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Definition

The *Kidney Disease: Improving Global Outcomes (KDIGO) 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease (CKD)* states that ‘CKD is defined as abnormalities of kidney structure or function, present for greater than three months, with implications for health and CKD is classified based on cause, GFR category, and albuminuria category (CGA)’¹ and that the criteria for CKD is the presence of one of the following (for more than three months):

- estimated glomerular filtration rate (eGFR) less than 60 mL/min/1.73m² **or**
- one or more markers of kidney damage:
 - o albuminuria (presence of albumin in the urine)
 - o urine sediment abnormalities
 - o electrolyte abnormalities due to tubular disorders
 - o renal histological (tissue) abnormalities
 - o structural abnormalities detected by imaging
 - o a history of kidney transplantation.¹

KDIGO also state that CKD is classified based on glomerular filtration rate (GFR) and albuminuria. GFR categories range from G1 (greater than or equal to 90 mL/min/1.73m²) to G5 (less than 15 mL/min/1.73m²), and albuminuria categories range from A1 (less than 3 mg/mmol ACR [albumin-to-creatinine ratio]) to A3 (greater than 30 mg/mmol ACR).¹ GFR stage G5 is also known as end-stage renal failure (ESRF).

KIDIGO has produced a table, shown here as Table 1, which outlines the full criteria for each GFR and albuminuria category and linked this to prognosis. The risk of CKD progressing to adverse outcomes starts low and ultimately leads to very high risk.²

Table 1 - Prognosis of CKD by GFR and albuminuria category heat map.²

Prognosis of CKD by GFR and Albuminuria Categories: KDIGO 2012				Persistent albuminuria categories		
				Description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30-300 mg/g 3-30 mg/mmol	>300 mg/g >30 mg/mmol
GFR categories (mL/min/ 1.73m ²) Description and range	G1	Normal or high	≥90			
	G2	Mildly decreased	60-89			
	G3a	Mildly to moderately decreased	45-59			
	G3b	Moderately to severely decreased	30-44			
	G4	Severely decreased	15-29			
	G5	Kidney failure	<15			

Green: low risk (if no other markers of kidney disease, no CKD); Yellow: moderately increased risk
Orange: high risk; Red: very high risk

Table 1 reproduced with permission from: *Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. Kidney Int Suppl. 2013; 3: x.*

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Prevalence and incidence

The incidence and prevalence of chronic kidney disease (CKD) varies depending on the population studied, including ethnic group and socio-economic class⁴. In 2014, Public Health England (PHE) estimated that 2.6 million people in England aged 16 and over had stage three to five CKD – this equated to 6.1 percent of the population of this age group.³ Prevalence also increases with age.⁴ The same PHE report, stated that 1.9 percent of those aged 64 and under had CKD stages three to five, compared to 13.5 percent of those aged 65 to 74 and 32.7 percent of those aged 75 and over.³

Black, Asian and minority ethnic communities are five times more likely to develop CKD than other groups⁵ and the age standardised prevalence of CKD stage three to five is higher in women at 10.6 percent, compared to 5.8 percent in men.⁴

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Signs and symptoms

At the early stages CKD is often symptomless. At the later stages people with CKD may present with:

- weight loss and poor appetite
- oedema (swollen ankles, feet or hands)
- shortness of breath
- tiredness
- haematuria (blood in urine)
- an increased need to urinate – particularly at night
- insomnia
- pruritus (itchy skin)
- muscle cramps
- feeling sick
- headaches
- erectile dysfunction.⁶

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Causes/risk factors

There are several causes of CKD, these include:

- conditions associated with intrinsic kidney disease (those that affect the kidney's tissues), such as hypertension, type 1 and type 2 diabetes mellitus, hypercholesterolemia
- kidney infections
- polycystic kidney disease – an inherited condition where cysts develop in the kidney
- glomerulonephritis (inflammation of the glomeruli of the kidneys)
- medicines which are impactful on the kidneys, such as lithium, ciclosporin, calcineurin inhibitors (such as tacrolimus), aminoglycosides, mesalazine
- conditions associated with obstructive kidney disease
- multi-system diseases that may involve the kidney.^{7,8}

For more information about the causes of CKD, visit the NICE Clinical Knowledge Summary (CKS)

Chronic kidney disease - Causes.

Risk factors for CKD also include increasing age, **acute kidney injury**, cardiovascular disease (**ischaemic heart disease**, chronic **heart failure**, peripheral vascular disease or cerebral vascular disease).^{1,9}

As previously stated, those of Black, Asian and minority ethnic communities are at increased risk of developing CKD.³⁻⁵

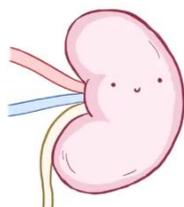
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Pathophysiology (mechanism of disease)

The following video by **Osmosis** looks at the causes, symptoms, diagnosis, treatment and pathology of CKD. It covers how hypertension and diabetes cause CKD and the effects of CKD on the function of the kidneys.

Chronic kidney disease - Osmosis

CHRONIC KIDNEY
DISEASE (CKD)



OSMOSIS.org
2020 Edition

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Prognosis and complications

Those with CKD have a substantially increased mortality risk.¹⁰ CKD can progress to end-stage kidney disease in a small but significant percentage of people,⁹ although those with CKD are roughly twenty times more likely to die of cardiovascular disease than to progress to end-stage renal disease.⁸

The introduction in **KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease (CKD)**, starting on page 15, explores the importance of kidney disease worldwide and includes a conceptual model for the development, progression, and complications of CKD (page 16).

Complications of CKD include:

- cardiovascular disease (**hypertension**, peripheral vascular disease and **heart failure**)
- cardiovascular events (**stroke** and **myocardial infarction**)
- **anaemia** or chronic disease
- renal bone disease
- malnutrition
- neuropathy (nerve pain)
- lipid abnormalities
- increased risk of **acute kidney injury**
- end-stage renal disease that requires renal replacement therapy (RRT)
- risk of acidosis (to learn about acidosis, access this Lab Tests Online article **Acidosis and Alkalosis**)
- increased risk of infection – those with CKD have been shown to be at increased risk of hospitalisation due to infections such as **pneumonia**, **sepsis**, and **urinary tract infections**.^{1,11}

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Diagnosis/detection

Early diagnosis of CKD aims to reduce as well as decrease initial morbidity and mortality, along with cardiovascular disease risk and progression to end-stage renal disease.

Testing in those with risk factors and conditions linked to CKD is recommended. For more information on who should be tested for CKD, access the NICE CKS **Chronic kidney disease, Diagnosis, Assessment - Who should I test for chronic kidney disease?**

Tests include creatinine-based estimate of GFR, cystatin C-based estimate of GFR, haematuria and albuminuria for proteinuria testing. More information about these investigations can be found in Section 1.1 *Investigations for chronic kidney disease* of NICE clinical guidance **Chronic kidney disease in adults: assessment and management [CG182]**.

Results from these tests can then be used to classify a person's CKD using the KDIGO classification categories, as per Table 2 on the next page.

Table 2 - Prognosis of CKD by GFR and albuminuria category heat map

Prognosis of CKD by GFR and Albuminuria Categories: KDIGO 2012				Persistent albuminuria categories Description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30-300 mg/g 3-30 mg/mmol	>300 mg/g >30 mg/mmol
GFR categories (ml/min/1.73m ²) Description and range	G1	Normal or high	≥90	Green	Yellow	Orange
	G2	Mildly decreased	60-89	Green	Yellow	Orange
	G3a	Mildly to moderately decreased	45-59	Yellow	Orange	Red
	G3b	Moderately to severely decreased	30-44	Orange	Red	Red
	G4	Severely decreased	15-29	Red	Red	Red
	G5	Kidney failure	<15	Red	Red	Red

Green: low risk (if no other markers of kidney disease, no CKD); Yellow: moderately increased risk
Orange: high risk; Red: very high risk

Table 2 reproduced with permission from: Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. *Kidney Int Suppl.* 2013; 3: x

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Non-pharmacological treatment

The main aim of both pharmacological and non-pharmacological treatment is to manage progression and complications of CKD. Information and education should be offered to those with CKD, and this advice should be tailored to the individual.

People with CKD should be encouraged to exercise, achieve a healthy weight and be offered smoking cessation and dietary advice. For more information about this, read Section 1.4 *Information and education* of NICE clinical guidance **Chronic kidney disease in adults: assessment and management [CG182]**. For information on when a referral should be made read Section 1.5 *Referral criteria*.

At the later stages of CKD renal replacement therapies may be offered, these include peritoneal dialysis, haemodialysis or kidney transplant.

The following Kidney Research UK video provides an insight into dialysis options that are currently available, through the stories of a number of older patients who have taken that particular route.

Dialysis Choices: What are the options?



For more information about kidney transplant, access NHS ***Kidney transplant*** page.

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Pharmacological treatment

The main pharmacological treatments offered to those with CKD are blood pressure control, management of renal bone disease, renal anaemia and metabolic acidosis. Statin therapy and oral antiplatelet and anticoagulants may also be offered for secondary prevention of cardiovascular disease.

Section 1.6 *Pharmacotherapy* of NICE clinical guidance ***Chronic kidney disease in adults: assessment and management [CG182]*** outlines the recommended therapies for different patient groups and links to relevant clinical guidance (the first part of this section outlines blood pressure control and the recommended blood pressure targets). Section 1.7 *Other complications* covers the management of complications associated with CKD: bone metabolism and osteoporosis, vitamin D supplements in the management of CKD–mineral and bone disorders, anaemia and oral bicarbonate supplements in the management of metabolic acidosis.

NICE also offers the following technology appraisal guidance; ***Immunosuppressive therapy for kidney transplant in adults [TA481]*** which outlines evidence-based recommendations on immunosuppressive therapies for preventing kidney rejection in adults.

Renal dosing

It is important to remember that prescribers should take renal function into account when prescribing all medicines. They should also be aware of the impact of RRT on pharmacological treatments.

You may have access to the ***Renal Drug Database*** which requires a subscription. This resource contains monographs with information on clinical use, dose in normal renal function, dose in renal impairment, important drug interactions, metabolism and ***administration*** and is a valuable tool when checking doses for those with renal impairment.¹²

The *British National Formulary (BNF)* also offers a **Prescribing in renal impairment** summary and where relevant, each *BNF* monograph offers a 'Renal impairment' section. This can be used alongside information found in each product's summary of product characteristics (SPC) when determining appropriate renal doses.

Vaccination

Annual vaccination with influenza vaccine is recommended for all adults with CKD. **KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease (CKD)** Section 4.6 *CKD and Risks for Infections, AKI, Hospitalizations, and Mortality* contains further recommendations regarding vaccination in those with CKD.¹

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Patient support

Think Kidneys has developed the **Transforming Participation in Chronic Kidney Disease (TP-CKD)** programme which aims to develop a person-centred approach to care. They also offer a dedicated **Information for the public** page.

Kidney Care UK works to improve the quality of life for adults and children with kidney disease.

Kidney Research UK is a national charity dedicated to research that will lead to better treatments and cures for kidney disease.

NHS Choices has a page dedicated to **Chronic kidney disease** with information on the symptoms, diagnosis, treatment, living with CKD and prevention.

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Further resources

Renal Medicine (Kidn-e) is one of the **e-Learning for Healthcare learning modules** available via CPPE's website. Within this module there is a CKD section, which explains how to recognise patients at risk of CKD and how to prevent the development of this condition, how to diagnose the presence of CKD and how to determine its cause. The module specifically discusses hypertension, cardiovascular disease, diabetic nephropathy, the treatment of complications in advanced CKD (anaemia and mineral and bone disorder), safe prescribing, and the effects of commonly used drugs.

The Renal Association is the professional body for United Kingdom nephrologists (renal physicians or kidney doctors) and renal scientists in the UK. They provide **Information and resources**.

The **UK Renal Pharmacy Group** connects renal pharmacists around the UK.

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External websites

CPPE is not responsible for the content of any non-CPPE websites mentioned on this page or for the accuracy of any information to be found there. All web links were accessed on 21 July 2021.

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