

J Sequeira Duarte<sup>1</sup>, Jorge Azinheira<sup>2</sup>

1 - Endocrinology, 2- Clinical Pathology Departments at Centro Hospitalar de Lisboa Ocidental

## Background

Low-density lipoprotein cholesterol (LDL-C) is usually estimated using the Friedewald equation. This equation assumes a fixed factor of 5 for the ratio of triglycerides to very low-density lipoprotein cholesterol (TG:VLDL-C); however, the actual TG:VLDL-C ratio varies significantly across the range of triglyceride and cholesterol levels. A new method was proposed by Martin, S and co-workers using NHANES data.

## Objectives

We aimed to evaluate the concordance Friedewald formula with the new method for LDL-C estimation from the standard lipid profile using an adjustable factor for the TG:VLDL-C ratio.

## Methods

We used the results of 40339 consecutive clinical lipid profiles obtained from 2000 through 2015 from patients of our outpatient clinic, at our hospital lab. The measurements were done mainly in type 2 diabetic - 66,1%. Females were 52% of cases Cholesterol concentrations were directly measured after vertical spin density. LDL-C was measured if triglycerides over 400mg/dL and calculated by Friedewald formula if lower. Data was analysed in SPSS package v20.

## TG:VLDL-C ratio tables by Martin et al

Triglyceride Levels, mg/dL <sup>a</sup>	Non-HDL-C, mg/dL					
	<100	100-129	130-159	160-189	190-219	≥220
7-49	3.5	3.4	3.3	3.3	3.2	3.1
50-56	4.0	3.9	3.7	3.6	3.6	3.4
57-61	4.3	4.1	4.0	3.9	3.8	3.6
62-66	4.5	4.3	4.1	4.0	3.9	3.9
67-71	4.7	4.4	4.3	4.2	4.1	3.9
72-75	4.8	4.6	4.4	4.2	4.2	4.1
76-79	4.9	4.6	4.5	4.3	4.3	4.2
80-83	5.0	4.8	4.6	4.4	4.3	4.2
84-87	5.1	4.8	4.6	4.5	4.4	4.3
88-92	5.2	4.9	4.7	4.6	4.4	4.3
93-96	5.3	5.0	4.8	4.7	4.5	4.4
97-100	5.4	5.1	4.8	4.7	4.5	4.3
101-105	5.5	5.2	5.0	4.7	4.6	4.5
106-110	5.6	5.3	5.0	4.8	4.6	4.5
111-115	5.7	5.4	5.1	4.9	4.7	4.5
116-120	5.8	5.5	5.2	5.0	4.8	4.6
121-126	6.0	5.5	5.3	5.0	4.8	4.6
127-132	6.1	5.7	5.3	5.1	4.9	4.7
133-138	6.2	5.8	5.4	5.2	5.0	4.7
139-146	6.3	5.9	5.6	5.3	5.0	4.8
147-154	6.5	6.0	5.7	5.4	5.1	4.8
155-163	6.7	6.2	5.8	5.4	5.2	4.9
164-173	6.8	6.3	5.9	5.5	5.3	5.0
174-185	7.0	6.5	6.0	5.7	5.4	5.1
186-201	7.3	6.7	6.2	5.8	5.5	5.2
202-220	7.6	6.9	6.4	6.0	5.6	5.3
221-247	8.0	7.2	6.6	6.2	5.9	5.4
248-292	8.5	7.6	7.0	6.5	6.1	5.6
293-399	9.5	8.3	7.5	7.0	6.5	5.9
400-13975	11.9	10.0	8.8	8.1	7.5	6.7

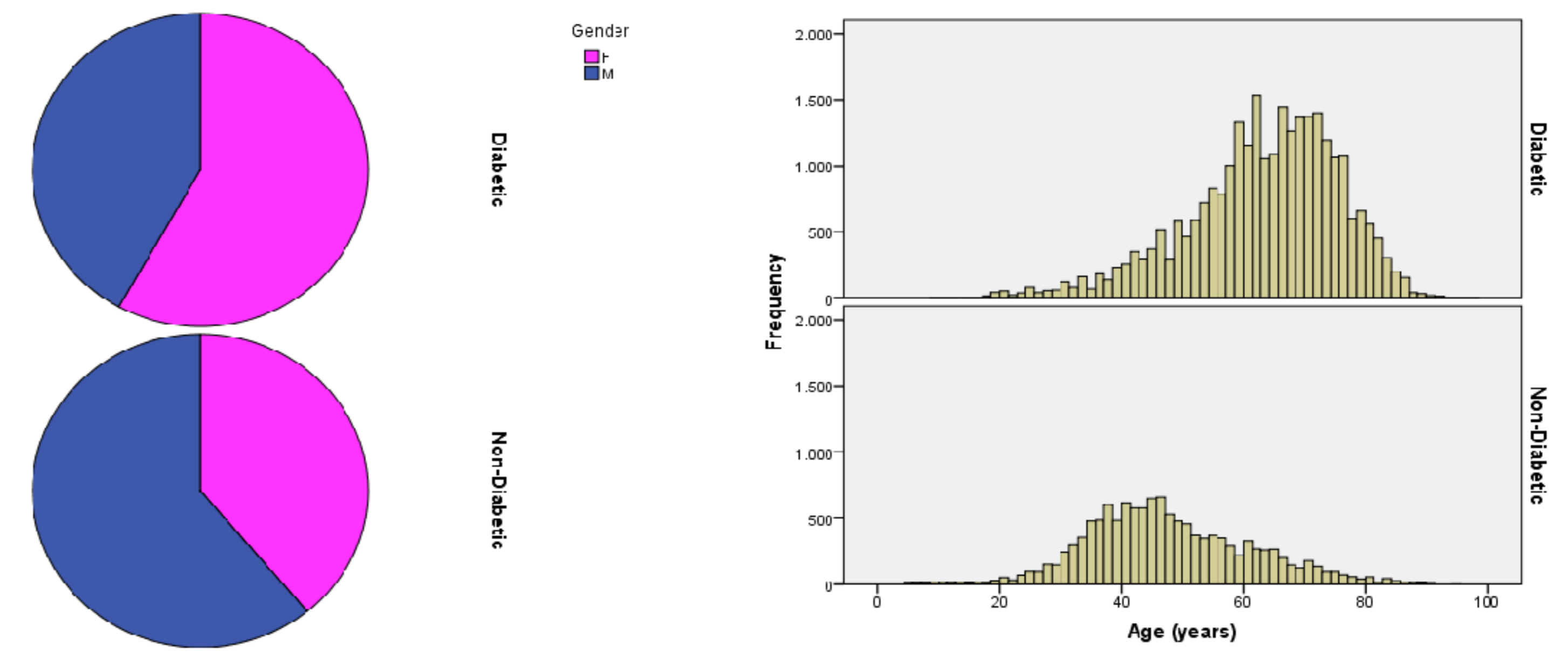
Median for the Ratio of Triglycerides to VLDL-c by Non-HDL-c and Triglyceride Strata (180-Cell)

Green, 4.5-5.5; yellow, 3.5-4.4, 5.6-6.5; red, <3.5, >6.5.

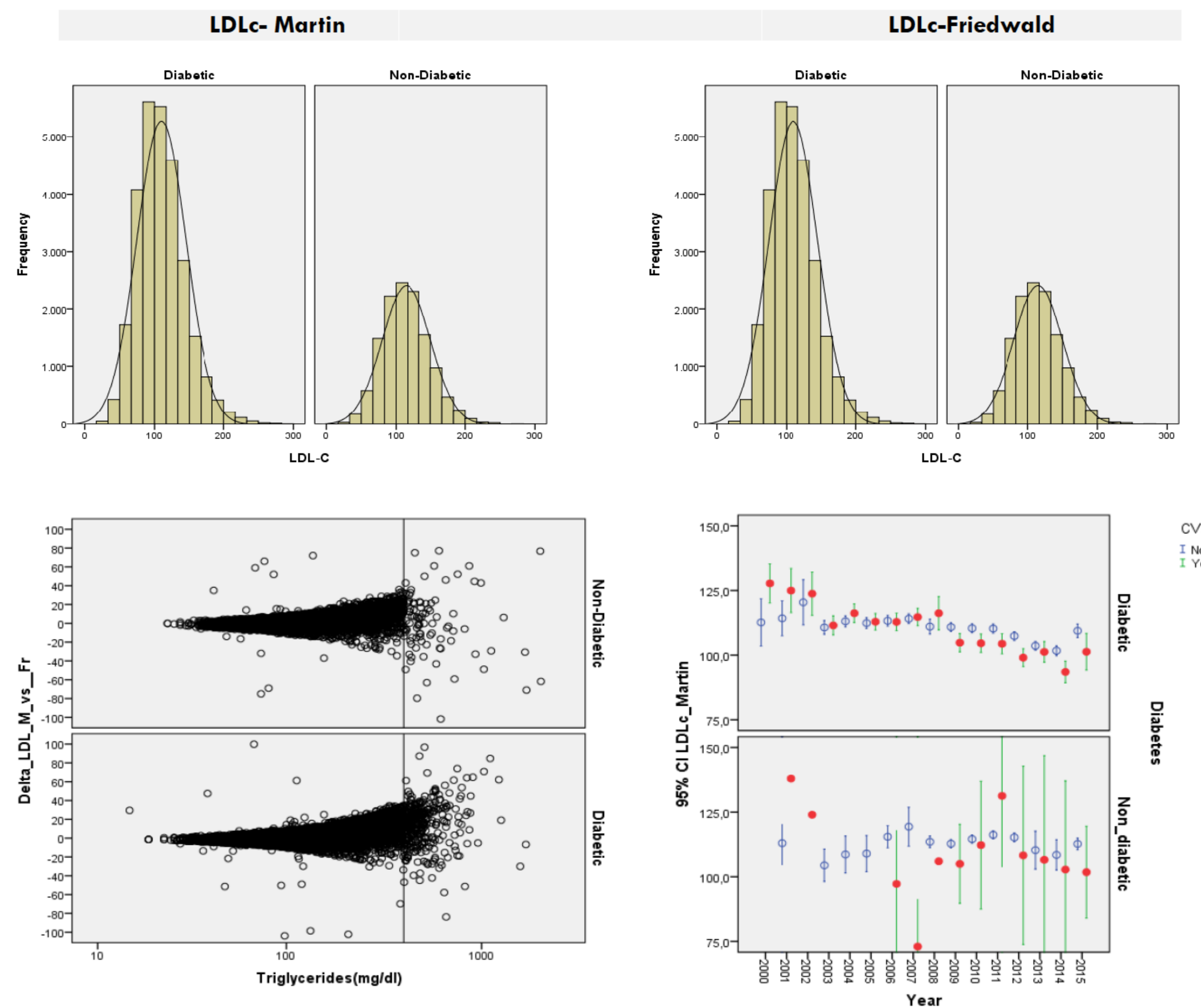
Friedewald formula will tend to underestimate LDL

JAMA. 2013;310(19):2061-2068.

## Patient Characteristics



Paired Samples T Test			
		Mean	Std. Deviation
p<0,01	VLDL_F	29,6	23,4
	VLDL_M	25,7	15,4
p<0,01	LDLc-Friedwald	108,4	35,6
	LDLc- Martin	110,7	35,6



## Results

Diabetic patients had lower LCL-C levels than non diabetics (92 vs 101 mg/dl- p<0,001). Results of LCL-C are highly correlated in the all lipid profiles (93% p<0,001) but mean values are 108,3 vs 96,4mg/dL using Friedewald formula vs the new method. Wilcoxon rank test find significant differences between the 2 methods(p<0,001).

## Conclusions

This novel method to estimate LDL-C using an adjustable factor for the TG:VLDL-C ratio produces significant lower values of LDL-C than the Friedewald equation. These findings require external validation, as well as assessment of their clinical importance. The implementation of the new method into clinical practice is particular relevant when triglycerides are higher than 400mg/dl.

## Bibliography

- Seth S. Martin, Michael J. Blaha, MPH, Mohamed B. Elshazly, Peter P. Toth, Peter O. Kwiterovich, Roger S. Blumenthal, and Steven R. Jones. Comparison of a Novel Method vs the Friedewald Equation for Estimating Low-Density Lipoprotein Cholesterol Levels From the Standard Lipid Profile. JAMA. 2013 November 20; 310(19): 2061–2068
- Friedewald WT, Levy RI, Fredrickson DS. Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. Clin Chem. 1972; 18(6):499–502.
- DeLong DM, DeLong ER, Wood PD, Lippel K, Rifkind BM. A comparison of methods for the estimation of plasma low- and very low-density lipoprotein cholesterol: the Lipid Research Clinics Prevalence Study. JAMA. 1986; 256(17):2372–2377.
- National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. Circulation. 2002; 106(25):3143–3421.
- Genest J, McPherson R, Frohlich J, et al. 2009 Canadian Cardiovascular Society/Canadian guidelines for the diagnosis and treatment of dyslipidemia and prevention of cardiovascular disease in the adult—2009 recommendations. Can J Cardiol. 2009; 25(10):567–579.
- Reiner Z, Catapano AL, De Backer G, et al. European Association for Cardiovascular Prevention & Rehabilitation; ESC Committee for Practice Guidelines (CPG) 2008–2010 and 2010–2012 Committees. ESC/EAS Guidelines for the management of dyslipidaemias. Eur Heart J. 2011; 32(14):1769–1818.