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Kidney disease management in UK primary care: guidelines, incentives and Information Technology

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The last few years have seen new developments to understand and tackle the significant public health issue posed by chronic kidney disease (CKD). Established renal disease currently consumes 2% of the UK National Health Service budget and predictions are that this figure will increase significantly due to the rising number of people requiring renal replacement therapy fuelled by the ageing population and the diabetes mellitus epidemic.

This paper reviews the scale of CKD and discusses the new developments such as staging, referral guidelines and new Department of Health incentives brought about to improve awareness. The importance of Information Technology in assisting the management of renal disease is also outlined. We identify various types of intervention which might be used to do this: feedback in an educational context, the establishment of computerized decision support and enhancement of the patient journey. Many principles may be extended to the management of any chronic disease. While new developments are necessary to improve care, wider implementation is required to be able to see if improved outcomes are achieved.

Keywords. Chronic kidney disease, glomerular filtration rate, National Service Framework, Quality and Outcomes Framework, Information Technology.

The prevalence of chronic kidney disease

The National Kidney Foundation—Kidney Disease Outcomes Quality Initiatives from the USA has introduced a simple categorization of chronic kidney disease (CKD)¹ (Table 1). This classification is based upon the calculation of estimated glomerular filtration rate (GFR) rather than using the traditional serum creatinine (SCr) concentration to define the level of impairment. SCr has long been recognized as a poor marker of overall renal function and this is now acknowledged by various guidelines and national bodies^{2–4} who recommend determination of GFR using the Modification of Diet in Renal Disease formula⁵ to better estimate renal function.

The Third National Health and Nutrition Examination Survey determined that approximately 11% (19

million) of the US adult population have CKD.⁶ Using the new stages of CKD stratification,¹ 6.5% (11.3 million) people were estimated to have stages 1–2 CKD and a further 5% (8.5 million individuals) stages 3, 4 and 5 CKD. In England, the New Opportunities for Early Renal Intervention by Computerised Assessment (NEOERICA) study⁷ reported a population prevalence of 4.9% for stages 3–5 CKD using a technique of data extraction looking for SCr concentrations from primary care databases.

Guidelines and kidney disease

Recent studies show that 30–50% of patients with CKD die prematurely from cardiovascular disease rather than progressing to end-stage renal disease.^{8,9}

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TABLE 1 *The new stages of CKD*

Stage	Description	GFR (ml/min/1.73m ²)	US population prevalence (%)	Co-morbidity
1	Kidney damage with normal or raised GFR ± haematuria ± proteinuria ± other pathology, e.g. polycystic renal disease	>90	3.3	Hypertension
2	Kidney damage with mild reduced GFR ± haematuria ± proteinuria ± other pathology, e.g. polycystic renal disease	60–89	3.0	Hypertension
3	Moderate reduced GFR	30–59	4.3 ^a	Hypertension Disorders of bone metabolism (↓Ca ⁺⁺ , ↑PO ₄ , ↑parathyroid hormone) Anaemia of chronic disease Left ventricular hypertrophy
4	Severe reduction in GFR	15–29	0.2 ^a	Above in increasing magnitude Electrolyte disturbance(↑K ⁺) Acidosis Fluid retention Malnutrition
5	Overt kidney failure	<15	0.2 ^a	Above Lethargy, anorexia Progressive uraemia Dialysis ± transplantation

Ca⁺⁺: serum calcium. K⁺: serum potassium. PO₄: serum phosphate.

^aNEOERICA UK prevalence 4.6%, 0.2%, 0.04% for stages 3–5, respectively; no data for stages 1–2 due to low recording of proteinuria information on primary care databases.

Go *et al.*¹⁰ highlighted that CKD is an independent predictor of cardiovascular disease, mortality and hospitalization. Reduction of cardiovascular disease is already being addressed in primary care through hypertension treatment, cholesterol reduction, diabetes control, smoking cessation education and exercise advice. However, CKD is not widely recognized by physicians to be an independent risk factor for cardiovascular disease and evidence-based treatment in this group of patients is limited.^{7,11} Renal disease is often wrongly considered a reason to avoid certain drugs such as angiotensin-converting enzyme inhibitors when in fact they are recommended by guidelines.

In 2005, the Department of Health published the second part of the National Service Framework for renal services, focussing on early identification and prevention of progression of CKD.¹² Subsequently, a joint working group hosted by the Department of Health published new guidelines for CKD management and referral.² These initiatives, together with the National Frameworks for renal,¹² diabetes,¹³ coronary heart disease¹⁴ and elderly care, underline the overlap between these groups and point to the important concept of chronic disease management integrated across primary and secondary care.

Usefulness of CKD staging

A system of staging of kidney disease can allow for improved patient management by alerting clinicians

to potential complications of CKD and dictating treatment strategies: Reduction of proteinuria can reduce the risk of progression of renal disease¹⁵ and patients with proteinuria, in the earlier stages of CKD could be targeted and treated earlier to prevent deterioration of their renal function. Some studies have suggested that earlier anaemia treatment can reduce the risk of development of left ventricular hypertrophy and other cardiac complications.^{16,17} Patients classified into stage 4 or 5 CKD with progressive renal disease should be managed in care pathways that prepare them for their choice of renal replacement therapy or for conservative management.²

Referral and management of patients with renal disease

The UK CKD guidelines² provide a general outline of who should be referred from primary care to nephrology services (Table 2). The guidelines recommend referral of patients with stages 4 and 5 CKD and selected individuals from stages 1 to 3 CKD. Given that the majority of stages 1–3 (and many stage 4) CKD patients do not have progressive renal impairment, a large proportion can be managed in primary care focussing on interventions which can delay progression of CKD and alleviate symptoms, such as blood pressure reduction with renin-angiotensin system blockade and management of anaemia and renal osteodystrophy. Regular follow up for SCr checks as

well as cardiovascular risk reduction would be required. It is recommended that individuals with stages 4–5 CKD should ideally be seen and managed in secondary care in order to plan and make provision for renal replacement therapy (dialysis and transplantation).

The new Quality and Outcomes Framework for renal disease

The Quality Management and Analysis System¹⁸ gives GP practices and Primary Care Trusts in England objective feedback regarding the specific quality of care delivered to their patients. The system gauges the practices' performance through the Quality Outcomes Framework (QOF), measured against national achievement targets detailed in the General Medical Services contract for England.¹⁹ The QOF performances are based entirely on primary care computer data and only data coded in the computer system using a limited list of read codes are counted towards achieving the quality target. These data are collected automatically from all brands of GP computer systems. After being aggregated centrally, they are made publically available through the National Health Service (NHS) Health and Social Care

Information Centre.²⁰ In order to encourage continual improvement in the clinical care of CKD patients, the new QOF for CKD in England was introduced in February 2006.²¹ The QOF contains four indicators of care (Table 3), each having the potential to enhance CKD management. This raises the profile of CKD and may allow for an opportunity for education on the importance of cardiovascular risk in CKD. Moreover, combined with the use of the CKD guidelines, appropriate referral could be enhanced.

Connecting for health

One of the aims of Connecting for Health,²² formerly known as the National Programme for Information Technology (IT), is to improve the patient experience through the use of modern computer systems and networks. Connecting for Health has largely three main goals, namely an electronic care records service for patients, the ability to book electronic appointments (Choose and Book) and electronic prescribing. These goals are reliant on the development of an efficient, reliable underlying IT infrastructure. Secure connections between GPs' practices and secondary care will save

TABLE 2 Referral criteria for patients with CKD

Renal function status	Referral	
	Immediate/urgent	Routine
Acute kidney injury	GFR fall >10 ml/min over 5 days	Not applicable
Stage 5 CKD	Newly detected	Stable
Stage 4 CKD	Newly detected	Stable
Stage 3 CKD		Haematuria
Any GFR	Accelerated phase hypertension <ul style="list-style-type: none"> • Hyperkalaemia (K^+ > 6 mmol/l) • Nephrotic syndrome • Multisystem disease with renal involvement 	<ul style="list-style-type: none"> • GFR fall > 15% on an ACEi/ARB • Proteinuria (PCR >100 mg/mmol) • Haematuria + proteinuria (PCR 30–100 mg/mmol) • Urologically unexplained haematuria • BP >150/90 mm Hg; on three anti-hypertensive agents

K^+ : serum potassium. ACEi/ARB: angiotensin-converting enzyme inhibitor/angiotensin II receptor blocker. PCR: protein: creatinine ratio.

TABLE 3 The Quality and Outcomes Framework indicators for renal disease and potential benefits

Indicator (points)	Benefits
1. Register of patients with stages 3–5 CKD (6 points)	<ul style="list-style-type: none"> • Large database creation for research purposes • Identification of high risk individuals to enable earlier management of risk e.g cardiovascular disease • Placement of patient in appropriate management pathway • Improved blood pressure recording
2. Percentage on CKD register with blood pressure record in the last 15 months (6 points)	<ul style="list-style-type: none"> • Improved treatment of elevated blood pressure
3. Percentage on CKD register with blood pressure <140/85 measured in the last 15 months (11 points)	<ul style="list-style-type: none"> • Increased use of appropriate medications such as ACEi in CKD
4. Percentage on CKD register treated with ACEi/ARB. (Unless a contraindication or side effects are recorded) (4 points)	

ACEi/ARB: angiotensin-converting enzyme inhibitor/angiotensin II receptor blocker.

time and transform the way the NHS works. Information will be able to be shared more quickly and securely. This will support patient's choice and allow first hospital outpatient referrals to be made at a location and time suitable to the patient.

Although the National IT program is not specific to kidney disease, there are various ways it can be of use to patients with CKD.

Making IT work for people with renal disease

The renal services information strategy

The renal services information strategy on CKD, acute renal failure and end of life care²³ has been written to complement and support the quality requirements of part two of the National Service Framework for renal services.

The main issues of the information strategy for CKD are outlined in Table 4.

Integrating clinical records and calculating GFR

In the UK, computerization of practices has increased substantially, currently at least 96% are computerized.²⁴ The QOF, discussed above, has provided additional incentives for the GP to code data on their computer system. IT links between surgeries and the hospital pathology laboratory have enabled surgeries to receive online laboratory results on patients. This comprehensive access to all patient historical investigations plus the use of read-coded information provides a wealth of information for the user in terms of disease profile and risk description. Individual patient risk for disease could be assessed and this information could be fed back to the GP to enhance evidence-based treatment. To fit in with the QOF coming into effect, laboratories have been asked by the Department of Health to implement estimated GFR reporting for all patients who have had an SCr test and, if available, to give an up to date estimate of compliance with this recommendation.²⁵

Where patients already have an SCr concentration measured before this date, GPs may wish to ascertain

stability of renal function by assessing eGFR on older results. This is an important factor to take into consideration when following the CKD guidelines. A range of tools are available to help them do this. Online eGFR calculators together with links to recommended guidelines are useful.²⁶ Other tools include mobile phone or personal digital assistant calculators, downloadable calculators and spreadsheets containing built-in macros enabling whole practice population eGFR calculations.²⁷

Using computers to identify CKD: utilizing existing patient information

Existing record systems in primary care have been demonstrated to be reliable sources to identify kidney disease.²⁸ In the NEOERICA project,⁷ structured and read-coded data were obtained from 12 GP surgeries based in Kent, Surrey and Salford, using Morbidity Information Query Export Syntax.²⁹ Variables were extracted to identify the prevalence, co-morbidity and medicines management of CKD. Eighty-three percent of patient with diabetes had already had some measure of renal function checked and testing of renal function increased exponentially with age (Fig. 1), demonstrating that testing of high-risk groups is already occurring. A formal screening program for CKD may therefore not necessarily be required as much of the information required already exists in primary care.

Use of feedback to improve the quality of care

One of the features of the NEOERICA programme was that practices were provided with feedback using techniques developed over the last 10 years in the Primary Care Data Quality Programme. Potential markers of success, such as quantification of appropriate referral and reduction of late referral of advanced CKD, are some of the outcomes that could be fed back to GPs. Feedback has been demonstrated to improve the quality of chronic disease management especially when given in an educational content.³⁰

Clinical decision support systems

Clinical decision support systems are computer-based applications that may be made available on local

TABLE 4 *Aims of the renal services information strategy*

To educate the general public on CKD and to increase awareness especially in high-risk groups.
To identify patients in primary care at risk of developing CKD.
To make information available to patients diagnosed with CKD empowering them to make decisions about their treatment and ongoing management.
Ensuring that IT systems are set up to support the diagnosis of acute kidney injury.
Ensuring that IT systems in primary care support the appropriate referral of patients to nephrology.
To support patients and their relatives in making informed choices about treatment options, including conservative management.
To provide decision support to secondary care clinicians from other disciplines, providing management advice if required.

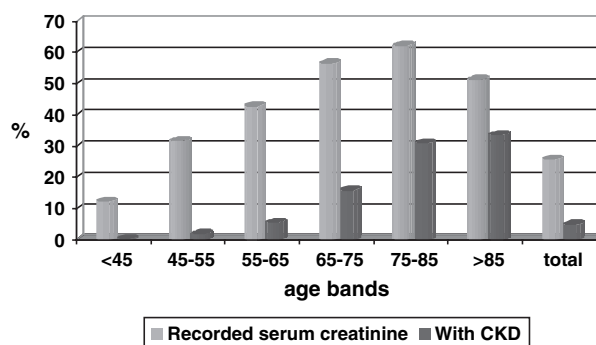


FIGURE 1 *NEOERICA study, population with SCr.*

computers or may be accessed via the internet. They serve many purposes and can be utilized in many different ways:

- Differential diagnosis assists: These can exploit information about current symptoms, laboratory results, radiology and medical records. A good example of a diagnosis tool is 'Isabel',³¹ a paediatric decision support system used in some UK hospitals.
- Alert and reminder systems: These can be used to warn health care providers of potential adverse occurrences. For example, alerts to significantly abnormal blood results or drug interaction and contraindication alerts at the time of medication prescribing.

Alert systems have been shown to be of benefit to patients. In a recent randomized controlled trial from the USA,³² a computer system was developed to highlight patients at risk of developing deep vein thrombosis when admitted to hospital. The argument for clinical decision support systems was strengthened in a recent review of 70 studies by Kawamoto *et al.*³³ where such systems improved clinical practice in 68% of trials.

There are a few caveats however; it is important to realize that computer 'tools' only serve as an adjunct to the decision-making process and should not replace the physician. Decision support systems may also be too time consuming to develop or modify as guidelines evolve. In some cases, they may also be difficult to incorporate into the general practice daily care and may have limited uptake by practitioners.^{34,35}

A clinical decision support system for nephrology

Renal patients may often be investigated by several specialists and also have biochemical and haematological tests undertaken in the community as well as the hospital. This can result in unnecessary duplication of tests and moreover wastes the opportunities that would follow from data integration. Reuse of test results might save money and time and could become the basis of an effective computer monitoring system provided by a decision support system or 'virtual nephrologist', linked to GP computer systems. A decision support tool or so-called virtual nephrologist based upon the current UK CKD guidelines is currently being developed.³⁶ The main aim being the provision of timely but unobtrusive advice about the interpretation of blood test results, drug prescriptions, specialist referrals and other clinical aspects of renal care.

Improving patient information: Renal Patient View

Renal Patient View³⁷ is an online service developed to provide patients with their individual diagnosis, treatment, latest test results and correspondence information. Patients are provided with their own login and have the ability to view or share their information any

time of day. Such an approach has potential to enhance the patient experience and empower the patient with up to date information on their treatment.

Sharing of information: Do Once and Share

The Do Once and Share programme³⁸ aims to introduce sharing of new IT knowledge among clinicians and to reduce unnecessary duplication of work in IT system development. With this programme, clinicians can share new IT developments in their speciality at a national level. These new IT approaches to care can then be shared and implemented across the NHS, saving time and reducing duplication of effort. Expert Systems and Renal Patient View are part of the Do Once and Share programme.

Conclusion

The last few years have seen new developments in the field of CKD and these will hopefully create an environment of better understanding renal disease. New guidelines, based upon GFR, have been released to assist with CKD management. In England, financial incentives have been introduced in primary care to improve recognition of CKD and its associated comorbidity. Primary care computer systems are able to correctly identify and stratify of the proportion of the population with CKD. New IT systems and developments can play an important role in the future, particularly by improving information exchange and the creation of partnerships between primary and secondary care to ensure that the specialist service is used appropriately. These partnerships might include feedback about the quality of care in CKD, ideally in an educational context. IT systems are important. Not only can they allow for integration of records and provision of information for health care providers, but they can empower patients too. Despite new developments in creation of new strategies, a challenge remains; the provision of an infrastructure to allow uptake of such innovations by the health care community.

Declaration

Authors' contributions: B Klebe conceived the idea of the article and wrote the script, co-authored by R Cooley, C Farmer, P Stevens, S de Lusignan, D O' Donoghue, R Middleton and J New. All authors declare that they have participated in the creation of the above manuscript and that they have seen and approved the final version.

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