

Calculators for Estimation of Glomerular Filtration Rate (eGFR) using the MDRD Formula(s) and newer CKD-EPI Formula

The National Kidney Disease Education Program NKDEP is recommending clinical laboratories routinely provide estimates of glomerular filtration rate (eGFR) with each serum creatinine determination as an aide to classifying stages of Chronic Kidney Disease. The previously advocated formula for calculating the GFR was the one developed by the *Modification of Diet in Renal Disease Study Group* (MDRD). This formula was later improved for creatinine methods using standardized calibrators. The newest CKD-EPI (Chronic Kidney Disease Epidemiology Collaboration) formula, published May 2009, is proposed to be more precise than the MDRD formula, especially when the actual GFR is >60 mL/min per 1.73 m². This interactive SLT template simultaneously performs all GFR calculations for each demographic group. **It is intended for use solely by Clinical Laboratory personnel as an aide in verifying the accuracy of GFR calculations reported from Laboratory Information Systems.**

To Calculate GFR, INPUT the following 2 variables:

Serum Creatinine
mg/dL

2 decimal pts.
is preferred

Age*
(Years)

* For > 18 yrs

Traditional equations

Should be used for routine creatinine test methods that **have not been** calibrated to be traceable to IDMS.

Re-expressed equations

Should be used only with those creatinine methods that **have been** recalibrated to be traceable to IDMS (Isotope Dilution Mass Spectrometry). (note: most Roche Methods are traceable)

Traditional Calibration 4 variable MDRD Study Equation			
Non-Black Male	Non-Black Female	Black Male	Black Female
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

$$\begin{aligned} \text{GFR (mL/min/1.73 m}^2\text{)} = & 186^* \times \text{Creatinine (serum)}^{-1.154} \\ & - x \text{Age}^{-0.203} \\ & - x 0.742 \text{ (if Female)} \\ & - x 1.210 \text{ (if Black)} \end{aligned}$$

* Uses 186 for traditional calibration

* Uses 175 for calibration traceable to IDMS

Calibration Traceable to IDMS Re-expressed 4 variable MDRD Study Equation			
Non-Black Male	Non-Black Female	Black Male	Black Female
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

With these equations, the NKDEP presently recommends reporting estimated GFR values above 60 mL/min/1.73 m² simply as **"above 60 mL/min/1.73 m²"**, not an exact number.

CKD-EPI GFR Newer Equation by Levey, et. al.			
Non-Black Male	Non-Black Female	Black Male	Black Female
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
CKD-EPI equation by Levey, et. al. $\text{eGFR} = 141 \times \min(\text{Scr}/k, 1)^a \times \max(\text{Scr}/k, 1)^{-1.209} \times 0.993^{\text{Age}}$ <p>[x 1.018 if female] [x 1.159 if Black]</p>			

- **Scr** is Serum Creatinine
- **k** is 0.7 for females
- **k** is 0.9 for males
- **a** is -0.329 for females
- **a** is -0.411 for males
- **min** indicates the minimum of Scr/k or 1
- **max** indicates the maximum of Scr/k or 1

This new equation is proposed to be more accurate at estimating GFR, particularly at a higher GFR.

CHRONIC KIDNEY DISEASE (CKD) STAGES

CKD Stage 1: Kidney Damage with normal GFR (>90)
 CKD Stage 2: Kidney Damage with mildly decreased GFR (60-89)
 CKD Stage 3: Moderately decreased GFR (30-59)
 CKD Stage 4: Severely decreased GFR (15-29)
 CKD Stage 5: Kidney failure (GFR<15 or D = Dialysis)
 T = Transplant patients can be at any stage depending on GFR

REFERENCES

Am J Kidney Dis. 39:(2) S1-S266, 2002 (NKF) Ann Intern Med. 2003;139:137-147
 Kidney Int. 2005; 67(6):2089-100 (KDIGO) N Engl J Med. 2006;354:2473-83
 Ref: Levey, A.S. et. al. Ann Intern Med 2006;145:247-254
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RESOURCES