Title  
Classification of chronic kidney disease ten years on: what have we learnt and what do we need to do now?

Running head  
Classification of chronic kidney disease

Article category  
Editorial

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**Background**  
Over the past ten years, chronic kidney disease (CKD) has become known as a common long-term condition, that affects around 13% of adults worldwide (1). CKD is defined as abnormalities of kidney structure or function, present for more than 3 months, and classified into five stages (2) using a blood test for estimated glomerular filtration rate (eGFR) and also a urine test for albumin-creatine ratio (ACR). To accurately diagnose CKD and improve health outcomes, it is important that both blood and urine tests are performed. CKD is associated with an increased risk of cardiovascular disease and also an increased risk for progression to advanced kidney disease that requires renal replacement therapy (dialysis or transplantation)(3).

A systematic review and meta-analysis of observational studies worldwide (1) that estimated CKD prevalence by stage in the general population suggested that 3.5% have stage 1; 3.9% have stage 2; 7.6% have stage 3; 0.4% have stage 4 and 0.1% have stage 5 CKD. However accurate estimation of GFR has become a heavily debated topic. As estimated GFR can be calculated by either Modification of Diet in Renal Disease (MDRD) or the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equation. The CKD-EPI equation is more accurate MDRD equation, as it is less biased at a GFR of more than 60 ml/min/1.73 m2 and performs better in people aged 75 years and over (4). The use of the MDRD equation may therefore over-diagnose CKD, with some authors having reported the **prevalence** of **stage** 3 CKD to be significantly higher when the MDRD equation is used (5).

**Impact of eGFR reporting**  
The benefits of the introduction of eGFR reporting have also been widely debated. In the UK there has been a paradigm shift since the introduction of eGFR reporting in 2006, as prior to that, **kidney** **disease** was considered primarily to be a secondary care condition. Today CKD stages 3-5 are considered a primary care priority as part of cardiovascular **disease** control and management. In the first 2 years following introduction of eGFR reporting, more than 40% of the expected **chronic** **kidney** **disease** stage 3 to 5 population were recorded (6). However, there has been controversy amongst primary care practitioners regarding whether people identified as having CKD, particularly older people, actually have a ‘disease’ (7). Current data from a recent national CKD audit (8), whereby audit software was automatically integrated with clinical systems to collect primary care data in England and Wales, estimated a CKD prevalence of approximately 5.5%. However, there was a large variation in those coded as having CKD (0-80%); only 86% of people with diabetes were tested for CKD (blood) and only 54% had an ACR annual test recorded. For people without diabetes, ACR testing rates were less than 15% (8). Despite apparent large variations in testing and coding, the introduction eGFR testing in some countries has had a significant impact on late referral rates. In the UK for example, Renal Registry data (9) are now showing late presentation rates (<90 days) falling from 23.9% in 2006 to 16.4% in 2015.

**Identification of progressive CKD**

Many laboratories have opted to report the numerical value for eGFR only if the eGFR is 60 ml/min/1.73 m2 or under, and not for eGFR 61-100ml/min/1.73m2, despite clinical practice guidelines that recommend for clinical laboratories to report GFR as a whole number if it is 90 ml/min/1.73 m2 or less” (4). There is some evidence that for patients without CKD who are managed in primary care, GFR is checked infrequently and there has been the suggestion that patients at high risk of progressive CKD (for example older people and those of African-Caribbean heritage), should have closer and more accurate monitoring of renal function (10, 11), which means a specific number for eGFR >60 would be helpful.

For those with coded or diagnosed CKD, efforts are being made to identify those at risk of progressive disease. A system of graphical surveillance of kidney function over time (eGFR graphs) has been operating in one hospital in the UK since 2004 (12) and has since been extended to other UK sites (13). Graphs of eGFR over time are automatically

generated for patients aged ≤65 years with eGFR <50 ml/min/1.73 m2 and patients >65 years with eGFR <40 ml/min/1.73 m2 using a dedicated software package (13). The graphs are then reviewed either in the laboratory or by a renal nurse. The eGFR graphs of those with progressive disease are then sent to family doctors with a request to review and potentially refer to secondary care. This intervention has been associated with a decline in the incident rate of renal replacement and the lowest percentage of patients referred late (most recently 4.9%) for dialysis in the UK (9).

**Renal learning health system**

A similar system is being implemented and evaluated in inner east London, UK (14). Here though, a wider renal learning health system (15) is being introduced with a number of different components: ‘trigger tools’ to alert family doctors to patients with a falling eGFR; CKD prevalence searches; shared primary care records with the secondary care team to enable e-referral (the patient does not need to have a face-to-face consultation); education of primary care physicians and nurses; plus patient education either 1-1 or group education with specialist nurses. A practice support package provides education and quality improvement tools for primary care practices, including educational resources to be used with patients.

**Patient involvement in mild-to-moderate CKD**Knowledge of CKD among those with the disease appears to be low (16), with people reporting a lack of understanding of the importance of self-management (18). In the renal learning system described above (14), the focus has been on development of self-management materials that are patient-centred. The materials include short and long-booklets, a film translated into four local languages and a Conversation Map™ (19), a pic­torial guide through which people are engaged in discussion, sharing beliefs and experiences of their condition. Conversation maps have been shown to be effective for diabetes self**-**managementeducation and facilitating behaviour change in people with type 2 diabetes (20), although not yet proven for CKD.

It is important to involve people in self-management of CKD. The first step is disclosure of the condition (21), followed by key messages that CKD is a long-term condition which requires monitoring, does not usually progress quickly and can be influenced by self-management strategies. Facilitation of self-management includes knowledge of the ‘kidney number’ (eGFR), plus ways in which patients can slow down progression such as smoking cessation, weight loss and exercise for blood pressure control, avoidance of harmful nephrotoxic mediations and good blood glucose control for those with diabetes.

The question of whether self-management is beneficial has been debated. One recent systematic review (22) focussed on the critical appraisal of self-management interventions for adults with CKD stages 1-4, and assessed whether these interventions improved adherence, knowledge, CKD progression, health literacy, self-efficacy, health-related quality of life and/or hospitalisations. The authors concluded that that although the effectiveness of self-management programmes in CKD is not proven (due to lack of well-tested interventions, and clear and consistent reporting of results), it is desirable that individuals with CKD are supported to effectively self-manage day-to-day aspects of their health.

Experience in patient education sessions (22) has confirmed that not all patients are aware of their diagnosis, despite having been referred to an e-clinic. The reason for non-disclosure is not clear, but it is possible that family doctors and nurses may be reluctant to inform patients of the ‘disease’ diagnosis because of fears of causing anxiety. The educational sessions offered have identified that many people do want more information about CKD, with good attendance at one-to-one sessions and group education sessions (22).

**Conclusion**

After the introduction of eGFR reporting over the past ten years, we have begun to understand that chronic kidney disease is common, although for the majority it is a condition that does not progress into advanced kidney disease that requires dialysis or transplantation. We have learnt that the condition is best managed in primary care, alongside support and guidance from secondary care teams.

Looking forward to the next ten years, there are specific clinical practice and research priorities. Clinical coding of people who have CKD needs to be improved, with less variation in practice. Accurate classification of CKD using ACR as well as eGFR is critical. Identification of people who have progressive kidney disease is a top priority, alongside timely referral. Renal teams require at least one year to prepare people for dialysis and it is well documented that poor preparation can lead to worse outcomes on dialysis.

One research priority is to find the best way to alert family doctors to patients with rapidly deceasing kidney function, and to see if these alerts have impact on late referral rates to secondary care in the longer term. The most important research priority however, from a patient perspective, is the question of whether self-management of CKD (by structured education) can increase patients' skills and confidence in managing their condition and improve clinical outcomes in the longer term.

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