Identification, management and referral of adults with chronic kidney disease: concise guidelines

Abstract

Chronic Kidney Disease (CKD) is often thought to be a relatively rare condition requiring specialist care. However, early CKD is common and referral of all patients would completely overwhelm existing specialist services. The purpose of this concise guidance is to inform general physicians and general practitioners about the identification and management of CKD, and who to refer for specialist care.

Introduction

Established renal failure (ERF) is uncommon but its treatment with dialysis or transplantation is very expensive. The number of patients receiving renal replacement therapy (RRT) in the UK is rising and is unlikely to reach steady state for another 25 years [1], costing over 2% of the total NHS budget. These figures make any improvement in the cost-effective treatment of early kidney disease highly desirable.

It is therefore important to note that:

- CKD increases in prevalence exponentially with age; the most common identifiable causes are diabetes and vascular disease. ERF is more common in ethnic minority populations
- Late referral of patients with established renal failure requiring renal replacement therapy to specialist renal services is associated with significant extra cost and poor clinical outcomes.
- The great majority of patients starting RRT have progressed from earlier stages of (CKD) and many could have been identified and referred earlier.
- The great majority of patients with early CKD do not progress to ERF but do have increased risks of cardiovascular disease; the risk of death outweighs the risk of progression.
- Progression is associated with proteinuria and uncontrolled hypertension.
- Optimal management of the risk factors for cardiovascular disease also reduces the risk of progression from early CKD to ERF.

Guideline development

This concise guidance is extracted from 'Chronic Kidney Disease in Adults: UK Guidelines for Identification, Management and Referral' [2]. Details of the development process are given in the full guidelines and summarised in Table 1.

Recommendations were graded using the same system as the National Service Framework for Renal Services (NSF) (see Table 2).

- Many of the questions posed by this guidance are about surveillance for, or referral of, kidney disease which have not been addressed by randomised controlled trials and we have had to rely mostly on expert opinion/consensus.
- Recommendations about the diagnosis of kidney disease have been based largely on observational diagnostic accuracy (DA) studies in which the test under consideration is compared with a reference standard; for simplification we have put diagnostic studies as level 3 DA to distinguish them from non-analytic intervention studies, and without subdivision by quality.
- As recommendations on organisation of care, rather than therapy, present problems with grading evidence, many of our recommendations are level 4.
- **All recommendations are graded as level 4 evidence unless otherwise stated.**

Implementation and cost implications

Disease-specific guidelines pose particular difficulties for implementation when applied to patients with multiple conditions [3]. Many patients with kidney disease have diabetes, hypertension, or cardiovascular disease. For this reason, these guidelines have been developed to be consistent, wherever possible, with existing UK guidelines and are designed to be integrated into the management of cardiovascular risk and diabetes in the NHS.

Full implementation will require:

- Revision of the electronic coding of CKD in the NHS, both in hospital episode statistics and in primary care computer systems.
- Standardisation and simplification of management of CKD.
- Incorporation of markers of quality care of CKD into the Quality and Outcomes Framework and other NHS quality and safety standards.
- Measurement of outcomes such as late referral for dialysis and disparities in access to care.
- Use of the chronic care model [4], with particular emphasis on decision support systems.
- An educational package for GPs, hospital physicians and surgeons, and community-based nurses, on the recognition and management of CKD.
- Standardisation of creatinine assay methods.
- Full funding of extra laboratory costs.

We have deliberately not addressed the question of which individuals should be responsible for the care plan for CKD outlined here.

- We anticipate that a variety of models will emerge, including conventional shared care between GPs and hospital-based nephrologists; geriatricians, diabetologists, and other secondary care physicians; specialist GPs [5, 6]; specialist nurses working at General Practice or Primary Care Trust (PCT) level; and computer-based shared care, including systems to prompt clinical actions [7].
- Disease registers based on primary care IT systems and an adequate IT infrastructure will be an essential pre-requisite for delivery of the care plan for CKD.
- The development of community nephrologists [8] may help to break down unnecessary barriers to the delivery of comprehensive chronic disease management.

Implementation of these guidelines will carry cost implications, particularly for the treatment of patients with anaemia, which is not covered by existing funding. It is important that the NHS develops a clear strategy for equitable funding of the management of CKD. Any system for implementation should be designed to reduce existing ethnic and socioeconomic differences in the consequences of CKD [9-11].

Membership of the committee

Dr C Tomson (Chair) (Royal College of Physicians/Renal Association)
Professor R Bilous (Professional Advisory Council, Diabetes UK)
Dr S Blades (Royal College of General Practitioners)
Dr R Burden (co-opted, Renal Association)
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Mr D Gilbert (Observer, Department of Health for England)
Dr E Lamb (Association for Clinical Biochemistry) (from May 2003)
Dr D Newman (Association for Clinical Biochemistry) (until March 2003)
Mr G Nicholas (National Kidney Federation)
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Dr P Roderick (Public Health observer from External Reference Group for NSF for Renal Services)
Dr P Stevens (Society for District General Hospital Nephrologists)
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Dr David Newman died in March 2003. He had contributed enormously to British nephrology, with many original research contributions as well as active input into the UK Renal Registry and to this Committee.

Acknowledgement

We are pleased to thank Professor Turner- Stokes for her help in editing and adapting this for the Concise Guidance series.

Table 1: Guideline Development Process The guidelines have been developed in accordance with the principles laid down by the AGREE collaboration (Appraisal of Guidelines for Research and development) [12,13].

Scope and purpose:	
Overall objective of the guidelines	To promote optimal management of patients with CKD within the NHS.
The patient group covered:	Adults with (or at risk of) Chronic Kidney Disease (CKD)
Target audience:	All clinicians, including general physicians, GPs and other health professions who are involved in the management of patients with CKD – in particular those working in diabetes, geriatrics or cardiovascular subspecialties.
Clinical questions covered:	Identification of patients, reduction of risks associated with CKD, and whom to refer to specialist services
Stakeholder involvement:	
The Guideline Development Group (GDG):	The Guidelines were instigated by the Renal Association and the RCP Joint Specialty Committee on Renal Disease, in association with: • Royal College of General Practitioners • Association for Clinical Biochemistry • Society for District General Hospital Nephrologists • British Geriatrics Society • Professional Advisory Council of Diabetes UK • National Kidney Federation
Funding	Cost of travel and accommodation for attending meetings were met by the Department of Health for England
Conflicts of interest	No external funding has been sought or obtained. All authors and group members have declared, and provided details of, any actual or potential conflicts of interest
Rigour of development	
Evidence gathering:	Evidence for these guidelines was provided by review of Cochrane Library, and Medline searches by individual members of the group according to their area of expertise. They draw on existing guidance including the relevant NSFs, NICE guidelines, and similar guidelines from other countries.
Review process	Drafts were circulated regularly and the group met on 10 occasions
Links between evidence and recommendations	The system used to grade the evidence and guidance recommendations is that used by the Renal NSF (see Table 2)**.**
Piloting and peer review	The final draft was widely circulated to all relevant parties and their comments incorporated together with the results of pilot exercises on patient referral.
Implementation	
Tools for application	Brief summaries are being prepared for use in clinics and surgeries together with versions suitable for electronic booking. Decision support software is being developed.
Plans for review	Review is planned in 4 years

Table 2: Levels of evidence as used in the Renal NSF

Level 1	Meta-analyses, systematic reviews of randomised controlled trials, or randomised controlled trials.
Level 2	Systematic reviews of case-control or cohort studies, or case-control or cohort studies
Level 3	Non-analytic studies, e.g. case reports, case series
Level 4	Expert opinion (in the absence of any of the above). This includes the views and experiences of people with renal failure and their carers.

Many of the questions posed by this guidance have not been tested by randomised controlled trials and rely on expert evidence. All recommendations are graded level 4 unless stated otherwise.

Table 3: Classification of Chronic Kidney Disease (CKD)

Stage	Description	Minimum test frequency
1	Normal GFR GFR >90 mL/min/1.73 m^2 **with other evidence of chronic kidney damage***	12 monthly
2	Mild impairment GFR 60-89 mL/min/1.73 m^2 **with other evidence of chronic kidney damage***	12 monthly
3	Moderate impairment GFR 30-59 mL/min/1.73 m^2	6 monthly (12 if stable**)
4	Severe impairment GFR 15-29 mL/min/1.73 m^2	3 monthly (6 if stable)**
5	Established renal failure (ERF) GFR < 15 mL/min/1.73 m^2 or on dialysis	3 monthly
	* The "**other evidence of chronic kidney damage**" may be one of the following: • Persistent microalbuminuria • Persistent proteinuria • Persistent haematuria (after exclusion of other causes, e.g. urological disease) • Structural abnormalities of the kidneys demonstrated on ultrasound scanning or other radiological tests, e.g. polycystic kidney disease, reflux nephropathy • Biopsy-proven chronic glomerulonephritis Patients found to have a GFR of 60-89 mL/min/1.73 m^2 <u>without</u> one of these markers • should not be considered to have CKD and • should not be subjected to further investigation (unless there are additional reasons to do so)	
	** stable = < 2ml/min/1.73 m^2 change over 6 months or more	

Box 1: Estimation of the Glomerular Filtration Rate

The GFR may be estimated using the 4-variable Modification of Diet in Renal Disease (MDRD) equation:

GFR (ml/min/1.73 m^2) = 186 x {[Serum Creatinine μmol/l/88.4] $^{-1.154}$}
x {age (years) $^{-0.203}$}
x 0.742 if female and
x 1.21 if African American.

Until laboratories are able to report results in this way, prediction tables can be used to estimate GFR from serum creatinine, age, gender and ethnicity (see Appendix).
Alternatively, an on-line GFR calculator based on this equation is available at
<http://cgi.www.renal.org/cgi-bin/www.renal.org/eGFR/GFR.pl

Table 4: Criteria for referral to specialist services

Estimated GFR	
<15 ml/min/1.73 m^2	Immediate referral but see section C14
15 – 29 ml/min/1.73 m^2	Urgent referral (routine referral if known to be stable) See section C14
30 – 59 ml/min/1.73 m^2	Routine referral if: • Progressive fall in GFR/increase in serum creatinine • Microscopic haematuria present • Urinary PCR > 45 mg/mmol • Unexplained anaemia (Hb <11g%), abnormal potassium, calcium or phosphate • Suspected systemic illness, eg SLE • Uncontrolled BP (>150/90 on 3 agents)
60 – 89 ml/min/1.73 m^2	Referral not required unless other problems present (see below & table 3)
Renal problems irrespective of GFR	Immediate referral for: • Malignant hypertension • Hyperkalaemia (potassium >7.0 mmol/l) Urgent referral for • Proteinuria with oedema and low serum albumin (nephrotic syndrome) Routine referral for: • Dipstick proteinuria present and urine protein/creatinine ratio >100 mg/mmol • Dipstick proteinuria and microscopic haematuria present • Macroscopic haematuria but urological tests negative
	When making referral, quote all information listed in Box 2

Box 2: Information needed for referral

1. General medical history
2. Urinary symptoms
3. Medication
4. Examination, eg. BP, oedema, palpable bladder or other positive findings
5. Urine dipstick for blood and protein
6. Urine protein/creatinine ratio, if proteinuria present - early morning urine (EMU) preferable (in diabetes, result of urine albumin/creatinine ratio if dipstick proteinuria negative)
7. Blood count
8. Serum creatinine, sodium, potassium, albumin, calcium, phosphate, cholesterol,
9. HbA1C (in diabetes)
10. All previous serum creatinine results with dates
11. Result of renal ultrasound scan if available (see section C 13)

	THE GUIDELINES	
	A. Identification and classification of CKD	***Level of evidence***
1.	***Glomerular fitration rate (GFR)*** • **Kidney function should be assessed by estimated GFR** and CKD is to be classified on this basis (see Table 3) ▪ **The GFR should be estimated from serum creatinine** using the 4-variable MDRD equation. (See Box 1 for calculation if not provided by local laboratories) **(Level 2)**	
2.	***Serum Creatinine measurement*** *to allow estimation of the GFR:* **Serum creatinine concentration should be measured at initial assessment** and then **at least annually** in all adult patients with: • Previously diagnosed CKD including: o Identified renal pathology (e.g. polycystic kidney, Biopsy proven GN, reflux nephropathy) o Persistent proteinuria (see page **X** section **X**) o Urologically unexplained haematuria • Conditions associated with a high risk of silent development of obstructive kidney disease: o Bladder voiding dysfunction (outflow obstruction, neurogenic bladder) o Urinary diversion surgery o Urinary stone disease (>one episode/year) • Conditions associated with a high risk of silent development of parenchymal kidney disease: o Hypertension, diabetes mellitus, heart failure, o Atherosclerotic coronary, cerebral, or peripheral vascular disease • Conditions requiring long-term treatment with potentially nephrotoxic drugs o e.g ACEIs, ARBs, NSAIDs, Lithium, Mesalazine, Cyclosporin, Tacrolimus • Multi-system diseases that may involve the kidney o e.g. systemic lupus erythematosus (SLE), vasculitis, myeloma, rheumatoid arthritis.	

3.	***Testing for urinary protein***
	
	Dipstick urinalysis for protein should be undertaken:
	
	• As part of the initial assessment of patients with
	  ○ Newly discovered hypertension, haematuria or reduced GFR
	  ○ Unexplained oedema or suspected heart failure
	  ○ Suspected multi-system disease, e.g. SLE, vasculitis, myeloma
	  ○ Diabetes mellitus
	• As part of the annual monitoring of patients with
	  ○ Biopsy-proven glomerulonephritis
	  ○ Reflux nephropathy
	  ○ Urologically unexplained haematuria or persistent proteinuria
	  ○ Diabetes mellitus
	  (patients with diabetes mellitus should also have annual testing for albumin:creatinine ratio to exclude 'microalbuminuria' if the dipstick urinalysis for protein is negative)
	• As part of routine monitoring for patients receiving nephrotoxic agents eg gold, penicillamine, according to the recommendations in the British National Formulary.	

4.	***Confirmation of proteinuria***
	There is no need to perform 24 hr urine collections for quantification of proteinuria **(Level 3 DA)**
	
	If protein dipstick test is positive (≥1+) the following should be undertaken
	• MSU for culture to exclude urinary tract infection (UTI).
	• Laboratory confirmation of proteinuria, **(Level 3DA)**
	preferably on early morning urine (EMU) sample, to exclude postural proteinuria
	
	• Positive tests for proteinuria are
	  ○ Urine protein:creatinine ratio ≥45 mg/mmol or
	  ○ Albumin:creatinine ratio of ≥30 mg/mmol
	
	• Persistent proteinuria should be defined as
	  ○ two or more positive tests for proteinuria, preferably spaced by 1 to 2 weeks
	
	In annual diabetes monitoring if dipstick test negative request albumin/creatinine ratio. Microalbuminuria is defined as ACR > 2.5 mg/mmol (men) or >3.5 mg/mmol (women) on 2 or 3 occasions (see section 10).
		3 DA

5.	***Haematuria***
	Routine screening for haematuria is not recommended.
	
	• **Dipstick urinalysis for blood is the test of choice (Level 3DA)** for
	  • confirmation of macroscopic haematuria
	  • detection of microscopic haematuria.
	
	Infection, trauma, and menstruation should t be excluded first.
	There is no need for microscopy of an MSU sample to detect or confirm haematuria.
	
	• Dipstick urinalysis for blood is indicated as part of initial assessment of patients with
	  • Newly found increased serum creatinine concentration/ reduced GFR
	  • Newly discovered proteinuria
	  • Suspected multi-system disease with possible renal involvement
		3 DA

	B. Interpretation of tests / Initial management	***Level of evidence***
6	***Recognition of acute renal failure (ARF)*** ARF is characterised by rapid deterioration of renal function over a period of hours or days ARF should be suspected in the context of an acute illness in the presence of: • A 50% rise in serum creatinine concentration • A fall in estimated GFR of >25% (if baseline unknown assume 75 ml/min/1.73m^2) but GFR must be interpreted with caution as formulae rely on a stable creatinine concentration **(Level 3 DA)** • Oliguria (urinary output <0.5 ml/kg/hr) Because it requires emergency treatment, all patients with newly detected abnormal renal function should be assumed to have ARF until proven otherwise, although the majority will turn out to have CKD	

7	***In newly diagnosed GFR <60 ml/min/1.73 m^2:*** **Management should include:**
	• Review of all previous measurements of serum creatinine
	  ○ to estimate GFR and assess rate of deterioration.
	• Review of medication, particularly
	  ○ recent additions (e.g. diuretics, non-steroidal anti-inflammatory drugs (NSAIDs), or any drug capable of causing interstitial nephritis eg penicillins, cephalosporins, mesalazine, diuretics)
	• Urinalysis: (see page **X**)
	  ○ haematuria and proteinuria suggest glomerulonephritis, which may progress rapidly
	• Clinical assessment,
	  ○ eg. looking for sepsis, heart failure, hypovolaemia, palpable bladder.
	• Repeat serum creatinine measurement within 5 days
	  ○ to exclude rapid progression.
	• **Check criteria for referral (see Table 4 and Box 2)**
	  ○ if not indicated ensure entry into a chronic disease management programme.	

8	***Management of haematuria*** **should include:** • Check serum creatinine concentration in all patients ○ refer to nephrologist if GFR < 60 mL/min/1.73 m^2. • Check for proteinuria in all patients. If GFR normal: Macroscopic haematuria, with or without proteinuria: • **fast track urology referral; refer to nephrology if initial investigations negative.** Microscopic haematuria (dipstick **or** laboratory microscopy) without dipstick proteinuria: • Age >50 yrs: refer to urology • Age <50 yrs, or >50 yrs after exclusion of urological cancer: treat as CKD (includes measurement of serum creatinine concentration, annual repeat if initially normal) Microscopic haematuria with urine protein:creatinine ratio > 45 mg/mmol • **refer to nephrology.** There is no need for laboratory confirmation of dipstick positive haematuria. **Level 3 DA**	**3DA**
9	***Proteinuria:*** **If found, management should include** • Quantification of proteinuria (see section A4), test for haematuria, estimate GFR. ○ Urine PCR > 100 mg/mmol – refer to Nephrologist irrespective of GFR.	

	○ Urine PCR >45 mg/mmol with microscopic haematuria – refer irrespective of GFR. • Check criteria for referral (see Table 4 and Box 2) ○ **if not indicated ensure entry into chronic disease management programme.**	
10	***Diabetes Mellitus (DM) and 'microalbuminuria' or proteinuria*** • Urinary albumin/creatinine ratio should be measured using a laboratory method if dipstick protein negative (see section 4) preferably on an EMU, but not during acute illness, intercurrent infection or menstruation. • Persistent urinary albumin/creatinine ratios of ≥2.5 mg/mmol (male) or ≥3.5 mg/mmol(female) on 2-3 occasions are consistent with micro-albuminuria **Manage patients with DM (Type I or II) and microalbuminuria or proteinuria as follows:** • Achieve good glycaemic control (HbA1c 6.5-7.5%). **Level 1** • Prescription of an ACEI (or ARB in the presence of a firm contraindication to ACEI), titrated to full dose, irrespective of initial blood pressure **Level 1** • Control of hypertension if necessary: Addition of other antihypertensive drugs in combination to reach the blood pressure goal. **(Level 1)** • Measurement at least once a year of • urine albumin:creatinine ratio (or PCR) • serum creatinine concentration (for estimated GFR). • **Referral to diabetes team for review.** • **Referral to a nephrologist** • **as for patients without diabetes.** • Co-ordination of care between the primary care team and specialist teams (including nephrology, ophthalmology, cardiology, and vascular surgery) at all stages of CKD including stage 5.	**1** **1** **1**
11	***Investigation for atherosclerotic renal artery stenosis*** **Patients should be referred for further investigation for atherosclerotic renal artery stenosis (ARAS), with a view to intervention, in the following situations:** • Refractory hypertension (ie BP > 150/90 mm Hg despite 3 anti-hypertensive agents). **Level 3 DA** • Recurrent episodes of pulmonary oedema despite normal left ventricular function on echocardiography (so-called "flash pulmonary oedema", usually associated with hypertension). **Level 3 DA** • Rising serum creatinine concentration (rise of >=20% or fall of GFR of >15%) ○ over 12 months with a high clinical suspicion of widespread atherosclerosis. ○ or during the first 2 months after initiation of ACEI or ARB treatment **(Level 3DA)** • Unexplained hypokalaemia with hypertension.	**3 DA** **3 DA** **3 DA**

	C. Management of CKD	***Level of evidence***
	All Stages	
12	Local arrangements should be made for the implementation of care plans for all adult patients with CKD irrespective of age, shared between primary, secondary and tertiary care as appropriate and to include: • Regular measurements of kidney function and other laboratory tests depending on the severity of kidney impairment (see Table 3). • General health advice as appropriate on: **2** ○ smoking cessation. **(Level 2)** **1** ○ weight loss **(Level 1)** ○ aerobic exercise ○ limiting alcohol intake ○ limiting sodium intake • Cardiovascular Prophylaxis For patients with 10 year risk of cardiovascular disease of > 20% (Joint British Society Guidelines) consider: ○ Aspirin treatment if BP < 150/90 mm Hg **(Level 2)** **2** ○ Lipid-lowering drug therapy (or entry into a trial). (**Level 2**) **2** • Blood pressure monitoring ○ Blood pressure should be measured according to BHS standards at least annually • Control of hypertension ○ Hypertension should be meticulously controlled**.** **2** ○ Threshold for initiation of anti-hypertensive medication: **(Level 2)** ▪ If urine protein/creatinine ratio (PCR) <100 mg/mmol • Threshold 140/90 mmHg – Target 130/80 ▪ If urine PCR >100 mg/mmol • Threshold 130/80 mmHg – Target 125/75 ○ ACEIs or ARBs to be included: **(Level 1)** 1 ▪ if urine PCR >100 mg/mmol ▪ in diabetic patients with micro-albuminuria (see sections 4 and 10) Serum creatinine and potassium should be checked • before starting medication • two weeks after starting, and after subsequent increases in dose. If Creatinine increase of >20% or fall in GFR of >15% • Repeat creatinine, check potassium, and refer for specialist opinion on whether to stop treatment or to investigate for renal artery stenosis. • If Hyperkalaemia present (serum K >6 mmol/l) • stop relevant drugs, eg. NSAIDs and potassium-retaining diuretics • check diet and proprietary treatments, eg. LoSalt. If hyperkalaemia persists the ACE or ARB should be stopped.	

	CKD stage 3 - additional management	

13	***Additional management for CKD stage 3*** **should include:**
	• Annual measurement of Hb, potassium, calcium and phosphate
	• If Hb <11 and other causes excluded:
	  • treat with erythropoiesis stimulating agents to maintain Hb 11-12 g/dl depending on the patient's functional needs. (**Level 1)**
	• Request renal ultrasonography in
	  • patients with lower urinary tract symptoms,
	  • refractory hypertension
	  • unexpected progressive fall in GFR.
	• Immunise against influenza and pneumococcus.
	• Review all prescribed medication regularly to ensure appropriate doses
	  • avoid nephrotoxic drugs including NSAIDs wherever possible .
	• Check parathyroid hormone (PTH) concentration when Stage 3 first diagnosed.
	  • If raised check serum 25-hydroxyvitamin D;
	  • if this is low treat with ergocalciferol or cholecalciferol with calcium supplement (not calcium phosphate).
	  • Repeat PTH after 3 months and **refer if still raised**.
		1

	CKD Stages 4-5 additional management	
14	***Care of all patients with stage 4 or 5 CKD should be discussed formally*** **with a nephrologist once the appropriate investigations are obtained, even if it is not anticipated that RRT will be appropriate.** **Exceptions may include:** • patients in whom stage 4 or 5 CKD supervenes as part of another terminal illness • patients with stable function in whom all the appropriate investigations and management interventions have been performed and who have an agreed and understood care pathway • patients in whom further investigation and management is clearly inappropriate **Management should be shared with GP and/or other healthcare professionals and should include:** • 3-monthly tests: serum creatinine (for GFR), Hb, calcium, phosphate, bicarbonate, PTH • dietary assessment • immunisation against hepatitis B • investigation and treatment of phosphate retention and hyper-parathyroidism • correction of acidosis (**Level 2)** • information about options for treatment • timely provision of dialysis access depending on treatment choice (**Level 2)**	

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Appendix 1. Prediction of GFR*

White Men — Age

Creatinine	20	30	40	50	60	70	80
70	>90	>90	>90	>90	>90	>90	>90
80	>90	>90	>90	>90	>90	88	86
90	>90	>90	86	82	79	77	75
100	88	81	76	73	70	68	66
110	79	72	68	65	63	61	59
120	71	66	62	59	57	55	54
130	65	60	56	54	52	50	49
140	60	55	52	49	48	46	45
150	55	51	48	46	44	43	42
160	51	47	44	42	41	40	39
170	48	44	41	40	38	37	36
180	45	41	39	37	36	35	34
190	42	39	36	35	34	32	32
200	39	36	34	33	32	31	30
210	37	34	32	31	30	29	28
220	35	33	31	29	28	27	27
230	34	31	29	28	27	26	25
240	32	29	28	27	26	25	24
250	31	28	27	25	24	24	23
260	29	27	25	24	23	23	22
270	28	26	24	23	22	22	21
280	27	25	23	22	21	21	20
290	26	24	22	21	21	20	19
300	25	23	21	21	20	19	19
310	24	22	21	20	19	18	18
320	23	21	20	19	18	18	17
330	22	20	19	18	18	17	17
340	21	20	19	18	17	17	16
350	21	19	18	17	17	16	16
360	20	18	17	17	16	16	15
370	19	18	17	16	16	15	15
380	19	17	16	16	15	15	14
390	18	17	16	15	15	14	14
400	18	16	15	15	14	14	13
410	17	16	15	14	14	13	13
420	17	15	15	14	13	13	13
430	16	15	14	14	13	13	12
440	16	15	14	13	13	12	12
450	15	14	13	13	12	12	12
460	15	14	13	13	12	12	11
470	15	14	13	12	12	11	11
480	14	13	12	12	11	11	11
490	14	13	12	12	11	11	11
500	14	13	12	11	11	11	10

*The tables for 'black' patients should be used to predict GFR in patients of African, African-American, or African-Caribbean origin. For all other ethnic minorities, the tables for 'white' patients should be used.

White Women

Creatinine	Age 20	30	40	50	60	70	80
50	>90	>90	>90	>90	>90	>90	>90
60	>90	>90	>90	>90	>90	>90	89
70	>90	>90	85	82	79	76	74
80	84	78	73	70	67	65	64
90	74	68	64	61	59	57	56
100	65	60	57	54	52	51	49
110	58	54	51	48	47	45	44
120	53	49	46	44	42	41	40
130	48	44	42	40	39	37	36
140	44	41	38	37	35	34	33
150	41	38	35	34	33	32	31
160	38	35	33	31	30	29	29
170	35	33	31	29	28	27	27
180	33	30	29	27	26	26	25
190	31	29	27	26	25	24	23
200	29	27	25	24	23	23	22
210	28	25	24	23	22	21	21
220	26	24	23	22	21	20	20
230	25	23	22	21	20	19	19
240	24	22	21	20	19	18	18
250	23	21	20	19	18	18	17
260	22	20	19	18	17	17	16
270	21	19	18	17	17	16	16
280	20	18	17	16	16	15	15
290	19	18	17	16	15	15	14
300	18	17	16	15	15	14	14
310	18	16	15	15	14	14	13
320	17	16	15	14	14	13	13
330	16	15	14	14	13	13	12
340	16	15	14	13	13	12	12
350	15	14	13	13	12	12	12
360	15	14	13	12	12	12	11
370	14	13	13	12	12	11	11

Black Men	Age						
Creatinine	**20**	**30**	**40**	**50**	**60**	**70**	**80**
90	>90	>90	>90	>90	>90	>90	>90
100	>90	>90	>90	88	85	82	80
110	>90	88	83	79	76	74	72
120	86	79	75	71	69	67	65
130	79	72	68	65	63	61	59
140	72	66	63	60	58	56	54
150	67	61	58	55	53	52	50
160	62	57	54	51	49	48	47
170	58	53	50	48	46	45	43
180	54	50	47	45	43	42	41
190	51	47	44	42	41	39	38
200	48	44	41	40	38	37	36
210	45	42	39	37	36	35	34
220	43	39	37	36	34	33	32
230	41	37	35	34	33	32	31
240	39	36	34	32	31	30	29
250	37	34	32	31	30	29	28
260	35	32	31	29	28	27	27
270	34	31	29	28	27	26	25
280	32	30	28	27	26	25	24
290	31	29	27	26	25	24	23
300	30	28	26	25	24	23	23
310	29	27	25	24	23	22	22
320	28	26	24	23	22	22	21
330	27	25	23	22	21	21	20
340	26	24	22	21	21	20	20
350	25	23	22	21	20	19	19
360	24	22	21	20	19	19	18
370	23	22	20	19	19	18	18
380	23	21	20	19	18	18	17
390	22	20	19	18	18	17	17
400	21	20	19	18	17	17	16
410	21	19	18	17	17	16	16
420	20	19	18	17	16	16	15
430	20	18	17	16	16	15	15
440	19	18	17	16	15	15	15
450	19	17	16	16	15	15	14
460	18	17	16	15	15	14	14
470	18	16	15	15	14	14	13
480	17	16	15	14	14	13	13
490	17	16	15	14	14	13	13
500	17	15	14	14	13	13	13
510	16	15	14	13	13	13	12
520	16	15	14	13	13	12	12
530	16	14	13	13	12	12	12
540	15	14	13	13	12	12	11
550	15	14	13	12	12	12	11
560	15	13	13	12	12	11	11
570	14	13	12	12	11	11	11

Black Women			Age				
Creatinine	**20**	**30**	**40**	**50**	**60**	**70**	**80**
70	>90	>90	>90	>90	>90	>90	>90
80	>90	>90	89	85	82	79	77
90	89	82	77	74	71	69	67
100	79	73	68	65	63	61	60
110	71	65	61	59	57	55	53
120	64	59	56	53	51	50	48
130	58	54	51	48	47	45	44
140	53	49	46	44	43	41	40
150	49	45	43	41	40	38	37
160	46	42	40	38	37	36	35
170	43	39	37	35	34	33	32
180	40	37	35	33	32	31	30
190	38	35	33	31	30	29	28
200	35	33	31	29	28	27	27
210	33	31	29	28	27	26	25
220	32	29	28	26	25	25	24
230	30	28	26	25	24	23	23
240	29	26	25	24	23	22	22
250	27	25	24	23	22	21	21
260	26	24	23	22	21	20	20
270	25	23	22	21	20	19	19
280	24	22	21	20	19	19	18
290	23	21	20	19	18	18	17
300	22	20	19	18	18	17	17
310	21	20	19	18	17	17	16
320	21	19	18	17	16	16	16
330	20	18	17	17	16	15	15
340	19	18	17	16	15	15	14
350	19	17	16	15	15	14	14
360	18	17	16	15	14	14	14
370	17	16	15	14	14	14	13
380	17	16	15	14	14	13	13
390	16	15	14	14	13	13	12
400	16	15	14	13	13	12	12
410	15	14	13	13	12	12	12
420	15	14	13	12	12	12	11
430	15	13	13	12	12	11	11
440	14	13	12	12	11	11	11

Key – Stages of Renal Failure

Stage 1	Stage 2	Stage 3	Stage 4	Stage 5