



To: UPHS Physicians and Staff

From: **Ping Wang, PhD, DABCC, FAACC**
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Date: May 6, 2024

Re: **New LDL Cholesterol Calculation using the Sampson-NIH Equation**

Effective May 7, 2024, across all Penn Medicine Clinical Laboratories, low-density lipoprotein-cholesterol (LDL-C) calculation will transition from using the Friedewald Equation (fLDL-C) to the Sampson Equation (sLDL-C) (Sampson M et al., JAMA Cardiol 2020), consistent with recommendations from National Lipid Association (NLA) (Wilson PWF et al. J Clin Lipidol 2021). Existing PennChart scripts and calculators that automatically pull LDL-C results will be based on the new calculation. Like the Friedewald calculation, the updated Sampson calculation cannot provide reliable LDL-C levels when triglycerides (TG) are greater than 400 mg/dL. In individuals with TG 400-800 mg/dL, clinicians are encouraged to make treatment decisions based on TG and non-high-density lipoprotein-cholesterol (nonHDL-C) and/or apolipoprotein B (apoB) levels. In individuals with very high TG levels (e.g. >500 mg/dL), it is recommended that treatment should be focused on lowering TG rather than primary management of LDL-C. Refer patients to lipid specialists if uncertain.

There is no change in clinical management or therapy initiation thresholds but it is expected that this will impact care at the lower LDL-C levels. The overall concordance between the two equations is high (>90%). However, in patients with low LDL-C and high TG concentrations, the Sampson Equation provides a more accurate calculated sLDL-C result than the Friedewald Equation, leading to fewer underestimations and misclassifications. In one study (Zafir B et al. J Atheroscler Thromb 2020), the proportion of patients with LDL-C<70 mg/dL reclassified to a higher LDL-C category is 8.8%, 29.7% and 44.2% for triglyceride <150 mg/dL, 150-199 mg/dL and 200-399 mg/dL, respectively. It is expected that this may result in change of therapy for as

many as 60% of individuals at high risk for atherosclerotic cardiovascular disease already treated with statin drugs, whose fLDL-C <70 mg/dL, but sLDL-C >70 mg/dL especially if TG are elevated. For detailed comparisons between the results from the two equations, refer to Tables 1 and 2 below (data re-analyzed and tabulated from Zafrir B et al. J Atheroscler Thromb 2020).

Please contact Dr. Ping Wang at Ping.Wang2@pennmedicine.upenn.edu or Dr. Daniel Soffer at Daniel.Soffer@pennmedicine.upenn.edu if you have questions about this change.

Table 1. Comparison between Friedewald vs Sampson Equations in different LDL-C categories. Percentage of samples in each category is shown. Upward reclassification: 7.5%, downward reclassification: 0.2%.

		Sampson LDL-C (mg/dL)				Total
		<70	70-99	100-189	≥ 190	
Friedewald LDL-C (mg/dL)	< 70	13.3%	3.1%	0	0	16.4%
	70-99	0.1%	30.9%	4.2%	0	35.2%
	100-189	0	0.02%	46.6%	0.2%	46.8%
	≥ 190	0	0	0	1.6%	1.6%
Total		13.4%	34%	50.8%	1.8%	100%

Table 2. Difference between Friedewald vs Sampson Equations in different Triglycerides categories.

LDL-C equations	Differences between LDL-C estimates	Triglycerides < 150 mg/dL	Triglycerides 150-199 mg/dL	Triglycerides 200-399 mg/dL
LDL-C (Sampson-Friedewald)	Difference (mg/dl)	2.1 (-1.0–5.3)	4.8 (1.5–8.1)	7.3 (0.8–13.8)
	Delta (%)	2.2% (-1.7%–6.1%)	5.3% (-1.3%–11.8%)	8.1% (-3.9%–20.1%)

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