Findings from the deployment of the IMPAKT™ chronic kidney disease audit tool in primary care practices in Greater Manchester and Eastern Cheshire

A National Institute for Health Research Collaboration for Leadership in Applied Health Research and Care (NIHR CLAHRC) Greater Manchester report

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1. Executive summary

The key findings of this report are:

- **Significant gaps remain between the number of recorded and estimated cases of CKD stages 3-5 in Greater Manchester**
- **Considerable numbers of patients coded with CKD may have insufficient evidence to support their diagnosis**
- **Substantial numbers of patients with CKD were not managed to NICE guidelines (i.e. did not have a test for proteinuria or blood pressure result recorded in the preceding 12 months)**
- **Suboptimal management of CKD has implications for the risk of developing or exacerbating other cardiovascular diseases given the prevalence of comorbidities in this patient population.**

Opportunities for improvement:

- **Diagnosing the significant number of patients that have CKD and remain undetected in primary care**
- **Improving the quality and accuracy of proteinuria diagnosis and pro-active management of the risk this represents to patients with CKD**
- **Controlling blood pressure for more patients diagnosed with CKD to reduce the risk of adverse events through progressive CKD or comorbidities.**

The IMPAKT™ chronic kidney disease (CKD) audit tool was deployed over six months (June – December 2015) across Greater Manchester and Eastern Cheshire (abbreviated to GM for this report) to extract data about the current status of identification and care of CKD patients on general practice registers.

- 312 audits were completed from a potential pool of 517 primary care practices – a 60% coverage rate, equivalent to 63% of the GM population over 18 years of age (18+)
- In these 312 practices, a mean average recorded CKD prevalence of 3.64% was reported for patients with CKD stages 3-5
- A prevalence modelling tool (within IMPAKT™) generated an estimated CKD prevalence in each practice based on age/sex profile data of all registered patients 18+. This was collated to calculate a mean average estimated prevalence per CCG. The average for GM as a whole was 6.62%, showing a 'gap' of 2.98 percentage points between these estimates and the currently recorded prevalence

- The average prevalence estimates from the audits were then extrapolated across each CCG based on the total recorded population from Quality and Outcomes Framework (QOF) data from 2014/15 in order to calculate the number of patients who might be expected to have CKD across GM
- The extrapolated data indicates an estimated 164,748 patients with CKD across GM, of which, 67,767 (41%) are potentially undiagnosed. However, readers should be mindful that the 2014 updates to NICE guidelines for CKD identification and care may result in slightly fewer diagnoses of CKD than the estimate suggests, particularly in lower-risk or borderline cases
- The audit also highlighted that a significant number of patients already identified and coded as having CKD by practices had inaccuracies pertaining to their diagnosis. These errors are typically caused by insufficient clinical evidence to support the diagnosis, coding errors, failure to follow guidelines for diagnosis, or fluctuations in eGFR function
- 9,947 patients were found in the 312 practices audited whose records showed that they could be diagnosed immediately with CKD, but were currently not coded with the disease. Across all 517 practices, an extrapolation of this evidence would indicate 16,483 uncoded patients could be diagnosed immediately
- Furthermore, from our sample of 312 practices there were 25,966 patients who warranted further investigation for CKD based on previous low eGFR readings. Across the whole of GM this equates to 43,027 patients
- The data reported that in the sample of 312 audited practices between 12,951 - 17,113 (23 - 31%), of patients with CKD stages 3 to 5, did not have a test for proteinuria recorded in the preceding 12 months as recommended by NICE CKD guidelines (and until April 2015 one of the QOF indicators for CKD care)
- In the 312 audited practices - of those CKD patients with a recorded proteinuria status, 2,667 - 2,952 (7%) did not have a recorded blood pressure reading in the previous 12 months. If we extrapolate this data to include proteinuria testing, then between 15,903 - 19,780 (28 - 35%) of recorded cases of CKD stages 3-5 did not have a measurement of proteinuria status and/or blood pressure recorded in the 12 months preceding the audit
- Of those patients with a recorded proteinuria test and status, and blood pressure reading in the previous 12 months, blood pressure was controlled to NICE 2008 CKD guideline recommendations in 29% of patients with known proteinuria, and 65% of patients with CKD and no proteinuria.

Opportunities exist to support primary care practices to improve identification and care of CKD patients, a patient population at higher risk of further complications. The findings of the earlier consultation exercise indicate that potentially targeting areas where there is an appetite and need for such a project may be the most suitable approach.

- Whilst the IMPAKT™ software has not yet been updated in line with the 2014 NICE CKD guidelines and would require it to support any future work, this is not a significant risk at present since most practices do not yet appear to be operating to these guidelines
- Support could also be used to promote the local implementation of aspects of the updated guidelines to make take-up easier for practices. For example, the commissioning of CystatinC

tests to exclude some low-risk cases; and laboratory reporting of eGFR using the CKD-EPI formula. These two factors would support a more accurate diagnosis process.

2. Introduction

2.1. Aim of the project

To provide comprehensive quantitative data on the status of primary care identification and management of chronic kidney disease (CKD), and to enrich the findings from two aligned pieces of work. These are:

1) An analysis of priorities for kidney health as outlined by strategic plans published by CCGs in Greater Manchester and NHS Eastern Cheshire (from here abbreviated to GM), reported in February 2015.

   CCGs priorities for kidney health: http://bit.ly/khpriorities

2) A consultation exercise of 45 interviews engaging key stakeholders with an interest in long-term condition (LTC) management in primary care across GM. These qualitative interviews were to establish contemporaneous opinions on local priorities for kidney health, other priorities, drivers for priorities, and consistencies with published plans. This was reported in July 2015.

   Executive summary: http://bit.ly/ahsnsummary
   Full report: http://bit.ly/ahsnreport

The three reports complete work that informs future interventions that CLAHRC GM and GM AHSN will offer to local settings by catering for expressed priorities, need and opportunities. The project has primarily provided this information for kidney health, but its nature has also provided data about other related areas of care.

2.2. Background

The deployment of IMPAKT™ was used to assess the current status of CKD on primary care practice registers in GM. This would provide evidence on:

- Current numbers of patients recorded with CKD, stratified into stages of severity
- The number of recorded cases where coding inaccuracies are recognised by IMPAKT™. This could either be that patients have been diagnosed without sufficient clinical evidence; false positives; or coded at a CKD stage that does not match the disease severity according to latest eGFR data
- Estimated figures of the number of patients with CKD that remain undiagnosed based on extrapolation of demographic data
- The number of patients within sample practices who have clinical evidence for an immediate diagnosis of CKD but remain uncoded
- The number of patients within sample practices who have clinical evidence from previous blood samples to support further investigation for possible CKD
- The number of diagnosed CKD patients with risk factors for progressive CKD
- The number of patients tested for proteinuria – a key indicator of progressive CKD and risk of cardiovascular events
- The number of patients with clinically significant proteinuria (based on 2008 NICE CKD guidelines)

- Data on blood pressure control for the CKD population.

The reported data provides added value because:

- Three CKD indicators were removed from the QOF contract in April 2015. Therefore, the only nationally mandated recorded data in primary care practices for CKD is the number of patients on registers (see Table 1) and without the use of custom-built searches it is not possible to gain this level of detail about how CKD is being managed within general practice.
- The data reported by IMPAKT™ maps against evidence-based recommendations provided in NICE guidelines developed for the identification and care of CKD.

Previous indicator code	New indicator code	Indicator wording	Changes
CKD001	CKD005	The contractor establishes and maintains a register of patients aged 18 or over with CKD (US National Kidney Foundation) stage 3 to 5	Wording change
CKD002	-	The percentage of patients on the CKD register in whom the last blood pressure reading (measured in the preceding 12 months) is 140/85 mmHg or less	Retired
CKD003	-	The percentage of patients on the CKD register with hypertension and proteinuria who are currently treated with an ACE-I or ARB	Retired
CKD004	-	The percentage of patients on the CKD register whose notes have a record of a urine albumin:creatinine ratio (or protein:creatinine ratio) test in the preceding 12 months	Retired

Table 1: List of CKD indicator changes for QOF 2015/16

2.3. What is IMPAKT™ and what does it do?

IMproving Patient Awareness of Kidney disease progression Together (IMPAKT™) is a toolkit comprising a bespoke CKD audit tool designed for primary care practices, an accompanying Improvement Guide, and other supporting resources available through the website (www.impakt.org.uk). This allows users to perform an audit at a practice and make a variety of improvements to CKD identification and management, based on evidence-based care recommendations.

The audit tool works by running a series of MIQUEST queries on a practice system and saving the results in an Excel spreadsheet at the practice. The accompanying Improvement Guide describes how to implement changes from the recommendations.

It is important to note that the IMPAKT™ tool was initially designed by CLAHRC Leicestershire, Northamptonshire and Rutland (CLAHRC LNR) to support a specific CKD study within their footprint (described here) and adapted in collaboration with CLAHRC GM since 2011 to support the implementation of a programme of quality improvement style CKD projects in Greater Manchester. Therefore, it wasn't designed explicitly for an audit-style deployment.

For this project, the approach described below left a set of audit results on clinical systems for each practice alongside the Improvement Guide. Practices had the opportunity to use this information to complete CKD-based improvement work independently, but this was not expected of them and the provision of facilitation to support this sat outside the scope of this project. Any improvement work completed by practices would not be assessed.

2.4. Approach

North-West Commissioning Support Unit (NWCSU) was contracted to contact every practice in each of the 13 constituent CCGs across GM, and request permission to install IMPAKT™ remotely once access had been negotiated with a lead in each corresponding CCG. This was to be delivered over a six month period ending on 7th December, 2015.

In May 2015 lead contacts in each CCG (generated by engagement during the consultation exercise) were emailed by CLAHRC GM to begin the deployment process. The assigned team members from NWCSU then followed-up initial correspondence to negotiate permission to contact practices within each CCG.

Approvals were ultimately granted by all 13 CCGs, however receipt of this ranged from May – October, 2015. When consent for contact had been granted, NWCSU sent invitations to participate to each practice. Contact was followed-up regularly to encourage practices to respond to the request. In the final 2-3 months of the roll-out, NWCSU began to follow-up emails with telephone calls to practices where they had not received a response. Furthermore, team members from NWCSU were asked to target areas where they had an established relationship, to positively influence take-up.

A small, anonymised XML file with practice-level CKD data was exported from each participating practice by NWCSU and forwarded to CLAHRC GM to create this report.

2.5. Audit participation

There were 517 primary care practices in GM at the time this project was delivered.

- Audits were completed in 312 (60%) practices
- 114 (22%) practices refused the request to permit access to run IMPAKT™
- 81 (16%) practices did not respond to any communication. These sites were all telephoned to follow-up email correspondence, but did not respond to repeated contact/messages
- 10 (2%) practices granted permission to run IMPAKT™ but encountered technical issues that prevented it working. These issues were normally related to practice servers causing the tool to run too slowly to complete the queries within working hours.

Of the 114 practices that refused access to install IMPAKT™, we asked NWCSU to debrief us on what reasons they'd given for their decision. Most commonly, these were:

- Shortage of time available to participate
- Lack of interest in the topic or not a priority for them

It was noted that they were practices that generally refused to engage with external requests.

Engagement in the roll-out was swifter and more easily negotiated in areas where there are on-going pieces of kidney health work and existing contacts from previous CLAHRC GM projects.

CLAHRC GM was advised by lead contacts from some of the CCGs that they could not mandate that their member practices grant access, so approval has primarily been granted at a practice level. Therefore, where practices opted-out of participation, this decision was not challenged.

3. Findings

Notes for readers on how the data in the below tables has been calculated

Tables 3.1.1 to 3.3 – No additional notes. Footnotes are provided to support interpretation of the data where required.

Table 3.4.1 – Undiagnosed cases of CKD stages 3-5 identified by IMPAKT™

As the findings are based on a deployment coverage of 60% of practices in GM, the data in table 3.4.1 has been extrapolated to replicate the findings in the remaining 40% of practices where audits were not completed.

Table 3.5 - Risk factors for progressive CKD (for those patients diagnosed with CKD)

Table 3.5 has been adjusted to demonstrate the presence of risk factors in only the proportion of audited patients known to have CKD stages 3-5 (90.3%) to avoid inclusion of very low-risk patients.

Tables:

- ***3.6.1 - Proteinuria testing***
- ***3.6.2 - Proteinuria coding***
- ***3.6.3 - Record of blood pressure test in previous 12 months***
- ***3.6.4 - Blood pressure control in previous 12 months***

To produce the data for these tables IMPAKT™ has performed the data analysis on CKD management for all patients with a CKD stage 1-5 or renal impairment code. Therefore we've performed adjustment calculations based on two scenarios for all of the four tables listed above.

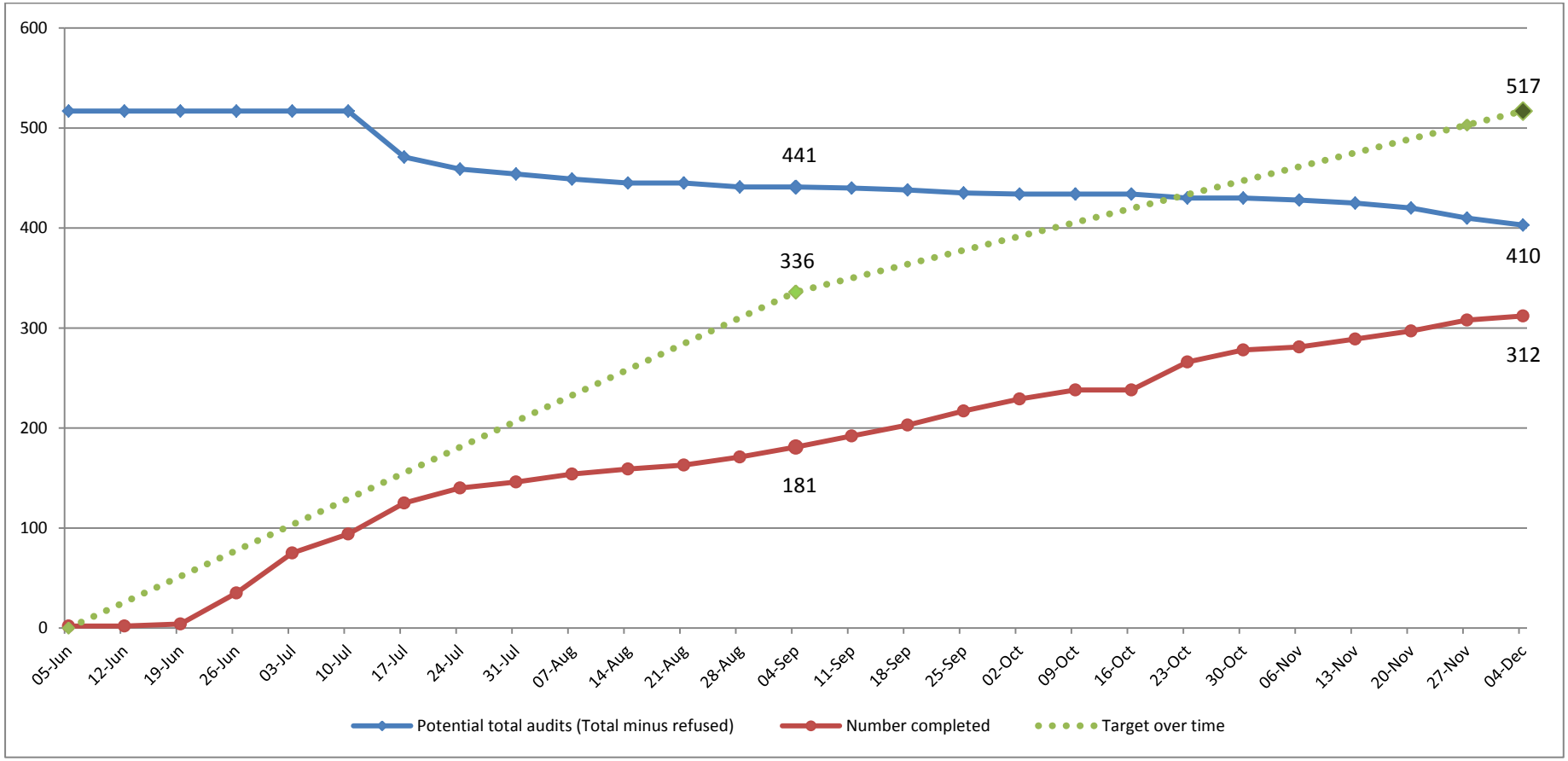
- Scenario 1 is likely to overestimate highlighted problems by assuming that all patients coded with CKD stages 1-5 are managed in the same way regardless of disease severity – and the total figure is adjusted down to 90.3% of the total CKD population to cover the proportion of patients in the audited practices who were coded in CKD stages 3-5 in Table 3.2.1.
- Scenario 2 will underestimate the same issues by assuming that only patients in CKD stages 3-5 will be managed in line with NICE CKD guidelines 2008. The two scenarios have been provided as a minimum and maximum estimate of the status in each measure as the exact figures of how many of the analysed group are in stages 3-5 are not known.
- Tables 3.6.2 to 3.6.4 act as derivatives of the data in the table immediately prior to them. For example, patients who have not been tested for proteinuria in the 12 months preceding the audit (Table 3.6.1) are then not included in Table 3.6.2.

3.1. IMPAKT™ deployment

3.1.1. Practice response rates in each CCG

	Audited %	Opted out %	Not audited %	Technical issues %	Total %
CCG A	0.47	0.39	0.14	-	1.00
CCG B	0.64	0.06	0.12	0.18	1.00
CCG C	0.58	0.19	0.19	0.03	1.00
CCG D	0.45	0.45	0.09	-	1.00
CCG E	0.18	0.13	0.68	-	1.00
CCG F	1.00	-	-	-	1.00
CCG G	0.51	0.19	0.28	0.02	1.00
CCG H	1.00	-	-	-	1.00
CCG I	0.58	0.21	0.21	-	1.00
CCG J	0.35	0.65	-	-	1.00
CCG K	0.63	0.10	0.22	0.05	1.00
CCG L	0.71	0.24	0.06	-	1.00
CCG M	0.70	0.19	0.11	-	1.00
Total (practices)	**312**	**114**	**81**	**10**	**517**

3.1.2. Progress to overall target



- The green line indicates the target for roll-out progress in order to achieve 65% coverage by three months (5th September), and 100% by six months (7th December)
- The blue line indicates the remaining potential number of audits once those who have opted out of participation are subtracted from the total footprint
- The red line indicates completed audits.

3.2. Recorded and estimated CKD prevalence for GM population

3.2.1. Recorded practice data

	CKD 1		CKD 2		CKD 3		CKD 4		CKD 5		Sum CKD1 - 5	Sum CKD 3 - 5	All CKD stages and renal impairment codes[1]	Average prevalence (%) (CKD 3 - 5)	Practices audited %
	n	Prev (%)	n	Prev (%)	n	Prev (%)	n	Prev (%)	n	Prev (%)					
CCG A	35	0.04	488	0.65	5,111	4.64	263	0.28	19	0.02	5,916	5393	6,031	5.14	0.47
CCG B	45	0.04	400	0.30	4,542	3.70	229	0.20	42	0.04	5,258	4,813	5,387	3.90	0.64
CCG C	12	0.01	188	0.17	2,555	2.49	186	0.18	31	0.03	2,972	2,772	3,092	2.69	0.58
CCG D	6	0.01	43	0.05	3,516	4.50	146	0.19	20	0.03	3,731	3,682	3,810	4.71	0.45
CCG E	6	0.02	67	0.26	1,277	3.94	90	0.28	9	0.04	1,449	1,376	1,486	4.30	0.18
CCG F	12	0.01	329	0.24	4,363	2.70	328	0.21	52	0.04	5,084	4,743	5,226	2.98	1.00
CCG G	101	0.07	1,529	0.96	3,852	3.08	267	0.22	39	0.03	5,788	4,158	5,879	3.14	0.51
CCG H	99	0.06	1,048	0.57	6,093	3.04	351	0.20	36	0.02	7,627	6,480	7,809	3.31	1.00
CCG I	5	0.01	74	0.09	1,956	2.16	158	0.20	30	0.05	2,223	2,144	2,295	2.43	0.58
CCG J	4	0.01	83	0.10	2,156	2.85	122	0.17	13	0.02	2,378	2,291	2,460	3.03	0.35
CCG K	59	0.06	293	0.32	3,024	2.65	231	0.21	30	0.03	3,637	3,285	3,760	2.94	0.63
CCG L	205	0.16	249	0.21	4,903	3.64	281	0.20	40	0.03	5,678	5,224	5,790	3.90	0.71
CCG M	22	0.01	596	0.34	9,162	4.60	368	0.19	32	0.02	10,180	9,562	10,385	4.84	0.70
Totals / Average	**611**	**0.04**	**5,387**	**0.37**	**52,510**	**3.39**	**3,020**	**0.21**	**393**	**0.03**	61,921	**55,923**	**63,410**	**3.64**	**0.60**

- This table lists the total number of patients that IMPAKT™ has detected as recorded at each stage of CKD at practices in each CCG
- Where patients have been coded using the new Read codes for CKD based on the 2014 update to the NICE CKD guidelines they will not be detected by IMPAKT™. Please see the note about this in the *Limitations* section
- This provided the average recorded prevalence in each CCG.

[1] **All CKD stages and renal impairment codes –** This includes all patients coded by practices with CKD stages 1-5 and other codes indicating renal impairment. Analysis for CKD management has included all of this patient group (as this is what is reported by IMPAKT™) and adjusted proportionally for the number of cases recorded in stages 3-5 from the completed audits.

3.2.2. Estimated practice data from IMPAKT™

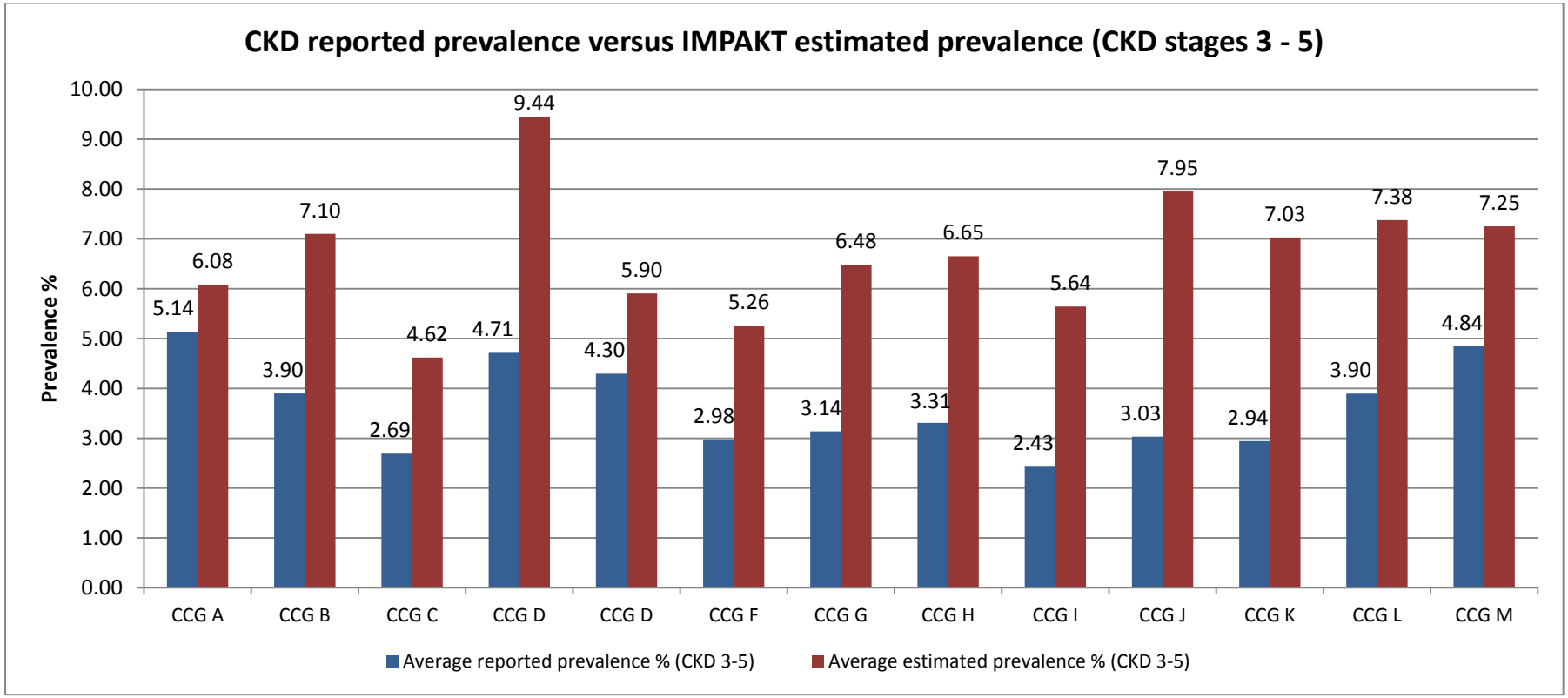
	CKD 3		CKD 4		CKD 5		Estimated sum CKD 3 - 5[2]	Average estimated prevalence % (CKD 3-5)[3]	Average prevalence gap (%) (CKD 3-5)[4]	Practices audited %
	n	Prev (%)	n	Prev (%)	n	Prev (%)				
CCG A	6,362	5.71	317	0.28	97	0.09	6,776	6.08	**0.95**	0.47
CCG B	8,100	6.67	399	0.33	118	0.10	8,616	7.10	**3.20**	0.64
CCG C	4,393	4.32	228	0.22	87	0.08	4,707	4.62	**1.93**	0.58
CCG D	7,151	8.87	368	0.46	93	0.11	7,611	9.44	**4.73**	0.45
CCG E	1,922	5.55	94	0.27	30	0.09	2,046	5.90	**1.61**	0.18
CCG F	7,566	4.92	381	0.25	134	0.09	8,081	5.26	**2.28**	1.00
CCG G	7,714	6.08	379	0.30	113	0.09	8,206	6.48	**3.34**	0.51
CCG H	11,914	6.23	604	0.33	188	0.09	12,706	6.65	**3.34**	1.00
CCG I	4,218	5.28	221	0.27	71	0.09	4,510	5.64	**3.22**	0.58
CCG J	5,643	7.47	290	0.38	79	0.10	6,012	7.95	**4.92**	0.35
CCG K	7,704	6.61	379	0.32	113	0.10	8,196	7.03	**4.09**	0.63
CCG L	9,483	6.92	486	0.36	138	0.10	10,106	7.38	**3.48**	0.71
CCG M	13,608	6.82	664	0.33	197	0.10	14,469	7.25	**2.41**	0.70
Totals / Average	**95,776**	**6.21**	**4,809**	**0.31**	**1,458**	**0.10**	**102,043**	**6.62**	**2.98**	**0.60**

[2] **Estimated sum CKD3 – CKD5 –** This is the estimated total number of CKD patients per CCG (diagnosed and undiagnosed) for the 312 audited practices based on modelling of their age/sex profiles at the time of audit.

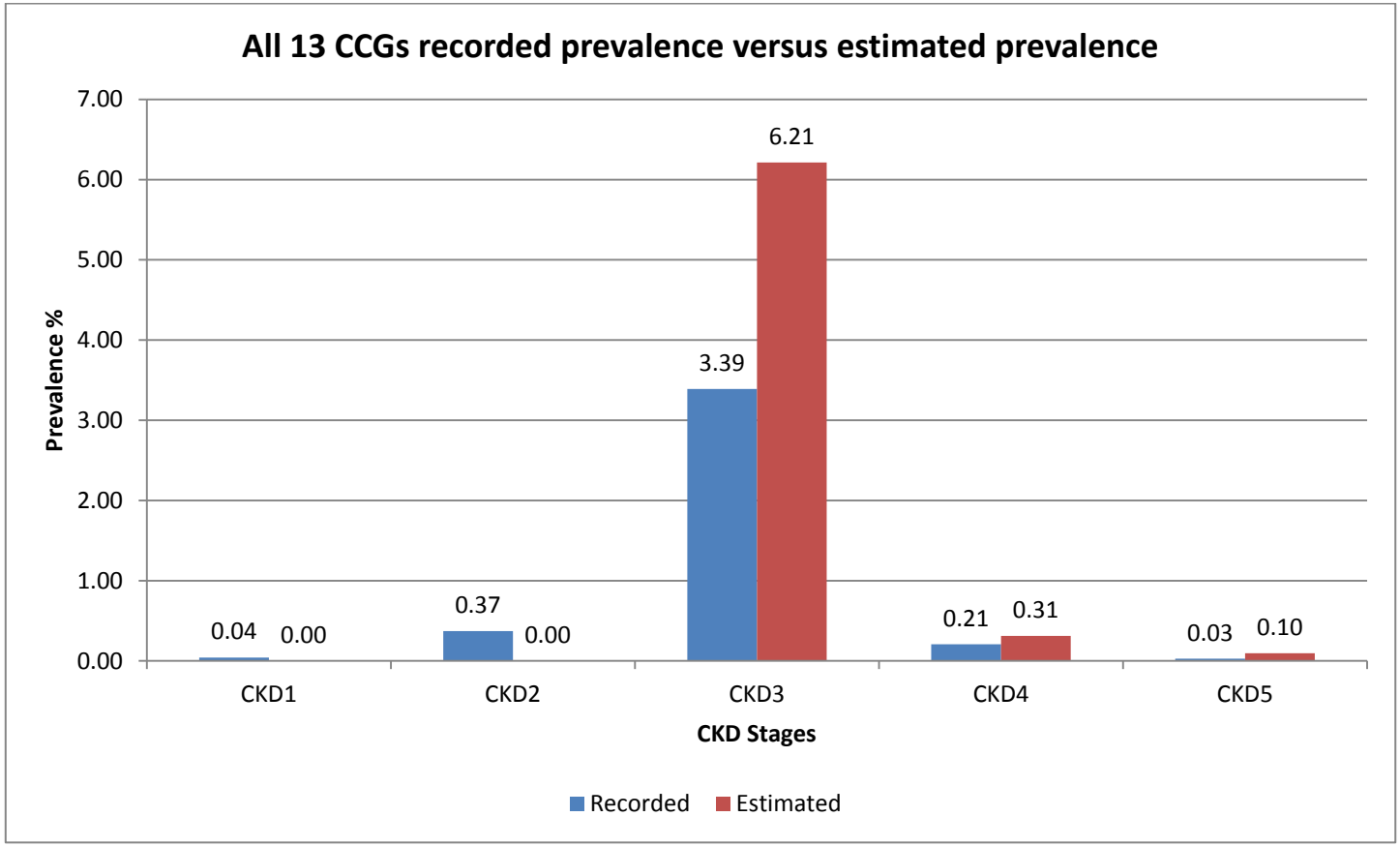
[3] **Average estimated prevalence (%) (CKD 3-5) –** Is the estimated average prevalence of CKD in each CCG for the 312 audited practices based on modelling of their age/sex profiles at the time of audit.

[4] **Average prevalence gap (%) (CKD 3-5) –** Is the average gap between recorded and estimated prevalence of CKD for each CCG.

3.2.3. Recorded versus estimated prevalence per CCG based on demographic (age/sex) data modelled by IMPAKT™



3.2.4. Recorded versus estimated prevalence of CKD by stage for all CCGs combined



3.2.5. Extrapolation of data using QOF 2014/15 figures for whole CCG population and overall for the GM region

	HSCIC reported QOF figures 2014/15			IMPAKT		Potential cases of undiagnosed CKD
	Estimated list size (18+)	CKD register (stages 3-5)	Prevalence (%)	Estimated prevalence (%) (stages 3-5)	Estimated size CKD register (100% CCG practices)	
CCG A	231,261	13,636	5.90	6.08	14,071	**435**
CCG B	154,445	7,057	4.57	7.10	10,969	**3,912**
CCG C	175,829	4,204	2.39	4.62	8,125	**3,921**
CCG D	165,944	7,381	4.45	9.44	15,666	**8,285**
CCG E	172,638	7,595	4.40	5.90	10,193	**2,598**
CCG F	151,399	5,029	3.32	5.26	7,956	**2,927**
CCG G	185,282	6,599	3.56	6.48	12,002	**5,403**
CCG H	202,419	7,139	3.53	6.65	13,464	**6,325**
CCG I	131,482	3,728	2.84	5.64	7,419	**3,691**
CCG J	240,987	7,641	3.17	7.95	19,162	**11,521**
CCG K	190,855	5,844	3.06	7.03	13,413	**7,569**
CCG L	185,619	7,452	4.01	7.38	13,695	**6,243**
CCG M	256,578	13,676	5.33	7.25	18,611	**4,935**
	2,444,738	**96,981**	**3.97**	**6.62**	**164,748**	**67,767**

- As the data that we received gives us only partial area coverage, we have extrapolated out the average findings on estimated gaps in detection to map the findings for all practices in each CCG for the whole GM footprint
- This gives us a potential number of undiagnosed cases of CKD across the region, and where the greatest gaps in detection exist, bearing in mind the caveats described in the *Limitations* section about the potential for overestimation of undiagnosed patients.

3.3. Accuracy of coding for recorded CKD cases

	Practices audited %	Total number patients CKD1 - CKD5	Accurately coded (CKD 1-5)		Potential false positive (CKD 1-5)		Incorrect CKD stage recorded (CKD 1 -5)		Incorrect proteinuria code (CKD 1-5)	
			No.	% of total	No.	% of total	No.	% of total	No.	% of total
CCG A	0.47	5,916	1,459	24.7	1,332	22.5	505	8.5	2,632	44.5
CCG B	0.64	5,258	687	13.1	1,327	25.2	543	10.3	2,741	52.1
CCG C	0.58	2,972	423	14.2	677	22.8	419	14.1	1,533	51.6
CCG D	0.45	3,731	161	4.3	1,056	28.3	438	11.7	2,279	61.1
CCG E	0.18	1,449	104	7.2	432	29.8	118	8.1	804	55.5
CCG F	1.00	5,084	929	18.3	1,275	25.1	664	13.1	2,436	47.9
CCG G	0.51	5,788	1,588	27.4	818	14.1	959	16.6	2,464	42.6
CCG H	1.00	7,627	1,366	17.9	2,077	27.2	948	12.4	3,327	43.6
CCG I	0.58	2,223	120	5.4	672	30.2	277	12.5	1,171	52.7
CCG J	0.35	2,378	111	4.7	792	33.3	238	10.0	1,249	52.5
CCG K	0.63	3,637	393	10.8	1,084	29.8	438	12.0	1,750	48.1
CCG L	0.71	5,678	561	9.9	1,386	24.4	747	13.2	3,069	54.1
CCG M	0.70	10,180	1,620	15.9	4,092	40.2	713	7.0	3,872	38.0
Totals[5]	**0.60**	**61,921**	**9,522**	**15.4**	**17,020**	**27.5**	**7,007**	**11.3**	**29,327**	**47.4**

[5] Please note that a small number of patients may appear in more than one of the four categories reported in this table (accurately coded, potential false positive, incorrect CKD stage and incorrect proteinuria code). For example, a patient's records could have an incorrect CKD stage but it could also have an incorrect proteinuria code. Therefore the totals in these four columns will not add up to the population of CKD stages 1-5.

3.4. Undiagnosed CKD stages 3-5

3.4.1. Undiagnosed cases of CKD stages 3-5 identified by IMPAKT™

	Practices audited %	Confirmed undiagnosed CKD cases per CCG[6] (CKD 3-5)	Total CKD count[7] (CKD 3-5)	Total CKD count (CKD 3-5) estimated by IMPAKT™[8]	Estimated gap number[9] (CKD 3-5)	% of estimated gap that would be reduced by coding confirmed undiagnosed cases	Potentially undiagnosed cases[10] (CKD 3-5)
CCG A	0.47	883	5,393	6,776	1,383	64%	2,475
CCG B	0.64	874	4,813	8,616	3,803	23%	2,479
CCG C	0.58	505	2,772	4,707	1,935	26%	1,435
CCG D	0.45	1,254	3,682	7,611	3,929	32%	2,430
CCG E	0.18	186	1,376	2,046	670	28%	637
CCG F	1.00	656	4,743	8,081	3,338	20%	2,265
CCG G	0.51	961	4,158	8,206	4,048	24%	2,369
CCG H	1.00	1,045	6,480	12,706	6,226	17%	3,072
CCG I	0.58	565	2,144	4,510	2,366	24%	1,095
CCG J	0.35	382	2,291	6,012	3,721	10%	1,006
CCG K	0.63	794	3,285	8,196	4,911	16%	1,472
CCG L	0.71	790	5,224	10,106	4,882	16%	2,075
CCG M	0.70	1,052	9,562	14,469	4,907	21%	3,156
Totals	**0.60**	**9,947**	**55,923**	**102,043**	**46,120**	**22%**	**25,966**
Extrapolation to all practices & all CCGS	**1.00**	**16,483**	**92,667**	**169,090**	**76,423**	**22%**	**43,027**

[6] **Confirmed undiagnosed CKD cases per CCG –** Describes the number of undiagnosed patients identified by IMPAKT™ who could be coded with CKD immediately based on clinical evidence.

[7] **Total CKD count –** The number of patients identified as coded with CKD stages 3-5 from the 312 practices audited.

[8] **Total CKD count (CKD 3-5) estimated by IMPAKT™ –** The number of patients estimated to have CKD per CCG in the audited practices based on age/sex practice profiles.

[9] **Estimated gap number –** The number of CKD patients estimated to be undiagnosed in each CCG within the audited practices based on recorded vs. estimated comparison.

[10] **Potentially undiagnosed cases (CKD 3-5) –** The number of patients identified in audited practices with indications of CKD based on previous low eGFR readings who should be investigated for confirmation or exclusion of CKD.

3.5. Risk factors for progressive CKD (for those patients diagnosed with CKD)

	Number of recorded risk factors for those patients diagnosed with CKD (1-5)										Total CKD patients with 1 or more risk factors	Total CKD patients (CKD 1-5)	% = 1 or more risk factors
	1	2	3	4	5	6	7	8	9	10			
CCG A	1,604	1,638	1,114	511	219	88	19	7	-	-	5,200	5,916	88%
CCG B	1,568	1,509	934	385	133	34	7	1	-	-	4,571	5,258	87%
CCG C	698	815	637	364	185	79	24	4	2	-	2,808	2,972	94%
CCG D	1,241	1,133	682	279	85	31	4	-	-	-	3,455	3,731	93%
CCG E	376	390	300	136	65	21	8	2	-	-	1,298	1,449	90%
CCG F	1,301	1,469	1,070	561	243	82	33	6	-	1	4,766	5,084	94%
CCG G	1,740	1,571	951	424	175	46	19	4	1	-	4,931	5,788	85%
CCG H	2,444	2,104	1,110	566	207	59	9	4	-	-	6,503	7,627	85%
CCG I	567	650	431	232	96	31	7	3	1	-	2,018	2,223	91%
CCG J	792	690	371	154	33	4	3	1	-	-	2,048	2,378	86%
CCG K	1,067	1,028	613	287	127	40	4	1	-	-	3,167	3,637	87%
CCG L	1,733	1,518	1,014	459	153	52	15	1	1	-	4,946	5,678	87%
CCG M	3,584	2,610	1,341	543	203	62	9	2	-	-	8,354	10,180	82%
Totals	**18,715**	**17,125**	**10,568**	**4,901**	**1,924**	**629**	**161**	**36**	**5**	**1**	**54,065**	**61,921**	**87%**

CKD 3-5 / All CKD 1-5	Number of recorded risk factors for those patients diagnosed with CKD (3-5)										Total CKD patients with 1 or more risk factors	Total CKD patients (CKD 3-5)	% = 1 or more risk factors
90.3%	1	2	3	4	5	6	7	8	9	10			
Totals	**16,902**	**15,466**	**9,544**	**4,426**	**1,738**	**568**	**145**	**33**	**5**	**1**	**48,828**	**55,923**	**87%**

- IMPAKT™ assesses risk against 12 factors (listed below) for progressive CKD. These factors are not weighted.
  The risk factors are as follows:

eGFR < 45ml/min	eGFR <45ml/min and Hb<10.5g/dl	eGFR declines to <15 by age 80 or <-10 rate over 80
No recent eGFR	Latest BP >150/90	Proteinuria
Total Cholesterol >6mmol/l	Diabetic	Urinary outflow tract obstruction
Cardiovascular Disease	Smoker	Black / Asian Ethnicity

3.6. Proteinuria testing and coding; and blood pressure control

3.6.1. Proteinuria testing

	CKD stages 1-5				
	Patients tested for proteinuria < 12m	**Patients not tested for proteinuria < in 12m**	**Tested + not tested**	**Total CKD 1-5**	**% patients not tested for proteinuria**
CCG A	3,071	2,845	5,916	5,916	48%
CCG B	3,138	2,120	5,258	5,258	40%
CCG C	1,997	975	2,972	2,972	33%
CCG D	3,364	367	3,731	3,731	10%
CCG E	901	548	1,449	1,449	38%
CCG F	3,069	2,015	5,084	5,084	40%
CCG G	2,779	3,009	5,788	5,788	52%
CCG H	5,943	1,684	7,627	7,627	22%
CCG I	1,372	851	2,223	2,223	38%
CCG J	1,531	847	2,378	2,378	36%
CCG K	3,092	545	3,637	3,637	15%
CCG L	3,403	2,275	5,678	5,678	40%
CCG M	9,312	868	10,180	10,180	9%
Totals	**42,972**	**18,949**	**61,921**	**61,921**	**31%**

	CKD stages 3-5				
	Patients tested for proteinuria < 12m	**Patients not tested for proteinuria < in 12m**	**Tested + not tested**	**Total CKD register (CKD 3-5)**	**% patients not tested for proteinuria**
Scenario 1. Assumption that patients CKD 1-5 stages offered a test for proteinuria – figures adjusted for proportion of patients coded in stages 3-5	**38,810**	**17,113**	**55,923**	**55,923**	**31%**
Scenario 2. Assumption that patients only tested for proteinuria if CKD stages 3-5	**42,972**	**12,951**	**55,923**	**55,923**	**23%**

- This table tells us the number of patients who have been tested for proteinuria in the 12 months preceding the audit date. This is one of the recommendations of the NICE CKD guidelines and until 1 April 2015 was also one of the QOF CKD indicators
- Unlike the old QOF measure, IMPAKT™ does not discount those patients who have been exception reported from QOF measurement.

3.6.2. Proteinuria coding

	CKD stages 1-5, patients tested for proteinuria				CKD 1-5 patients not tested for proteinuria	
	Patients coded 'CKD with proteinuria'	**Patients coded without proteinuria**	**Total patients tested for proteinuria**	**% patients coded 'CKD with proteinuria'**	**Patients not tested for proteinuria**	**Estimate of patients coded with proteinuria based on % patients coded**
CCG A	765	2,306	3,071	25%	2,845	709
CCG B	716	2,422	3,138	23%	2,120	484
CCG C	518	1,479	1,997	26%	975	253
CCG D	347	3,017	3,364	10%	367	38
CCG E	217	684	901	24%	548	132
CCG F	794	2,275	3,069	26%	2,015	521
CCG G	664	2,115	2,779	24%	3,009	719
CCG H	945	4,998	5,943	16%	1,684	268
CCG I	379	993	1,372	28%	851	235
CCG J	281	1,250	1,531	18%	847	155
CCG K	515	2,577	3,092	17%	545	91
CCG L	663	2,740	3,403	19%	2,275	443
CCG M	1,097	8,215	9,312	12%	868	102
Totals	**7,901**	**35,071**	**42,972**	**18%**	**18,949**	**4,150**

	CKD stages 3-5					
	CKD Stages 3-5, patients tested for proteinuria				CKD 3-5 patients not tested for proteinuria	
	Patients coded 'CKD with proteinuria'	**Patients coded without proteinuria**	**Total patients tested for proteinuria**	**% patients coded 'CKD with proteinuria'**	**Patients not tested for proteinuria**	**Estimate of CKD patients with undiagnosed proteinuria based on prevalence in extracted data**
Scenario 1. Assumption that patients recorded at CKD 1-5 stages offered a test for proteinuria – figures adjusted for proportion of patients known coded in stages 3-5	**7,136**	31,674	38,810	18%	17,113	**3,146**
Scenario 2. Assumption that patients only tested for proteinuria if CKD stages 3-5	**7,901**	35,071	42,972	18%	12,951	**2,381**

- This table shows how many detected CKD patients have been tested for proteinuria <12 months and coded either 'with' or 'without' proteinuria
- The data in this table is actually antiquated by the updated NICE CKD guidelines of 2014 as proteinuria in CKD is now categorised differently. However, we've included it to demonstrate that within the framework of the previous NICE CKD guidelines (2008) – many cases of proteinuria within CKD patients remain undetected. Proteinuria is a strong indicator for progressive CKD and cardiovascular events.

3.6.3. Record of blood pressure test in previous 12 months

	CKD 1-5 patients				
	Record of blood pressure in <12 months (of those tested for proteinuria and coded according to result)				
	Tested for proteinuria	**Tested for BP in <12 months**	**% of CKD patients with defined proteinuria status with a recorded BP in <12 months**	**Not tested for proteinuria (and therefore no target BP re: NICE guidelines)**	**Total without recorded blood pressure in <12 months and/or no test for proteinuria**
CCG A	3,071	2,899	94%	2,845	3,017
CCG B	3,138	2,881	92%	2,120	2,377
CCG C	1,997	1,893	95%	975	1,079
CCG D	3,364	3,091	92%	367	640
CCG E	901	836	93%	548	613
CCG F	3,069	2,864	93%	2,015	2,220
CCG G	2,779	2,627	95%	3,009	3,161
CCG H	5,943	5,533	93%	1,684	2,094
CCG I	1,372	1,267	92%	851	956
CCG J	1,531	1,460	95%	847	918
CCG K	3,092	2,897	94%	545	740
CCG L	3,403	3,131	92%	2,275	2,547
CCG M	9,312	8,641	93%	868	1,539
Totals	**42,972**	**40,020**	**93%**	**18,949**	**21,901**

	CKD stages 3-5				
	Tested for proteinuria			Not tested for proteinuria	No recorded blood pressure and/or no test for proteinuria
	Tested for proteinuria	**Tested for BP in <12 months**	**% tested for BP in <12 months**		
Scenario 1. Assumption that patients recorded at CKD 1-5 stages offered a test for proteinuria and blood pressure – figures adjusted for proportion of patients known coded in stages 3-5	**38,810**	**36,143**	**93%**	17,113	19,780
Scenario 2. Assumption that patients only tested for proteinuria and blood pressure if CKD stages 3-5	**42,972**	**40,020**	**93%**	12,951	15,903

- This table shows the number of patients detected with CKD who have a recorded test and coded result for proteinuria in the preceding 12 months, and also have a blood pressure reading in the same time period – and therefore have a recommended target blood pressure based on their proteinuria status using the NICE CKD guidelines 2008.

3.6.4. Blood pressure control in previous 12 months

	CKD stages 1-5					
	BP recorded in last 12 months	BP to target in last 12 months with and without proteinuria	BP to target in last 12 months, CKD with proteinuria		BP to target in last 12 months, CKD without proteinuria	
			n	% (of those with proteinuria in CCG)	n	% (of those without proteinuria in CCG)
CCG A	2,899	1,773	244	32%	1,529	66%
CCG B	2,881	1,780	222	31%	1,558	64%
CCG C	1,893	1,030	125	24%	905	61%
CCG D	3,091	1,919	94	27%	1,825	60%
CCG E	836	483	49	23%	434	63%
CCG F	2,864	1,759	263	33%	1,496	66%
CCG G	2,627	1,477	176	27%	1,301	62%
CCG H	5,533	3,576	270	29%	3,306	66%
CCG I	1,267	706	113	30%	593	60%
CCG J	1,460	965	88	31%	877	70%
CCG K	2,897	1,874	153	30%	1,721	67%
CCG L	3,131	1,821	167	25%	1,654	60%
CCG M	8,641	5,725	299	27%	5,426	66%
Totals	**40,020**	**24,888**	**2,263**	**29%**	**22,625**	**65%**

	CKD stages 3-5					
	BP recorded in last 12 months	BP to target in last 12 months with and without proteinuria	BP to target in last 12 months, CKD with proteinuria		BP to target in last 12 months, CKD without proteinuria	
			n	% (of those with proteinuria in CCG)	n	% (of those without proteinuria in CCG)
Scenario 1. Assumption that blood pressure control is attempted for patients recorded at CKD 1-5 stages – figures adjusted for proportion of patients coded in stages 3-5	**36,143**	**22,477**	**2,044**	**29%**	**20,433**	**65%**
Scenario 2. Assumption that blood pressure only controlled in CKD stages 3-5	**40,020**	**24,888**	**2,263**	**29%**	**22,625**	**65%**

- This table shows, of those patients reported in Table 3.6.3, how many are recorded as meeting the recommended target blood pressure based on their proteinuria status using the NICE CKD guidelines 2008.

4. Limitations

IMPAKT™ was written to analyse CKD registers based on recommendations in the NICE CKD Guidelines 2008 (CG73). These guidelines were superseded by the release of updated guidelines (CG182) in 2014. IMPAKT™ still provides strong evidence-based data with regards to the accuracy of existing registers, identifying undiagnosed CKD and highlighting where proteinuria has not been tested, or blood pressure is uncontrolled. However, the new guidelines represent some significant changes to recommendations for identifying and treating CKD. The key changes are:

- Change in formula for calculating blood results from MDRD to CKD-EPI
- Introduction of an additional blood test (CystatinC) to confirm or exclude borderline and low-risk cases
- Changes to the coding of CKD. Reported eGFR ranges remain the same for categorising stage but all patients now have a quantified stage of proteinuria (A1,2,3) instead of being identified as 'with' or 'without' proteinuria
- All readings of proteinuria ≥3 mg/mmol are now regarding as clinically significant. Previously, any reading <30 mg/mmol would be disregarded unless the patient was also diabetic.

The first two changes noted above are likely to have the effect of reducing overall prevalence (see NICE guidelines 2014 and O'Callaghan *et al,* 2011). The new formula for calculating eGFR provides greater sensitivity in borderline patients and is likely to move some patients from stage 3A to stage 2. Further, the CystatinC test is designed to filter out some of the very stable stage 3A patients where no other risk factors (e.g. proteinuria) are present. These two factors would reduce the number of patients recorded on CKD registers, but allow clinicians to stratify a smaller group of patients according to risk. However, at the time of the consultation exercise for this project, none of the 13 local CCGs were commissioning the CystatinC test – and the local laboratories were still reporting on eGFR using the MDRD formula instead of CKD-EPI.

The second limitation of this work was that the Read codes used in general practices to code CKD were augmented by new codes to match the 2014 NICE CKD guidelines immediately prior to the deployment of IMPAKT™ for this project. IMPAKT™ cannot recognise the new codes as it was written based on the 2008 version of the guidelines. The effect of this is that any patients diagnosed with the latest set of Read codes will not have been counted by IMPAKT™. From our experience of implementing improvements to CKD registers through quality improvement approaches, this is likely to have had a negligible effect on the data outcomes, as there is often significant delay in practices switching to new sets of Read codes.

The final limitation of approach is that engagement for this deployment was weakest in CCGs where no previous CLAHRC GM projects have been delivered. This was anticipated prior to the project and optimal routes of engagement were discussed and planned at baseline, but as expected new contacts often had to be generated in these areas to negotiate access to practices and then build recognition with individual sites, this hindered progress and acceptance of participation.

5. Summary and implications

The data from this audit supports some anticipated findings based on evidence from the consultation exercise and anecdotal findings from the implementation of CKD projects by CLAHRC GM. In summary:

Recorded cases

- 55,923 patients had CKD stages 3-5 coded on practice systems in the 312 practices audited
- This is comparable to the 2014/15 QOF data, which recorded 96,981 CKD cases (3-5) in 512 practices in the region. The IMPAKT™ data extrapolated to all 517 of the GM predicted a recorded 92,667, which is also comparable to the QOF reported figure.
- The mean average CKD 3-5 prevalence in the audited practices is 3.64%. Of these patients 94% are coded with CKD stage 3A or 3B.

Inaccuracies in diagnosis

- In the sample of 312 practices, 17,020 (27.5%) of recorded cases of CKD have some element of doubt over whether they meet the criteria for diagnosis. The reasons for this could include a recent calculation of eGFR falling outside the coding range for stages 3-5 of CKD, multiple tests outside of the coding range, insufficient clinical evidence of low eGFR to support initial diagnosis, or the readings used to diagnose CKD being too close together in time proximity. Sometimes records require minor adjustments to resolve these inaccuracies, in some other cases removal from the CKD register is recommended
- 7,007 (11.3%) of recorded CKD cases are not coded at the appropriate stage (3-5) based on the latest clinical evidence for the patients.

Gaps in detection

IMPAKT™ reports on the number of undiagnosed cases of CKD that can be coded immediately due to clinical evidence or investigated further based on indicative evidence. It also models an estimate for CKD prevalence at practices based on demographic information of the practice register.

- IMPAKT™ identified 9,947 undiagnosed cases of CKD in the 312 audited practices that have sufficient clinical evidence to be coded immediately
- A further 25,966 patients have evidence of low eGFR readings that could be further investigated to confirm or exclude CKD
- If we extrapolate these findings across all 517 practices, then we could anticipate finding in the region of 16,483 patients with undiagnosed CKD who could be coded immediately. Similarly, some 43,027 patients could warrant further investigation just on the basis of previous low eGFR readings that may not have been followed-up.
- IMPAKT™ has provided an estimated prevalence for CKD in these 312 practices of 6.62%, a gap of 2.98% percentage points between recorded and estimated prevalence of CKD. That demographic estimate extrapolated to the 512 practices reported in the 2014/15 QOF data would indicate a potential 67,767 patients with undiagnosed CKD. However, this figure needs to be treated with caution as the *Limitations* section (4.) explains the strong likelihood that, when fully implemented, the updated NICE CKD guidelines of 2014 would result in many stable stage 3A CKD patients with evidence of little or no proteinuria being removed from practice registers.

Care of detected cases

When assessing the care that practices provide for CKD, IMPAKT™ follows a decision-tree process to analyse data so that it is following NICE CKD guidelines (2008). So patients detected with CKD are measured in the following process:

1. Has the patient received a test for proteinuria in the preceding 12 months? (Table 3.6.1.)
   - Yes – patient data will be analysed in Table 3.6.2.
   - No – proteinuria status of patient is unknown (or not followed guidelines) so proteinuria coding and blood pressure management not counted in practice figures.
2. Following the test for proteinuria, what proteinuria status been coded for each patient? (Table 3.6.2.)
   - With/without – patient data will be analysed in Table 3.6.3.
   - No test for proteinuria (as per Table 3.6.1. – figures have been extrapolated based on the prevalence of proteinuria in CKD to estimate how many of those missing a recorded test for proteinuria could be expected to have clinically significant proteinuria.
3. Of those CKD patients tested for proteinuria, does the patient also have a recorded blood pressure in their clinical notes in the preceding 12 months? (Table 3.6.3.)
   - Yes – blood pressure data will be analysed in Table 3.6.4.
   - No – without a recorded blood pressure reading within the recommended timeframe, IMPAKT™ cannot assess whether the patient has been managed to recommended blood pressure target.
4. Of those CKD patients meeting the above criteria for proteinuria tested/coding and blood pressure testing, has the patient had their blood pressure controlled to NICE recommended BP targets (NICE 2008)? (Table 3.6.4.)
   - Yes
   - No

Because IMPAKT™ performs the data analysis for Tables 3.6.1. – 3.6.4. based on all patients with a CKD 1-5 or renal impairment code, we've performed the adjustment calculations based on two scenarios for these tables – as described at the start of the *Findings* section (3.). Each scenario has its limitations – as they each contain assumptions about how CKD is managed which are inaccurate – but they provide us with an accuracy range to frame the current issues of providing care for CKD patients.

- 23 - 31% of recorded CKD patients had not been tested for the presence of proteinuria in the 12 months preceding the audits. In our sample of audited practices this equates to between 12,951 and 17,113 stage 3-5 patients without a proteinuria test in the previous year
- Our data indicated that of those detected CKD patients tested for proteinuria, 18% were coded as having clinically significant levels of proteinuria. If we extrapolate this ratio to the cohort of CKD stages 3-5 patients 'missing' a test for proteinuria, we estimated that between 2,381 - 3,146 detected CKD stages 3-5 patients have undiagnosed proteinuria. Although the new definitions of proteinuria quantification in the 2014 NICE CKD guidelines (e.g. A1,A2,A3) have antiquated the measurement of proteinuria coding accuracy used by IMPAKT™ (e.g. with/without proteinuria), the results are indicative that identification and care of proteinuria in CKD is still a relatively weak area in primary care – despite the previous guidelines being in place since 2008. It is also notable that before QOF 2015/16, practices were explicitly financially rewarded for testing for proteinuria, but not for subsequent coding and tighter blood pressure control for patients comorbid with diabetes or proteinuria results ≥ 70mg/mmol

- Of those CKD patients with a recorded proteinuria status (Table 3.6.3.), 2, 667 - 2,952 (7%) did not have a recorded blood pressure reading in the previous 12 months. If we extrapolate this data to include proteinuria testing, then between 15,903 - 19,780 (28 - 35%) of recorded cases of CKD stages 3-5 did not have a measurement of proteinuria status and/or blood pressure recorded in the 12 months preceding the audit
- Of those patients with a recorded proteinuria status and blood pressure reading in the previous 12 months (Table 3.6.4), 29% (of those 'with proteinuria'); and 65% (of those 'without proteinuria') had controlled blood pressure. Based on the two scenarios, this equated to between 22,477 - 24,888 (40% - 45%) of all CKD stage 3-5 patients meeting all NICE 2008 recommendations for proteinuria testing and blood pressure control.

Potential outcomes of increasing detection and blood pressure control

A meta-analysis by Perkovic (2013) concluded that active treatment over four years to control BP (ACE inhibitor or calcium channel blocker regimen) on patients with CKD stages 3-5 could avoid one major CVD event (such as stroke, myocardial infarction, heart failure, or CVD death) for every 35 patients treated.

Applying the findings of the meta-analysis to our data indicates the potential to diagnose and treat a substantial number of unidentified cases of CKD, as well as improve outcomes for a significant cohort of diagnosed patients. Our audit data represents a coverage rate of 60% of the practices in GM and therefore gives us a representative proportion for extrapolation of the findings for the known population of the region. From the data in Table 3.6.4 we know that, across the 13 CCGs, there were 15,132 CKD stage 1 - 5 patients with uncontrolled BP in the 12 months preceding the audit. Within this figure, we estimate that the number of CKD stage 3 - 5 patients ranges between 13,666 and 15,132 (see scenarios explained below in Table 5.1). Based on the findings of the meta-analysis, this means that between 390 and 432 major CVD events could be avoided over the next four years if these patients had their BP treated to target (Table 5.1).

Similarly, data from Table 3.6.3 indicated that a total of 2,952 patients with a test for proteinuria did not have a record of BP measurement in the 12 months prior to being audited. Within these, the estimated number of patients with CKD stages 3 - 5 only, was between 2,667 and 2,952 patients. This group potentially requires improved BP control according to their proteinuria status, which could potentially result in the avoidance of further 76 to 84 major CVD events (Table 5.1).

Table 5.1. Estimated number of CVD events avoided over four years if BP treated to target

				Number of major CVD events that could be avoided over four years if BP treated to target (Perkovic, 2013)	
		Patients with BP recorded in last 12 months but not managed to target	BP not recorded in last 12 months	Patients with BP recorded in last 12 months but not managed to target	BP not recorded in last 12 months
Scenario 1 Total adjusted for 90.3% proportion of CKD stages 3-5	55,923	13,666	2,667	390	76
Scenario 2 Assumption that blood pressure only controlled in CKD stages 3-5	55,923	15,132	2,952	432	84

By coding and treating the undiagnosed CKD patients identified by IMPAKT™, even further CVD events could be avoided. Data from Table 3.4.1 evidences that 9,947 additional cases of CKD could be coded immediately (see Table 5.2). Additionally, further investigation into those 25,966 patients with indications of CKD from previous clinical evidence could yield significant additional diagnoses. Previous CKD projects delivered by CLAHRC GM suggest that in the region of 10% of cases in this category result in a diagnosis of CKD based on 2008 NICE CKD guidelines. Assuming that all of the newly coded patients have uncontrolled BP, Table 5.2 below illustrates scenarios about the potential for CVD events that could be avoided should the patients identified through this deployment be coded and managed to guideline recommendations.

Table 5.2. Estimated number of CVD events avoided over four years if BP treated to target

	Total CKD 3-5	Confirmed undiagnosed cases	Potentially undiagnosed cases	10% of potentially undiagnosed cases	Confirmed undiagnosed cases	10% of potentially undiagnosed cases
All CCGs from audit of 312 practices	**55,923**	**9,947**	**25,966**	**2,597**	**284**	**74**
All CCGs extrapolated to 517 practices	**92,667**	**16,483**	**43,027**	**4,303**	**471**	**123**

Conclusions

There are a number of potential opportunities for improvement work based on these findings, including:

- Improvement of accuracy in detection and management
- Increased detection of CKD cases based on confirmed undiagnosed patients and investigation of cases with indications of CKD
- Improved risk stratification of patients with diagnosed CKD
- Improved blood pressure control for CKD patients.

The key findings of this report are:

- **Significant gaps remain between the number of recorded and estimated cases of CKD stages 3-5 in Greater Manchester**
- **Considerable numbers of patients coded with CKD may have insufficient evidence to support their diagnosis**
- **Substantial numbers of patients with CKD were not managed to NICE guidelines (i.e. did not have a test for proteinuria or blood pressure result recorded in the preceding 12 months)**
- **Suboptimal management of CKD has implications for the risk of developing or exacerbating other cardiovascular diseases given the prevalence of comorbidities in this patient population.**

Opportunities for improvement:

- **Diagnosing the significant number of patients that have CKD and remain undetected in primary care**
- **Improving the quality and accuracy of proteinuria diagnosis and pro-active management of the risk this represents to patients with CKD**
- **Controlling blood pressure for more patients diagnosed with CKD to reduce the risk of adverse events through progressive CKD or comorbidities.**

6. References

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