Clinical Practice Assessment  
Estimating Glomerular Filtration Rates (GFR)

Clinical Question:  
Is estimation of glomerular filtration rate (GFR) using the CKD EPI (CHRONIC KIDNEY DISEASE EPIDEMIOLOGY COLLABORATION) equation compared to the MDRD (MODIFICATION OF DIET IN RENAL DISEASE) equation better at predicting outcomes in adults?

Bottom line:  
Estimation of GFR using the CKD EPI equation correlates better with risk assessment and patient outcomes compared to GFR estimation using the MDRD equation.

Synopsis:  
Chronic kidney disease (CKD) is defined as decreased kidney function and/or kidney damage persisting for at least three months. Kidney damage is most frequently manifested as increased urinary albumin excretion. Kidney dysfunction is indicated by a GFR <60 ml/min per 1.73 m2.  
CKD is categorized into 5 stages:  
Stage 1: Kidney damage with GFR > 90 ml/min per 1.73 m2.  
Stage 2: Kidney damage with GFR of 60-89 ml/min per 1.73 m2.  
Stage 3: GFR of 30-59 ml/min per 1.73 m2 regardless of kidney damage.  
Stage 4: GFR of 15-29 ml/min per 1.73 m2 regardless of kidney damage.  
Stage 5: GFR of <15 ml/min per 1.73 m2 regardless of kidney damage, or kidney failure treated by dialysis or transplantation.

Equations to estimate GFR use a combination of variables and coefficients.  
Both the MDRD and CKD EPI equations use the same variables of age, sex, race and serum creatinine level, but apply different coefficients to estimate GFR.  Serum creatinine measurement is typically standardized to isotope dilution mass spectrometry. The majority of laboratories in the United States use the MDRD equation in reporting the estimated GFR.  Estimation of GFR more accurately could result in fewer patients being exposed to unnecessary interventions, and identifying those patients who could benefit from interventions that improve patient oriented outcomes.

In a meta-analysis (2) the author’s objective was to determine whether estimated GFR using the CKD EPI equation predicted outcomes better than the GFR estimation using the MDRD equation. Outcomes studied were all cause mortality, cardiovascular mortality and end stage renal disease (ESRD). To be included studies needed to fulfill the following criteria:  
1. Have at least 1000 participants (not applied to the CKD cohorts).  
2. Have information at baseline on estimated GFR and urine albumin levels and at least 50 events for any of the outcomes.  
Analyses were restricted to patients 18 years of age or older. The study was based on secondary data analysis. 45 cohorts were included. 25 were general population cohorts.
7 high risk cohorts (participants had risk factors for cardiovascular disease or kidney disease). 13 CKD cohorts. Results were reported on 1.1 million patients belonging to multiple nationalities. 940,366 from the general population cohort. 151,494 from the high risk cohort. 38,612 from the CKD cohort. Mean duration of follow up was 7.4 years.

The mean GFR was higher when reported using the CKD EPI equation in the general population and high risk cohorts but was comparable in the CKD cohorts. Patients reclassified to a higher GFR tended to be younger, female and non-black and had fewer comorbidities such as hypertension and diabetes and less albuminuria.

<table>
<thead>
<tr>
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<th>Upward reclassification of patients (%)</th>
<th>Downward reclassification of patients (%)</th>
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</thead>
<tbody>
<tr>
<td>General cohort</td>
<td>24.4</td>
<td>0.6</td>
</tr>
<tr>
<td>High risk cohort</td>
<td>15.4</td>
<td>1.2</td>
</tr>
<tr>
<td>CKD cohort</td>
<td>6.6</td>
<td>3.2</td>
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Patients reclassified to a higher GFR using the CKD EPI equation had a lower incidence of the measured outcomes in all cohorts. The incidence of measured outcomes was higher in those patients reclassified to a lower GFR using the CKD EPI equation. The highest reclassification occurred in patients classified by the MDRD equation with an estimated GFR of 45-59. 34.7% of these participants were reclassified with the CKD EPI equation to an estimated GFR of 60-89. Heterogeneity was noted among studies.

The USPTF concluded that the role of CKD (stages 1-3) screening and monitoring in asymptomatic adults, in improving patient outcomes remains uncertain (1) (Recommendation Grade I meaning insufficient evidence to make a recommendation).

References:

SORT Criteria: Level of evidence: 2.