

## Summary of the MDRD Study and CKD-EPI Estimating Equations

The table below summarizes GFR estimating equations developed by the Modification of Diet in Renal Disease (MDRD) Study Group and the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI). The latest versions of these equations are based on broad collaboration, are expressed for filtration marker assays that have been calibrated to international standards, and have been recommended by clinical practice guidelines. We recommend specifying equations based on the research group, filtration marker and year of publication.

### Equations developed by the MDRD Study Group and CKD-EPI

Filtration Marker and eGFR	GFR Estimating Equation	Description	Advantages
Creatinine eGFRcr	MDRD Study (creatinine) 1999 and MDRD Study (creatinine) 2006 [Levey et al. Ann Intern Med 1999; 130: 461-70; Levey et al. Ann Intern Med 2006; 145: 247-54]	Developed in 1999 using 1628 subjects with CKD. Re-expressed for use with IDMS traceable creatinine assay in 2006.	First and most widely used eGFRcr equation with a known calibration. Recommended by NKF-KDOQI 2002.
	CKD-EPI creatinine 2009 [Levey et al. Ann Int Med 2009; 150: 604-12]	Developed in 2009 using 12,150 subjects in diverse populations (8254 for development and 3896 for validation).	Improves on the MDRD Study equation, particularly in reducing bias at eGFR>60 allowing for reporting across the full range of eGFR. Recommended by KDIGO 2013.
Cystatin C ± Creatinine eGFRcys eGFRcr-cys	CKD-EPI cystatin C 2008 and CKD-EPI creatinine-cystatin C 2008 CKD-EPI cystatin C 20011 and CKD-EPI creatinine-cystatin C 2011 [Stevens et al. Am J Kidney Dis 2008; 51: 395-406; Inker et al. Am J Kidney Dis 2011; 58: 682-684]	Developed in 2008 using 3418 subjects with CKD (2980 for development and 438 for validation). Re-expressed for use with IFCC-traceable cystatin C assay in 2011.	First eGFRcys and eGFRcr-cys equations with a known calibration. eGFRcys is not more accurate than eGFRcr, but eGFRcr-cys is more precise than either eGFRcr and eGFRcys.
	CKD-EPI cystatin C 2012 and CKD-EPI creatinine-cystatin C 2012 [Inker et al. N Engl J Med 2012; 367: 20-9]	Developed in 6471 subjects in diverse populations (5352 for development and 1119 for validation).	Improves on the CKD-EPI 2011 equations by reducing bias at eGFR >60. Recommended by KDIGO 2013.

### Equations developed by the MDRD Study Group and CKD-EPI

Filtration Marker	eGFR	Research Group	Year of Publication	Study Population Number of subjects (development, validation)	Assays	Equation	Advantages	References
Creatinine	eGFR <sub>cr</sub>	MDRD Study	1999	CKD 1628 (1628, 0)	Non-standardized	MDRD Study creatinine 1999	Recommended by NKF-KDOQI 2002	Levey et al. Ann Intern Med 1999; 130: 461-70;
		MDRD Study	2006	Same as above	Re-expressed for standardized assay	MDRD Study creatinine 2006	Appropriate for use with standardized assays	Levey et al. Ann Intern Med 2006; 145: 247-54
		CKD-EPI	2009	Diverse 12,150 ( 8254, 3896,)	Standardized	CKD-EPI creatinine 2009	Lesser bias at eGFR >60. Recommended by KDIGO 2013	Levey et al. Ann Int Med 2009; 150: 604-12
Cystatin C ± Creatinine	eGFR <sub>cys</sub> eGFR <sub>cr-cys</sub>	CKD-EPI	2008	CKD 3418 (2980, 438)	Non-standardized	CKD-EPI cystatin C 2008 CKD-EPI creatinine-cystatin C 2008	eGFR <sub>cr-cys</sub> more precise than eGFR <sub>cr</sub> or eGFR <sub>cys</sub>	Stevens et al. Am J Kidney Dis 2008; 51:395-406
		CKD-EPI	2011	Same as above	Re-expressed for standardized assay	CKD-EPI cystatin C 2011 CKD-EPI creatinine-cystatin C 2011	Appropriate for use with standardized assays	Inker et al. Am J Kidney Dis 2011; 58: 682-684
		CKD-EPI	2012	Diverse 6471 (5352, 1119)	Standardized	CKD-EPI cystatin C 2012 CKD-EPI creatinine-cystatin C 2012	Lesser bias at eGFR >60. Recommended by KDIGO 2013	Inker et al. N Engl J Med 2012; 367: 20-9