MDRD EQUATION

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

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

The equation requires 4 variables:

\begin{itemize}
  \item Serum creatinine
  \item Age
  \item Sex
  \item African American or not
\end{itemize}

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 1.73m\textsuperscript{2} 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/1.73m\textsuperscript{2} merely as “above 60 ml/min/1.73m\textsuperscript{2}” not as an exact number such as 92 ml/min/1.73m\textsuperscript{2}. For values below 60 ml/min/1.73m\textsuperscript{2}, the report should give the numerical estimate such as “32 ml/min/1.73m\textsuperscript{2}” (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.\textsuperscript{3}
3. Quantification of GFR below 60 ml/min/1.73m\textsuperscript{2} 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/1.73m\textsuperscript{2}

Average GFR for 50-59 years old = 93 ml/min/1.73m\textsuperscript{2}
Chronic Kidney Disease less than 60 ml/min/1.73m\textsuperscript{2}
Kidney failure less than 15 ml/min/1.73m\textsuperscript{2}

Sample report for 63-year old woman
Creatinine = 1.8 mg/dl
Glomerular filtration rate (GFR) estimate = 30 ml/min/1.73m\textsuperscript{2} if non-African American
Glomerular filtration rate (GFR) estimate = 37 ml/min/1.73m\textsuperscript{2} if African American

Average GFR for 60-69 years old = 85 ml/min/1.73m\textsuperscript{2}
Chronic Kidney Disease less than 60 ml/min/1.73m\textsuperscript{2}
Kidney failure less than 15 ml/min/1.73m\textsuperscript{2}
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

<table>
<thead>
<tr>
<th>AGE (years)</th>
<th>AVERAGE GFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-29</td>
<td>116 ml/min/1.73m²</td>
</tr>
<tr>
<td>30-39</td>
<td>107 ml/min/1.73m²</td>
</tr>
<tr>
<td>40-49</td>
<td>99 ml/min/1.73m²</td>
</tr>
<tr>
<td>50-59</td>
<td>93 ml/min/1.73m²</td>
</tr>
<tr>
<td>60-69</td>
<td>85 ml/min/1.73m²</td>
</tr>
<tr>
<td>70+</td>
<td>75 ml/min/1.73m²</td>
</tr>
</tbody>
</table>

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