



MDRD EQUATION

In adults, the best equation for estimating glomerular filtration rate (GFR) from serum creatinine is the MDRD equation.^{1,2}

$$\text{GFR (ml/min/1.73m}^2\text{)} = 186 \times (\text{P}_{\text{cr}})^{-1.154} \times (\text{Age})^{-0.203} \times (0.742 \text{ if female}) \times (1.210 \text{ if African American})$$

The equation requires 4 variables:

- Serum creatinine**
- Age**
- Sex**
- African American or not**

Since a patient’s race is often not available to clinical laboratories, a good alternative is to report estimated GFR values for both African Americans and non-African Americans (see Sample Reports below). Note that the equation does not require weight because the result is reported normalized to 1.73m² body surface area, which is an accepted average adult surface area. If your printing system does not allow for superscripts, we recommend reporting ml/min/1.73 square meters.

REPORTING VALUES

We presently recommend reporting values above 60 ml/min/1.73m² merely as “above 60 ml/min/1.73m²” not as an exact number such as 92 ml/min/1.73m². For values below 60 ml/min/1.73m², the report should give the numerical estimate such as “32 ml/min/1.73m²” (see Sample Reports below).

There are 3 reasons for this recommendation:

1. The equation has been most extensively evaluated in people with some degree of renal insufficiency.
2. Inter-laboratory differences in calibration of the creatinine assay have their greatest impact in the near normal range and therefore lead to greater inaccuracies.³
3. Quantification of GFR below 60 ml/min/1.73m² has more clinical implications than above that level.

SAMPLE REPORTS

Sample report for a 55-year old man

Creatinine = 1.1 mg/dl

Glomerular filtration rate (GFR) estimate greater than 60 ml/min/1.73m²

Average GFR for 50-59 years old = 93 ml/min/1.73m²

Chronic Kidney Disease less than 60 ml/min/1.73m²

Kidney failure less than 15 ml/min/1.73m²

Sample report for 63-year old woman

Creatinine = 1.8 mg/dl

Glomerular filtration rate (GFR) estimate = 30 ml/min/1.73m² if non-African American

Glomerular filtration rate (GFR) estimate = 37 ml/min/1.73m² if African American

Average GFR for 60-69 years old = 85 ml/min/1.73m²

Chronic Kidney Disease less than 60 ml/min/1.73m²

Kidney failure less than 15 ml/min/1.73m²

Sample report for 62-year old man

Creatinine = 1.4 mg/dl

Glomerular filtration rate (GFR) estimate = 55 ml/min/1.73m² if non-African American

Glomerular filtration rate (GFR) estimate greater than 60 ml/min/1.73m² if African American

Average GFR for 60-69 years old = 85 ml/min/1.73m²

Chronic Kidney Disease less than 60 ml/min/1.73m²

Kidney failure less than 15 ml/min/1.73m²

REFERENCE TABLE FOR POPULATION MEAN GFRs FROM NHANES III⁴

AGE (years)	AVERAGE GFR
20-29	116 ml/min/1.73m ²
30-39	107 ml/min/1.73m ²
40-49	99 ml/min/1.73m ²
50-59	93 ml/min/1.73m ²
60-69	85 ml/min/1.73m ²
70+	75 ml/min/1.73m ²

THE FUTURE

This approach provides the best means currently available of providing more accurate interpretation of the serum creatinine as renal function (GFR) and even appears better than 24-hour urine collections. However, efforts are underway to validate the equation in more diverse populations including Hispanics, people with diabetes, and people with normal renal function.

The inter-laboratory variation in the creatinine assay's calibration is being addressed by a Laboratory Working Group of the NKDEP (www.nkdep.nih.gov).⁵ The Laboratory Working Group is developing a program to standardize and improve serum creatinine measurements that will allow for accurate estimations of GFR in the range greater than 60 ml/min/1.73m² and in children by all clinical laboratories.

CONTACT INFORMATION

For assistance, please contact Tom Hostetter at 301-594-8864 or Elisa Gladstone at 301-435-8116 with the National Kidney Disease Education Program.

REFERENCES

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2. Manjunath G, Sarnak MJ, Levey AS. Prediction equations to estimate glomerular filtration rate: an update. *Curr Opin Nephrol Hypertens* 2001; 10:785-92.
3. Coresh J, Astor BC, McQuillan G, et al. Calibration and random variation of the serum creatinine assay as critical elements of using equations to estimate glomerular filtration rate. *Am J Kidney Dis* 2002; 39:920-9.
4. Coresh J, Astor BC, Greene T, Eknoyan G, Levey AS. Prevalence of chronic kidney disease and decreased kidney function in the adult US population: Third National Health and Nutrition Examination Survey. *Am J Kidney Dis*. 2003; 41:1-12.
5. National Kidney Disease Education Program. Meeting on Creatinine Assay and Reporting of Estimated GFR 2003. <http://www.nkdep.nih.gov>.