified CKD patients and correctly coded them, specific treatments should be initiated. **The outcomes for patients with CKD can be improved by controlling blood pressure, reducing cholesterol, providing appropriate vaccinations and careful prescribing to avoid medicines toxic to the kidney.**

This report details the findings of the audit programme, which compared GP practice performance against NICE quality standards[1]. We asked:

1. Are people with risk factors being tested for CKD?
2. Are people with CKD being correctly identified and given an appropriate CKD Read code?
3. For people with CKD:
    - Are blood pressure targets being met?
    - Is appropriate CVD risk management being initiated?
    - Are annual CKD reviews being performed?
    - Are appropriate immunisations being given?

This National CKD Audit was commissioned by the Healthcare Quality Improvement Partnership (HQIP)[2], as part of the National Clinical Audit and Patient Outcomes Programme (NCAPOP), and was delivered by Informatica Systems in collaboration with London School of Hygiene & Tropical Medicine, University College London and Queen Mary (University of London).

1 National Institute for Health and Care Excellence, 2011; updated in 2014; Guideline 182, National Institute for Health and Care Excellence, 2014b)

2 HQIP is led by a consortium of the Academy of Medical Royal Colleges, the Royal College of Nursing and National Voices. Its aim is to promote quality improvement, and in particular to increase the impact that clinical audit has on healthcare quality in England and Wales. HQIP holds the contract to manage and develop the NCA Programme, comprising more than 30 clinical audits that cover care provided to people with a wide range of medical, surgical and mental health conditions. The programme is funded by NHS England, the Welsh Government and, with some individual audits, also funded by the Health Department of the Scottish Government, DHSSPS Northern Ireland and the Channel Islands. The NCKDA is funded by NHS England and the Welsh Government.

Originally designed to achieve full national coverage of general practices across England and Wales, the audit encountered technical challenges accessing primary care data. Therefore this report includes data from 911 practices representing approximately 74% of all Welsh practices and 8% of those in England. Approximately 100 additional practices received local benefits, but their data was not available in time for the national report.

The National CKD Audit provides a snapshot of performance in primary care against agreed evidence based targets. The audit involved an initial pilot period (September 2014 until February 2015) in which data extraction was tested and an integrated quality improvement component was designed and refined. Following national roll out (March 2015 to July 2016), data was extracted from practices twice; giving time for feedback of results and implementation of the quality improvement tools in the interim. The final data extraction, on which the audit results and recommendations contained in this report are based, took place in June 2016. A further report from the audit, due later in 2017, will use linked primary and secondary care data to report on referrals to secondary care and hospital admissions.

Findings and Recommendations

The audit recommendations are directed at general practices and clinical commissioning groups (CCGs), as well as secondary care providers. They are also relevant to patients and patient support groups. There are three main recommendations from the audit presented with a summary of the supporting findings from the audit:

Recommendation 1. For people at high risk of CKD, GPs should review practice to ensure that they are including both blood tests for eGFR and urinary testing for albumin to creatinine ratio (ACR).

Relevant audit findings:

- On average GPs test 86% of people with diabetes for CKD (using annual blood tests), but only 54% have the relevant annual urine tests.
- For other groups (such as those with hypertension), ACR rates are below 30%.

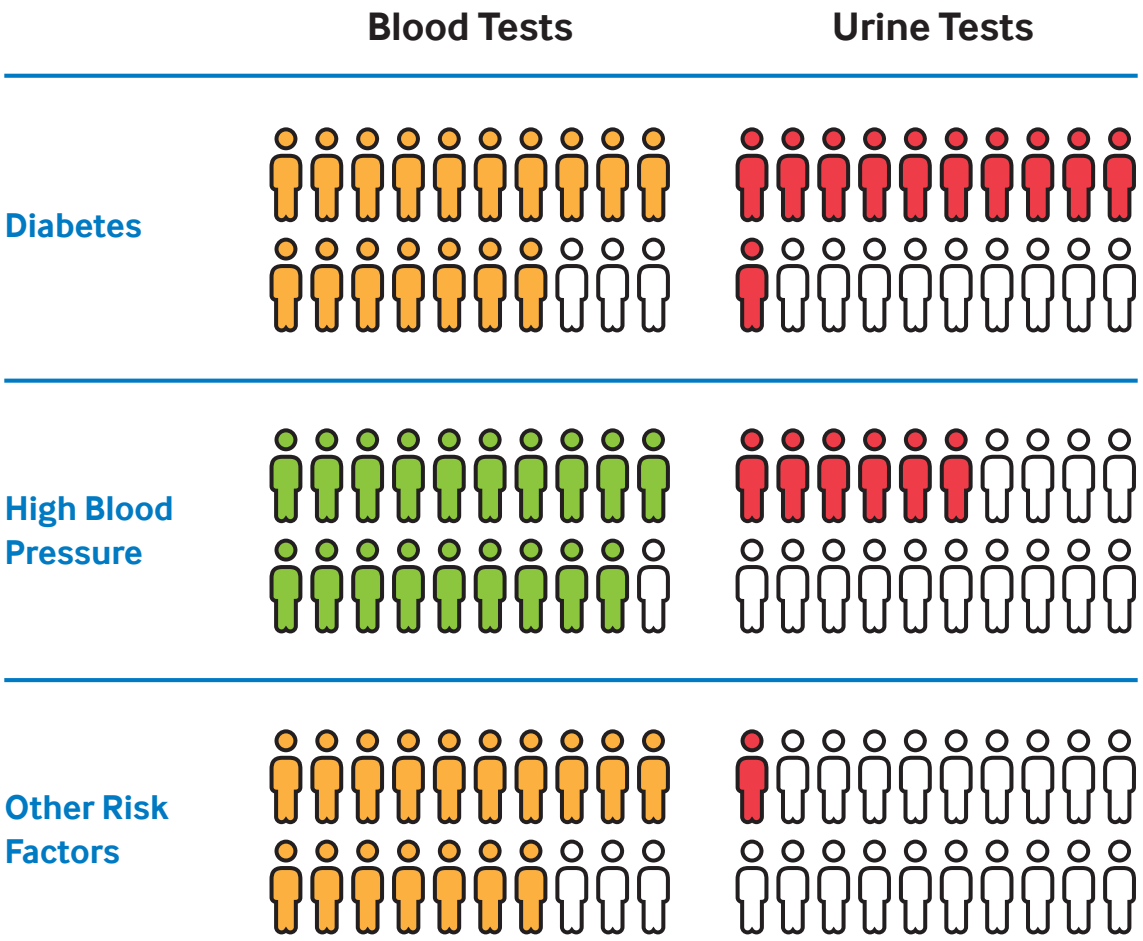
Testing for CKD

Performing blood and urine tests in those at risk is the best way to identify people with CKD.

The NCKDA measured whether those at risk of CKD had undergone blood and urine testing.

Blood tests were performed most of the time but urine tests often were not.

The charts below show the proportion of patients with different risk factors for CKD who have had blood and urine tests.



Key: *There are no formal targets in the guidance, but the audit selected 70% and 90% as quality markers.*

Red < 70% **Amber 71-90%** **Green > 90%**

Recommendation 2. GPs should review practice to improve the coding of patients with CKD.

Relevant audit findings:

- 70% of biochemically confirmed cases of CKD were given an appropriate Read code.
- There is high variability in the accuracy of coding. The proportion of CKD cases that were uncoded ranged between 0% to 80%.
- 11% of people given a CKD stage 3-5 Read code had biochemical evidence that they did not have CKD stage 3-5.
- Computerised quality improvement tools, such as those used in this programme, can be used to improve CKD identification and to assist GPs with appropriate coding, which in turn supports improvements in management.

The reasons for incomplete or inaccurate coding are complex, and are discussed further in chapters 5 and 6, but may include:

- Practices not testing those patients at risk;
- Failure to adjust the eGFR measurement for patients of black ethnicity;
- Patients fluctuating around the eGFR threshold for CKD;
- Process issues around coding, and the requirements for 2 eGFR measures below 60mL/min/1.7m^2.

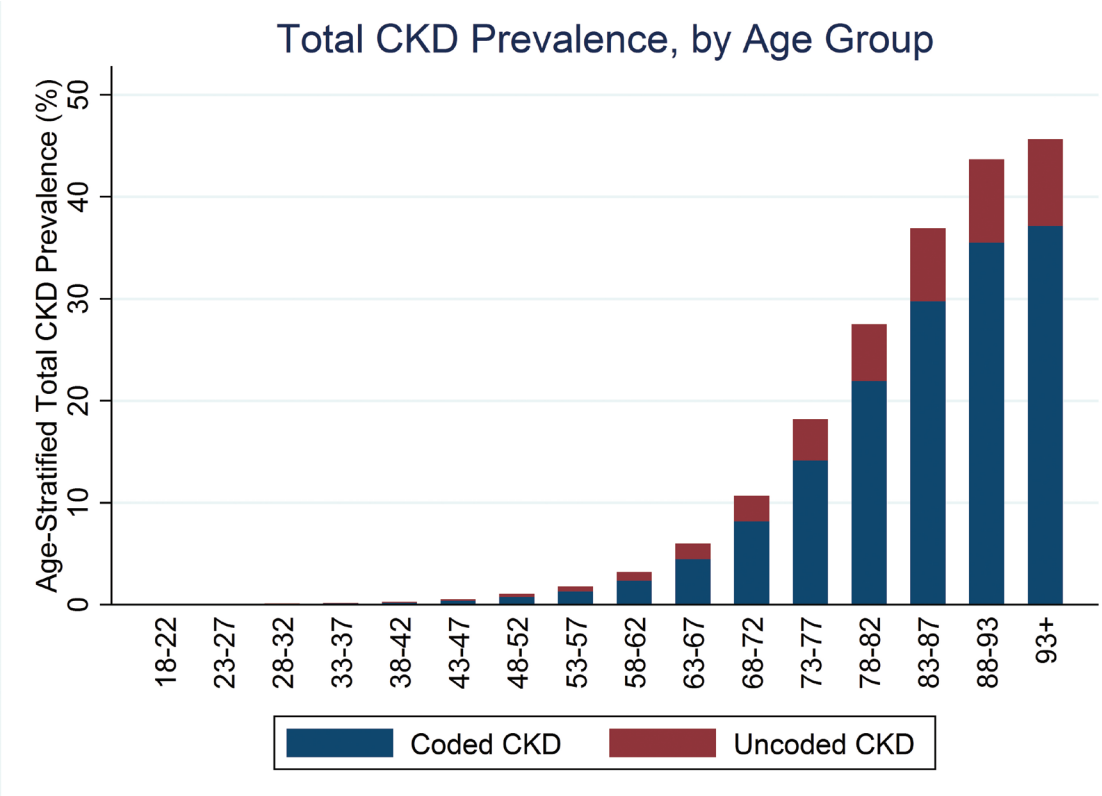
Recommendation 3. Having identified patients with CKD, effort should be focused on regular review, management of high blood pressure, prescribing cholesterol lowering treatments, and performing vaccinations to improve health outcomes.

Relevant audit findings:

- Whilst over 80% of those with CKD had had an eGFR test in the previous year, only 31% had a repeat ACR test. For people without diabetes, ACR testing rates are less than 15%.
- Among groups with the highest risk of developing progressive CKD (i.e. those with diabetes or an ACR >70mg/mmol) 70% had BP values above the recommended target range. Achievement of optimal blood pressure varied widely between practices.
- 69% of people with identified CKD were prescribed statin medication in accordance with NICE guidelines. The lowest rates (40%) were among younger people without diabetes, a group that may have the most to gain from an informed offer of statin therapy for CVD prevention.
- Whilst 75% of people with identified CKD had a flu vaccination in accordance with NICE Guidance, only 23% of people with CKD stages 4 and 5 had the recommended pneumococcus vaccination.

CKD Coding

Overall we found between 5 and 6% of the adult population had CKD and around three quarters of the people with CKD had been given an appropriate code by their GP practice.

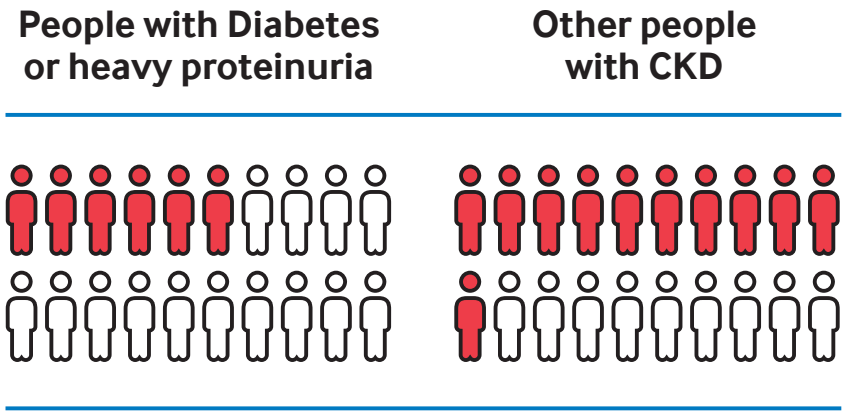


This chart shows the number of people with CKD in each age group. The blue bars show those coded with CKD by their GP and the red bars are an estimate of those that remain uncoded.

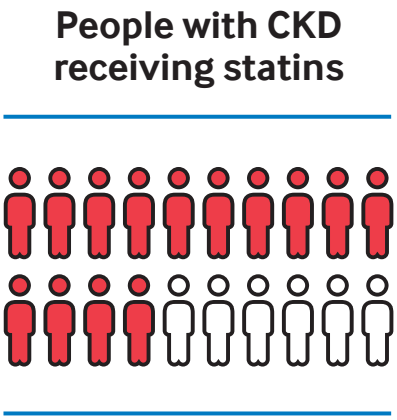
CKD Management

The NCKDA found that the blood pressure of most patients with CKD at highest risk of kidney failure doesn't meet targets.

The charts below show the proportion of people with CKD achieving blood pressure targets. A lower target is advised in those with diabetes or proteinuria but fewer people achieve this.



It is recommended that people with CKD should receive cholesterol lowering treatments or 'statins'.



Key: *There are no formal targets in the guidance, but the audit selected 70% and 90% as quality markers.*
Red < 70% **Amber 71-90%** **Green > 90%**

Report Key

Text in blue boxes summarise audit findings

Text in yellow boxes summarise quality improvement aspects

Text in green boxes provide additional information aimed at patients

Sources:

NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE 2011. Chronic kidney disease in adults: Quality standard

NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE 2014b. Chronic Kidney Disease: Early Identification and Management of Chronic Kidney Disease in Adults in Primary and Secondary Care. 182 ed. UK.

//1 Background to Chronic Kidney Disease

In 2008 the National Institute for Clinical Excellence (NICE) issued guidance on the early identification and management of chronic kidney disease (CKD) in adults in primary and secondary care (National Institute for Health and Care Excellence, 2008). There was a recent update in 2014 (National Institute for Health and Care Excellence, 2014b).

The majority of people with CKD also have diabetes (approximately 20%) and/or hypertension (approximately 75-85%). Most of the remaining patients have more rare diseases (e.g. connective tissue diseases, gout or glomerulonephritis) or obstruction of the renal tract (Fraser et al., 2015a, Fraser et al., 2015b). The prevalence of CKD rises steadily with age. Chronic kidney disease is prospectively associated with a high risk of premature cardiovascular disease (Chronic Kidney Disease Prognosis Consortium et al., 2010). Some medications are cleared by the kidney, and as kidney function declines, there is an increased risk of medication side-effects. People with CKD are more likely to suffer acute kidney injury (Hsu et al., 2008) and a small proportion (<1% per year) will progress to end stage kidney disease requiring dialysis or transplantation (Marks et al., 2014).

The early stages of CKD are usually asymptomatic. Hence it is important that those who are at risk are tested at appropriate intervals so that CKD is identified early. This provides GPs the opportunity to provide education and information to people with CKD as well as offer lifestyle advice and treatments aimed at delaying progression and cardiovascular disease (CVD) complications.

Most people with CKD will be identified and managed by their GP and there are a number of Read codes used by all general practice computer systems, which enable a practice register to be maintained. This in turn will support regular monitoring, treatment and prescribing decisions. There is good quality evidence to suggest that optimising treatment of CKD will improve outcomes (Baigent et al., 2011, Lv et al., 2013). As only a minority of those with CKD will need to be referred on to kidney specialists in secondary care, there is the opportunity to obtain substantial health benefits from adherence to evidence based care in General Practice.

Improving identification in primary care delivers these benefits for people living with CKD

- Personalised information and education about CKD
- Opportunities to make lifestyle changes that will help maintain kidney health
- Regular review of kidney function
- Improved management of blood pressure and cardiovascular risk
- Safer prescribing of medications
- Specialist kidney care if and when necessary

//2 Aims and Rationale of the National CKD Audit and Quality Improvement Programme

The purpose of the National CKD Audit and Quality Improvement Programme (NCKDA) is to improve the identification and management of CKD in primary care. As CKD is a silent disease in the early stages, it is important to test for it. Once a patient is coded for CKD they are more likely to get regular renal reviews. In addition, GP prescribing software will identify coded patients as having kidney disease, which may in turn lead to safer prescribing decisions.

The audit measures:

a. Performance against NICE guidelines and quality standards (National Institute for Health and Care Excellence, 2011).

b. Variation between practices, clinical commissioning groups (CCGs) and local health boards (LHBs) in Wales, in the identification and management of CKD.

The audit has been designed to address the following questions:

CKD Identification and Recording:

- Are people with risk factors being tested for CKD?
- Are people with CKD stages 3-5 being given an appropriate CKD stage 3-5 Read code?

CKD Management:

- Are people with recorded CKD stages 3-5 meeting blood pressure targets?
- Are people with recorded CKD stages 3-5 having their kidney function monitored regularly?
- Are people with recorded CKD stages 3-5 receiving appropriate cardiovascular risk management?
- Are people with CKD stages 3-5 being appropriately referred to specialist care?

The first three years of the audit were focussed on CKD identification, recording and primary care management. Because of variation in GP recording of specialist referrals, appropriate and timeliness of referrals cannot be investigated in this audit. Similar issues apply to whether patients with CKD were informed about their disease.

Each practice signed up to the audit is provided with computer based quality improvement (QI) tools to:

- Improve the identification of CKD amongst people at risk.
- Improve coding of CKD stages 3-5, and identification of potentially miscoded people.
- Monitor kidney function at appropriate intervals.
- Improve blood pressure management to appropriate targets.
- Increase the appropriate use of statins to reduce CVD risk.

//3 Methods

The national data collection for the audit aimed to recruit most of the practices in England and Wales. The data extraction from participating practices used the Informatica Audit Plus tool. Informatica provides a range of IT services to GP practices and in particular provides data extraction for all primary care audits in Wales.

An initial pilot phase of the main audit was carried out to ensure that the potential challenges associated with collecting national data on CKD identification and management were understood and dealt with in the early phases. Details of the pilot phase have already been reported[3].

It was only possible to enrol the practices which used Informatica Audit Plus software. Over the course of the audit this included all 459 practices in Wales and 1267 practices in England. A national roll out of the NCKDA to other practices in England was contingent on the GP Systems of Choice (GPSoC) contract, which would have allowed practices to install Informatica Audit+ software and for audit data to be extracted without incurring Application Programme Interface (API) fees from clinical system providers. Due to delays with the national implementation of GPSoC, the audit was only available to practices that already use Informatica software.

Practices which have installed a current issue of the Audit Plus software were asked for their consent to take part. For those practices which gave consent to data extraction, the audit tool and the QI tool were activated. The audit tool identified patient data in GP software, and directly exported this information to a secure data centre. Data were only extracted if a practice had agreed to take part in the NCKDA. Those individuals with a Read code recording their decision to opt out of data collection for research or audit purposes did not have their data uploaded (approximately 4% of patient records were not uploaded due to opting out[4]).

The patient identifiable data were held in secure servers at Informatica for which Health Research Authority (HRA, previously NIGB) approval under section 251 had been given. Coded data were only extracted from those people with coded CKD, risk factors for CKD or people with tests of kidney function. In total this represented around a quarter of the registered adult patient records. Summary data on practice population, age structure, sex and ethnicity for the whole practice were obtained directly from the practice, with consent, or from publically available sources. More details on practice population estimates, along with a full list of the variables extracted are presented in the appendix (Appendix Tables 1-3 and Appendix Figure 1). All personal identifying information was removed and pseudo-anonymised identifiers added before data were passed electronically to the analysis team at the London School of Hygiene & Tropical Medicine.

Only Read coded data were used for the audit, hence additional information that the primary care practitioner had entered into their system, such as free text, could not be used. This computerised approach to auditing care had the advantage that many records were collected in a short amount of time, provided the primary care practitioners agreed to take part and install the software on their clinical systems. Two rounds of data were extracted from each participating practice. The first round of data extraction was used to check that the extraction process and data completeness was adequate. Practices received an email to inform them that their data had been successfully processed. This email gave some initial feedback on CKD coding and suggested to practices that they use the quality improvement (QI) tool to review the data of their practice. The second data extract took place at least 3 months after the first extract. Practices received an individual practice report following a successful analysis of second-round data. Except where stated, the data presented in this report are based on a third extract that was performed in June 2016.

3 http://tiny.cc/03CKD
4 See Appendix

Development of the QI tool

The electronic QI tool was developed by Informatica Systems in collaboration with clinicians from both primary and secondary care. The development proceeded iteratively throughout the period of the pilot phase of the audit.

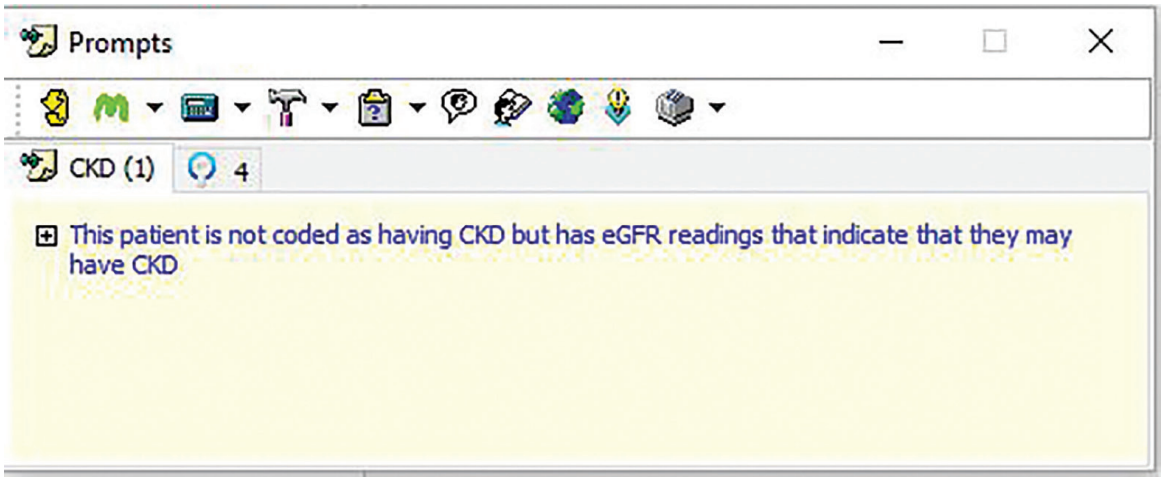
The QI identifies lists of people who may require testing for CKD, lists of potentially miscoded or un-coded people with CKD, as well as lists of people with CKD who might benefit from further management. The QI tool therefore gave the GP an opportunity to review the coding and management of patients. Further functionality included a pop up box which appears in the consultation screen as an alert for un-coded CKD. Further pop up triggers for different aspects of CKD management were enabled determined by practice choice.

The NCKDA Quality Improvement Tool aimed to:

- Help practices identify patients at risk of CKD who require testing for CKD.
- Flag patients with biochemical evidence of CKD who might need a CKD stage 3-5 code.
- Improve the management of blood pressure and cardiovascular risk amongst those with CKD.

Below are some screen shots of electronic prompts to improve quality of care of people with identified CKD:

Figure 1. QI tool. Screenshot of electronic prompt to code or review coding



Both figures below show dashboards that were available to the GP through the quality improvement software.

All the graphs provided 'click-through' functionality, i.e. Clicking the relevant part of the chart takes the GP directly to patient names included in the coloured bar.

Figure 2. Screen shot of the QI tool dashboard to illustrate 'click-through' graphics to reach people at risk of CKD who need testing

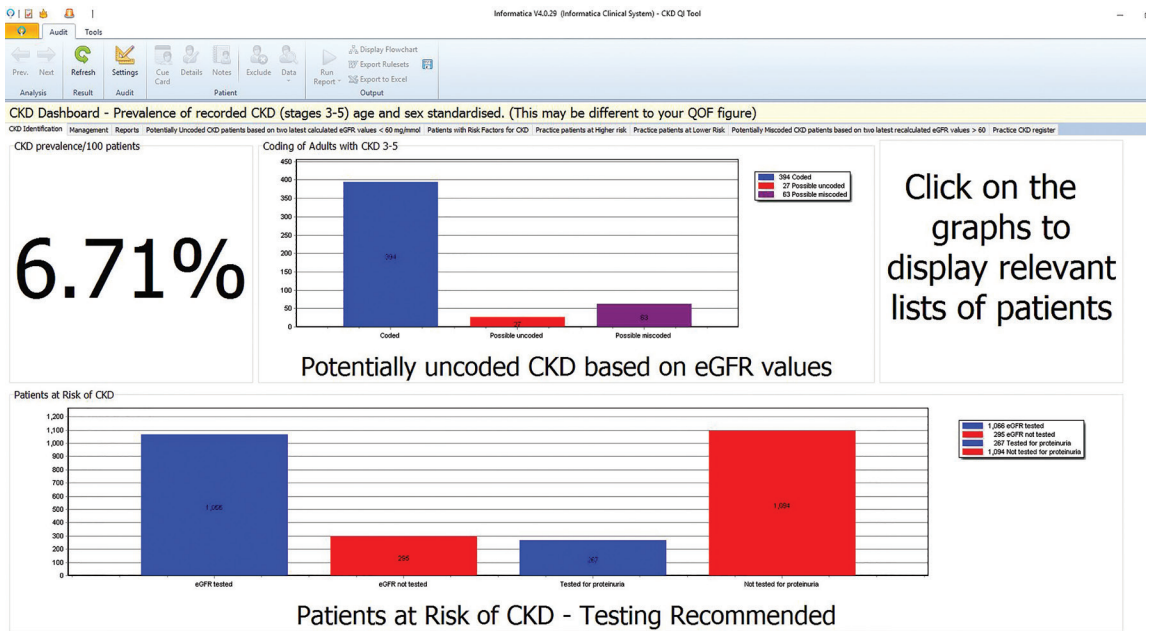
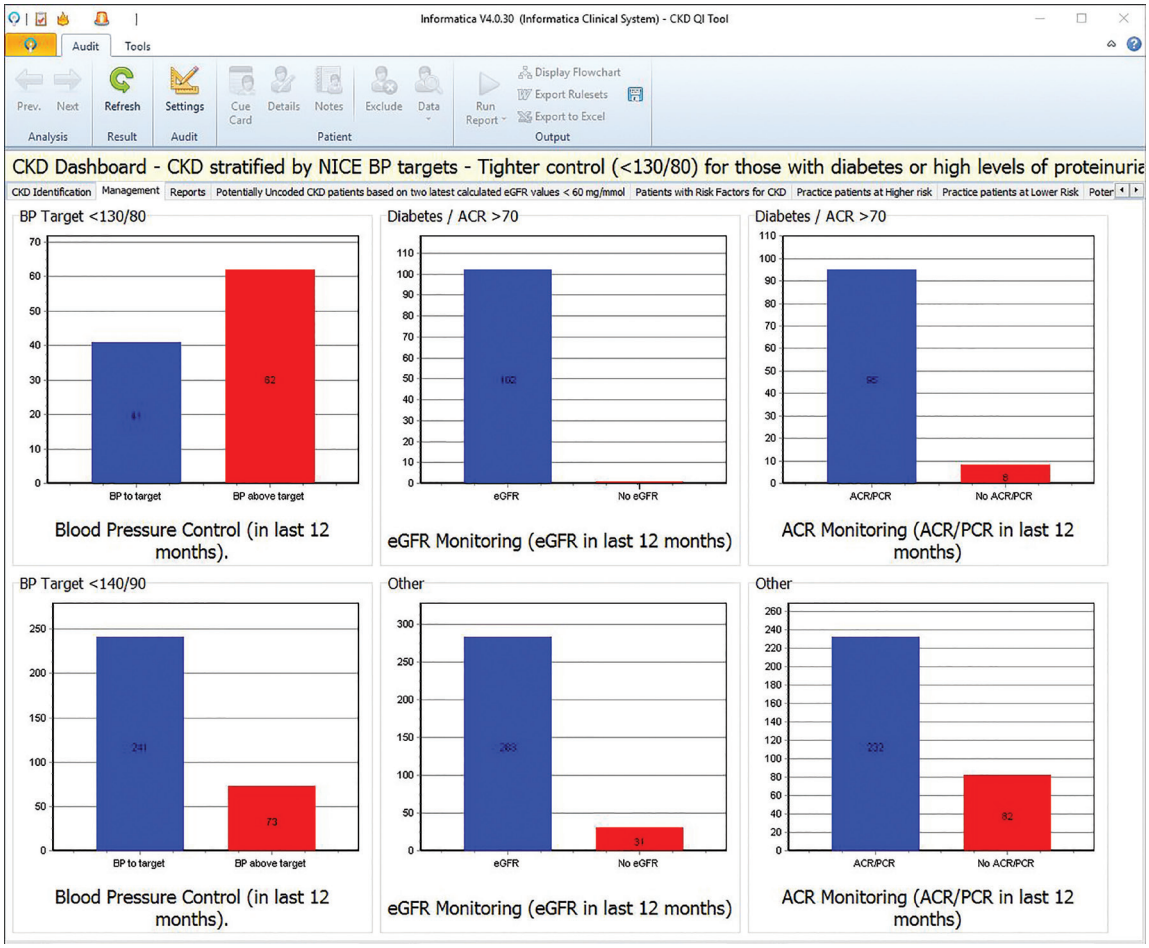


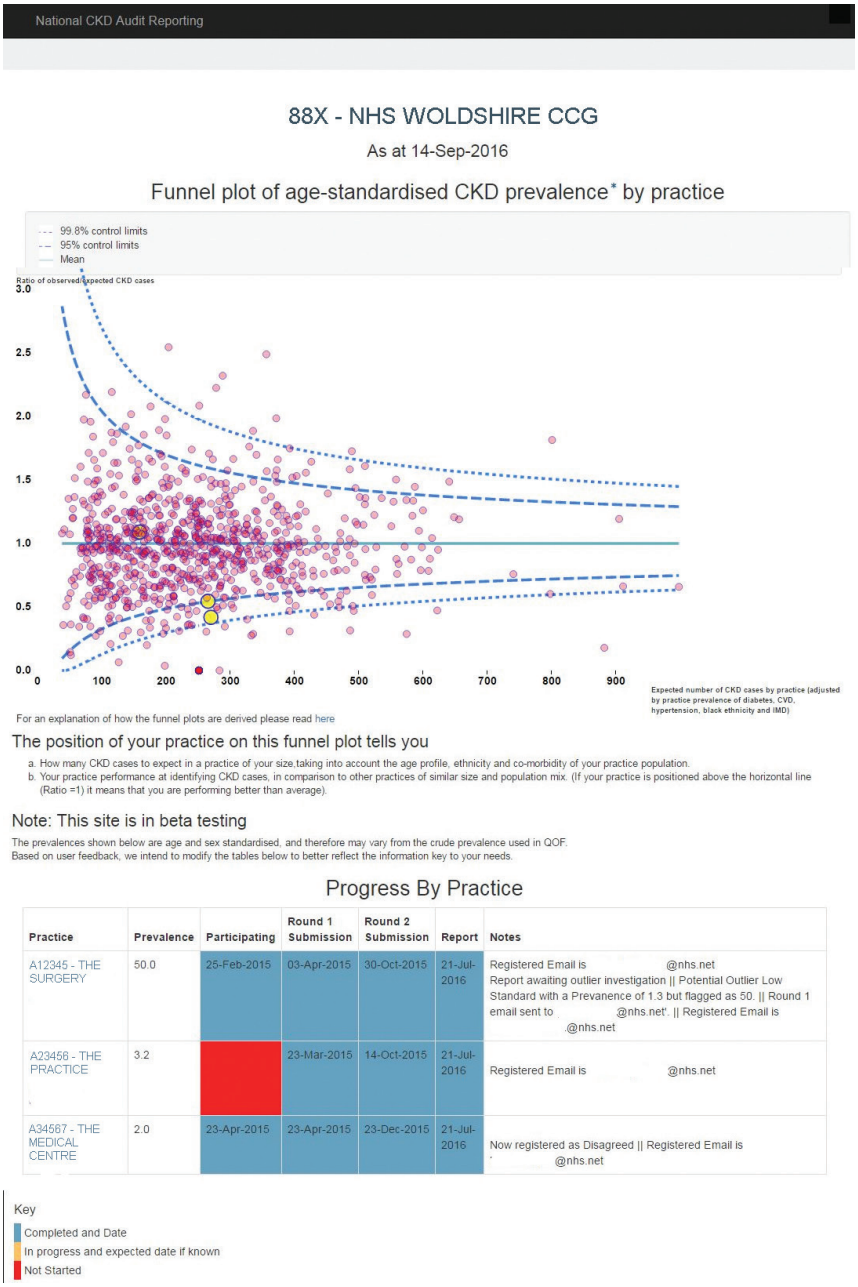
Figure 3. Screen shot of the QI tool CKD management dashboard. People are stratified by NICE blood pressure targets. 'Click-through' graphics to reach people at risk of CKD who need more management/tests



Reporting to practices

Reporting is done through a web portal in which each participating practice can log in to see their latest data. CCGs and LHBs can see the data for their respective practices. A screenshot is provided below.

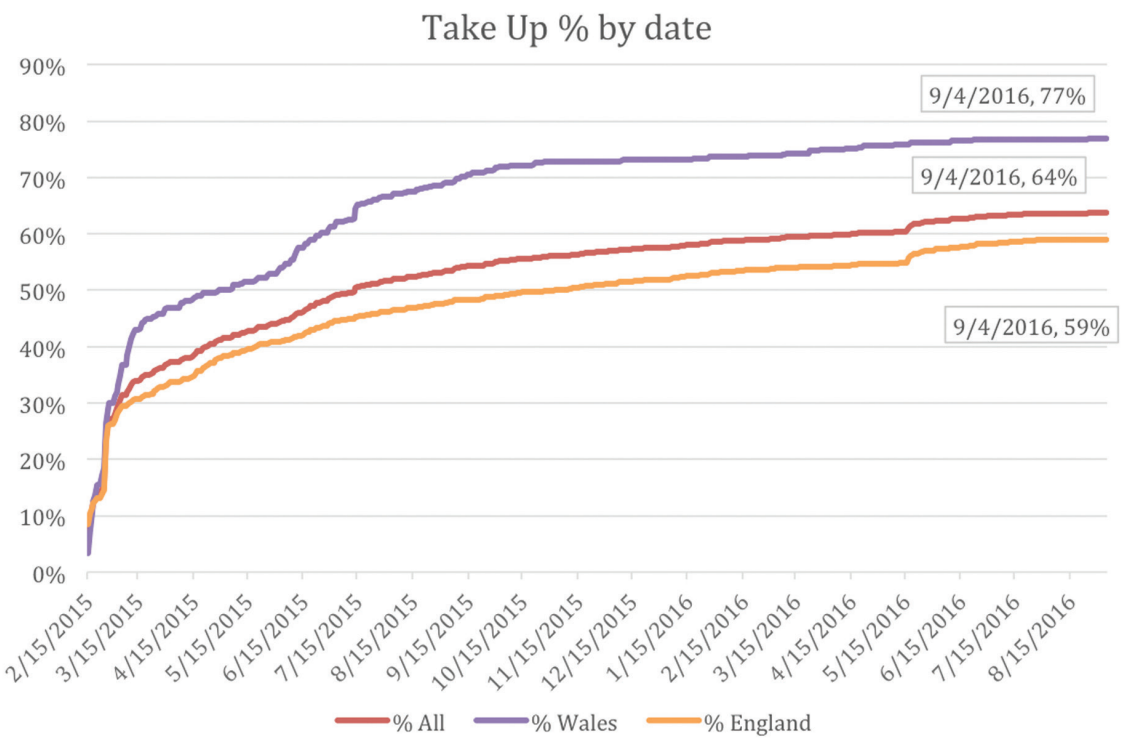
Figure 4. Screen shot of the CCG/LHB reporting website



// 4 Coverage of the National CKD Audit and features of the population studied

Due to issues with the GPSoC commercial framework, only practices that used Informatica Systems software were offered the opportunity to take part in the audit. The total number of practices eligible for the audit was 1267 in England (out of a total of 7841 practices) and all 459 practices in Wales. Recruitment over time is shown in Figure 5, for the entire eligible practice population as well as separately for England and Wales. The numbers of practices in England transferring the different data extracts varied over time so the numbers of practices in all analyses may not be the same. As Informatica systems already provide primary care audits for Wales, NCKDA practice recruitment achieved high coverage in Wales. In contrast, the practices in England may be self-selecting, as they have invested in Audit software and have volunteered to sign up for the Audit. This means that English practices participating in the Audit were not truly representative of the English population and likely to perform better than a random sample of practices. Figure 6 outlines the CCG/LHBs with participating practices who transferred at least one round of data.

Figure 5. Recruitment over time in England and Wales, and total recruitment of practices using Informatica Systems software



Key demographic characteristics of the practice populations represented in the audit are outlined in the appendix (Appendix Table 1 and Appendix Figure 1). The practice populations were representative in terms of age and sex distribution in England and Wales. Ethnicity recording was poor in Wales, with approximately 60% missing codes compared to less than one third in England, and people with white ethnicity may not have been coded. No conclusions can be drawn about the 4% (238,269) of people who opted out of the audit. Approximately half of people at risk of CKD had hypertension, and close to a fifth of extracted patient data were on people with diabetes, and/or existing cardiovascular disease (CVD), reflecting the importance of these risk factors with regards to CKD prevalence in the population (Figure 7).

Coverage of the NCKDA report

- 911 participating practices encompassing 5.2 million adults.
- 7.5% of English, and 70% of Welsh practices.
- The audit population had a similar age and sex distribution to the whole of England and Wales.
- 1.5 million people with CKD, or a risk factor for CKD.

Figure 6. Map of coverage of Audit within practices using Informatica systems

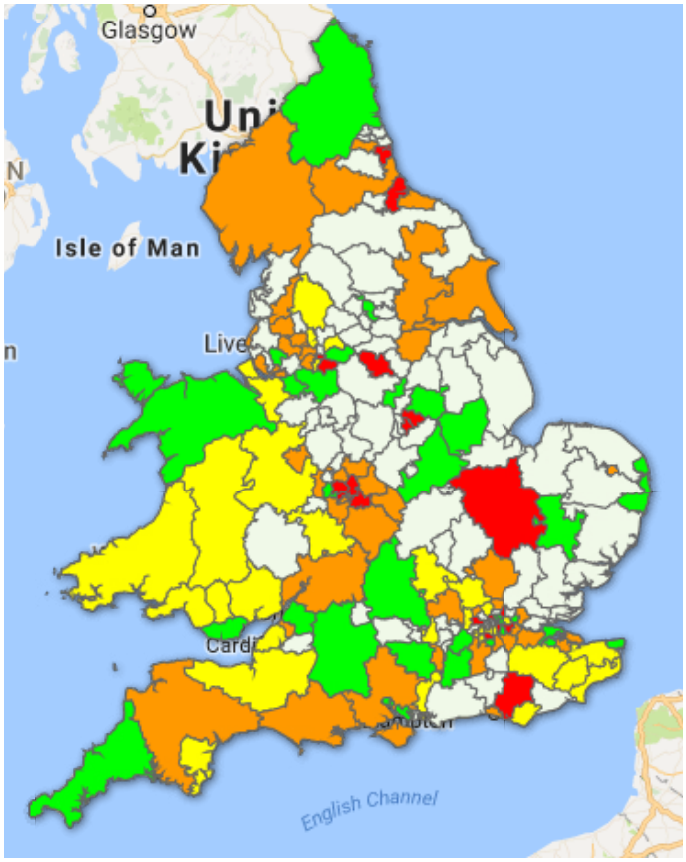
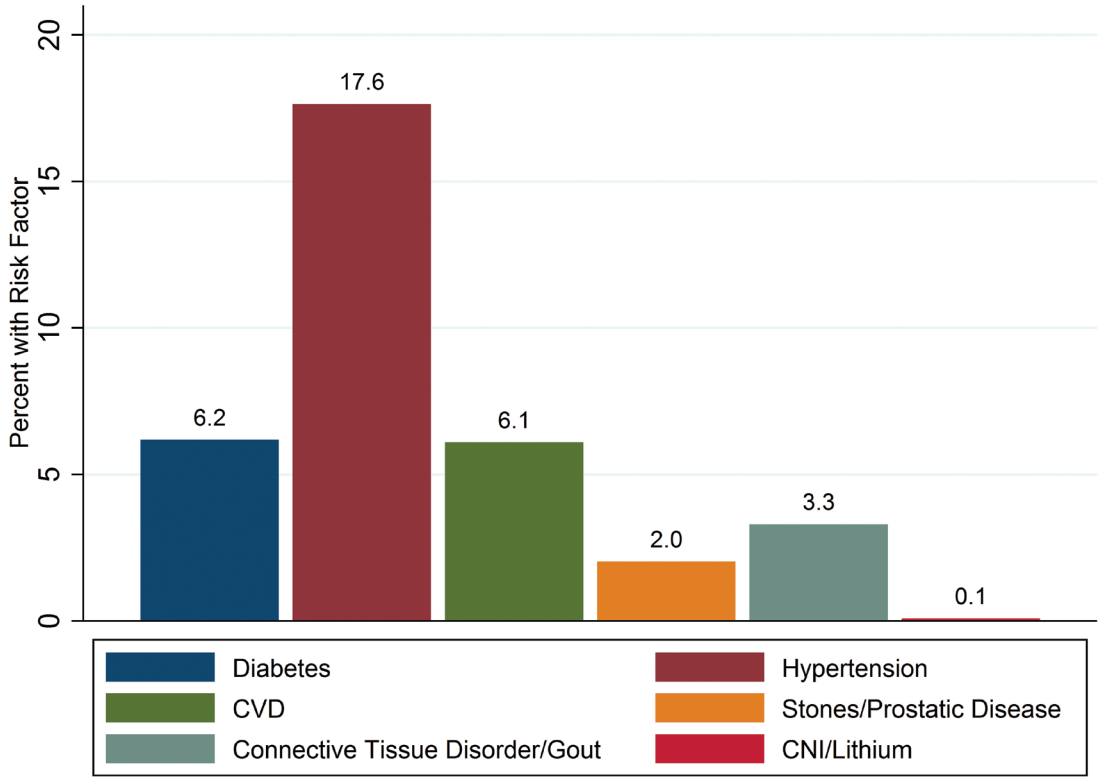


Figure 7. Percentage of the audit population with various risk factors for CKD



//5 Are people with risk factors being tested for CKD?

Testing for CKD requires people to have blood and urine tests. The results of these tests are sent electronically from the local pathology laboratory to GP computer systems. The audit extracts data on creatinine and urinary protein test results and a range of other clinical factors from the GP computer systems. Further technical details are found in the appendix.

CKD NICE guidelines (2014) suggest testing for CKD in those at risk with an annual estimated Glomerular Filtration Rate (eGFR) and urinary albumin/creatinine ratio (ACR) in those with a diagnosis of diabetes, and an annual eGFR in those taking kidney-damaging medications such as lithium or calcineurin inhibitors[5, 6]. Those with other risk factors for CKD (hypertension, cardiovascular disease, kidney stones, prostatic disease, connective tissue disorders, family history of kidney disease or previous episodes of acute kidney injury) should be offered an eGFR and ACR test[7], repeated at intervals agreed between the patient and the clinician (for the purposes of this audit this interval has been set at five years)[8].

The percentage of people with risk factors (present for at least 1 year) that have had testing according to NICE guidelines is shown in Figures 8 and 9. The respective figures for England looked very similar to those in Wales (Appendix Figures 2 and 3).

Overall, GPs are testing people with diabetes annually using serum creatinine (with practices testing 85.9% of people) and less frequently using urinary ACR tests (53.9%)[9]. This figure differs from the National Diabetes Audit, which uses different methods to calculate this proportion. There is wide variation between practices in whether tests have been used in the last year, with some GPs achieving very high coverage (Figure 8 and 9). Among people who are at risk of CKD and who do not have diabetes, eGFR results are available for most. However, less than a third undergo annual urine testing. The largest at risk group is people with hypertension where the figures show that almost all practices (95%) achieve an eGFR testing rate of more than 90% of this group in the previous five years. However, there is substantial room for improvement on urinary ACR testing, where almost all practices only achieve testing for 10-50% of the same group in the previous 5 years. It is possible that the difference in urinary ACR testing between those with diabetes and those with hypertension may be related to the Quality and Outcomes Framework (QOF) which incentivises urinary ACR testing in diabetes but not for hypertension. There was limited regional variation in testing for eGFR (Appendix Table 4).

5 Although non-steroidal anti-inflammatory drugs (NSAIDS) may also potentially harm the kidney in certain circumstances, the NCKDA does not attempt to capture data on people receiving these medications regularly. This is because GP prescription of NSAIDs does not necessarily reflect regular usage and many people buy these medications directly 'over-the-counter'

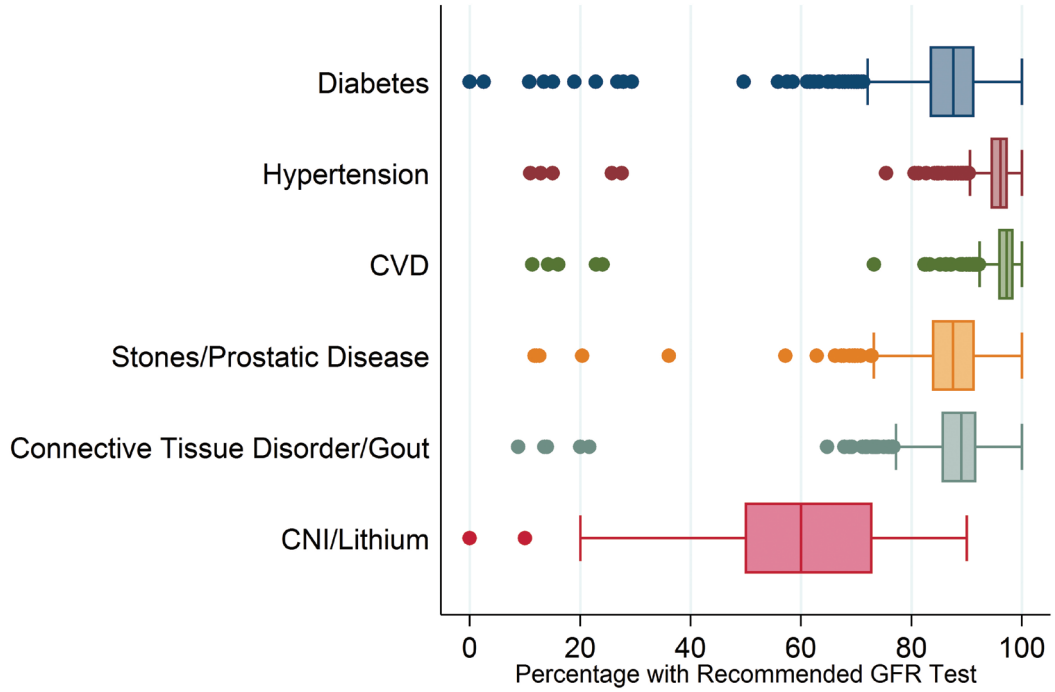
6 Calcineurin inhibitors include drugs such as Cyclosporin and Tacrolimus.

7 There is no precise read code for family history of having a relative with stage 5 CKD, so this risk factor could not be assessed. The Read codes for CKD risk factors are listed on the NCKDA website http://tiny.cc/01CKD

8 Although no frequency of testing is prescribed in NICE guidance a test since diagnosis but within the last 5 years was accepted for the purposes of the NCKDA

9 Percentages have been calculated as average across the at risk population, which is algebraically equivalent to a practice average weighted by size of the at-risk population

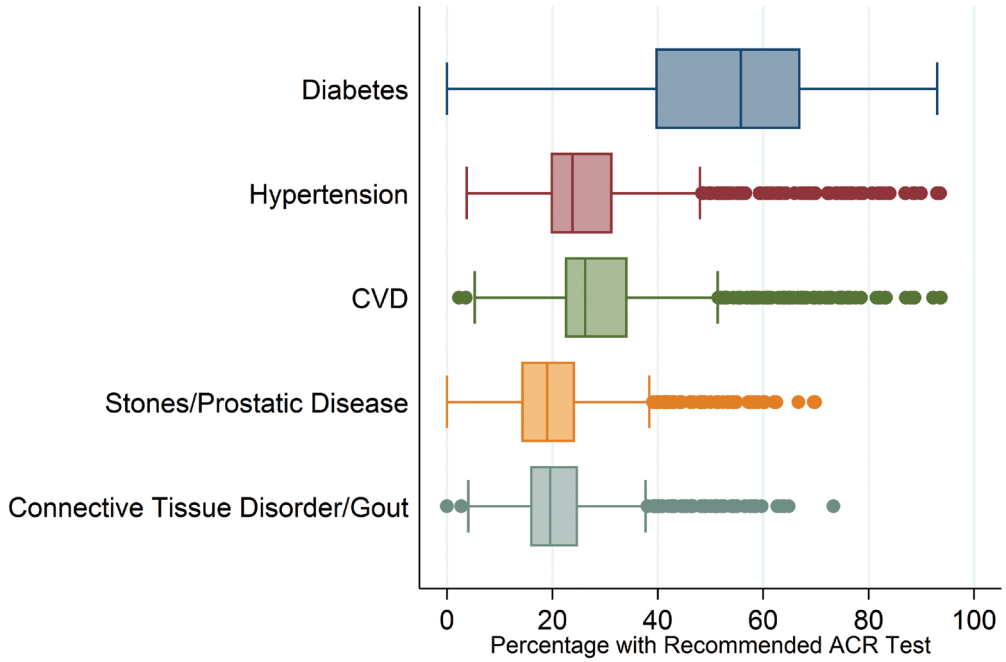
Figure 8. Practice variation in percentage of patients at risk of CKD but not on the CKD 3-5 Register who are receiving recommended eGFR testing (past year for diabetes and CNI/Li; past 5 years for others), by risk factor



Number of Practices = 911; Practices with denominators < 10 excluded for each measure;
Diabetes N = 908; Hypertension N = 909; CVD N = 908; Stones/Prostatic Disease N = 896;
Connective Tissue Disorder/Gout N = 902; CNI/Lithium N = 47

CVD: cardiovascular disease CVD CNI/Li: prescription of calcineurin inhibitor or lithium; The line in the middle of each bar is the median percentage tested per practice. The boxes show the interquartile range, which is half of all practices have tested a given percentage of people for an eGFR in the range of the box. The whiskers show the upper and lower 2.5centile tested per practice, i.e. 95% of practices are within the whisker range. The dots are practices outside the 95% range.

Figure 9. Practice variation in percentage of patients at risk of CKD but not on the CKD 3-5 Register who are receiving recommended urinary ACR testing (past year for diabetes; past 5 years for others), by risk factor



Number of Practices = 911; Practices with denominators < 10 excluded for each measure;
Diabetes N = 908; Hypertension N = 909; CVD N = 908; Stones/Prostatic Disease N = 896;
Connective Tissue Disorder/Gout N = 902

CVD: cardiovascular disease. CNI/Li: prescription of calcineurin inhibitor or lithium; The line in the middle of each bar is the median percentage tested per practice. The boxes show the interquartile range, which is half of all practices have tested a given percentage of people for an ACR test in the range of the box. The whiskers show the upper and lower 2.5centile tested per practice, i.e. 95% of practices are within the whisker range. The dots are practices outside the 95% range.

//6 Are people with CKD given an appropriate CKD Read code?

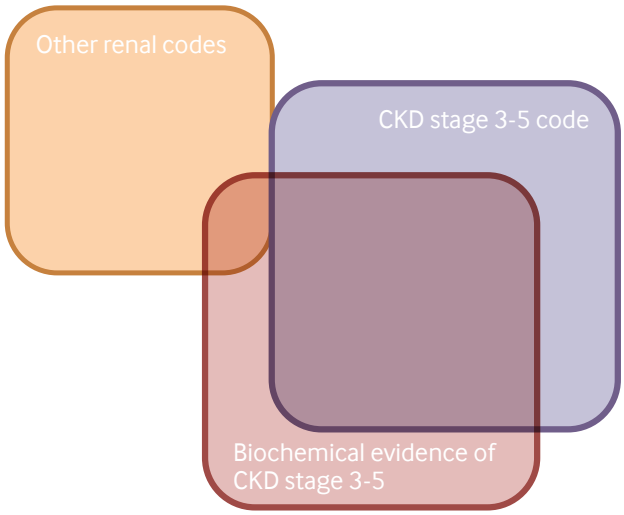
Once the tests are done, a subset of people will have eGFR blood results and/or urinary ACR test results that are compatible with CKD. To add a read code for people who have CKD the GP needs to confirm the diagnosis with a repeat blood test 3 months later. For the purposes of the NCKDA we grouped people into three categories: those with a CKD stage 3-5 code (a QOF code), those with biochemical evidence of CKD stage 3-5 (based on eGFR values) and those with other codes that suggest somebody has CKD (e.g. those with polycystic kidney disease). Any one person can fall into one or more of these categories (Figure 10).

How many people have an appropriate CKD Read Code?

The QOF incentivises GPs in England to have a register of people with moderate to severe CKD, i.e. Read coded CKD stages 3-5. The Read coded CKD 3-5 prevalence reported by QOF to each practice is derived as the number of people with CKD aged 18 or above, divided by the total practice population. However, reports from the Health and Social Care Information Centre (HSCIC), which provide publically available reports based on QOF, report practice CKD prevalence uses both numerator and denominator based on the adult population > 18 years of age leading to a different prevalence figure.

Among the 862 practices with available practice list size data, 4.4% of people over 18 were coded as having CKD stage 3-5. This gives a crude prevalence for coded CKD 3-5 of 3.5%. This figure is similar to the prevalence reported by the current English QOF CKD register prevalence[10]. The CKD (stages 3-5) prevalence stratified by age and sex is presented in the appendix (appendix Table 5).

Figure 10. Venn diagram demonstrating relationship between biochemical CKD and use of different Read codes for people with CKD



The size of the boxes and the degree to which they overlap represents the number of people in each category. A CKD stage 3-5 code is equivalent to QOF code. Other renal codes include specific renal disease codes (e.g. polycystic kidney disease), diagnostic proteinuria codes and codes for CKD stage 1 and 2. For the purposes of the audit where patients have both CKD stage 3-5 codes and other renal codes they are included in the CKD stage 3-5 code group. Biochemical evidence for CKD is defined as two measurements at least 3 months apart demonstrating an eGFR <60mL/min.

10 QOF prevalence for CKD in the population of over 18 was 4.13. (Health and Social Care Information Centre, 2014-15).

The diagnosis of CKD stage 3-5 is based on the presence of two estimated eGFR measurements <60mL/min/1.73m^2 at least 3 months apart. 69.8% of those with biochemical evidence of CKD on the results available from primary care had a CKD code whereas amongst all people coded by GPs as having CKD, we found two supporting eGFR results in 65.4% of these people[11].

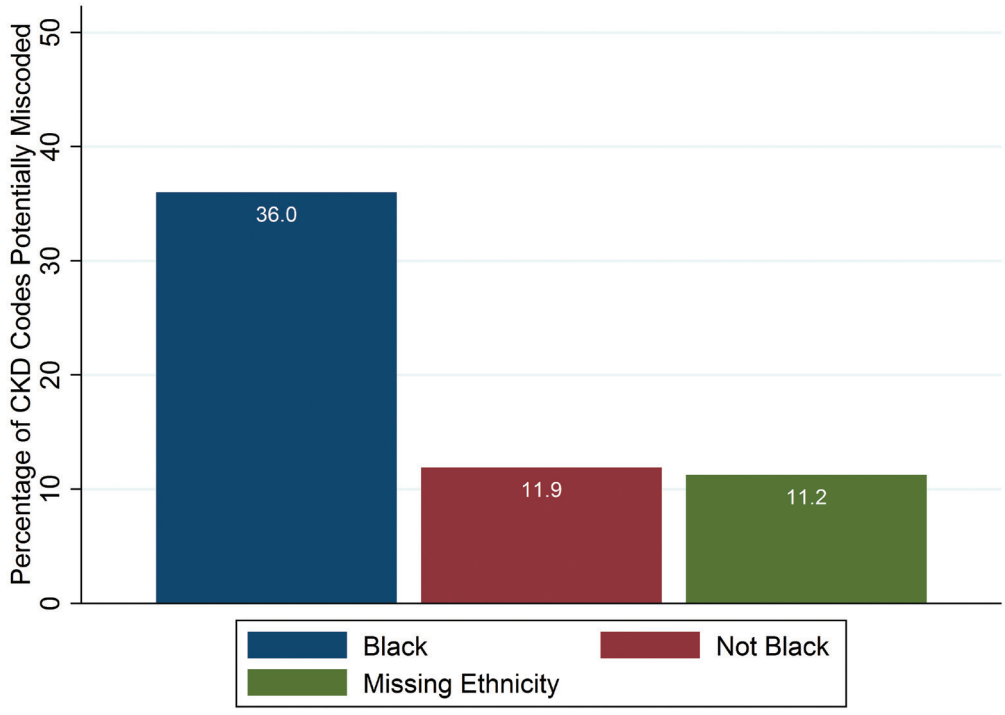
What practice features influence coding of CKD?

Apart from the age and sex of the practice populations, the number of people with coded CKD stage 3-5 within the practice was positively related to the practice prevalence of diabetes, hypertension and cardiovascular disease. There was no significant association with the practice Index of Multiple Deprivation (IMD) or prevalence of ethnic minority population registered at the practice.

Are there people who should not have had a CKD stage 3-5 Read code?

Not every person with a CKD stage 3-5 Read code had compatible eGFR results. Overall there were 11.1% of people where the two most recent eGFRs more than 3 months apart were 60mL/min/1.73m^2 or more. This occurred in particular for people with Black ethnicity in whom the eGFR should be appropriately corrected by a factor of 1.2 (20% increase in eGFR) to allow for their higher muscle mass. Of the people with a CKD stage 3-5 Read code who were recorded to have Black ethnicity[12], 36% did not have biochemical evidence of CKD when the eGFR was appropriately adjusted for ethnicity (Figure 11).

Figure 11. Percentage of people on the CKD register in whom we found biochemical evidence not compatible with CKD stage 3-5 stratified by ethnicity



11 This figure does not take into test results that were reported to the GP which the doctor may have manually entered into the primary care record or used for staging people; there were 8.2% of people with a CKD stage 3-5 Read code who had a single corresponding eGFR <60mL/min/1.73m^2 but no second eGFR available to the NCKDA.

12 The list of codes used for recording a patient's ethnicity is available in the appendices on the NCKDA website: http://tiny.cc/01CKD

People with other codes suggesting kidney disease

There were people who had other diagnostic codes consistent with CKD. These people may have CKD stage 1 or 2 (i.e. an eGFR of 60ml/min/1.73m^2 or more and other signs of kidney damage). Across all practices, this figure amounted to 2.6% of the adult population. The Health Survey for England tested a representative sample of adults for the prevalence of CKD stages 1 or 2 and found 6.1% of the adult population (Fraser SD, et al. 2015). This suggests that the prevalence of CKD stage 1 or 2 is underestimated by the audit; most likely due to the low frequency of coding and/or testing for proteinuria.

How many people potentially have CKD stage 3-5 but are un-coded?

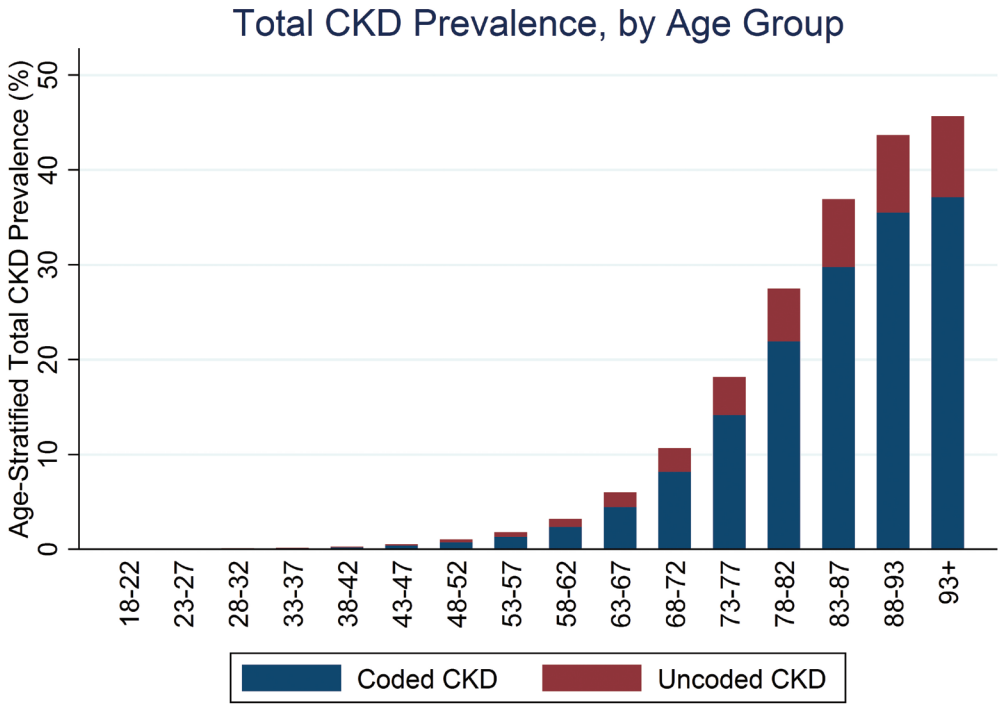
The diagnosis of CKD stage 3-5 is based on the presence of two eGFR measurements <60 mL/min/1.73m^2 at least 3 months apart. The percentage of people without a CKD 3-5 Read code but who have two eGFR measurements consistent with CKD 3-5, are presented in Figure 12 (red bars) and in detail in Table 6 in the appendix. This group amounts to 1.2% of the adult GP practice population. If those with one eGFR measurement <60 mL/min/1.73m^2 but with no identifiable eGFR measurements ≥60 ml/min/1.73m^2 are included, this figure increases to 1.5%

There was high variability between practices in rates of coding CKD 3-5 (the range lay between 0% and 80% potentially uncoded). We derived funnel plots to identify practices who were significantly different from others with similar practice characteristics, also termed outliers, in terms of the percentage of potentially uncoded CKD cases in those with biochemical evidence (Appendix Figure 4). The funnel plot allows for additional between practice variation in coding and the 'control lines' enable meaningful outlier identification (*http://tiny.cc/04CKD*). A total of 21 practices were identified as outliers for un-coded CKD 3-5 and were contacted by the audit team to help understand these findings (*http://tiny.cc/02CKD*).

What is the total number of people with CKD stages 3-5?

Overall, comparing these data and the data presented in Tables 5 and 6 suggest almost three quarters of those people with biochemical evidence suggesting they have CKD stage 3-5 have been given a CKD 3-5 stratification Read code. Combining the coded and uncoded figures gives a prevalence figure similar to that reported in the Health Survey for England (Fraser S, et al. 2015). Figure 12 shows results of adding those whose last two measurements of eGFR measurements are <60 ml/min/1.73m^2 at least 3 months apart to those with an appropriate CKD stage 3-5 code, providing an estimate the total prevalence of CKD stage 3-5 by different age groups. If those people with only one measurement of eGFR<60 ml/min/1.73m^2 (but in whom there are no results showing an eGFR≥60 ml/min/1.73m^2) are also included in this calculation it leads to a slightly higher total prevalence of 5.8%. The estimated prevalence of CKD in the older age-groups appeared somewhat lower for Wales compared to England (Appendix Figure 5).

Figure 12. Estimated total prevalence of CKD stages 3-5 (coded and un-coded) in Audit practices, stratified by age, excluding potentially miscoded people



Each bar represents the estimated prevalence (%) of CKD stages 3-5 in age category. This has been calculated by adding the percentage of appropriately coded cases to the number of un-coded cases in each practice. Based on 862 practices. Total prevalence is 5.5% across the adult population.

Variation in coding of CKD and CKD prevalence in England and Wales

Putting all the above information together allows us to examine the total CKD prevalence, and the proportion of this which is coded and that which is not coded. These measures are demonstrated in Figure 13 by CCG. When looking at these figures by country the lower estimate of prevalence of CKD is 5.5% in Wales and 5.3% in England, with 4.1% coded in Wales and 4.2% coded in England.

Funnel plots were used to identify practices that were outliers in terms of coded CKD 3-5 (see Figure 14). These practices included many of the practices that had high proportions of un-coded CKD 3-5. However the overall numbers identified with CKD stages 3-5 codes is influenced not only by the actual numbers of people with CKD stage 3-5 but also by the effectiveness of practices in identifying, testing and coding those with biochemical evidence of CKD. This measure therefore represents a composite of a number of care processes. The funnel plot for CKD prevalence was adjusted for practice features that may be associated with CKD, such as age and gender, diabetes, hypertension, proportion of ethnic minority population, and IMD.

Why are patients with CKD stages 3-5 not coded?

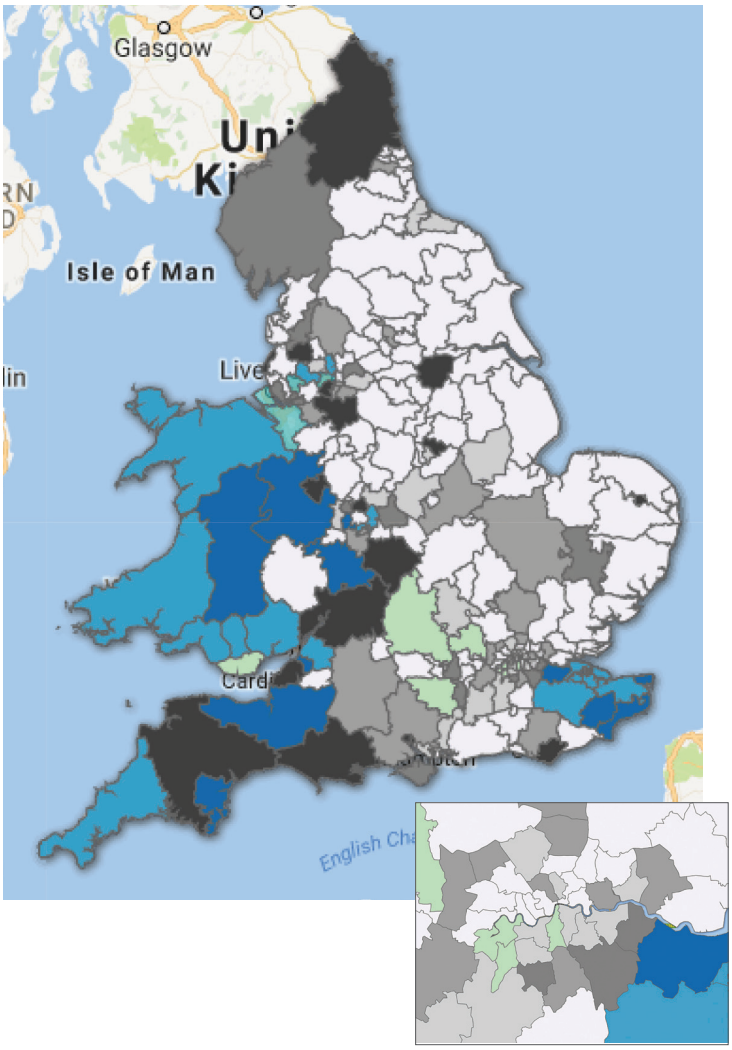
- The practice may not be testing people at risk of CKD regularly.
- Those with a single eGFR< 60ml/min/1.73m^2 may not be retested to confirm CKD.
- Those with biochemical evidence for CKD stages 3-5 may not be coded.

Practices which fell outside the lower 'control lines' for CKD coding (low outliers) were contacted to let them know there may be problems with their rates of coding CKD (*http://tiny.cc/02CKD*). A total of 29 practices were identified as outliers for coded CKD stage 3-5 prevalence and were contacted by the audit team to help understand these findings.

Summary findings of CKD Coding and Prevalence :

- Around 1.2% of the adult population have clear evidence of CKD 3-5 on blood tests but don't have a code.
- About 2.6% had non-CKD stage 3-5 renal codes – possibly reflecting CKD stages 1-2.
- Overall approximately 4.2% of adults have an appropriate CKD stage 3-5 code.
- We estimate between 5.5% and 5.8% of the adult population in England and Wales have CKD stage 3-5.

Figure 13. Map of variation in coded and uncoded crude CKD prevalence by CCG/LHA[13]



Crude coded CKD prevalence

Non-participating CCGs are uncoloured

5 or more participating practices in CCG/LHB

- *Very High >5%*
- *High 4-5%,*
- *Medium 3-4%*
- *Low <3%*

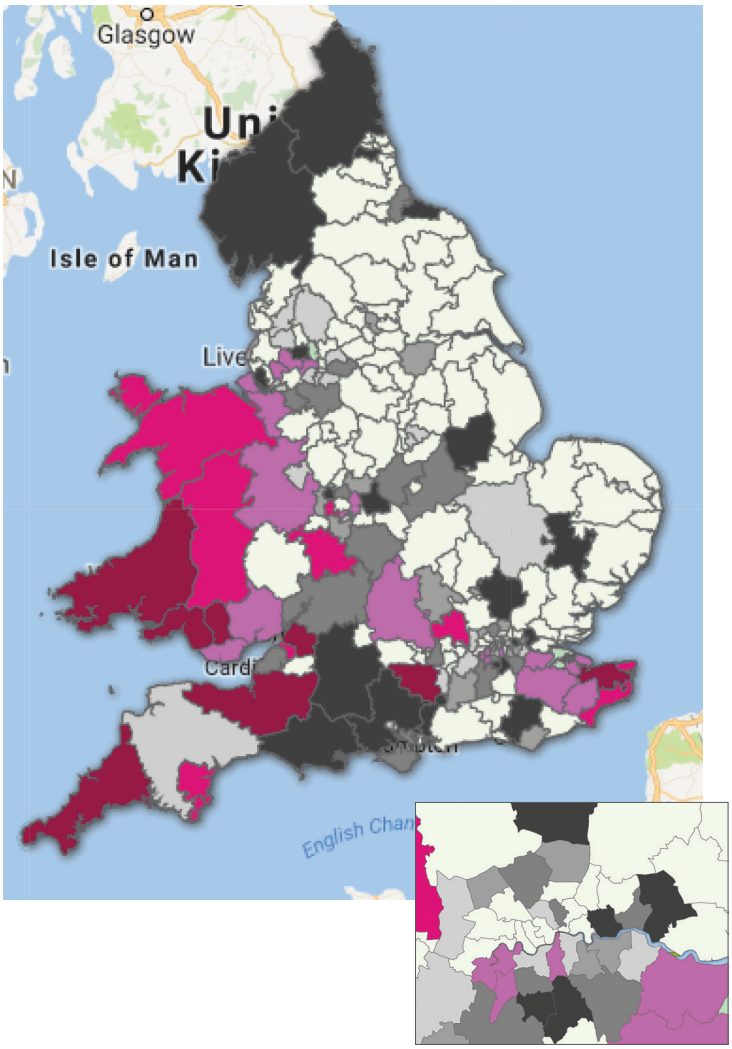
4 or less participating Practices

- *Very High >5%*
- *High 4-5%,*
- *Medium 3-4%*
- *Low <3%*

Includes potentially miscoded cases; Inset: London

13 Scalable graphics available at http://tiny.cc/G1CKD and http://tiny.cc/G2CKD

Figure 13. (Continued)[13]



Uncoded CKD prevalence

Non-participating CCGs are uncoloured

5 or more participating practices in CCG/LHB

- *Very High >5%*
- *High 4-5%,*
- *Medium 3-4%*
- *Low <3%*

4 or less participating Practices

- *Very High >5%*
- *High 4-5%,*
- *Medium 3-4%*
- *Low <3%*

Inset: London

//7 Quality improvement

All practices taking part in the NCKDA received the electronic quality improvement tool as well as links to online quality improvement resources. Although there is no way to identify how practices undertake quality improvement, we were able to quantify the changes in practice coding between different rounds of data extraction.

How much can coding for CKD change between the first and most recent data extract?

For each of the 911 practices with more than one round of data, the proportion of people with biochemical evidence of CKD that were undiagnosed (proportion uncoded), the proportion of people with a diagnosis of CKD that did not exhibit evidence of biochemical CKD (proportion miscoded) and the total number of cases of biochemical CKD were derived and summarised at each round. Practices exhibiting an improvement in the number of people with biochemical CKD being clinically diagnosed, without a resultant increase in miscoding, were flagged as 'coding improvers'[14].

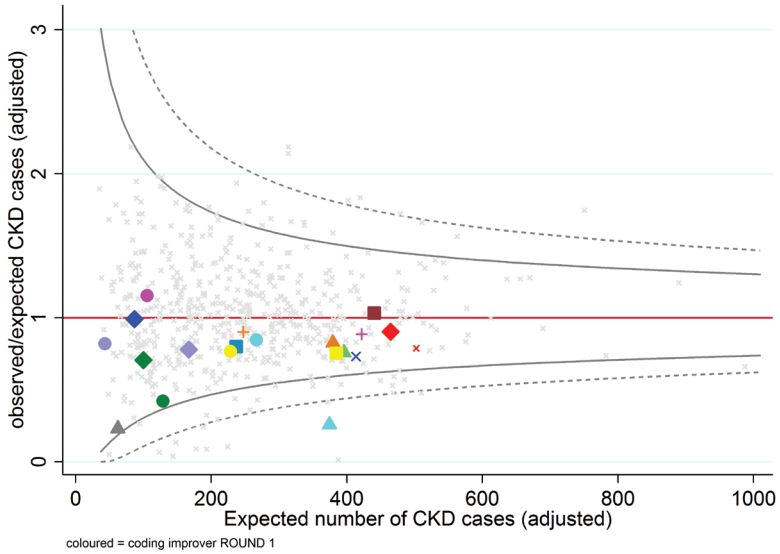
Although the majority of practices have not changed, there are some high performers that have considerably improved coding for CKD. 36 practices demonstrated an improvement in coding (4% of practices evaluated). Some of these improvements have been impressive and show that it is possible to achieve substantive change in a short period of time (Figure 14 and Table 7 in appendix). However, the majority of practices showed no change in their coding behaviour and it may be that further incentives are needed to ensure widespread improvements in CKD coding.

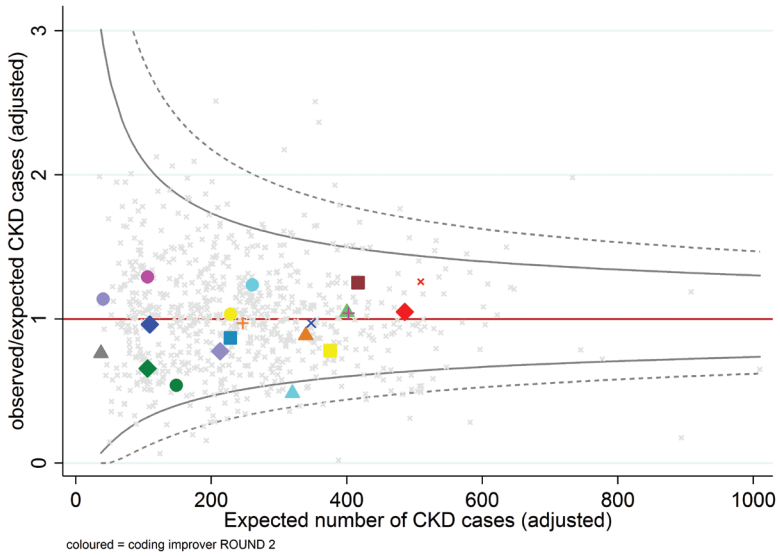
Improving the rate of correct coding for CKD

- Overall 4% of practices improved coding according to our criteria.
- This demonstrates that it is possible to substantially improve CKD coding in a short space of time.
- CCGs may need to consider practice incentives to further improve coding and gains for patient care.

14 Practices were coding improvers if they showed a decrease (difference) in proportion uncoded of greater than 10%, AND an increase (difference) in proportion miscoded of no more than 5%, AND a decrease in the number of practice biochemical CKD cases of no more than 20% (this criterion is to exclude practices who have recently merged and have a substantive change in the CKD population as a result).

Figure 14. Funnel plots demonstrating coding improvement between first and latest data extract





The position of a practice on the funnel plots demonstrates how many CKD cases to expect in a practice of a given size, taking into account the age profile, ethnicity and comorbidity of the practice population and the practice performance at identifying CKD cases, in comparison to other practices of similar size and population mix. (If a practice is positioned above the horizontal line (Ratio =1) it means that it is performing better than average). Practices lying above or below the control lines demonstrate a prevalence of CKD cases that is substantially different (two SDs solid; 3SDs dotted) from what would be expected due to natural variation. These practices are identified as outliers.

Each coloured symbol corresponds to an improving practice, with the same symbol used in all the plots. Practices which move up between the first (left) and latest (right) top funnel plots are improving relative to other practices with regard to the identification of expected CKD cases.

//8 Management of people with coded CKD

Primary care physicians are responsible for the majority of key interventions required at early stages of CKD to improve outcomes, these include patient information/and education, a regular review of kidney function, blood pressure control, statin prescription and medication management. Safe prescribing in CKD is facilitated when the practice prescribing software appropriately identifies people who have CKD, hence the importance of coding in CKD – as discussed above. For the purpose of the audit we only review management for those people whom the GP has coded for CKD stages 3-5 (including the 11% of people in whom we did not find corresponding biochemical evidence). This report does not review the management of people with uncoded CKD – which make up about a quarter of cases in the audit population.

Are people with coded CKD meeting blood pressure targets?

NICE recommends different blood pressure targets according to whether a patient has substantial proteinuria and/or diabetes. Among people coded with CKD stage 3-5 and without diabetes or an ACR<70 mg/mmol the blood pressure target is less than 140/90 mmHg. People are deemed to meet this target if both the systolic and the diastolic measures are below these values[15]. Amongst this group of people, 53.1% had blood pressures below the target. In 16.1% of patients no blood pressure result was available in the previous year. Among people coded with CKD stage 3-5 and who should meet the lower target of less than 130/80mmHg, only 29.2% met this target, 6.9% had no available blood pressure measurement in the previous year. Among the group with the lower target those with diabetes were slightly better managed (Figure 15). If 100% of people met this target, it is likely that a proportion would be over treated, so the figures have to be interpreted in this context. There was wide variation between practices on whether blood pressure targets were met in - with some practices achieving excellent results. Confusing sentence?

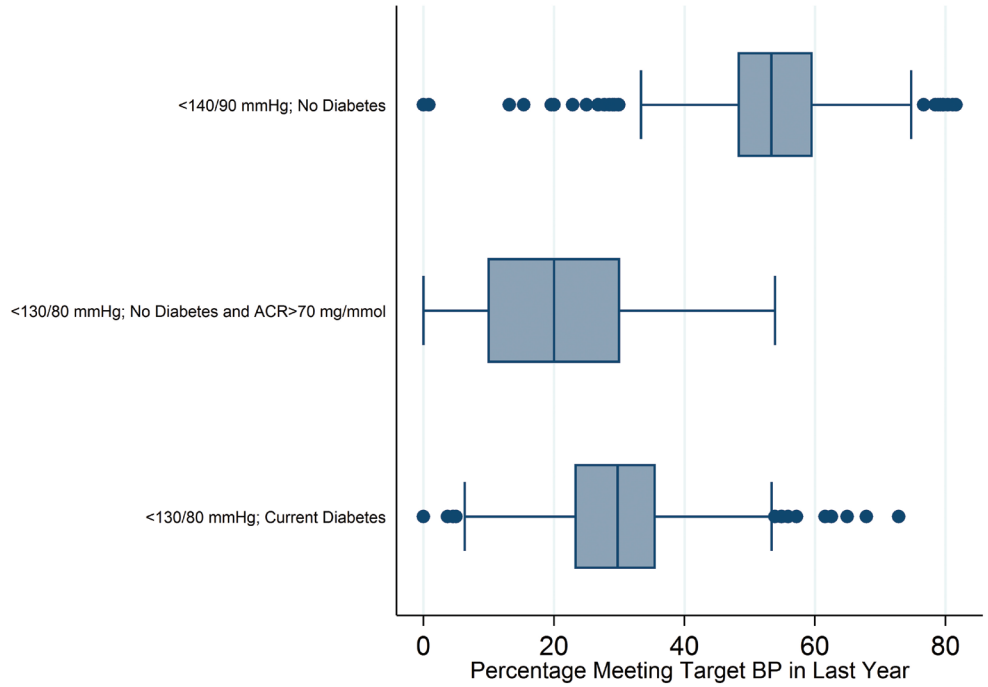
Meeting blood pressure targets was dependent on age. Fewer very elderly people met these stricter targets (Figure 16). This is likely to be appropriate given that there is much less evidence supporting strict blood pressure control in older and frail people and a greater risk of causing harm.

Blood pressure management

- On average practices achieve the higher blood pressure target for CKD without proteinuria in over 50% of their patients. However the lower target for those with diabetes or ACR≥70 is not met in two-thirds of patients. Tight BP control may not be appropriate in frail or elderly people and the NCKDA was not able to assess this.
- There is huge variation between practices in the achievement of blood pressure targets meaning there is a lot of potential to improve blood pressure management of people with CKD in primary care.

15 The NCKDA uses a maximum threshold to determine if BP targets are met. In fact NICE advises a target range for BP but the NCKDA did not examine this.

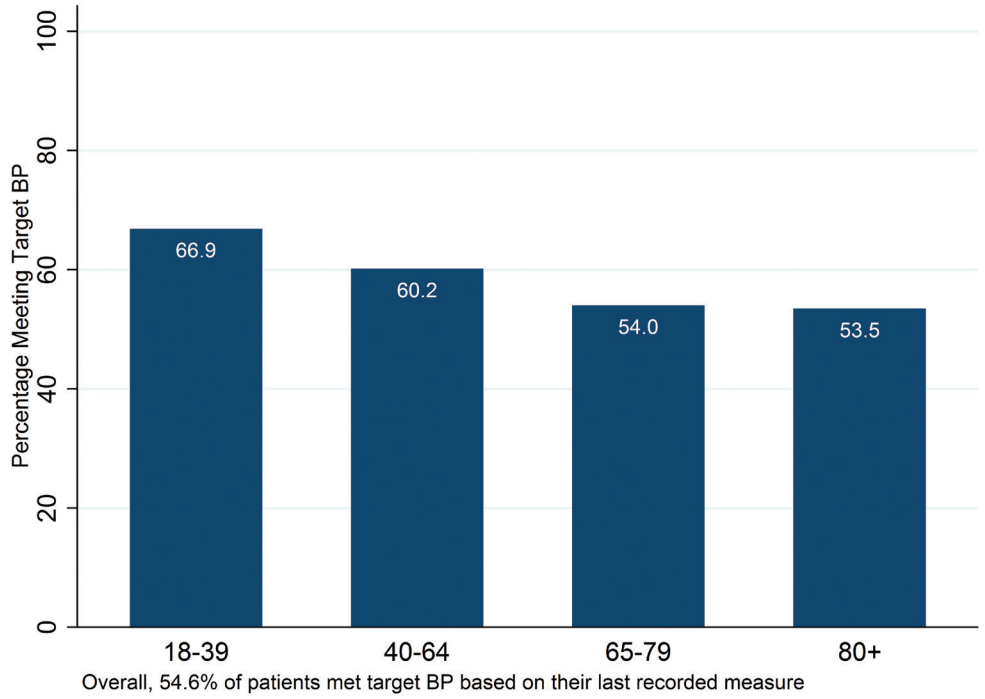
Figure 15. Practice performance in percentage of people meeting blood pressure targets by target and diabetes status



Includes data from 900 of 910 practices; 29.2% of strata-specific measures excluded with denominator < 10

The line in the middle of each bar is the median percentage achieving the blood pressure (BP) target per practice. The boxes show the interquartile range, which is half of all practices have a given percentage of people for a BP target in the range of the box. The whiskers show the upper and lower 2.5centile per practice, i.e. 95% of practices are within the whisker range. The dots are practices outside the 95% range.

Figure 16. Percentage of people with coded CKD meeting guideline recommended target blood pressure (both <140/90 and <130/80 mmHg targets combined), by age



Blood Pressure control

- Good blood pressure control is essential to delay progression of renal disease, and to reduce the risk of developing cardiovascular disease.
- The audit suggests that there is considerable scope for improving the management of blood pressure in people living with CKD. This is particularly the case for those with diabetes who benefit from stricter control.

Are people with coded CKD receiving appropriate medical cardiovascular risk management?

Aside from smoking cessation, the most important medical interventions for primary prevention of cardiovascular outcomes in people with CKD are blood pressure control and statin prescription. Blood pressure management is discussed above.

The SHARP trial has shown that primary prevention with statins reduces adverse cardiovascular outcomes in people with CKD (Baigent et al., 2011) and this was followed by guidance from NICE recommending all people with CKD be offered a statin (National Institute for Health and Care Excellence, 2014a). Therefore, any patient with coded CKD stage 3-5 should be offered a lipid-lowering drug, a statin, unless there are known contraindications. The audit found that 68.8% of those with CKD had been prescribed statin medication. As might be expected the prescription rate was higher in those with previous cardiovascular disease and differed by diabetes status (Figure 17), but it did not differ by CKD stage (Figure 18). Of note is that only 41% of those aged 65 years or less without diabetes but with CKD, were prescribed statin medication. This group would in particular benefit from therapy with statins.

In terms of secondary prevention, amongst coded CKD stage 3-5 people who had evidence of previous cardiovascular disease, 84.9% were on aspirin treatment or had contra-indications for aspirin use.

Figure 17. Percentage of people with coded CKD 3-5 on a statin, by age (below 65 years vs above) and diabetes

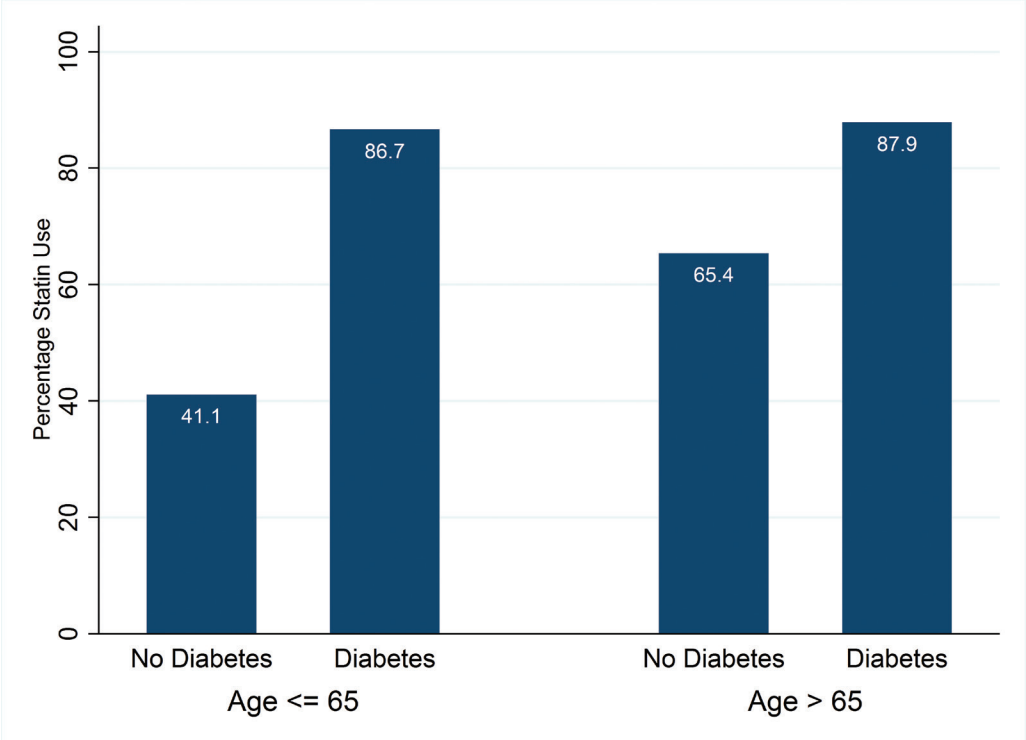
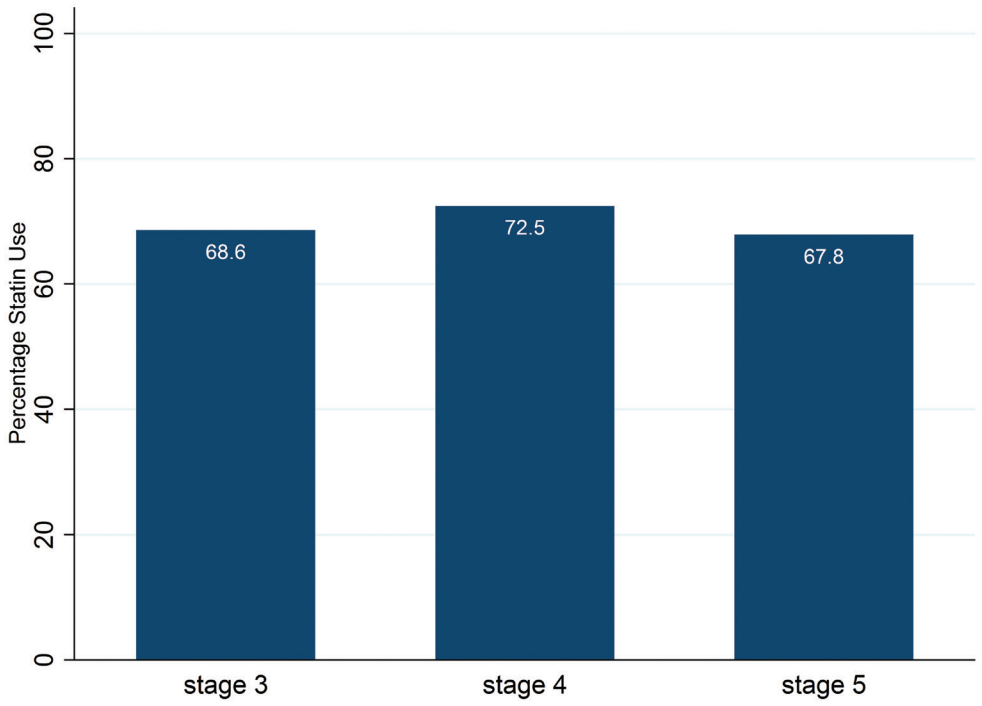


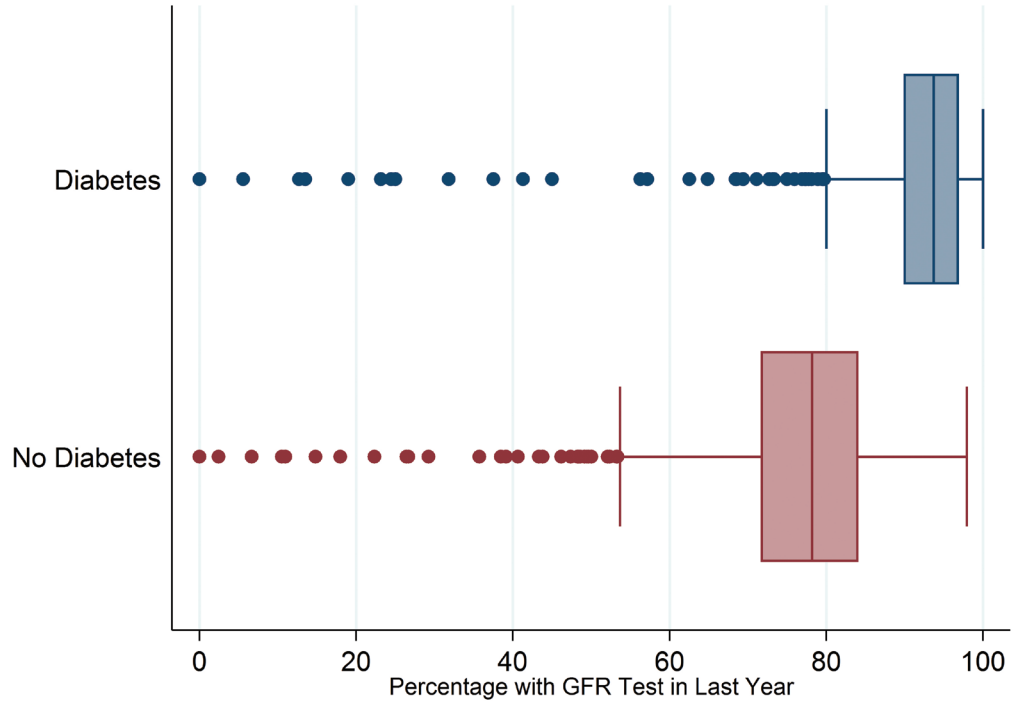
Figure 18. Percentage of people with coded CKD 3-5 on a statin, by CKD stage



Are people with coded CKD having their kidney function monitored regularly?

Most people (81.3%) with coded CKD stages 3-5 had a repeat blood test of their kidney function in the last year. 31.1% of people with coded CKD stages 3-5 had an ACR urinary test result in the previous year. Figures 19 and 20 below show the results stratified by diabetes status.

Figure 19. Practice variation in percentage of people with coded CKD with annual repeat tests of eGFR by diabetes status

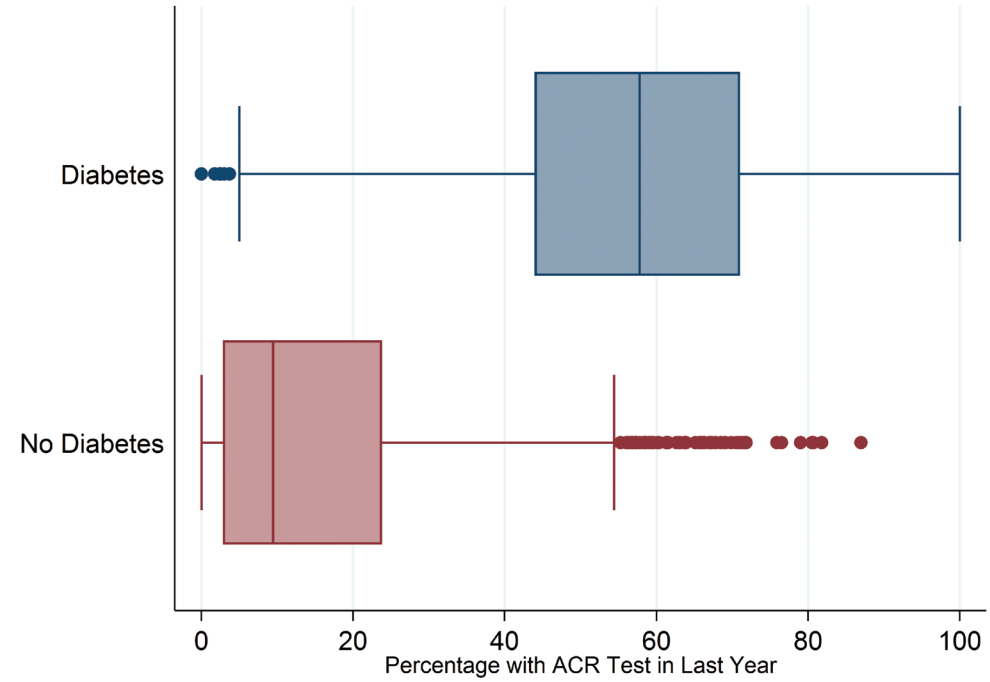


Includes data from 872 of 910 practices; 4.2% of strata-specific measures excluded with denominator < 10

The line in the middle of each bar is the median percentage tested per practice. The boxes show the interquartile range, which is half of all practices have tested a given percentage of people for an eGFR in the range of the box. The whiskers show the upper and lower 2.5centile tested per practice, i.e. 95% of practices are within the whisker range. The dots are practices outside the 95% range.

This may impact on the GP's ability to determine the correct blood pressure treatment target in these people, and to treat the blood pressure accordingly.

Figure 20. Practice variation in percentage with coded CKD stage 3-5 who have repeat urinary ACR tests stratified by diabetes



Includes data from 872 of 910 practices; 4.2% of strata-specific measures excluded with denominator < 10

The line in the middle of each bar is the median (average) percentage tested per practice. The boxes show the interquartile range, which is half of all practices have tested a given percentage of people for an ACR test in the range of the box. The whiskers show the upper and lower 2.5centile tested per practice, i.e. 95% of practices are within the whisker range. The dots are practices outside the 95% range within the whiskers.

Once people reach an eGFR<45ml/min, they should have a haemoglobin blood test to screen for renal anaemia. This was recorded in 73.9% of people in the past year. People with advanced CKD stages 4 and 5 should have measurements of serum calcium, phosphate and parathyroid hormone levels. Such measurements were only recorded in 5.5% of these people. As most people with CKD stage 4 or more will be referred for specialist review, test results are likely to have been carried out in secondary care by kidney specialists.

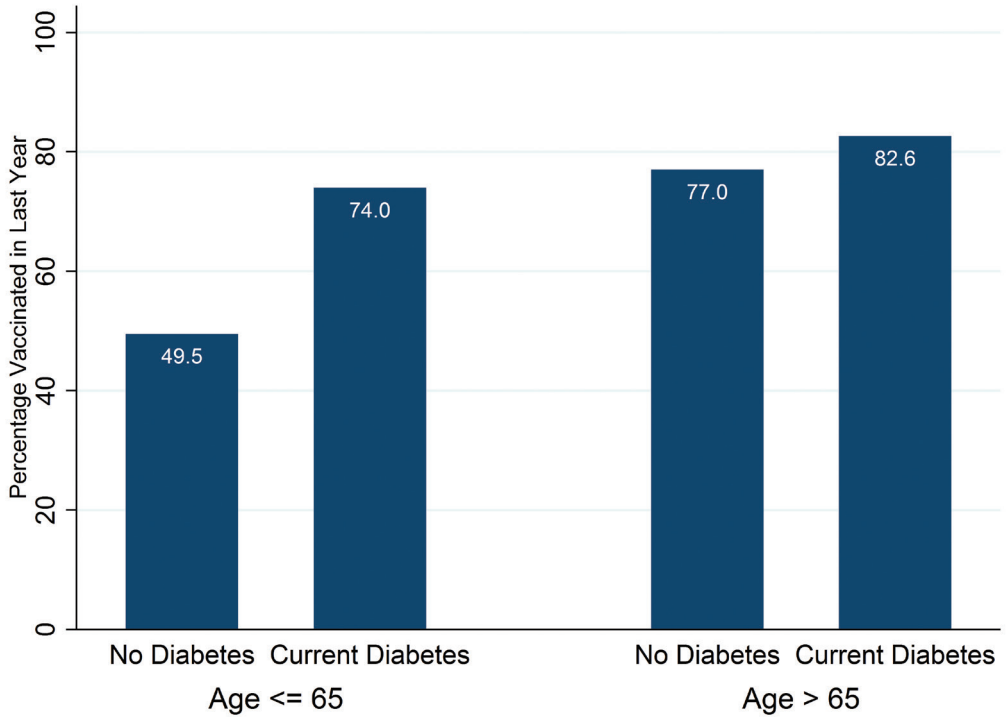
Are people with coded CKD being appropriately referred to specialist care?

People who require specialist input are those who have progressive reduction of their kidney function (25% drop or sustained decrease by 15ml/min within 12 months), and/or significant proteinuria or other signs of kidney damage suggesting systemic or genetic disease, problems of blood pressure control requiring at least 4 antihypertensive drugs at therapeutic doses, and those who have CKD stage 4 or worse. We found electronic evidence of a referral in 33.5% of all such people requiring referral (coded and un-coded). However, it is known that the quality of coded referral in GP records is an underestimate – most of the relevant information may not be recorded on practice systems in a way the audit software could extract.

Are people with CKD being appropriately vaccinated against Flu?

All people with CKD stages 3-5 should be offered vaccination against flu every year. Amongst those coded with CKD stage 3-5 75.3% had a record of this in the past year (Figure 21). Those with stage 4 and 5 CKD should additionally be vaccinated against pneumococcus every 5 years. Only in 23.3% of people with coded stage 4 and 5 CKD there was a record of a pneumococcus vaccination in the past 5 years. There was little variation in vaccination rates by coded CKD stage.

Figure 21. Percentage of people with coded CKD 3-5 vaccinated against flu in the past year, by age (below 65 years vs above) and diabetes



//9 Findings, Recommendations and Next Steps

Main Findings

CKD Identification and coding in Primary Care

Practices perform very well at providing annual eGFR tests for CKD among people with diabetes with an average of 86.0% tested. Performance is less good for annual ACR testing at 53.7%. CKD is more common among the population with hypertension than among those with diabetes and NICE guidance on the frequency of testing in this group is unclear. The NCKDA used a low threshold of tests every five years – these thresholds were chosen by the Audit team. Against this standard GPs measure eGFR with a median testing rate of 95.1%, but ACR testing over the five-year period remains very low at 27.7%. Therefore, the large proportion of the population with hypertension would benefit from improved proteinuria and eGFR testing. These tests have never been incentivised by QOF, and therefore, may never have become part of the annual hypertension review. These low rates of testing for ACR suggest there are missed opportunities to optimise renal care, particularly blood pressure treatment.

There is wide variation in identification and coding CKD by GPs although on average 70% of people with biochemical evidence of CKD stage 3-5 are coded as such. This proportion is somewhat higher than that reported in the Pilot phase of the audit. This may be because, unlike the pilot phase where practices were randomly selected, the practices who took part in the audit during the roll out phase in England were volunteers who may be more engaged with the audit process. The practice sample for Wales is more representative of the Welsh GP practice population as all practices use Audit+.

Ethnicity is poorly recorded in primary care (particularly amongst practices with a majority white population), so we were unable to perform many analyses in this area. There is miscoding in 11% of people with CKD stage 3-5 Read codes and this is concentrated among people with Black ethnicity recorded. This is almost certainly because laboratories do not report eGFRs appropriately adjusted for ethnicity.

CKD Management in Primary Care

GPs re-test most people (81.3%) with coded CKD stage 3-5 using eGFR on at least an annual basis but less than half of people (31.1%) with CKD have a record of a urinary ACR test in the last year. Annual eGFR and urinary ACR testing in those with CKD was supported by the QOF until April 2014 when these tests were deemed part of routine clinical care and no longer incentivised.

There is wide variation in GPs performance in annual eGFR and ACR reviews for those people with CKD who do not have diabetes. With the removal of the CKD indicators from the QOF pay for performance scheme, the authors recommend local incentives to encourage regular testing and reduce the variation between practices which contributes to health inequalities.

People with CKD stage 3-5 who are at lower risk (those with a higher blood pressure target of <140/90 mmHg appear to achieve target blood pressure control more often than those at higher risk (with a lower blood pressure target of <130/80 mmHg), including all those with diabetes. Furthermore, the NCKDA has shown that those with CKD at younger age who could benefit most from CV risk reduction are least likely to be prescribed statins. Finally, most people with CKD receive appropriate vaccination against flu, with much room for improvement in pneumococcal vaccination for those with stage 4-5.

CKD coding and primary care management

- GPs generally test people with diabetes for CKD in primary care by routinely performing eGFR tests but less well using ACR testing.
- There is huge variation in how GPs perform eGFR and urinary ACR tests among other people at risk for CKD (those who do not have diabetes).
- On average around three quarters of people with biochemical evidence of CKD stage 3-5 are being coded as such.
- GPs retest most people with coded CKD stage 3-5 function using eGFR on at least an annual basis, but less than half of people with CKD have a record of a urinary ACR test in the last year.
- People with CKD stage 3-5 who are at lower risk (those with a higher blood pressure target of <140/90 mmHg) appear to achieve target blood pressure control more often than those at higher risk (with a lower blood pressure target of <130/80 mmHg), including all those with CKD and diabetes.
- Only 40% of people aged <=65 years with CKD and without diabetes were prescribed statin medication, although there is clear evidence that such patients would benefit from statin therapy.
- Most people with CKD receive appropriate vaccination against flu, with room for improvement with regards to pneumococcal vaccination for those with stage 4-5.

Quality improvement

- Taking part in the NCKDA has been helpful for a number of engaged GPs who have substantially improved the coding of their CKD population during the audit period.
- The QI tools were easy to use.
- Providing individual feedback on practice performance, in isolation from other methods of incentivisation, is likely to generate a small but significant improvement in quality.
- Engaging CCGs/LHBs to provide additional practice incentives to increase identification, coding and management may produce system wide improvements with gains to patient care.

Implications

Investment in effective primary care quality improvement systems to improve the identification of those with CKD, and improve regular follow up and management is needed. In turn this will contribute to delaying the progression of those with CKD and reduce the risk of associated CVD complications and episodes of AKI. This is particularly important in the absence of incentives from QOF. There is room for improvement in testing those at risk of CKD, particularly with urine ACR tests, as well as in coding the quarter of patients with biochemical evidence of CKD but without a code. For those people with established CKD improvements in blood pressure management and the provision of cholesterol lowering treatment are key priorities. Although only a small number of cases progress to end stage renal disease, for those individuals (and their families) it is very difficult, and it is very costly for the health economy. Early identification and active management of patients with progressive CKD is the only way to reduce ESRD incidence and effectively plan for these events.

The NCKDA provides a snapshot of performance in primary care against agreed evidence based targets. Continuing efforts at reducing the variation between practices in the identification and management of CKD are clearly a priority. The NCKDA findings can inform local, regional and national schemes that promote improvements in quality.

Implications for patients

- About a quarter with blood tests suggesting they have CKD appear not to have been coded for CKD by their GP.
- Identifying those with CKD allows patients and their families, in partnership with healthcare professionals, to obtain information, manage risks and make lifestyle changes that reduce the chances of complications such as heart attacks and strokes, acute kidney injury, or the need for dialysis.

Next steps

This the first of two reports on CKD in primary care. These data have now been linked to hospital attendance data from both England and Wales, and the next and final report (to be released towards end of 2017) will investigate outcomes of patients with CKD in primary care.

The current data provide a useful snapshot of the identification, coding and management at practice, CCG/LHA and country level, with the hope this will stimulate further local quality improvement work to benefit patients with CKD.

// Glossary and Abbreviations

Text in blue boxes summarise audit findings

Text in yellow boxes summarise quality improvement aspects

Text in green boxes provide additional information aimed at patients

AKI	acute kidney injury
ACR	albumin/creatinine ratio
CVD	cardiovascular disease
CKD	chronic kidney disease
CKD Coding	Read codes given by primary care physicians to encode that a patient has CKD. A subset of CKD codes allow entry of the patient onto a QOF incentivised CKD practice register with payment to practices to maintain this information
CCGs	clinical commissioning groups
eGFR	estimated glomerular filtration rate
GPSoC	GP Systems of Choice
HSCIC	Health and Social Care Information Centre
HRA	Health Research Authority
IMD	index of multiple deprivation
LHB	local health boards
NCKDA	National CKD Audit and Quality Improvement Programme
NICE	National Institute for Health and Care Excellence
NIGB	National Information Governance Board for Health and Social Care
Proteinuria	Presence of protein in the urine. The most common protein found in urine is albumin. NICE currently recommends using ACRs to quantify this, instead of the commonly used urine dipstick tests which are less sensitive
Read Codes	Standardised set of codes given by primary care physicians for recording patient findings and procedures in health and social care
QOF	Quality and Outcomes Framework
QI	quality improvement
UKRR	UK Renal Registry

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// List of Figures

// Appendix, Tables and Additional Figures

Methodology of the National CKD Audit and Data Adequacy

Code lists

The full list of read codes used in the audit can be found here *http://tiny.cc/01CKD*

eGFR values and thresholds

The NCKDA has identified several issues around the reported eGFR that impact on the calculation of audit outcome measures and the delivery of electronic quality improvement. These include the availability of numeric eGFR measurements (i.e. not <15 or >90), ethnicity-adjustment, laboratory calibration and the introduction of new estimating equations. The NCKDA has therefore undertaken recalculation of all eGFRs from the laboratory reported serum creatinine to determine eGFRs. The laboratory reported eGFR does not adjust for ethnicity, while the audit recalculated eGFR does. See the Audit Pilot Report for more detail (*http://tiny.cc/05CKD*)

Proteinuria values

Although NICE guidance advises the laboratory testing of albumin (or protein) to creatinine ratios in clinical practice a subset of GPs do not send urine tests for ACR testing unless the dipstick test is positive. The NCKDA has only used ACR tests as an indicator of proteinuria. Inclusion of protein to creatinine ratios (PCR) did not alter the NCKDA findings. Furthermore historically two sets of units for both ACR and PCR have been used under the same READ code, which makes interpretation of actual proteinuria values (as opposed to absence/presence) impossible in older lab tests. Future reports will contain separate analyses examining formal laboratory proteinuria testing and dipstick testing separately.

eGFR equations

NICE CKD guidance was updated in July 2014. This guidance advises that the diagnosis of CKD should be based on the CKD EPI GFR estimate rather than the previously used CKD MDRD equation. As of late 2016, many UK laboratories are still reporting eGFR based on the MDRD equation. The NCKDA therefore continues to use the MDRD to calculate eGFR with ethnicity adjustment for the purposes of determining whether a patient has CKD. However the NCKDA QI tool has been programmed to make the eGFR calculated by CKD EPI available to practices and estimates of CKD prevalence and coding based on these values are planned in future analyses.

Acute Kidney Injury

Episodes of AKI are now recognised as an important risk factor for CKD and this is reflected in the

NICE guidance of July 2014. During the period of the pilot study there were no agreed Read codes for AKI, so the NCKDA pilot has not examined whether people are being tested for CKD following a diagnosis of AKI. Once primary care is routinely using AKI Read codes both the QI tool functionality and audit measures will be extended to include testing for CKD in those at risk due to a previous diagnosis of AKI.

Practice population

Data on practice population size have been taken in aggregate directly from participating practices with agreement from the GP. Where GPs did not agree to share these data, publicly available practice population data are taken from the HSCIC and ethnicity data from the results of the most recent GP patient survey. These sources are not available for practices in Wales. Where these data are not available these figures have been obtained from earlier versions of the survey, extrapolated from census data or retrieved from alternative sources in Wales.

Table 1. Prevalence of CKD risk factors studied in the audit using total practice populations included in the audit

Summary measures for total patient population	Wales	England	England & Wales	*ONS W*	*ONS E*	*ONS E&W*
Number of CCGs/LHBs	7	106	113	*7*	*211*	*218*
Number of practices	327	584	911	*470*	*7779*	*8432*
Number of practices with list size data	278	584	862	/	/	/
Patient population with list size data	2,048,603	4,614,705	6,663,308	/	/	/
Mean age*	41.4	40.9	41.0	*41.2*	*39.7*	*39.8*
Percent female*	50.1%	50.7%	50.5%	*50.8%*	*50.7%*	*50.7%*
Percent non-white*	2.8%	8.0%	6.4%	/	/	/
Diabetes prevalence in adults *(QOF England denominator 17+, QOF Wales denominator 0+)**	7.2%	5.9%	6.3%	*5.7%*	*6.4%*	/
Hypertension prevalence in adults *(QOF denominator 0+)**	19.0%	16.7%	17.4%	*15.6%*	*13.8%*	/

***References for national comparisons:**
Age/Sex statistics in England and Wales:
https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland - ONS MYE2_.xls
Number of practices in England and Wales:
PressBriefintGeneralPracticeInTheUK_July2014_v2.pdf (*www.bma.org.uk*)
Diabetes and hypertension prevalence:
QOF statistics, separately for England and Wales

Table 2. Summary Measures for the at risk and CKD patient population included in the Audit analyses (individual data)

Summary Measures for Patient Population	Wales	England	England & Wales
Number of patients with CKD or at risk	539,633	913,083	1,452,716
Mean age	66.7	66.6	66.6
Percent aged 18-39	3.5%	3.8%	3.7%
Percent aged 40-64	37.0%	37.2%	37.1%
Percent aged 65-79	40.7%	39.4%	39.9%
Percent aged 80+	18.7%	19.6%	19.3%
Percent female	48.0%	47.9%	47.9%
Percent white	38.3%	64.1%	54.5%
Percent black	0.2%	1.6%	1.1%
Percent Asian	0.7%	2.9%	2.1%
Percent other ethnicity	0.3%	1.0%	0.7%
Percent ethnicity missing	60.5%	30.5%	41.6%
Percent diabetes code*	25.4%	24.0%	24.5%
Percent hypertension code*	68.3%	67.2%	67.6%
Percent CVD code	25.0%	23.2%	23.9%
Percent lithim code	0.6%	0.5%	0.5%
Percent cni code	0.3%	0.4%	0.4%
Percent renal calculi code	3.0%	3.6%	3.4%
Percent prostatic hypertrophy code	4.6%	4.9%	4.8%
Percent connective tissue disorder	13.8%	12.6%	13.1%
Percent with IMD data	0.6%	99.6%	62.8%
Median IMD Score	12.5	15.3	15.3

* Includes those with diagnosis for <1 year (not included in risk factor table below).

Table 3. Data completeness of key audit variables

Variable	No. practices with data	Median	IQR	Range
Ethnicity	911	32.6%	10.3% - 66.7%	0% - 100%
Age	911	0%	0% - 0%	0% - 0%
GFR measurements with missing creatinine on same date	911	0.3%	0.1% - 0.6%	0% - 36.0%
Creatinine measurements with missing GFR on same date	911	1.89%	0.8% - 5.3%	0% - 46.1%
ACR/PCR/dipstick test date, but missing value	911	0%	0% - 0%	0% - 0%
GFR >10% different from MDRD-IDMS calculated value*	911	0.3%	0% - 4.5%	0% - 71.5%

Table 4. Variation in terms of testing between E&W and by CCGs

Country	Practices	Practices with list size	Mean of mean age	Mean percent black	Mean percent non-white	Mean of median IMD*	Mean practice diabetes prevalence**	Mean practice percentage GFR tested if diabetes***	Mean practice percentage ACR tested if diabetes***	Mean practice hypertension prevalence**	Mean practice percent GFR tested if hypertension***	Mean practice percent ACR tested if hypertension***
Wales	327	278	41.5	0.5%	2.8%	15.8	5.6%	85.3%	52.1%	15.7%	95.3%	25.6%
England	584	584	40.7	2.1%	8.6%	18.9	4.6%	85.8%	51.7%	13.3%	95.0%	29.8%
Total	**911**	**862**	**41.0**	**1.6%**	**6.7%**	**18.8**	**4.9%**	**85.6%**	**51.8%**	**14.0%**	**95.1%**	**28.3%**

*mean 99.3% missing IMD data in Wales; 0.9% missing in England; 35.2% missing overall; **diabetes and hypertension coded for at least 1 year; ***ACR/GFR test in last year for diabetes, last 5 years for hypertension

Country	CCG	Number of practices in CCG	Mean of mean age	Mean percent black	Mean percent non-white	Mean of median IMD*	Mean practice diabetes prevalence**	Mean practice percentage GFR tested if diabetes***	Mean practice percentage ACR tested if diabetes***	Mean practice hypertension prevalence**	Mean practice percent GFR tested if hypertension***	Mean practice percent ACR tested if hypertension***
Wales	1	>=5	42.7	0.2%	1.3%	16.7*	5.2%	84.5%	43.8%	16.0%	95.7%	20.4%
Wales	2	>=5	41.8	0.3%	1.9%	*	6.2%	83.3%	61.9%	16.4%	93.9%	30.1%
Wales	3	>=5	40.6	0.2%	1.7%	*	5.6%	85.9%	52.0%	16.3%	96.7%	24.8%
Wales	4	>=5	41.0	0.5%	2.6%	12.7*	6.1%	87.0%	52.4%	16.3%	96.6%	32.7%
Wales	5	>=5	46.2	0.1%	1.1%	18.0*	5.1%	87.7%	64.9%	15.6%	96.4%	37.3%
Wales	6	>=5	43.8	0.2%	1.3%	*	5.7%	86.3%	61.4%	16.8%	93.6%	23.3%
Wales	7	>=5	37.6	1.6%	8.0%	*	4.8%	85.4%	48.5%	12.6%	95.2%	23.5%
England	8	<5	36.7	6.7%	23.6%	31.1	3.5%	87.7%	71.8%	8.6%	97.4%	33.1%

Country	CCG	Number of practices in CCG	Mean of mean age	Mean percent black	Mean percent non-white	Mean of median IMD*	Mean practice diabetes prevalence**	Mean practice percentage GFR tested if diabetes***	Mean practice percentage ACR tested if diabetes***	Mean practice hypertension prevalence**	Mean practice percent GFR tested if hypertension***	Mean practice percent ACR tested if hypertension***
England	9	<5	35.8	15.3%	32.1%	44.3	5.2%	81.0%	62.3%	9.7%	95.9%	41.1%
England	10	>=5	40.3	0.7%	3.2%	23.7	4.9%	86.0%	49.3%	13.9%	97.1%	44.4%
England	11	<5	38.6	1.5%	5.3%	16.5	4.5%	92.9%	58.0%	11.1%	95.3%	29.8%
England	12	>=5	41.5	0.6%	3.8%	10.4	3.7%	89.7%	55.8%	12.2%	95.2%	26.5%
England	13	<5	41.3	0.0%	1.4%	21.8	4.5%	93.6%	58.8%	15.4%	97.3%	42.1%
England	14	<5	37.2	11.8%	61.6%	24.7	7.7%	88.0%	14.1%	14.1%	96.1%	35.3%
England	15	<5	36.4	5.6%	18.3%	47.8	6.8%	92.2%	63.4%	14.4%	95.9%	31.4%
England	16	>=5	38.9	1.5%	5.6%	11.7	3.4%	86.9%	58.6%	10.3%	95.4%	36.1%
England	17	<5	42.2	0.3%	1.1%	23.8	4.9%	88.7%	45.7%	15.0%	96.6%	43.4%
England	18	<5	42.3	2.0%	10.1%	10.3	4.5%	82.3%	53.6%	13.8%	94.2%	26.9%
England	19	<5	40.9	0.7%	4.4%	21.3	5.3%	90.6%	64.4%	14.1%	96.6%	35.0%
England	20	<5	37.8	7.3%	17.2%	18.6	5.0%	84.1%	61.0%	14.4%	97.8%	25.9%
England	21	<5	37.8	0.5%	2.4%	13.9	4.2%	91.9%	30.9%	11.1%	97.1%	31.0%
England	23	<5	39.6	1.1%	8.0%	8.0	3.7%	86.9%	29.7%	10.7%	93.5%	25.0%
England	24	<5	35.8	12.5%	62.1%	37.9	6.9%	90.8%	54.0%	12.3%	97.1%	41.0%
England	25	<5	43.3	0.3%	4.9%	14.8	4.4%	75.1%	31.8%	13.6%	94.6%	24.1%
England	27	<5	23.5	4.7%	29.6%	27.4	0.6%	74.4%	38.5%	0.8%	92.2%	72.5%
England	28	<5	40.2	3.2%	17.3%	7.6	4.5%	82.0%	23.8%	13.1%	94.2%	22.1%

Country	CCG	Number of practices in CCG	Mean of mean age	Mean percent black	Mean percent non-white	Mean of median IMD*	Mean practice diabetes prevalence**	Mean practice percentage GFR tested if diabetes***	Mean practice percentage ACR tested if diabetes***	Mean practice hypertension prevalence**	Mean practice percent GFR tested if hypertension***	Mean practice percent ACR tested if hypertension***
England	29	>=5	40.7	1.1%	5.0%	15.6	4.4%	90.3%	59.5%	13.6%	95.0%	40.8%
England	30	<5	40.5	1.2%	4.4%	9.5	4.7%	93.8%	41.0%	14.6%	96.0%	25.1%
England	31	<5	38.3	1.5%	5.0%	22.9	3.9%	88.2%	73.6%	10.9%	98.1%	26.5%
England	32	>=5	40.1	0.9%	4.9%	8.4	3.9%	83.1%	57.3%	11.5%	96.1%	36.2%
England	33	>=5	39.7	1.9%	4.4%	24.3	5.3%	85.1%	41.7%	13.6%	96.5%	37.0%
England	34	<5	38.9	0.2%	19.9%	16.9	5.7%	81.7%	35.3%	13.7%	96.0%	31.0%
England	35	>=5	43.6	0.4%	2.3%	20.8	5.3%	90.0%	61.0%	14.9%	95.7%	25.3%
England	36	>=5	38.9	2.3%	12.8%	9.6	2.9%	85.1%	46.2%	9.8%	94.9%	22.0%
England	37	<5	39.3	10.7%	23.5%	17.8	4.8%	85.8%	25.6%	14.5%	95.0%	20.5%
England	38	<5	29.5	11.0%	53.8%	47.2	5.6%	89.8%	65.4%	8.8%	98.9%	57.0%
England	39	<5	40.6	0.6%	3.5%	14.1	3.8%	86.3%	54.0%	12.9%	92.7%	21.5%
England	40	<5	40.1	1.0%	2.9%	18.6	4.2%	84.8%	58.4%	9.3%	96.0%	28.1%
England	41	<5	37.2	3.2%	11.6%	11.5	4.1%	86.7%	63.4%	10.5%	93.9%	28.8%
England	42	<5	41.7	0.2%	0.7%	8.8	3.6%	79.1%	52.3%	13.7%	95.7%	24.0%
England	43	<5	32.6	21.5%	71.4%	50.8	9.4%	79.1%	36.1%	13.4%	91.5%	43.0%
England	44	<5	47.1	0.4%	1.8%	15.7	4.8%	90.3%	66.3%	16.2%	91.5%	33.5%
England	45	>=5	44.3	0.2%	1.4%	15.9	4.1%	90.6%	51.6%	13.3%	96.1%	26.7%
England	46	>=5	42.0	0.3%	3.2%	25.1	4.7%	82.1%	47.1%	13.0%	95.9%	29.4%

Country	CCG	Number of practices in CCG	Mean of mean age	Mean percent black	Mean percent non-white	Mean of median IMD*	Mean practice diabetes prevalence**	Mean practice percentage GFR tested if diabetes***	Mean practice percentage ACR tested if diabetes***	Mean practice hypertension prevalence**	Mean practice percent GFR tested if hypertension***	Mean practice percent ACR tested if hypertension***
England	47	<5	45.2	0.2%	0.8%	11.3	5.3%	86.9%	63.4%	17.6%	97.6%	22.0%
England	48	<5	40.8	0.5%	1.5%	9.7	4.9%	86.5%	57.1%	12.8%	96.5%	19.9%
England	49	<5	40.2	3.8%	20.0%	11.7	4.3%	78.4%	49.4%	13.8%	92.6%	19.9%
England	50	<5	43.8	0.4%	1.2%	11.3	4.0%	94.4%	71.2%	13.2%	98.2%	35.6%
England	51	<5	45.7	0.3%	1.7%	15.2	4.4%	82.7%	50.2%	14.2%	93.5%	17.7%
England	52	>=5	39.3	1.2%	7.6%	20.3	5.3%	90.1%	59.5%	12.5%	96.9%	30.6%
England	53	<5	29.5	16.4%	47.4%	36.6	4.0%	79.8%	50.0%	7.3%	94.0%	37.7%
England	54	>=5	41.6	2.1%	5.3%	29.1	4.4%	86.7%	57.6%	13.0%	96.1%	31.7%
England	55	>=5	35.7	18.5%	33.3%	31.8	4.4%	77.0%	39.8%	10.2%	92.9%	29.9%
England	56	<5	35.7	0.0%	0.0%	17.6	3.7%	84.2%	50.1%	10.0%	94.9%	25.1%
England	57	<5	41.4	0.6%	1.9%	30.6	5.0%	87.5%	44.0%	13.6%	95.1%	27.1%
England	58	<5	34.5	22.1%	36.5%	32.0	6.0%	83.4%	52.0%	12.7%	95.2%	42.4%
England	59	<5	44.1	0.4%	2.4%	11.1	4.0%	89.0%	33.2%	14.0%	96.2%	21.2%
England	60	<5	38.7	0.6%	24.2%	24.6	5.8%	63.5%	42.4%	13.4%	95.6%	45.0%
England	61	>=5	40.3	0.6%	2.5%	10.7	4.0%	77.9%	70.3%	11.4%	84.6%	35.6%
England	62	<5	41.9	0.0%	0.8%	11.1	4.6%	82.4%	48.9%	15.6%	96.6%	67.7%
England	63	>=5	39.9	2.6%	7.4%	18.5	5.0%	83.7%	42.8%	14.3%	93.9%	24.4%
England	64	<5	42.0	0.4%	1.6%	16.8	3.9%	84.8%	44.2%	11.3%	92.7%	16.1%

Country	CCG	Number of practices in CCG	Mean of mean age	Mean percent black	Mean percent non-white	Mean of median IMD*	Mean practice diabetes prevalence**	Mean practice percentage GFR tested if diabetes***	Mean practice percentage ACR tested if diabetes***	Mean practice hypertension prevalence**	Mean practice percent GFR tested if hypertension***	Mean practice percent ACR tested if hypertension***
England	66	<5	43.8	0.6%	1.3%	19.1	5.0%	92.1%	59.9%	14.1%	97.2%	49.2%
England	68	<5	38.5	1.1%	7.4%	24.2	4.6%	86.6%	77.8%	14.6%	97.4%	93.6%
England	69	<5	43.7	0.0%	0.6%	4.6	3.3%	85.5%	44.9%	12.6%	94.8%	16.8%
England	71	<5	43.9	4.5%	6.6%	11.7	4.7%	88.4%	65.8%	13.4%	93.7%	19.6%
England	72	>=5	40.7	3.0%	9.2%	13.9	4.6%	84.3%	56.1%	13.6%	95.0%	42.5%
England	74	<5	42.2	1.4%	9.8%	6.2	1.5%	78.5%	31.9%	8.6%	84.5%	13.6%
England	76	>=5	38.1	2.0%	24.6%	10.0	4.0%	81.6%	55.1%	10.5%	90.1%	26.4%
England	77	<5	38.8	0.2%	3.6%	40.4	5.8%	45.6%	23.5%	15.4%	93.9%	53.4%
England	78	>=5	41.3	0.5%	2.6%	16.4	4.6%	77.1%	45.2%	12.2%	96.9%	21.2%
England	80	<5	41.9	0.6%	1.8%	18.5	4.2%	81.2%	54.1%	10.6%	94.6%	21.4%
England	81	<5	35.8	3.3%	3.3%	33.0	4.7%	93.9%	34.8%	12.8%	96.2%	22.8%
England	83	<5	40.4	0.9%	3.5%	13.7	4.7%	90.6%	76.4%	12.7%	94.9%	23.1%
England	85	<5	40.3	3.0%	3.0%	25.5	4.8%	93.6%	82.8%	14.1%	98.3%	30.5%
England	86	<5	34.7	7.9%	26.6%	19.0	4.2%	80.9%	62.1%	12.8%	88.7%	23.6%
England	87	<5	36.7	4.7%	13.8%	38.1	4.5%	93.5%	55.0%	11.5%	97.9%	33.2%
England	88	>=5	41.4	1.4%	6.0%	14.7	4.5%	85.2%	57.1%	13.9%	91.4%	26.4%
England	89	>=5	42.4	0.6%	5.7%	6.0	4.0%	71.6%	49.8%	14.6%	93.5%	33.5%
England	90	>=5	40.2	1.9%	14.5%	23.7	5.2%	88.4%	51.9%	15.5%	95.3%	27.2%

Country	CCG	Number of practices in CCG	Mean of mean age	Mean percent black	Mean percent non-white	Mean of median IMD*	Mean practice diabetes prevalence**	Mean practice percentage GFR tested if diabetes***	Mean practice percentage ACR tested if diabetes***	Mean practice hypertension prevalence**	Mean practice percent GFR tested if hypertension***	Mean practice percent ACR tested if hypertension***
England	91	<5	43.4	0.3%	1.5%	7.5	3.6%	92.2%	65.7%	12.8%	96.2%	26.5%
England	93	>=5	44.5	0.3%	4.1%	22.6	4.3%	83.7%	53.8%	13.5%	96.2%	18.9%
England	94	>=5	46.0	0.2%	2.0%	15.3	5.0%	94.0%	56.1%	15.7%	97.1%	34.6%
England	95	<5	42.0	0.6%	1.9%	13.4	4.2%	75.7%	44.9%	15.6%	97.1%	27.7%
England	96	<5	42.8	0.8%	4.4%	4.1	4.2%	86.9%	69.6%	13.5%	94.5%	19.2%
England	97	<5	41.3	0.0%	0.9%	34.1	5.1%	22.8%	15.0%	15.2%	91.5%	18.8%
England	98	<5	34.9	5.2%	30.9%	39.8	6.5%	79.9%	44.4%	11.0%	97.2%	56.6%
England	99	<5	42.5	2.9%	28.3%	13.7	3.1%	91.2%	58.0%	12.1%	93.8%	39.5%
England	100	<5	41.2	0.6%	2.5%	11.9	4.7%	87.9%	2.9%	12.8%	91.1%	14.1%
England	101	<5	45.3	0.0%	3.1%	13.4	5.4%	27.8%	19.7%	16.7%	90.9%	23.1%
England	102	<5	44.6	0.2%	1.5%	8.7	4.2%	88.0%	58.5%	14.5%	96.1%	21.9%
England	103	<5	32.2	33.9%	61.4%	36.4	4.5%	74.3%	69.0%	11.5%	89.2%	28.1%
England	104	<5	41.9	1.3%	4.4%	26.6	4.0%	87.0%	48.9%	13.3%	95.2%	25.0%
England	105	<5	44.8	1.1%	5.1%	24.7	5.5%	78.7%	35.1%	15.2%	95.3%	25.8%
England	106	<5	35.2	1.2%	4.4%	42.0	4.8%	81.9%	63.9%	10.8%	96.1%	28.9%
England	107	<5	37.3	6.2%	23.6%	20.4	5.6%	92.3%	59.1%	11.9%	94.4%	31.3%
England	108	<5	41.4	0.0%	0.0%	8.4	3.5%	89.0%	64.0%	12.1%	95.9%	18.7%
England	110	<5	36.4	0.0%	43.9%	8.7	7.7%	86.4%	69.2%	12.8%	97.4%	39.9%

Country	CCG	Number of practices in CCG	Mean of mean age	Mean percent black	Mean percent non-white	Mean of median IMD*	Mean practice diabetes prevalence**	Mean practice percentage GFR tested if diabetes***	Mean practice percentage ACR tested if diabetes***	Mean practice hypertension prevalence**	Mean practice percent GFR tested if hypertension***	Mean practice percent ACR tested if hypertension***
England	111	>=5	37.2	7.1%	16.2%	33.0	5.0%	87.7%	52.2%	11.8%	96.1%	43.9%
England	112	<5	43.1	0.9%	1.9%	15.7	3.8%	0.0%	0.0%	11.6%	94.3%	20.3%
England	113	<5	41.4	3.8%	10.7%	12.5	4.6%	86.7%	36.5%	14.7%	89.3%	18.0%
England	114	<5	45.8	0.0%	3.1%	11.0	5.1%	95.5%	57.9%	15.8%	98.5%	25.0%
England	115	>=5	42.4	0.8%	3.6%	23.4	5.2%	85.2%	49.9%	15.2%	94.5%	24.5%
England	116	<5	42.3	1.4%	11.1%	6.7	3.4%	90.1%	50.2%	11.6%	95.0%	20.9%
England	117	>=5	38.0	8.0%	20.1%	30.9	5.5%	87.3%	59.8%	13.5%	92.5%	35.1%
England	118	<5	39.9	1.7%	7.7%	36.4	5.5%	89.2%	58.9%	13.5%	94.9%	32.7%
England	119	<5	45.7	0.1%	0.9%	10.7	4.0%	95.0%	58.6%	17.3%	96.5%	26.1%
England	120	<5	38.9	2.7%	6.0%	9.6	3.4%	90.1%	40.6%	10.2%	96.7%	27.8%
England	121	>=5	41.0	0.2%	1.9%	25.9	4.9%	86.6%	41.7%	15.6%	95.7%	28.6%
England	122	<5	32.1	4.9%	14.5%	20.0	1.8%	79.8%	7.0%	4.8%	91.4%	22.3%
England	123	>=5	44.0	0.1%	0.7%	21.2	4.5%	92.7%	61.0%	13.8%	96.0%	28.7%
England	124	<5	44.1	0.0%	5.2%	8.1	5.8%	15.1%	7.2%	15.9%	97.3%	78.2%
England	125	>=5	44.5	0.3%	1.7%	12.9	5.3%	91.4%	66.8%	14.3%	97.2%	21.7%

*mean 99.3% missing IMD data in Wales; **diabetes and hypertension coded for at least 1 year; ***ACR/GFR test in last year for diabetes, last 5 years for hypertension

Table 5. Prevalence of coded CKD stages 3-5 for all 862 practices combined

Age band	Males	Females	Total
18-22	0.02%	0.02%	0.02%
23-27	0.04%	0.04%	0.04%
28-32	0.09%	0.08%	0.08%
33-37	0.13%	0.11%	0.12%
38-42	0.21%	0.22%	0.21%
43-47	0.37%	0.42%	0.40%
48-52	0.64%	0.87%	0.75%
53-57	1.08%	1.53%	1.30%
58-62	2.07%	2.66%	2.36%
63-67	3.96%	4.96%	4.47%
68-72	7.57%	8.74%	8.18%
73-77	13.11%	15.08%	14.15%
78-82	20.51%	23.05%	21.91%
83-87	28.83%	30.35%	29.74%
88-93	33.71%	36.47%	35.50%
93+	35.52%	37.67%	37.12%
Total, for 18+ only, observed	**3.45%**	**4.85%**	**4.17%**
Total, for 18+ only, standardised to 2011 census population for England & Wales			**3.80%** **(If standardised to total population, coded prevalence is 3.02%)**

Table 6. Percentage of those without a CKD 3-5 Read Code but with GFR evidence for CKD*, by individual age and sex. Results combined for all 862 practices with eGFR and list size data

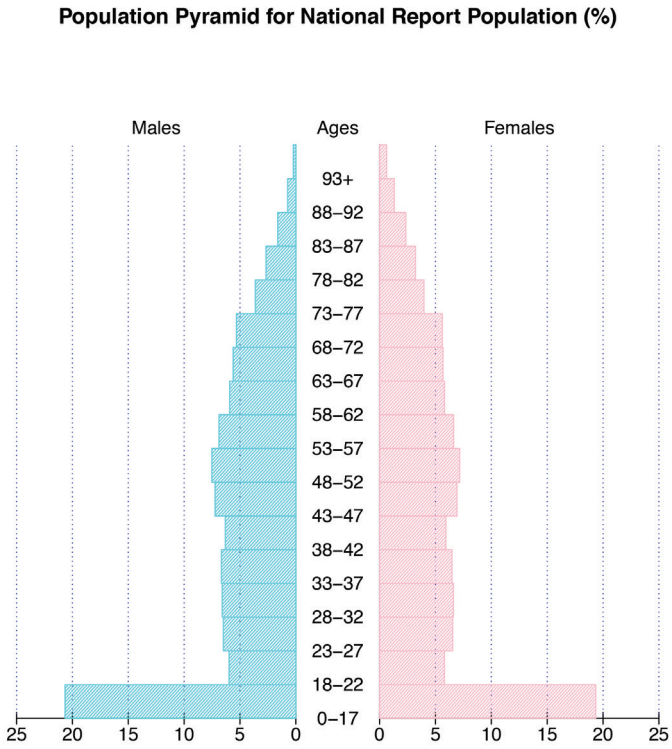
Age band	Males	Females	Total
18-22	0.01%	0.01%	0.01%
23-27	0.01%	0.01%	0.01%
28-32	0.02%	0.03%	0.03%
33-37	0.04%	0.05%	0.04%
38-42	0.06%	0.09%	0.07%
43-47	0.10%	0.18%	0.14%
48-52	0.22%	0.37%	0.30%
53-57	0.37%	0.65%	0.51%
58-62	0.66%	1.06%	0.86%
63-67	1.28%	1.78%	1.53%
68-72	2.28%	2.74%	2.52%
73-77	3.67%	4.32%	4.01%
78-82	5.17%	5.90%	5.57%
83-87	6.80%	7.42%	7.17%
88-93	7.74%	8.36%	8.14%
93+	8.35%	8.56%	8.50%
Totals	**0.94%**	**1.37%**	**1.16%**

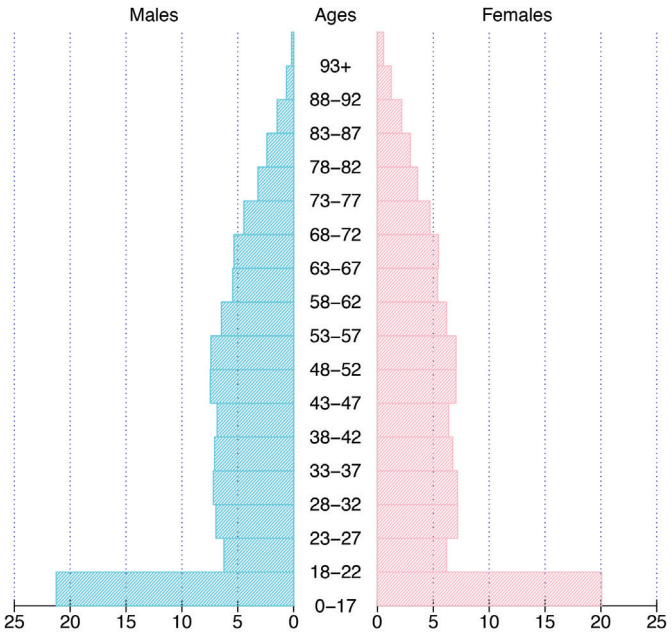
* Two eGFR measurements <60 over 3 months

Table 7. Coding Statistics for Top 20 Coding Improvers. Practices are not identified

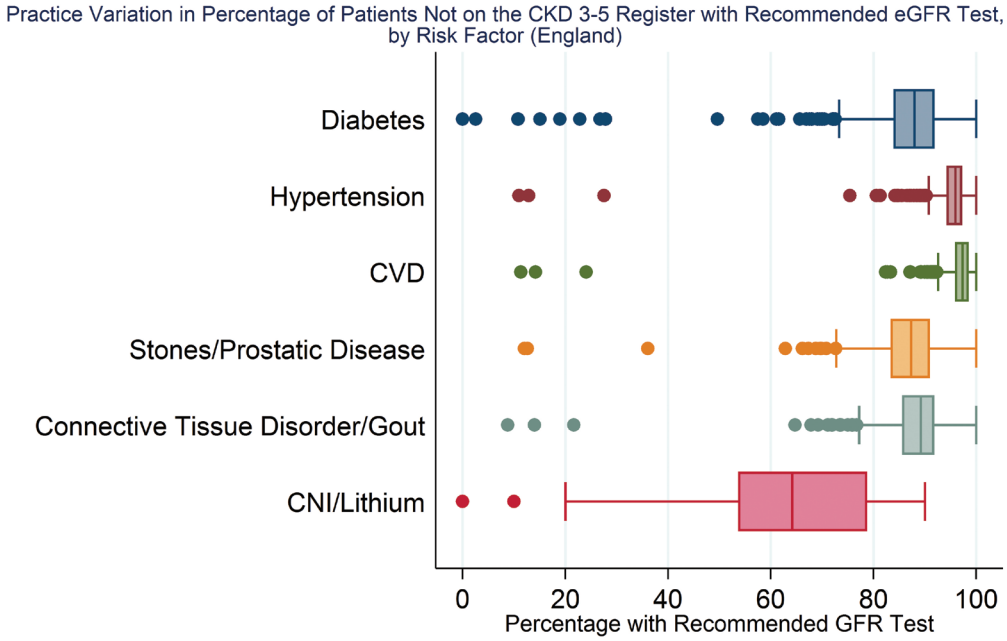
	ROUND 1 CODING STATISTICS						ROUND 2 CODING STATISTICS						CHANGE IN CODING STATISTICS (R2 – R1)					
Practice pseudo-ID	Number Biochemical CKD	Number Uncoded CKD	Percent Uncoded CKD	Number Coded CKD	Number Miscoded CKD	Percent Miscoded CKD	Number Biochemical CKD	Number Uncoded CKD	Percent Uncoded CKD	Number Coded CKD	Number Miscoded CKD	Percent Miscoded CKD	Number Biochemical CKD	Number Uncoded CKD	Percent Uncoded CKD	Number Coded CKD	Number Miscoded CKD	Percent Miscoded CKD
856	24	19	79.2%	15	10	66.7%	24	5	20.8%	31	12	38.7%	+0	-14	-58.3%	+16	+2	-28%
64	436	190	43.6%	410	164	40%	512	59	11.5%	638	185	29%	+76	-131	-32.1%	+228	+21	-11%
666	199	75	37.7%	182	58	31.9%	195	12	6.2%	263	80	30.4%	-4	-63	-31.5%	+81	+22	-1.4%
142	329	262	79.6%	105	38	36.2%	283	156	55.1%	168	41	24.4%	-46	-106	-24.5%	+63	+3	-11.8%
250	424	131	30.9%	415	122	29.4%	504	42	8.3%	616	154	25%	+80	-89	-22.6%	+201	+32	-4.4%
877	259	101	39%	228	70	30.7%	279	50	17.9%	312	83	26.6%	+20	-51	-21.1%	+84	+13	-4.1%
111	130	81	62.3%	74	25	33.8%	144	63	43.8%	106	25	23.6%	+14	-18	-18.6%	+32	0	-10.2%
461	146	47	32.2%	133	34	25.6%	152	21	13.8%	171	40	23.4%	+6	-26	-18.4%	+38	+6	-2.2%
537	659	228	34.6%	615	184	29.9%	683	111	16.3%	759	187	24.6%	+24	-117	-18.3%	+144	+3	-5.3%
140	37	18	48.6%	32	13	40.6%	39	12	30.8%	40	13	32.5%	+2	-6	-17.9%	+8	0	-8.1%
502	160	39	24.4%	175	54	30.9%	157	11	7%	193	47	24.4%	-3	-28	-17.4%	+18	-7	-6.5%
192	616	157	25.5%	662	203	30.7%	636	62	9.7%	804	230	28.6%	+20	-95	-15.7%	+142	+27	-2.1%
574	244	96	39.3%	238	90	37.8%	243	59	24.3%	274	90	32.8%	-1	-37	-15.1%	+36	0	-5%
758	41	21	51.2%	34	14	41.2%	44	16	36.4%	40	12	30%	+3	-5	-14.9%	+6	-2	-11.2%
307	30	9	30%	50	29	58%	25	4	16%	39	18	46.2%	-5	-5	-14%	-11	-11	-11.8%
4	267	65	24.3%	359	157	43.7%	249	26	10.4%	345	122	35.4%	-18	-39	-13.9%	-14	-35	-8.4%
211	120	26	21.7%	141	47	33.3%	109	10	9.2%	149	50	33.6%	-11	-16	-12.5%	+8	+3	+0.2%
262	427	151	35.4%	459	183	39.9%	428	105	24.5%	507	184	36.3%	+1	-46	-10.8%	+48	+1	-3.6%
228	379	151	39.8%	344	116	33.7%	371	108	29.1%	401	138	34.4%	-8	-43	-10.7%	+57	+22	+0.7%
539	603	196	32.5%	551	144	26.1%	618	138	22.3%	616	136	22.1%	+15	-58	-10.2%	+65	-8	-4.1%

Appendix Figure 1. Population pyramid comparing audit coverage population with national data (England)

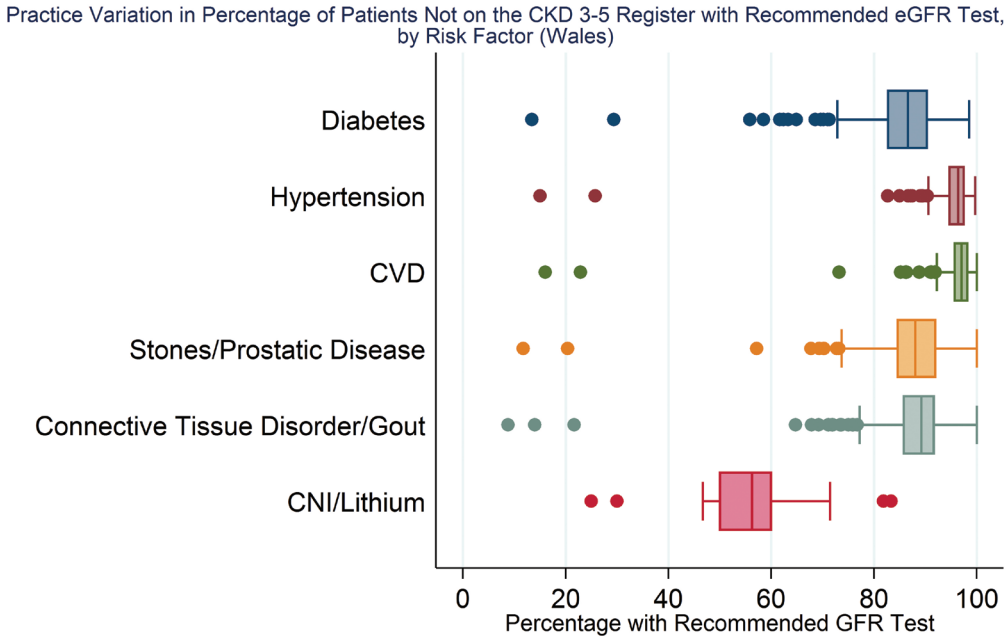




Appendix Figure 2. Percentage of people receiving recommended eGFR testing (past year for diabetes and CNI/Li; past 5 years for others), by risk factor, separately for England and Wales

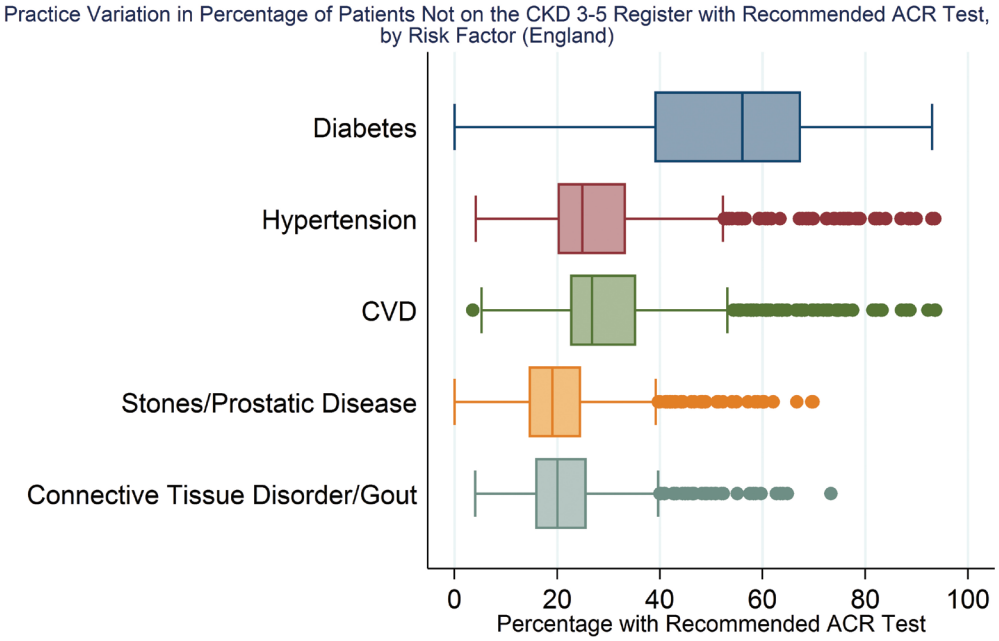


Number of Practices = 584; Practices with denominators < 10 excluded for each measure;
Diabetes N = 582; Hypertension N = 582; CVD N = 581; Stones/Prostatic Disease N = 574;
Connective Tissue Disorder/Gout N = 576; CNI/Lithium N = 30

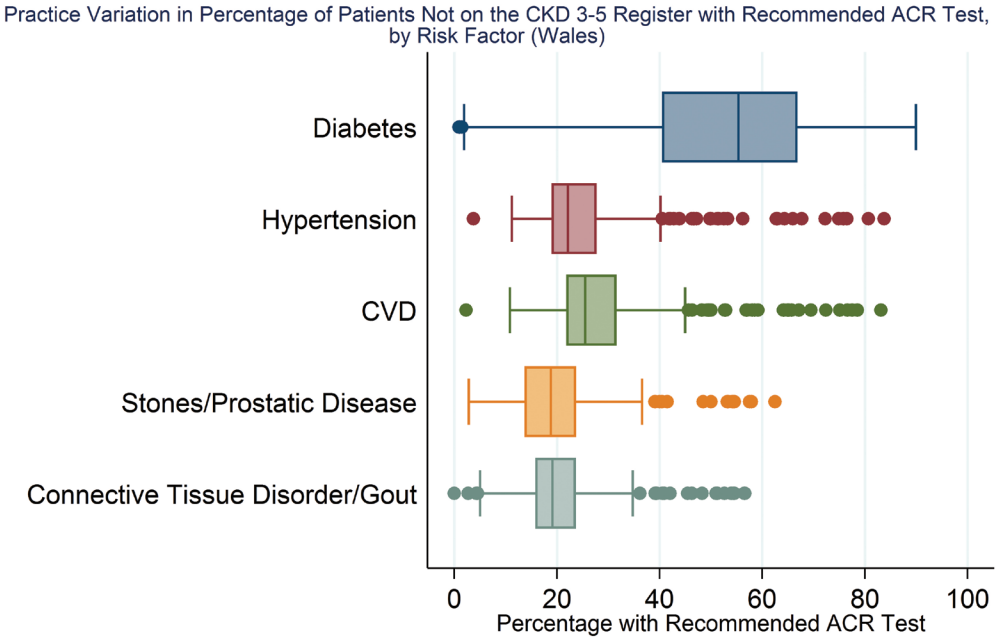


Number of Practices = 327; Practices with denominators < 10 excluded for each measure;
Diabetes N = 326; Hypertension N = 327; CVD N = 327; Stones/Prostatic Disease N = 322;
Connective Tissue Disorder/Gout N = 326; CNI/Lithium N = 17

Appendix Figure 3. Percentage of people receiving recommended ACR testing (past year for diabetes; past 5 years for others), by risk factor, separately for England and Wales

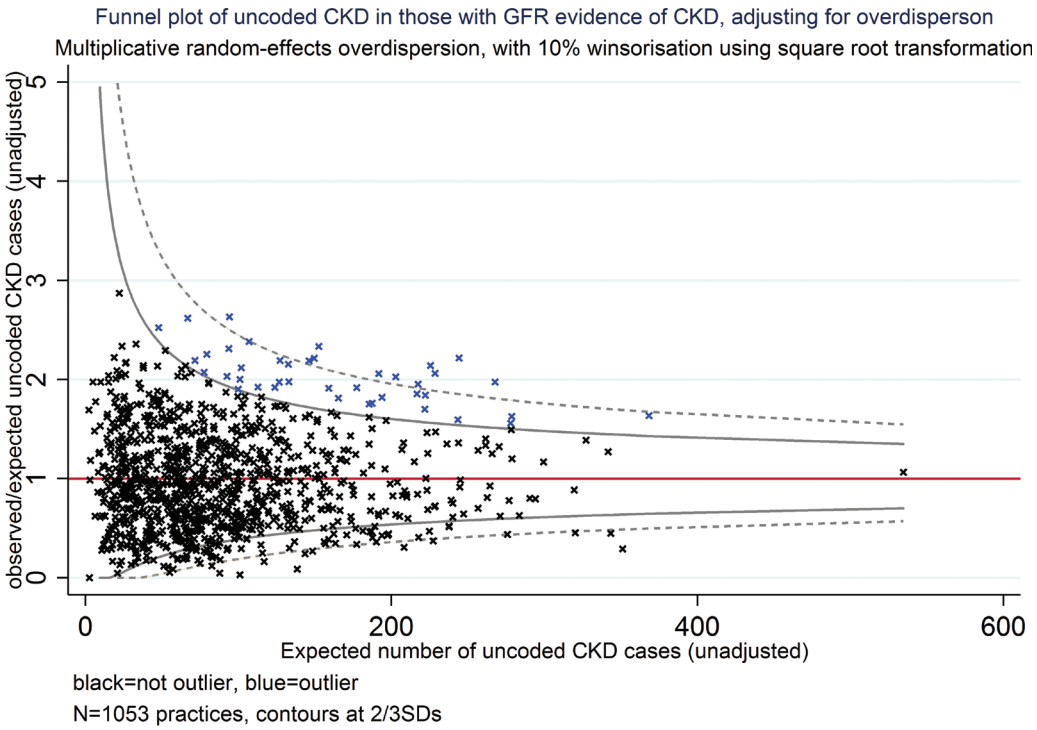


Number of Practices = 584; Practices with denominators < 10 excluded for each measure;
Diabetes N = 582; Hypertension N = 582; CVD N = 581; Stones/Prostatic Disease N = 574;
Connective Tissue Disorder/Gout N = 576

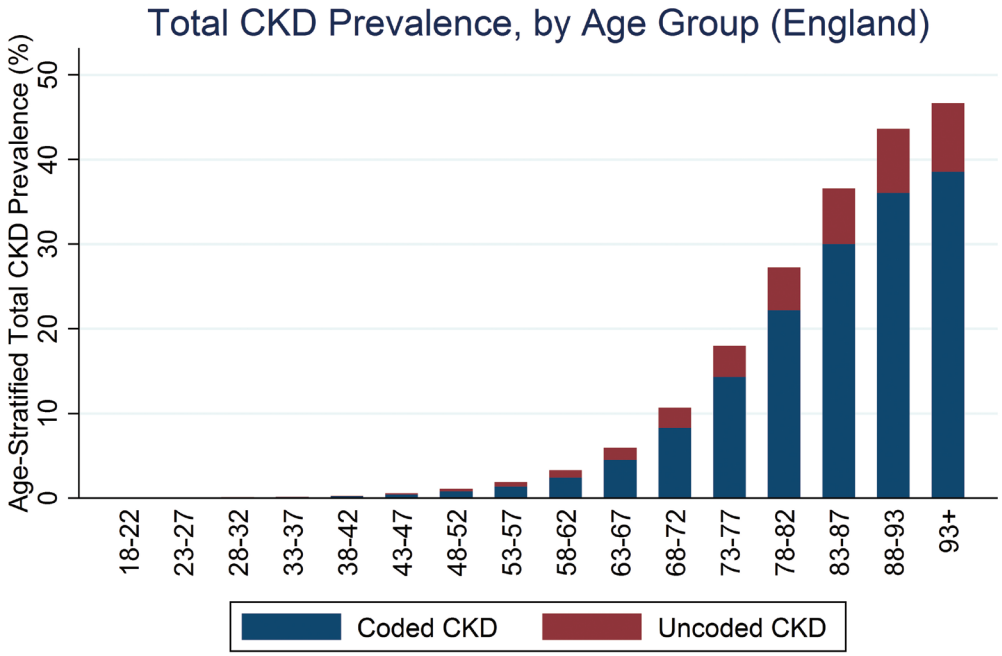


Number of Practices = 327; Practices with denominators < 10 excluded for each measure;
Diabetes N = 326; Hypertension N = 327; CVD N = 327; Stones/Prostatic Disease N = 322;
Connective Tissue Disorder/Gout N = 326

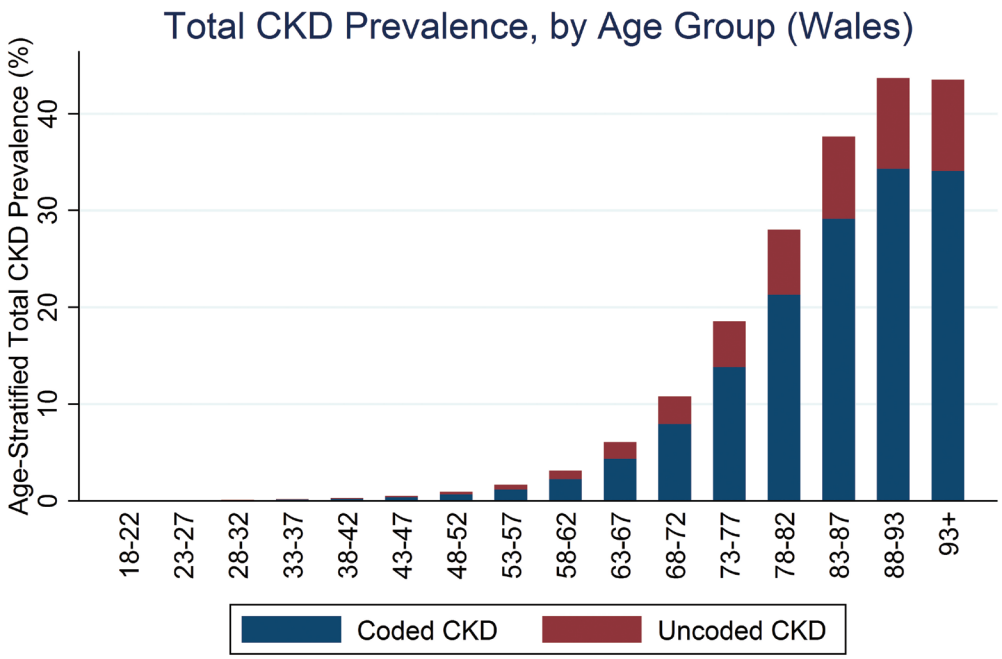
Appendix Figure 4. Funnel plot of uncoded CKD



Appendix Figure 5. Age-stratified CKD prevalence by age in England and Wales (including only two measurements of eGFR<60mL/min/1.73m^2)



Uncoded CKD includes confirmed biochemical CKD over 3 months only.
Coded CKD excludes miscoded.



Uncoded CKD includes confirmed biochemical CKD over 3 months only.
Coded CKD excludes miscoded.

Overall audit measures

Measure	Description	Numerator	Denominator	Percent
0	QOF CKD prevalence (denom inc <18)	235009	6650077	3.5%
1_1_1	GFR in past year in diabetics	235226	273972	85.9%
1_1_2	ACR/PCR in past year in diabetics	147563	273972	53.9%
1_2_1	GFR/PCR in past year in cni/li	1849	2971	62.2%
1_3_1	GFR in past 5 years in at risk	942152	1012630	93.0%
1_3_2	ACR/PCR in past 5 years in at risk	274279	1012630	27.1%
1_4_1	GFR in past 5 years in hypertensives	740283	778772	95.1%
1_4_2	ACR/PCR in past 5 years in hypertensives	231399	778772	29.7%
1_5_1	GFR in past 5 years in CVD	239942	249804	96.1%
1_5_2	ACR/PCR in past 5 years in CVD	79508	249804	31.8%
1_6_1	GFR in past 5 years in stones/ prostatic disease	80679	93121	86.6%
1_6_2	ACR/PCR in past 5 years in stones/ prostatic disease	19866	93121	21.3%
1_7_1	GFR in past 5 years in SLE	123182	140820	87.5%
1_7_2	ACR/PCR in past 5 years in SLE	31510	140820	22.4%
2_1_1	2 GFRs < 60 if QOF	153611	235009	65.4%
2_1_2	Last GFR < 60 (no prev) if QOF	4203	235009	1.8%
2_1_3	Last GFR < 60 (prev >=60) if QOF	16174	235009	6.9%
2_1_4	2 GFRs >= 60 if QOF	26695	235009	11.4%
2_1_5	Last GFR >= 60 (no prev) if QOF	1054	235009	0.4%
2_1_6	Not CKD (>= 60) if QOF	27749	235009	11.8%
2_1_7	Not CKD (>= 60) if QOF & black	653	1815	36.0%
2_2_1	2 GFRs < 60 if no QOF	66401	5097097	1.3%
2_2_2	Last GFR < 60 (no prev) if no QOF	12253	5097097	0.2%
2_2_3	CKD (<60) if no QOF	78654	5097097	1.5%
2_2_4	CKD (<60) if no QOF & black	303	303	100.0%

Measure	Description	Numerator	Denominator	Percent
2_3	Renal/proteinuria/1-2 QOF code	140959	5319817	2.6%
3_	GFR confirms stage if QOF 3-5 & 1+ GFRs	140668	218932	64.3%
4_1a	GFR in past year, group 1+3	297549	375968	79.1%
4_1b	GFR in past year, group 1	190998	235009	81.3%
4_2a	ACR/PCR in past year, group 1+3	125382	375968	33.3%
4_2b	ACR/PCR in past year, group 1	73172	235009	31.1%
5a	Referral high risk, group 1+3	16889	50469	33.5%
6_1	Ca/phos/pth in past year, QOF 4-5	836	15168	5.5%
6_2	Hb in past year, QOF 3b-5	54039	73109	73.9%
7a	CV assess if 40-75, group 1+3	81904	189117	43.3%
7b	CV assess if 40-75, group 1	41208	93241	44.2%
8_1a	Statins, high CV risk, group 1+3	244708	375968	65.1%
8_1b	Statins, high CV risk, group 1	161580	235009	68.8%
8_2a	Aspirin, previous CVD, group 1+3	92156	108457	85.0%
8_2b	Aspirin, previous CVD, group 1	67705	79761	84.9%
9_1a	BP control in past year, target 140/90, group 1+3	125016	250563	49.9%
9_1am	No BP in last year, target 140/90, group 1+3	52789	250563	21.1%
9_1b	BP control in past year, target 140/90, group 1	89241	167910	53.1%
9_1bm	No BP in last year, target 140/90, group 1	27037	167910	16.1%
9_2a	BP control in past year, target 130/80, group 1+3	34765	125405	27.7%
9_2am	No BP in last year, target 130/80, group 1+3	8248	125405	6.6%
9_2b	BP control in past year, target 130/80, group 1	19600	67099	29.2%
9_2bm	No BP in last year, target 130/80, group 1	4657	67099	6.9%

Measure	Description	Numerator	Denominator	Percent
9_3a	BP control in past year, missing p/u, group 1+3	0	431	0.0%
9_3b	BP control in past year, missing p/u, group 1	0	0	/
9_3bm	No BP in past year, missing p/u, group 1	0	0	/
10_1a	Flu vaccination in past year, group 1+3	258319	375968	68.7%
10_1b	Flu vaccination in past year, group 1	176874	235009	75.3%
10_3	Pneumococcus immunised in past 5 years, QOF 4-5	3538	15168	23.3%

Extra table:

Crude coded and uncoded adult CKD prevalence by CCG:

CCG	Country	Number of practices in CCG	Mean practice adult crude coded CKD prevalence	Mean practice adult uncoded CKD prevalence*
1	Wales	>=5 Practices in CCG	4.8%	1.22%
2	Wales	>=5 Practices in CCG	4.5%	1.69%
3	Wales	>=5 Practices in CCG	4.3%	1.74%
4	Wales	>=5 Practices in CCG	3.9%	1.06%
5	Wales	>=5 Practices in CCG	6.0%	1.35%
6	Wales	>=5 Practices in CCG	4.5%	2.08%
7	Wales	>=5 Practices in CCG	2.5%	0.85%
8	England	<5 Practices in CCG	3.4%	0.16%
9	England	<5 Practices in CCG	1.2%	1.30%
10	England	>=5 Practices in CCG	4.3%	0.72%
11	England	<5 Practices in CCG	5.3%	1.19%
12	England	>=5 Practices in CCG	3.8%	0.72%
13	England	>=5 Practices in CCG	2.8%	1.72%

CCG	Country	Number of practices in CCG	Mean practice adult crude coded CKD prevalence	Mean practice adult uncoded CKD prevalence*
14	England	<5 Practices in CCG	2.4%	0.85%
15	England	<5 Practices in CCG	4.8%	1.18%
16	England	>=5 Practices in CCG	3.0%	0.72%
17	England	<5 Practices in CCG	3.3%	2.63%
18	England	<5 Practices in CCG	3.6%	1.67%
19	England	<5 Practices in CCG	4.3%	3.58%
20	England	<5 Practices in CCG	3.4%	0.90%
21	England	<5 Practices in CCG	3.0%	2.42%
23	England	>=5 Practices in CCG	3.6%	0.57%
24	England	<5 Practices in CCG	3.4%	1.90%
25	England	<5 Practices in CCG	3.5%	0.52%
27	England	<5 Practices in CCG	0.2%	0.00%
28	England	>=5 Practices in CCG	3.9%	0.50%
29	England	>=5 Practices in CCG	5.2%	1.06%
30	England	<5 Practices in CCG	3.2%	1.99%
31	England	<5 Practices in CCG	4.9%	0.20%
32	England	>=5 Practices in CCG	3.0%	1.61%
33	England	>=5 Practices in CCG	3.8%	0.88%
34	England	<5 Practices in CCG	3.2%	0.81%
35	England	>=5 Practices in CCG	5.9%	1.41%
36	England	>=5 Practices in CCG	2.2%	0.74%
37	England	>=5 Practices in CCG	3.2%	1.02%
38	England	>=5 Practices in CCG	2.2%	2.00%
39	England	<5 Practices in CCG	3.2%	1.68%
40	England	<5 Practices in CCG	6.3%	1.03%
41	England	>=5 Practices in CCG	2.7%	0.78%
42	England	<5 Practices in CCG	7.1%	0.55%

CCG	Country	Number of practices in CCG	Mean practice adult crude coded CKD prevalence	Mean practice adult uncoded CKD prevalence*
43	England	<5 Practices in CCG	3.3%	0.20%
44	England	>=5 Practices in CCG	6.9%	0.90%
45	England	>=5 Practices in CCG	5.1%	0.92%
46	England	>=5 Practices in CCG	3.8%	0.99%
47	England	<5 Practices in CCG	4.5%	3.18%
48	England	<5 Practices in CCG	3.6%	0.57%
49	England	>=5 Practices in CCG	3.8%	1.94%
50	England	<5 Practices in CCG	5.1%	0.56%
51	England	<5 Practices in CCG	3.9%	1.35%
52	England	>=5 Practices in CCG	4.6%	0.35%
53	England	<5 Practices in CCG	1.0%	1.41%
54	England	>=5 Practices in CCG	3.6%	0.78%
55	England	>=5 Practices in CCG	1.8%	0.66%
56	England	<5 Practices in CCG	2.0%	0.77%
57	England	<5 Practices in CCG	2.9%	1.18%
58	England	>=5 Practices in CCG	2.0%	1.06%
59	England	<5 Practices in CCG	5.0%	1.36%
60	England	>=5 Practices in CCG	4.2%	0.59%
61	England	>=5 Practices in CCG	4.4%	1.66%
62	England	<5 Practices in CCG	3.5%	1.40%
63	England	>=5 Practices in CCG	3.8%	0.70%
64	England	>=5 Practices in CCG	4.9%	1.73%
66	England	>=5 Practices in CCG	4.2%	2.39%
68	England	<5 Practices in CCG	3.5%	0.50%
69	England	<5 Practices in CCG	3.2%	0.83%
71	England	<5 Practices in CCG	4.2%	0.52%

CCG	Country	Number of practices in CCG	Mean practice adult crude coded CKD prevalence	Mean practice adult uncoded CKD prevalence*
72	England	>=5 Practices in CCG	5.0%	0.87%
74	England	<5 Practices in CCG	2.1%	1.09%
76	England	>=5 Practices in CCG	2.3%	0.88%
77	England	<5 Practices in CCG	4.2%	0.38%
78	England	>=5 Practices in CCG	3.2%	0.99%
80	England	<5 Practices in CCG	1.6%	1.52%
81	England	<5 Practices in CCG	6.7%	0.18%
83	England	<5 Practices in CCG	3.4%	1.56%
85	England	<5 Practices in CCG	4.6%	2.79%
86	England	<5 Practices in CCG	3.7%	0.44%
87	England	<5 Practices in CCG	3.7%	2.19%
88	England	>=5 Practices in CCG	4.6%	1.61%
89	England	>=5 Practices in CCG	2.6%	1.50%
90	England	>=5 Practices in CCG	5.5%	1.11%
91	England	>=5 Practices in CCG	7.0%	1.52%
93	England	>=5 Practices in CCG	5.2%	1.15%
94	England	>=5 Practices in CCG	5.0%	1.60%
95	England	<5 Practices in CCG	3.4%	2.38%
96	England	<5 Practices in CCG	3.9%	1.42%
97	England	<5 Practices in CCG	2.2%	1.08%
98	England	<5 Practices in CCG	3.3%	0.13%
99	England	<5 Practices in CCG	2.5%	1.22%
100	England	<5 Practices in CCG	3.7%	0.82%
101	England	<5 Practices in CCG	4.2%	1.74%
102	England	>=5 Practices in CCG	5.0%	1.13%
103	England	<5 Practices in CCG	1.9%	0.37%
104	England	<5 Practices in CCG	9.5%	0.22%

CCG	Country	Number of practices in CCG	Mean practice adult crude coded CKD prevalence	Mean practice adult uncoded CKD prevalence*
105	England	<5 Practices in CCG	8.4%	0.42%
106	England	<5 Practices in CCG	4.8%	0.60%
107	England	<5 Practices in CCG	3.4%	0.69%
108	England	<5 Practices in CCG	3.3%	1.71%
110	England	<5 Practices in CCG	3.2%	1.07%
111	England	>=5 Practices in CCG	5.5%	1.43%
112	England	<5 Practices in CCG	5.6%	0.59%
113	England	<5 Practices in CCG	3.4%	6.27%
114	England	<5 Practices in CCG	6.8%	0.89%
115	England	>=5 Practices in CCG	5.3%	1.31%
116	England	>=5 Practices in CCG	2.6%	1.55%
117	England	>=5 Practices in CCG	4.4%	0.89%
118	England	<5 Practices in CCG	3.7%	0.62%
119	England	<5 Practices in CCG	6.2%	5.00%
120	England	<5 Practices in CCG	4.4%	1.28%
121	England	>=5 Practices in CCG	3.7%	0.90%
122	England	<5 Practices in CCG	0.7%	0.36%
123	England	>=5 Practices in CCG	4.2%	1.90%
124	England	<5 Practices in CCG	2.6%	1.21%
125	England	>=5 Practices in CCG	5.6%	1.20%

*Uncoded CKD: two GFR measures < 60 over a period of at least 3 months

Appendix A. Codes used to identify patients as having opted out of the Audit

The presence of the following "Opt-out" codes was taken to indicate that the patient had opted out of providing data to the audit unless there was a later "Opt-in" code

93C1	Refused consent for upload to local shared electronic record
93C3	Refused consent for upload to national shar electronic rec
9M1	Informed dissent for national audit
9M10	Informed dissent for diabetes national audit
9NdH	Declined consent to share pt data with specified 3rd party
9NdJ	Consent withdrawn to share pt data with specified 3rd party
9Ndo	Express dissent for Summary Care Record dataset upload
9Nu0	Dissent from secondary use of GP patient identifiable data
9Nu4	Dissent from disclosure of personal confidential data HSCIC

The presence of the following code subsequent to an "Opt-out" code cancelled the opted out status of that patient.

9M0	Informed consent for national audit

Appendix B. Codes indicating patient is at risk of CKD

G2	Hypertensive disease
G20	Essential hypertension
G200	Malignant essential hypertension
G201	Benign essential hypertension
G202	Systolic hypertension
G203	Diastolic hypertension
G20z	Essential hypertension NOS
G24	Secondary hypertension
G240	Secondary malignant hypertension
G240z	Secondary malignant hypertension NOS
G241	Secondary benign hypertension
G241z	Secondary benign hypertension NOS
G244	Hypertension secondary to endocrine disorders
G24z	Secondary hypertension NOS
G24z0	Secondary renovascular hypertension NOS
G24zz	Secondary hypertension NOS
G25	Stage 1 hypertension (NICE - Nat Ins for Hth Clin Excl 2011)
G250	Stage 1 hyperten (NICE 2011) without evidnce end organ damge
G251	Stage 1 hyperten (NICE 2011) with evidnce end organ damge
G26	Severe hypertension (Nat Inst for Health Clinical Ex 2011)
G28	Stage 2 hypertension (NICE - Nat Ins for Hth Clin Excl 2011)
G2y	Other specified hypertensive disease
G2z	Hypertensive disease NOS
Gyu2	[X]Hypertensive diseases

Gyu20	[X]Other secondary hypertension
C10	Diabetes mellitus
C109J	Insulin treated Type 2 diabetes mellitus
C109K	Hyperosmolar non-ketotic state in type 2 diabetes mellitus
C10C	Diabetes mellitus autosomal dominant
C10D	Diabetes mellitus autosomal dominant type 2
C10E	Type 1 diabetes mellitus
C10E0	Type 1 diabetes mellitus with renal complications
C10E1	Type 1 diabetes mellitus with ophthalmic complications
C10E2	Type 1 diabetes mellitus with neurological complications
C10E3	Type 1 diabetes mellitus with multiple complications
C10E4	Unstable type 1 diabetes mellitus
C10E5	Type 1 diabetes mellitus with ulcer
C10E6	Type 1 diabetes mellitus with gangrene
C10E7	Type 1 diabetes mellitus with retinopathy
C10E8	Type 1 diabetes mellitus - poor control
C10E9	Type 1 diabetes mellitus maturity onset
C10EA	Type 1 diabetes mellitus without complication
C10EB	Type 1 diabetes mellitus with mononeuropathy
C10EC	Type 1 diabetes mellitus with polyneuropathy
C10ED	Type 1 diabetes mellitus with nephropathy
C10EE	Type 1 diabetes mellitus with hypoglycaemic coma
C10EF	Type 1 diabetes mellitus with diabetic cataract
C10EG	Type 1 diabetes mellitus with peripheral angiopathy
C10EH	Type 1 diabetes mellitus with arthropathy
C10EJ	Type 1 diabetes mellitus with neuropathic arthropathy
C10EK	Type 1 diabetes mellitus with persistent proteinuria
C10EL	Type 1 diabetes mellitus with persistent microalbuminuria
C10EM	Type 1 diabetes mellitus with ketoacidosis
C10EN	Type 1 diabetes mellitus with ketoacidotic coma
C10EP	Type 1 diabetes mellitus with exudative maculopathy
C10EQ	Type 1 diabetes mellitus with gastroparesis
C10ER	Latent autoimmune diabetes mellitus in adult
C10F	Type 2 diabetes mellitus
C10F0	Type 2 diabetes mellitus with renal complications
C10F1	Type 2 diabetes mellitus with ophthalmic complications
C10F2	Type 2 diabetes mellitus with neurological complications
C10F3	Type 2 diabetes mellitus with multiple complications
C10F4	Type 2 diabetes mellitus with ulcer
C10F5	Type 2 diabetes mellitus with gangrene
C10F6	Type 2 diabetes mellitus with retinopathy
C10F7	Type 2 diabetes mellitus - poor control
C10F9	Type 2 diabetes mellitus without complication
C10FA	Type 2 diabetes mellitus with mononeuropathy
C10FB	Type 2 diabetes mellitus with polyneuropathy
C10FC	Type 2 diabetes mellitus with nephropathy
C10FD	Type 2 diabetes mellitus with hypoglycaemic coma
C10FE	Type 2 diabetes mellitus with diabetic cataract
C10FF	Type 2 diabetes mellitus with peripheral angiopathy
C10FG	Type 2 diabetes mellitus with arthropathy
C10FH	Type 2 diabetes mellitus with neuropathic arthropathy

C10FJ	Insulin treated Type 2 diabetes mellitus
C10FK	Hyperosmolar non-ketotic state in type 2 diabetes mellitus
C10FL	Type 2 diabetes mellitus with persistent proteinuria
C10FM	Type 2 diabetes mellitus with persistent microalbuminuria
C10FN	Type 2 diabetes mellitus with ketoacidosis
C10FP	Type 2 diabetes mellitus with ketoacidotic coma
C10FQ	Type 2 diabetes mellitus with exudative maculopathy
C10FR	Type 2 diabetes mellitus with gastroparesis
C10FS	Maternally inherited diabetes mellitus
C10G	Secondary pancreatic diabetes mellitus
C10G0	Secondary pancreatic diabetes mellitus without complication
C10H	Diabetes mellitus induced by non-steroid drugs
C10H0	DM induced by non-steroid drugs without complication
C10M	Lipoatrophic diabetes mellitus
C10M0	Lipoatrophic diabetes mellitus without complication
C10N	Secondary diabetes mellitus
C10N0	Secondary diabetes mellitus without complication
C10N1	Cystic fibrosis related diabetes mellitus
PKyP	Diab insipidus,diab mell,optic atrophy and deafness
Fyu55	[X]Other transnt cerebral ischaemic attacks+related syndroms
G3	Ischaemic heart disease
G30	Acute myocardial infarction
G300	Acute anterolateral infarction
G301	Other specified anterior myocardial infarction
G3010	Acute anteroapical infarction
G3011	Acute anteroseptal infarction
G301z	Anterior myocardial infarction NOS
G302	Acute inferolateral infarction
G303	Acute inferoposterior infarction
G304	Posterior myocardial infarction NOS
G305	Lateral myocardial infarction NOS
G306	True posterior myocardial infarction
G307	Acute subendocardial infarction
G3070	Acute non-Q wave infarction
G3071	Acute non-ST segment elevation myocardial infarction
G308	Inferior myocardial infarction NOS
G309	Acute Q-wave infarct
G30B	Acute posterolateral myocardial infarction
G30X	Acute transmural myocardial infarction of unspecif site
G30X0	Acute ST segment elevation myocardial infarction
G30y	Other acute myocardial infarction
G30y0	Acute atrial infarction
G30y1	Acute papillary muscle infarction
G30y2	Acute septal infarction
G30yz	Other acute myocardial infarction NOS
G30z	Acute myocardial infarction NOS
G31	Other acute and subacute ischaemic heart disease
G311	Preinfarction syndrome
G3110	Myocardial infarction aborted
G3111	Unstable angina
G3112	Angina at rest
G3113	Refractory angina
G3114	Worsening angina
G3115	Acute coronary syndrome
G311z	Preinfarction syndrome NOS

G312	Coronary thrombosis not resulting in myocardial infarction
G31y	Other acute and subacute ischaemic heart disease
G31y0	Acute coronary insufficiency
G31y1	Microinfarction of heart
G31y2	Subendocardial ischaemia
G31y3	Transient myocardial ischaemia
G31yz	Other acute and subacute ischaemic heart disease NOS
G32	Old myocardial infarction
G33	Angina pectoris
G330	Angina decubitus
G3300	Nocturnal angina
G330z	Angina decubitus NOS
G33z	Angina pectoris NOS
G33z0	Status anginosus
G33z1	Stenocardia
G33z2	Syncope anginosa
G33z3	Angina on effort
G33z4	Ischaemic chest pain
G33z5	Post infarct angina
G33z6	New onset angina
G33z7	Stable angina
G33zz	Angina pectoris NOS
G34	Other chronic ischaemic heart disease
G340	Coronary atherosclerosis
G3400	Single coronary vessel disease
G3401	Double coronary vessel disease
G342	Atherosclerotic cardiovascular disease
G343	Ischaemic cardiomyopathy
G344	Silent myocardial ischaemia
G34y	Other specified chronic ischaemic heart disease
G34y0	Chronic coronary insufficiency
G34y1	Chronic myocardial ischaemia
G34yz	Other specified chronic ischaemic heart disease NOS
G34z	Other chronic ischaemic heart disease NOS
G34z0	Asymptomatic coronary heart disease
G35	Subsequent myocardial infarction
G350	Subsequent myocardial infarction of anterior wall
G351	Subsequent myocardial infarction of inferior wall
G353	Subsequent myocardial infarction of other sites
G35X	Subsequent myocardial infarction of unspecified site
G38	Postoperative myocardial infarction
G380	Postoperative transmural myocardial infarction anterior wall
G381	Postoperative transmural myocardial infarction inferior wall
G382	Postoperative transmural myocardial infarction other sites
G383	Postoperative transmural myocardial infarction unspec site
G384	Postoperative subendocardial myocardial infarction
G38z	Postoperative myocardial infarction, unspecified
G39	Coronary microvascular disease
G3y	Other specified ischaemic heart disease
G3z	Ischaemic heart disease NOS
G61	Intracerebral haemorrhage
G610	Cortical haemorrhage
G611	Internal capsule haemorrhage
G612	Basal nucleus haemorrhage
G613	Cerebellar haemorrhage

G614	Pontine haemorrhage
G615	Bulbar haemorrhage
G616	External capsule haemorrhage
G618	Intracerebral haemorrhage, multiple localized
G619	Lobar cerebral haemorrhage
G61X	Intracerebral haemorrhage in hemisphere, unspecified
G61X0	Left sided intracerebral haemorrhage, unspecified
G61X1	Right sided intracerebral haemorrhage, unspecified
G61z	Intracerebral haemorrhage NOS
G63y0	Cerebral infarct due to thrombosis of precerebral arteries
G63y1	Cerebral infarction due to embolism of precerebral arteries
G64	Cerebral arterial occlusion
G640	Cerebral thrombosis
G6400	Cerebral infarction due to thrombosis of cerebral arteries
G641	Cerebral embolism
G6410	Cerebral infarction due to embolism of cerebral arteries
G64z	Cerebral infarction NOS
G64z0	Brainstem infarction
G64z1	Wallenberg syndrome
G64z2	Left sided cerebral infarction
G64z3	Right sided cerebral infarction
G64z4	Infarction of basal ganglia
G65	Transient cerebral ischaemia
G650	Basilar artery syndrome
G651	Vertebral artery syndrome
G6510	Vertebro-basilar artery syndrome
G652	Subclavian steal syndrome
G653	Carotid artery syndrome hemispheric
G654	Multiple and bilateral precerebral artery syndromes
G656	Vertebrobasilar insufficiency
G657	Carotid territory transient ischaemic attack
G65y	Other transient cerebral ischaemia
G65z	Transient cerebral ischaemia NOS
G65z0	Impending cerebral ischaemia
G65z1	Intermittent cerebral ischaemia
G65zz	Transient cerebral ischaemia NOS
G66	Stroke and cerebrovascular accident unspecified
G660	Middle cerebral artery syndrome
G661	Anterior cerebral artery syndrome
G662	Posterior cerebral artery syndrome
G663	Brain stem stroke syndrome
G664	Cerebellar stroke syndrome
G665	Pure motor lacunar syndrome
G666	Pure sensory lacunar syndrome
G667	Left sided CVA
G668	Right sided CVA
G6760	Cereb infarct due cerebral venous thrombosis, nonpyogenic
G6W	Cereb infarct due unsp occlus/stenos precerebr arteries
G6X	Cerebrl infarctn due/unspcf occlusn or sten/ cerebrl artrs
G73	Other peripheral vascular disease
G734	Peripheral arterial disease
G73y	Other specified peripheral vascular disease
G73z	Peripheral vascular disease NOS
G73z0	Intermittent claudication
G73zz	Peripheral vascular disease NOS

Gyu3	[X]Ischaemic heart diseases
Gyu30	[X]Other forms of angina pectoris
Gyu32	[X]Other forms of acute ischaemic heart disease
Gyu33	[X]Other forms of chronic ischaemic heart disease
Gyu34	[X]Acute transmural myocardial infarction of unspecif site
Gyu35	[X]Subsequent myocardial infarction of other sites
Gyu36	[X]Subsequent myocardial infarction of unspecified site
Gyu62	[X]Other intracerebral haemorrhage
Gyu63	[X]Cerebrl infarctn due/unspcf occlusn or sten/ cerebrl artrs
Gyu64	[X]Other cerebral infarction
Gyu65	[X]Occlusion and stenosis of other precerebral arteries
Gyu66	[X]Occlusion and stenosis of other cerebral arteries
Gyu6F	[X]Intracerebral haemorrhage in hemisphere, unspecified
Gyu6G	[X]Cereb infarct due unsp occlus/stenos precerebr arteries
Gyu74	[X]Other specified peripheral vascular diseases
ZV12D	[V]Personal history of transient ischaemic attack
4G4	O/E: renal calculus
4G41	O/E: oxalate renal calculus
4G42	O/E: phosphate -staghorn-stone
4G43	O/E: uric acid renal calculus
4G44	O/E: cystine renal calculus
4G4Z	O/E: renal stone NOS
C3411	Uric acid nephrolithiasis
K12	Calculus of kidney and ureter
K120	Calculus of kidney
K1200	Staghorn calculus
K120z	Renal calculus NOS
K122	Calculus of kidney with calculus of ureter
PD31	Congenital calculus of kidney
K20	Benign prostatic hypertrophy
K200	Prostatic hyperplasia unspecified
K201	Prostatic hyperplasia of the lateral lobe
K202	Prostatic hyperplasia of the medial lobe
K20z	Prostatic hyperplasia NOS
C34	Gout
C340	Gouty arthropathy
C341	Gouty nephropathy
C3410	Gouty nephropathy unspecified
C341z	Gouty nephropathy NOS
C342	Idiopathic gout
C343	Lead-induced gout
C344	Drug-induced gout
C345	Gout due to impairment of renal function
C346	Acute exacerbation of gout
C34y	Other specified gouty manifestation
C34y0	Gouty tophi of ear
C34y1	Gouty tophi of heart
C34y2	Gouty tophi of other sites
C34y3	Gouty iritis
C34y4	Gouty neuritis
C34y5	Gouty tophi of hand
C34y6	Gouty tophi of toe
C34yz	Other specified gouty manifestation NOS
C34z	Gout NOS
N00	Diffuse diseases of connective tissue
N000	Systemic lupus erythematosus
N0000	Disseminated lupus erythematosus
N0001	Libman-Sacks disease

N0002	Drug-induced systemic lupus erythematosus
N0003	Systemic lupus erythematosus with organ or sys involv
N0004	Systemic lupus erythematosus with pericarditis
N0005	Neonatal lupus erythematosus
N0006	Cerebral lupus
N000z	Systemic lupus erythematosus NOS
N001	Scleroderma
N0010	Progressive systemic sclerosis
N0011	CREST syndrome
N0012	Systemic sclerosis induced by drugs and chemicals
N002	Sicca (Sjogren's) syndrome
N003	Dermatomyositis
N0030	Juvenile dermatomyositis
N0031	Dermatopolymyositis in neoplastic disease
N003X	Dermatopolymyositis, unspecified
N004	Polymyositis
N005	Adult Still's Disease
N006	Antiphospholipid syndrome
N00y	Other specified diffuse collagen diseases
N00y0	Eosinophilic fasciitis
N00y1	Fibrosclerosis systemic
N00z	Collagen disease NOS
Nyu4	[X]Systemic connective tissue disorders
Nyu40	[X]Other conditions related to polyarteritis nodosa
Nyu41	[X]Other giant cell arteritis
Nyu42	[X]Other specified necrotizing vasculopathies
Nyu43	[X]Other forms of systemic lupus erythematosus
Nyu44	[X]Other dermatomyositis
Nyu45	[X]Other forms of systemic sclerosis
Nyu46	[X]Other overlap syndromes
Nyu47	[X]Other systemic diseases of connective tissue
Nyu48	[X]Dermato(poly)myositis in neoplastic disease CE
Nyu4C	[X]Systemic disorders/connective tissue in other diseases CE
Nyu4D	[X]Necrotising vasculopathy, unspecified
Nyu4E	[X]Dermatopolymyositis, unspecified
Nyu4F	[X]Mixed connective tissue disease
d6	LITHIUM SALTS
d61	LITHIUM CARBONATE
d611	CAMCOLIT 250mg tablets
d612	CAMCOLIT 400mg tablets
d613	LISKONUM 450mg m/r tablets
d614	PHASAL 300mg m/r tablets
d615	PRIADEL 400mg m/r tablets
d616	PRIADEL 200mg m/r tablets
d617	PRIADEL 520mg/5mL sugar free liquid
d618	LITHIUM CARBONATE 520mg/5mL sugar free liquid
d619	LITHONATE 400mg m/r tablets
d61s	LITHIUM CARBONATE 200mg m/r tablets
d61v	LITHIUM CARBONATE 250mg tablets
d61w	LITHIUM CARBONATE 400mg tablets
d61x	LITHIUM CARBONATE 450mg m/r tablets
d61y	LITHIUM CARBONATE 300mg m/r tablets
d61z	LITHIUM CARBONATE 400mg m/r tablets
d62	LITHIUM CITRATE
d621	LITAREX 564mg m/r tablets
d622	LI-LIQUID 5.4mmol/5mL liquid
d623	LI-LIQUID 10.8mmol/5mL liquid
d624	PRIADEL 520mg/5mL sugar free liquid 150mL
d625	PRIADEL 520mg/5mL sugar free liquid

d62w	LITHIUM CITRATE 520mg/5mL sugar free liquid
d62x	LITHIUM CITRATE 5.4mmol/5mL liquid
d62y	LITHIUM CITRATE 10.8mmol/5mL liquid
d62z	LITHIUM CITRATE 564mg m/r tablets
h82	CICLOSPORIN
h821	SANDIMMUN 100mg/mL sugar free oral solution
h822	SANDIMMUN 50mg/1mL injection
h823	SANDIMMUN 250mg/5mL injection
h824	SANDIMMUN 25mg capsules
h825	SANDIMMUN 100mg capsules
h826	CICLOSPORIN 25mg capsules
h827	CICLOSPORIN 100mg capsules
h828	SANDIMMUN 50mg capsules
h829	CICLOSPORIN 50mg capsules
h82A	NEORAL 25mg capsules
h82B	NEORAL 50mg capsules
h82C	NEORAL 100mg capsules
h82D	NEORAL 100mg/mL sugar free oral solution
h82E	CICLOSPORIN 10mg capsules
h82F	NEORAL 10mg capsules
h82G	SANGCYA 100mg/mL oral solution
h82H	DEXIMUNE 25mg capsules
h82I	DEXIMUNE 50mg capsules
h82J	DEXIMUNE 100mg capsules
h82K	CAPIMUNE 25mg capsules
h82L	CAPIMUNE 50mg capsules
h82M	CAPIMUNE 100mg capsules
h82N	CAPSORIN 25mg capsules
h82O	CAPSORIN 50mg capsules
h82P	CAPSORIN 100mg capsules
h82Q	IKERVIS 1mg/mL single-use eye drops 0.3mL
h82w	CICLOSPORIN 1mg/mL single-use eye drops
h82x	CICLOSPORIN 100mg/mL sugar free oral solution
h82y	CICLOSPORIN 50mg/1mL injection
h82z	CICLOSPORIN 250mg/5mL injection
h83	TACROLIMUS
h831	TACROLIMUS 1mg capsules
h832	TACROLIMUS 5mg capsules
h833	TACROLIMUS 5mg/1mL intravenous infusion concentrate
h834	PROGRAF 1mg capsules
h835	PROGRAF 5mg capsules
h836	PROGRAF 5mg/1mL intravenous infusion concentrate
h837	PROGRAF 0.5mg capsules
h838	ADVAGRAF 0.5mg m/r capsules
h839	ADVAGRAF 1mg m/r capsules
h83A	ADVAGRAF 5mg m/r capsules
h83B	ADVAGRAF 3mg m/r capsules
h83C	MODIGRAF 200micrograms/sachet granules for oral suspension
h83D	MODIGRAF 1mg/sachet granules for oral suspension
h83E	ADOPORT 500micrograms capsules
h83F	ADOPORT 1mg capsules
h83G	ADOPORT 5mg capsules
h83H	VIVADEX 500micrograms capsules
h83I	VIVADEX 1mg capsules
h83J	VIVADEX 5mg capsules
h83K	CAPEXION 500micrograms capsules
h83L	CAPEXION 1mg capsules
h83M	CAPEXION 5mg capsules
h83N	PERIXIS 500micrograms capsules

h83O	PERIXIS 1mg capsules
h83P	PERIXIS 5mg capsules
h83Q	ENVARSUS 750micrograms m/r tablets
h83R	ENVARSUS 1mg m/r tablets
h83S	ENVARSUS 4mg m/r tablets
h83T	ADOPORT 0.75mg capsules
h83U	ADOPORT 2mg capsules
h83o	TACROLIMUS 2mg capsules
h83p	TACROLIMUS 750micrograms capsules
h83q	TACROLIMUS 4mg m/r tablets
h83r	TACROLIMUS 1mg m/r tablets
h83s	TACROLIMUS 750micrograms m/r tablets
h83t	TACROLIMUS 1mg/sachet granules for oral suspension
h83u	TACROLIMUS 200micrograms/sachet granules for oral suspension
h83v	TACROLIMUS 3mg m/r capsules
h83w	TACROLIMUS 5mg m/r capsules
h83x	TACROLIMUS 1mg m/r capsules
h83y	TACROLIMUS 500microgram m/r capsules
h83z	TACROLIMUS 0.5mg capsules
K04	Acute renal failure
K040	Acute renal tubular necrosis
K041	Acute renal cortical necrosis
K042	Acute renal medullary necrosis
K043	Acute drug-induced renal failure
K0430	Acute renal failure due to ACE inhibitor
K0431	Acute renal failure induced by aminoglycoside
K0432	Acute renal failure induced by cisplatin
K0433	Acute renal failure induced by cyclosporin A
K0434	Acute renal failure induced by non-steroid anti-inflamm drug
K044	Acute renal failure due to urinary obstruction
K045	Acute renal failure due to non-traumatic rhabdomyolysis
K046	Acute renal failure induced by toxin
K0460	Acute renal failure induced by animal toxin
K0461	Acute renal failure induced by plant toxin
K047	Acute renal failure induced by heavy metal
K048	Acute renal failure induced by poison
K049	Acute renal failure induced by radiographic contrast media
K04A	Acute renal failure induced by solvent
K04B	Acute renal failure due to traumatic rhabdomyolysis
K04C	Acute kidney injury stage 1
K04D	Acute kidney injury stage 2
K04E	Acute kidney injury stage 3
K04y	Other acute renal failure
K04z	Acute renal failure NOS

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