

Estimated Glomerular Filtration Rate

What is the eGFR? – it is the “estimated” glomerular filtration rate, a measure of kidney function. This value can often replace 24 hour urine collection and measurement of creatinine clearance. It is a value calculated from the serum creatinine using age and sex and using prediction equations (MDRD equation)¹. The MDRD equation is a four variable formula derived from the Modification of Diet in Renal Disease study.

Why is eGFR reported on all electrolyte reports now?

In 2005 the Australasian Creatinine Consensus Working Group reported on the utility of eGFR in the MJA¹. This group recommended that all pathology laboratories automatically report the eGFR each time a serum Creatinine test is ordered in adults.

What was the rationale for introduction of the eGFR?

The reasons for this are well outlined in the position statement (MJA, 2005; 183 (3) 138-141)¹ of the Australasian Creatinine Consensus Working Group. In summary, these included that - systematic staging of chronic kidney disease (CKD) by glomerular filtration measurement and proteinuria has allowed the development of appropriate management plans for CKD. However, one of the barriers to early detection of CKD previously was the lack of a precise, reliable and consistent measure of kidney function. The authors argued that the formula (MDRD) which estimates GFR from age, sex, race and serum Creatinine, without any requirement for measurement of body mass, allows pathology labs to now automatically generate an eGFR. The provision of an eGFR calculated from serum Creatinine, was expected to help identify asymptomatic kidney dysfunction at an earlier stage. It was argued that the eGFR correlated well with complications of CKD and increased risk of adverse outcomes such as cardiovascular morbidity and mortality.

What is a normal eGFR?

A normal GFR is ~ 140 mL/min in the healthy adult human².

eGFR and age

The Creatinine Consensus Working Group stated in revised recommendations (2007) that it would be premature to recommend age-related decision points for eGFR.⁶ However, they did consider that in people > 70 years, an eGFR in the range of 45-59 mL/min/1.73m², if stable over time and unaccompanied by other evidence of kidney damage, may be interpreted as consistent with a typical eGFR for this age group. This was as such, unlikely to be associated with chronic kidney disease-related complications.

eGFR levels between 60 - 90 mL/min and > 90

Initially Australian guidelines¹ suggested the highest reported eGFR level should be > 60 mL/min/1.73m². This is because the eGFR does not perform as well in normal people or those with only mildly reduced kidney function³ and so there was caution about reporting levels higher than 60 mL/min. However this cut-off was reviewed by the Australian Consensus working group.⁶ In the revised recommendations issued in 2007 the Working group stated that the upper limit for reporting be extended to > 90 mL/min/1.73m². The internationally agreed classification of chronic kidney disease (as outlined by the National Kidney Foundation)⁵ also supports the use of the > 90 mL/min cut-off. eGFR values above 90 should be reported as > 90 rather than a precise figure.

What are the limitations of the eGFR?

The eGFR does not perform well in people with normal or mildly reduced kidney function². Its best role is in earlier recognition of patients with CKD than if serum Creatinine alone was used².

Some limitations to the use of the eGFR were also outlined by the Australian working group in their Position Statement¹. Groups in which eGFR may not be appropriate include:

Severe malnutrition or obesity

Extremes of body size

Extremes of age (eg < 18 years and > 65 years may need further consideration)

Use in children and pregnancy not recommended

Exceptional dietary intake (eg Vegetarian or Creatinine supplements)

Diseases of Skeletal muscle, paraplegia

Rapidly changing kidney function

EGFR is also not suitable to use in dialysis patients or for calculating drug doses where body surface area is important.

Precision of the eGFR is influenced by accurate Creatinine measurement.

eGFR should be used with caution in populations where the MDRD equation is not validated (eg Asian people) or in whom validation studies have not been performed (Aboriginal or Torres Strait Islander populations)

However in 2007, the Australasian Creatinine Consensus Working group recommended that pending publication of validation studies, laboratories should continue to automatically report eGFR in Aboriginal and Torres Strait Islander peoples and other ethnic groups.⁶

Early Kidney Disease

Very early kidney disease (Stages 1 and 2) can occur in people with eGFR levels of > 60 mL/min or even > 90 mL/min. It is important to recognise Stage 1 and 2 chronic kidney disease as these occur in 3.3 and 3.0 % of the population³. (See the Table below) However the diagnosis of Stage 1 and 2 CKD requires the presence of kidney damage for > 3 months as manifest by pathological abnormalities of the kidney or abnormal urine -(haematuria, proteinuria, albuminuria) or abnormal imaging tests, or reduced eGFR.

Internationally agreed classification of chronic kidney disease (CKD) adapted from the National Kidney Foundation.^{3,5}

Stage	Description	GFR (mL/min/1.73m²)	Pop prevalence (%)
1*	Kidney damage with normal or increased GFR	≥ 90	3.3
2*	Kidney damage with mildly decreased GFR	60-89	3.0
3	Mod. decreased GFR	30-59	4.3
4	Severely reduced GFR	15-29	0.2
5	Kidney failure	< 15	0.2

*The diagnosis of Stage 1 and 2 CKD requires the presence of kidney damage for > 3 months manifest by pathological abnormalities of the kidney or abnormalities in the composition of urine, such as haematuria or proteinuria, or abnormalities in imaging tests wither with (stage 2) or without (stage1) decreased GFR.

How does WDP report the eGFR cut-off?

WDP report values of eGFR between 60 and 90 mL/min/1.73m² as per the updated 2007 Australasian guidelines⁶. However our comment alerts clinicians that these values should be interpreted with caution. Results between 60 and 90 are only consistent with CKD in the presence of other evidence such as microalbuminuria, proteinuria or haematuria.²

What is the effect of a cooked meat meal?

Of interest has been the influence of cooked-meat meals on the eGFR. Recent work has verified that a meal of cooked meat on the day of the blood test has a significant effect on the serum Creatinine concentration and eGFR. The cooking of the meat converts a fraction of creatine in the meat to Creatinine. The calculated eGFR can fall and misclassification of CKD is possible if measurements are made after cooked meat meals.⁴ It may be appropriate for patients with borderline eGFR values to have a repeat level taken fasted or in the morning. Morning collection would mean patients are less likely to have recently consumed a meat meal.

What are the strengths of the eGFR?

Strengths of the eGFR include the earlier identification of people with early CKD.^{1,2,3} The reference interval for serum Creatinine concentration includes up to 25% of people (especially thin, elderly women) who have an estimated eGFR that is significantly reduced to $< 60 \text{ mL/min/1.73m}^2$.¹ These people would not as easily be identified with serum Creatinine alone as this result may be in the normal reference range despite reduced eGFR.

For further queries please refer to the articles below and feel free to discuss further with us.
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1. Chronic kidney disease and automatic reporting of estimated glomerular filtration rate: a position statement. MJA 2005; 183 (3): 138-141
2. Estimating kidney function in adults using formulae. Lamb et al. Ann Clin Biochemistry 2005: 42: 321-345
3. Challenging times in renal medicine. Editorial. Lamb and Stevens. Ann Clin Biochemistry 2005:42: 318-320
4. The influence of a cooked-meat meal on estimated glomerular filtration rate. Preiss et al. Ann Clin Biochemistry 2007; 44 (Pt 1): 35-42.
5. National Kidney Foundation. Clinical Practice guidelines for chronic kidney disease: evaluation classification and stratification. Am J Kidney Dis 2002; 39 (Suppl 1); S1-266.
6. Chronic kidney disease and automatic reporting of estimated glomerular filtration rate: revised recommendations, Medical Journal of Australia, 227; 187 (8) 459-463.