

Supplementary Material - Additional File 1

The clinical impact of estimating low-density lipoprotein cholesterol (LDL-C) using different equations in the general population

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Supplementary Table 1 Comparison of LDL-C estimated by the Friedewald and Martin-Hopkins Equations for those participants with triglycerides < 400 mg/dL and further stratified by triglycerides <175 and 175<400 mg/dL, count (%)

Supplementary Table 2 Comparison by LDL-C estimated by the Martin-Hopkins and Sampson Equations stratified by triglycerides levels, count (%)

Supplementary Table 3 Comparison of LDL-C estimated by the Sampson and Martin-Hopkins Equations stratified by 10-Year ASCVD Risk for those participants with triglycerides < 400 mg/dL, count (%)

Supplementary Fig. 1 Distribution of triglycerides in the study population. The median triglyceride level is represented by the dotted blue line.

Supplementary Fig. 2 Non-HDL (mg/dL) levels by triglyceride levels for triglyceride 0-800 mg/dL.

Supplementary Fig. 3 Estimated low-density lipoprotein cholesterol (LDL-C) by triglyceride levels for Martin-Hopkins and Sampson when triglyceride (400 mg/dL – 800 mg/dL)

Supplementary Fig. 4 Comparison of low-density lipoprotein cholesterol (LDL-C) for diabetic patients with triglycerides < 400 mg/dL and 10-year atherosclerotic cardiovascular disease risk

(ASCVD) $\geq 7.5\%$. (A) Concordance and discordance around LDL values of 70 mg/dL and (B) median triglyceride level for each quadrant.

Supplementary Fig. 5 Comparison of low-density lipoprotein cholesterol (LDL-C) for diabetic patients with triglycerides < 400 mg/dL and low 10-year atherosclerotic cardiovascular disease risk (ASCVD) $< 7.5\%$. (A) Concordance and discordance around LDL values of 100 mg/dL and (B) median triglyceride level for each quadrant.

Supplementary Fig. 6 Comparison of low-density lipoprotein cholesterol (LDL-C) at the 190 mg/dL threshold by equation.

Supplementary Table 1 Comparison of LDL-C estimated by the Friedewald and Martin-Hopkins Equations for those participants with triglycerides < 400 mg/dL and further stratified by triglycerides <175 and 175<400 mg/dL, count (%)

Triglycerides <400 mg/dL		Friedewald					
LDL Value (mg/dL)		Desirable≤70 (N=20156)	Desirable 71-99 (N=54726)	Above Desirable 100-129 (N=64937)	Borderline High 130-159 (N=37925)	High 160-189 (N=12936)	Very High≥190 (N=4040)
Martin-Hopkins	Desirable≤70	15620 (77.5%)	865 (1.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Desirable 71-99	4536 (22.5%)	46398 (84.8%)	1690 (2.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Above Desirable 100-129	0 (0.0%)	7463 (13.6%)	57812 (89.0%)	1232 (3.2%)	0 (0.0%)	0 (0.0%)
	Borderline High 130-159	0 (0.0%)	0 (0.0%)	5435 (8.4%)	34823 (91.8%)	540 (4.2%)	0 (0.0%)
	High 160-189	0 (0.0%)	0 (0.0%)	0 (0.0%)	1870 (4.9%)	12121 (93.7%)	140 (3.5%)
	Very High≥190	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	275 (2.1%)	3900 (96.5%)
Triglycerides <175 mg/dL		Friedewald					
LDL Value (mg/dL)		Desirable≤70 (N=15994)	Desirable 71-99 (N=44869)	Above Desirable 100-129 (N=51962)	Borderline High 130-159 (N=28828)	High 160-189 (N=8994)	Very High≥190 (N=2440)
Martin-Hopkins	Desirable≤70	14194 (88.7%)	865 (1.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Desirable 71-99	1800 (11.3%)	41282 (92.0%)	1690 (3.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Above Desirable 100-129	0 (0.0%)	2722 (6.1%)	48672 (93.7%)	1232 (4.3%)	0 (0.0%)	0 (0.0%)
	Borderline High 130-159	0 (0.0%)	0 (0.0%)	1600 (3.1%)	27301 (94.7%)	540 (6.0%)	0 (0.0%)
	High 160-189	0 (0.0%)	0 (0.0%)	0 (0.0%)	295 (1.0%)	8452 (94.0%)	140 (5.7%)
	Very High≥190	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (0.0%)	2300 (94.3%)
Triglycerides 175<400 mg/dL		Friedewald					
LDL Value (mg/dL)		Desirable≤70 (N=4162)	Desirable 71-99 (N=9857)	Above Desirable 100-129 (N=12975)	Borderline High 130-159 (N=9097)	High 160-189 (N=3942)	Very High≥190 (N=1600)
Martin-Hopkins	Desirable≤70	1426 (34.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Desirable 71-99	2736 (65.7%)	5116 (51.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Above Desirable 100-129	0 (0.0%)	4741 (48.1%)	9140 (70.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Borderline High 130-159	0 (0.0%)	0 (0.0%)	3835 (29.6%)	7522 (82.7%)	0 (0.0%)	0 (0.0%)

High 160-189	0 (0.0%)	0 (0.0%)	0 (0.0%)	1575 (17.3%)	3669 (93.1%)	0 (0.0%)
Very High≥190	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	273 (6.9%)	1600 (100.0%)
<i>LDL-C</i> lipoprotein cholesterol						

Supplementary Table 2 Comparison by LDL-C estimated by the Martin-Hopkins and Sampson Equations stratified by triglycerides levels, count (%)

Triglycerides <400 mg/dL		Martin-Hopkins					
LDL-C Value (mg/dL)		Desirable≤70 (N=16485)	Desirable 71-99 (N=52624)	Above Desirable 100-129 (N=66507)	Borderline High 130-159 (N=40798)	High 160-189 (N=14131)	Very High≥190 (N=4175)
Sampson	Desirable≤70	15716 (95.3%)	1494 (2.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Desirable 71-99	769 (4.7%)	48188 (91.6%)	2473 (3.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Above Desirable 100-129	0 (0.0%)	2942 (5.6%)	60848 (91.5%)	1978 (4.8%)	0 (0.0%)	0 (0.0%)
	Borderline High 130-159	0 (0.0%)	0 (0.0%)	3186 (4.8%)	37072 (90.9%)	830 (5.9%)	0 (0.0%)
	High 160-189	0 (0.0%)	0 (0.0%)	0 (0.0%)	1748 (4.3%)	12793 (90.5%)	174 (4.2%)
	Very High≥190	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	508 (3.6%)	4001 (95.8%)
Triglycerides <175 mg/dL		Martin-Hopkins					
LDL-C Value (mg/dL)		Desirable≤70 (N=15059)	Desirable 71-99 (N=44772)	Above Desirable 100-129 (N=52626)	Borderline High 130-159 (N=29441)	High 160-189 (N=8887)	Very High≥190 (N=2302)
Sampson	Desirable≤70	14290 (94.9%)	521 (1.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Desirable 71-99	769 (5.1%)	41309 (92.3%)	500 (1.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Above Desirable 100-129	0 (0.0%)	2942 (6.6%)	48943 (93.0%)	210 (0.7%)	0 (0.0%)	0 (0.0%)
	Borderline High 130-159	0 (0.0%)	0 (0.0%)	3183 (6.0%)	27503 (93.4%)	0 (0.0%)	0 (0.0%)
	High 160-189	0 (0.0%)	0 (0.0%)	0 (0.0%)	1728 (5.9%)	8401 (94.5%)	0 (0.0%)
	Very High≥190	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	486 (5.5%)	2302 (100.0%)
Triglycerides 175<400 mg/dL		Martin-Hopkins					
LDL-C Value (mg/dL)		Desirable≤70 (N=1426)	Desirable 71-99 (N=7852)	Above Desirable 100-129 (N=13881)	Borderline High 130-159 (N=11357)	High 160-189 (N=5244)	Very High≥190 (N=1873)
Sampson	Desirable≤70	1426 (100.0%)	973 (12.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Desirable 71-99	0 (0.0%)	6879 (87.6%)	1973 (14.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Above Desirable 100-129	0 (0.0%)	0 (0.0%)	11905 (85.8%)	1768 (15.6%)	0 (0.0%)	0 (0.0%)
	Borderline High 130-159	0 (0.0%)	0 (0.0%)	3 (0.0%)	9569 (84.3%)	830 (15.8%)	0 (0.0%)
	High 160-189	0 (0.0%)	0 (0.0%)	0 (0.0%)	20 (0.2%)	4392 (83.8%)	174 (9.3%)
	Very High≥190	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	22 (0.4%)	1699 (90.7%)

Triglycerides 400-800 mg/dL		Martin-Hopkins					
	LDL-C Value (mg/dL)	Desirable≤70 (N=137)	Desirable 71-99 (N=663)	Above Desirable 100-129 (N=1208)	Borderline High 130-159 (N=892)	High 160-189 (N=317)	Very High≥190 (N=229)
Sampson	Desirable≤70	137 (100.0%)	374 (56.4%)	2 (0.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Desirable 71-99	0 (0.0%)	289 (43.6%)	681 (56.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Above Desirable 100-129	0 (0.0%)	0 (0.0%)	525 (43.5%)	490 (54.9%)	0 (0.0%)	0 (0.0%)
	Borderline High 130-159	0 (0.0%)	0 (0.0%)	0 (0.0%)	402 (45.1%)	193 (60.9%)	7 (3.1%)
	High 160-189	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	124 (39.1%)	108 (47.2%)
	Very High≥190	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	114 (49.8%)
LDL-C lipoprotein cholesterol							

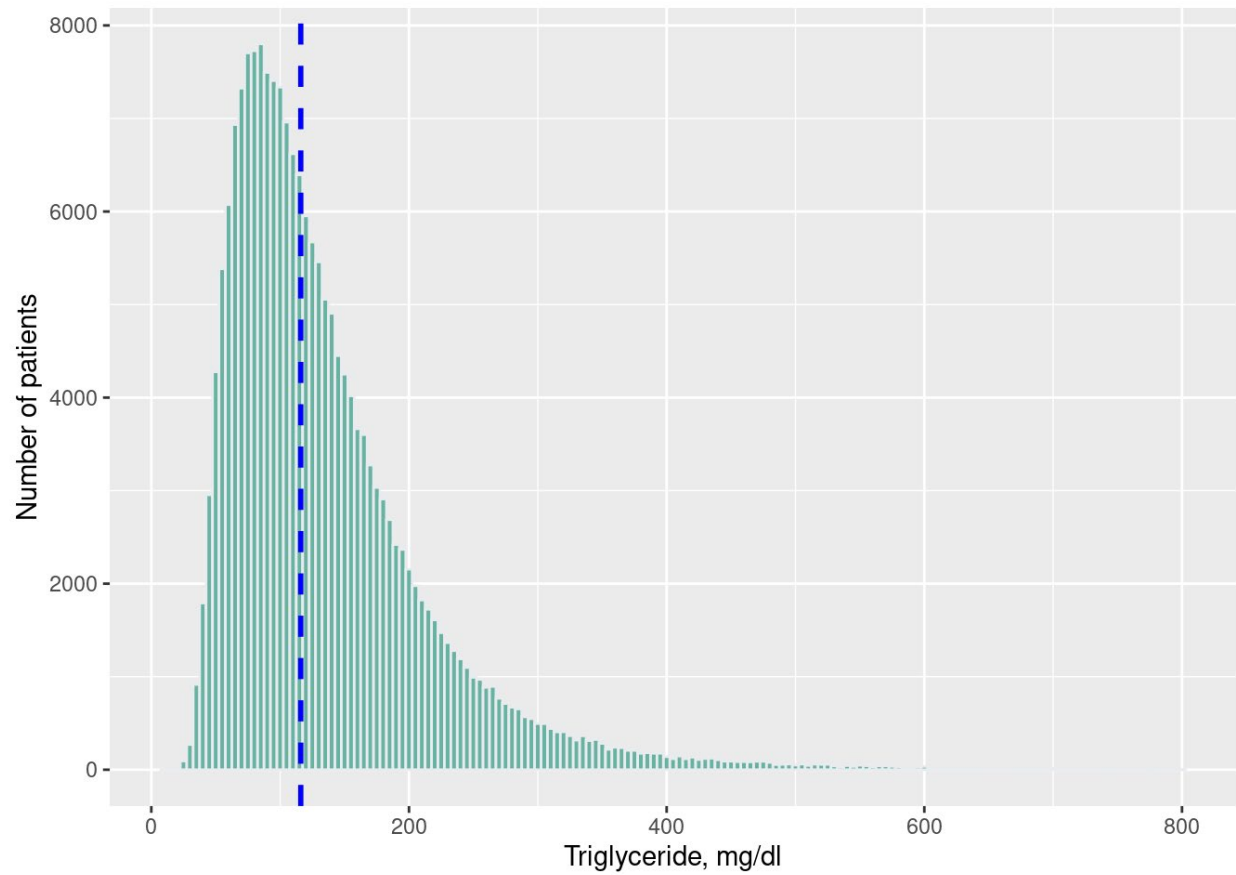
Supplementary Table 3 Comparison of LDL-C estimated by the Sampson and Martin-Hopkins Equations stratified by 10-Year ASCVD Risk for those participants with triglycerides < 400 mg/dL, count (%)

ASCVD risk < 7.5		Sampson					
LDL Value (mg/dL)		Desirable≤70 (N=10077)	Desirable 71-99 (N=33993)	Above Desirable 100-129 (N=44397)	Borderline High 130-159 (N=25713)	High 160-189 (N=8192)	Very High≥ 190 (N=2261)
Martin-Hopkins	Desirable≤70	8135 (80.7%)	664 (2.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Desirable 71-99	1942 (19.3%)	29207 (85.9%)	1366 (3.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Above Desirable 100-129	0 (0.0%)	4122 (12.1%)	39717 (89.5%)	951 (3.7%)	0 (0.0%)	0 (0.0%)
	Borderline High 130-159	0 (0.0%)	0 (0.0%)	3314 (7.5%)	23644 (92.0%)	392 (4.8%)	0 (0.0%)
	High 160-189	0 (0.0%)	0 (0.0%)	0 (0.0%)	1118 (4.3%)	7670 (93.6%)	94 (4.2%)
	Very High≥190	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	130 (1.6%)	2167 (95.8%)
ASCVD risk 7.5 < 20%		Sampson					
LDL Value (mg/dL)		Desirable≤70 (N=3451)	Desirable 71-99 (N=9247)	Above Desirable 100-129 (N=11589)	Borderline High 130-159 (N=7690)	High 160-189 (N=3181)	Very High≥ 190 (N=1184)
Martin-Hopkins	Desirable≤70	2478 (71.8%)	79 (0.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Desirable 71-99	973 (28.2%)	7471 (80.8%)	175 (1.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Above Desirable 100-129	0 (0.0%)	1697 (18.4%)	10133 (87.4%)	176 (2.3%)	0 (0.0%)	0 (0.0%)
	Borderline High 130-159	0 (0.0%)	0 (0.0%)	1281 (11.1%)	7054 (91.7%)	100 (3.1%)	0 (0.0%)
	High 160-189	0 (0.0%)	0 (0.0%)	0 (0.0%)	460 (6.0%)	2989 (94.0%)	31 (2.6%)
	Very High≥190	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	92 (2.9%)	1153 (97.4%)
ASCVD risk ≥ 20%		Sampson					
LDL Value (mg/dL)		Desirable≤70 (N=6628)	Desirable 71-99 (N=11486)	Above Desirable 100-129 (N=8951)	Borderline High 130-159 (N=4522)	High 160-189 (N=1563)	Very High≥ 190 (N=595)
Martin-Hopkins	Desirable≤70	5007 (75.5%)	122 (1.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Desirable 71-99	1621 (24.5%)	9720 (84.6%)	149 (1.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Above Desirable 100-129	0 (0.0%)	1644 (14.3%)	7962 (89.0%)	105 (2.3%)	0 (0.0%)	0 (0.0%)
	Borderline High 130-159	0 (0.0%)	0 (0.0%)	840 (9.4%)	4125 (91.2%)	48 (3.1%)	0 (0.0%)

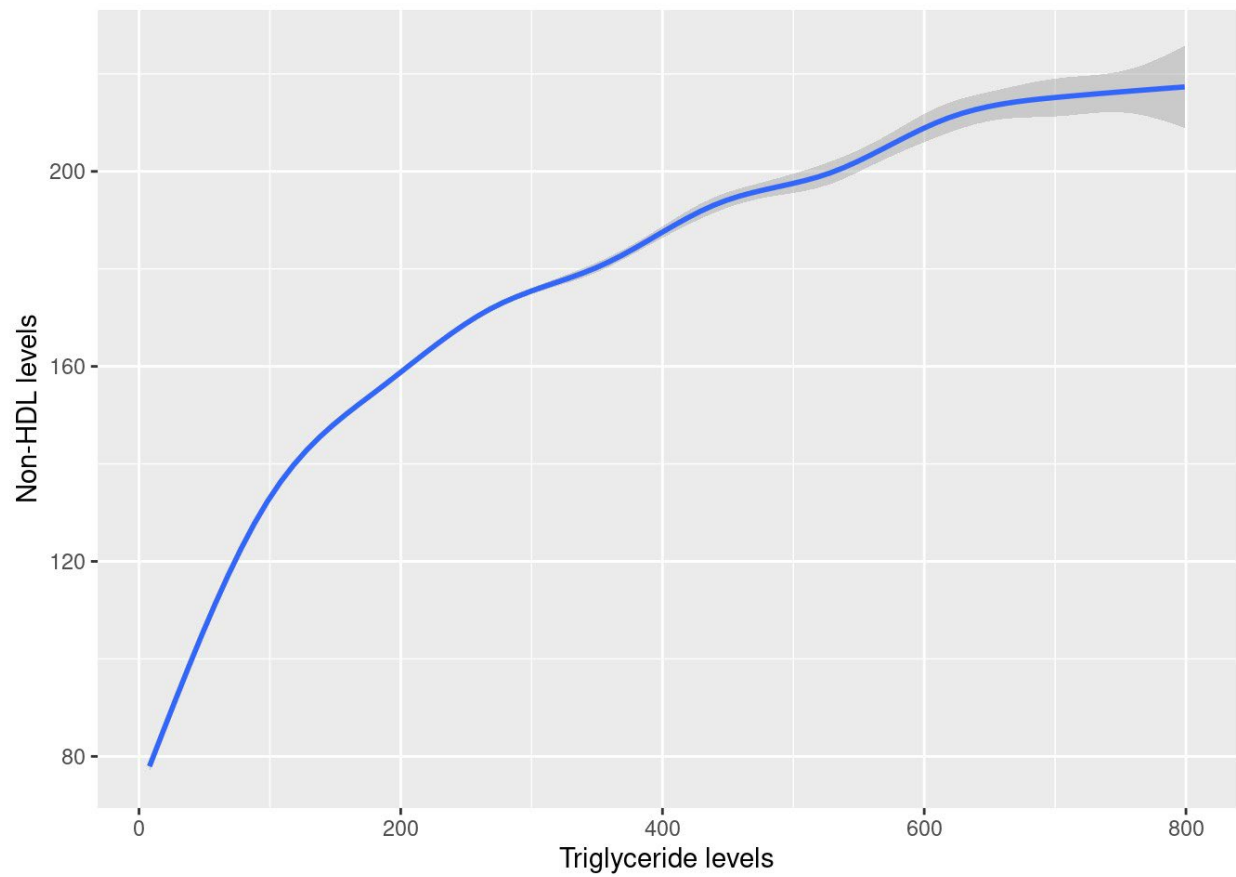
High 160-189	0 (0.0%)	0 (0.0%)	0 (0.0%)	292 (6.5%)	1462 (93.5%)	15 (2.5%)
Very High≥190	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	53 (3.4%)	580 (97.5%)

LDL-C lipoprotein cholesterol, *ASCVD* atherosclerotic cardiovascular disease

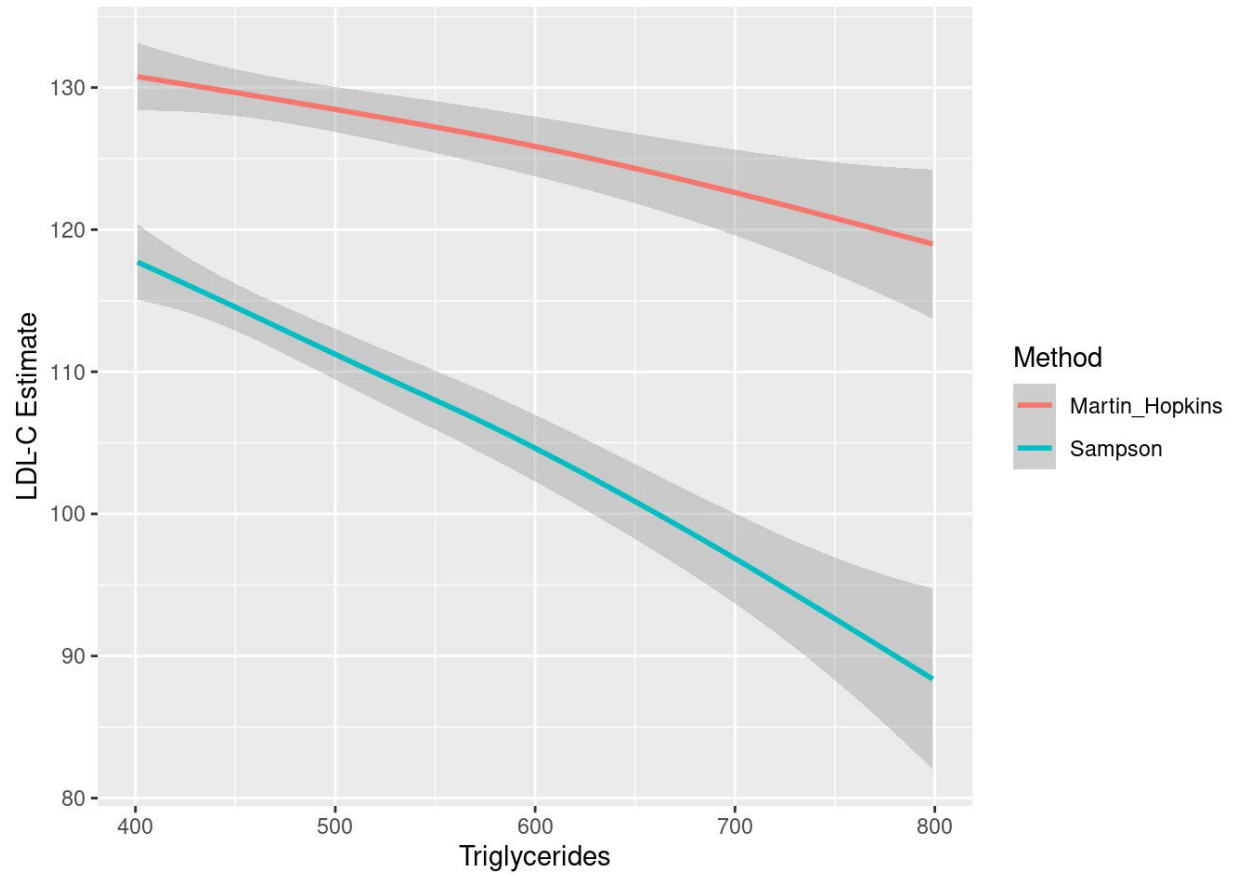
Supplementary Fig. 1 Distribution of triglycerides in the study population. The median triglyceride level is represented by the dotted blue line.



Supplementary Fig. 2 Non-HDL (mg/dL) levels by triglyceride levels for triglyceride 0-800 mg/dL.

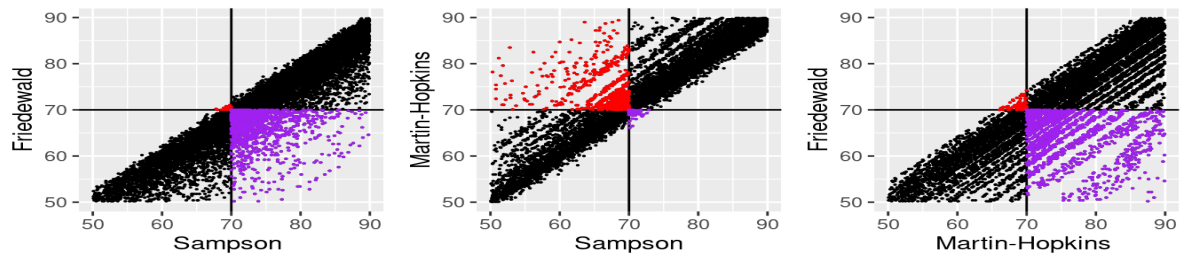


Supplementary Fig. 3 Estimated low-density lipoprotein cholesterol (LDL-C) by triglyceride levels for Martin-Hopkins and Sampson when triglyceride (400 mg/dL – 800 mg/dL).

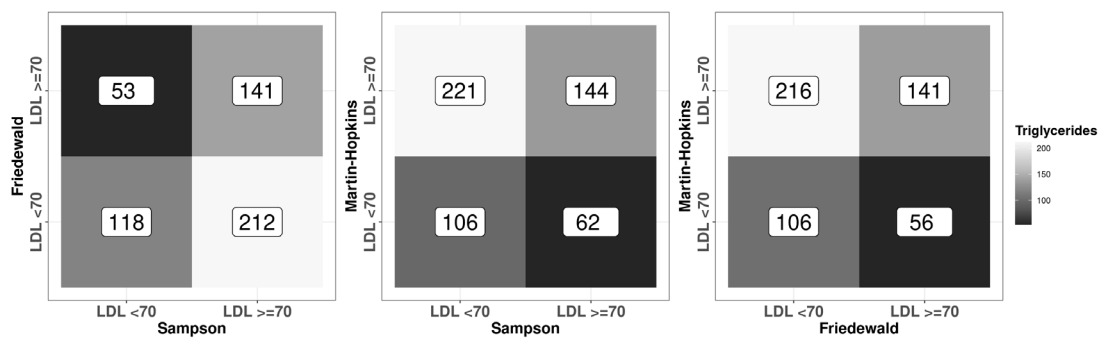


Supplementary Fig. 4 Comparison of low-density lipoprotein cholesterol (LDL-C) for diabetic patients with triglycerides < 400 mg/dL and 10-year atherosclerotic cardiovascular disease risk (ASCVD) $\geq 7.5\%$. (A) Concordance and discordance around LDL values of 70 mg/dL and (B) median triglyceride level for each quadrant.

A

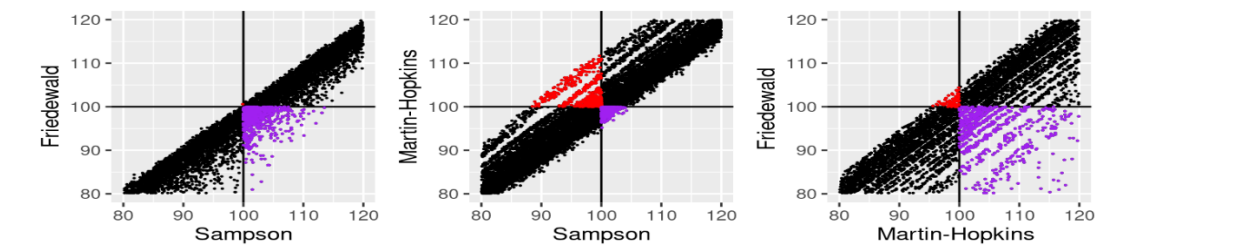


B

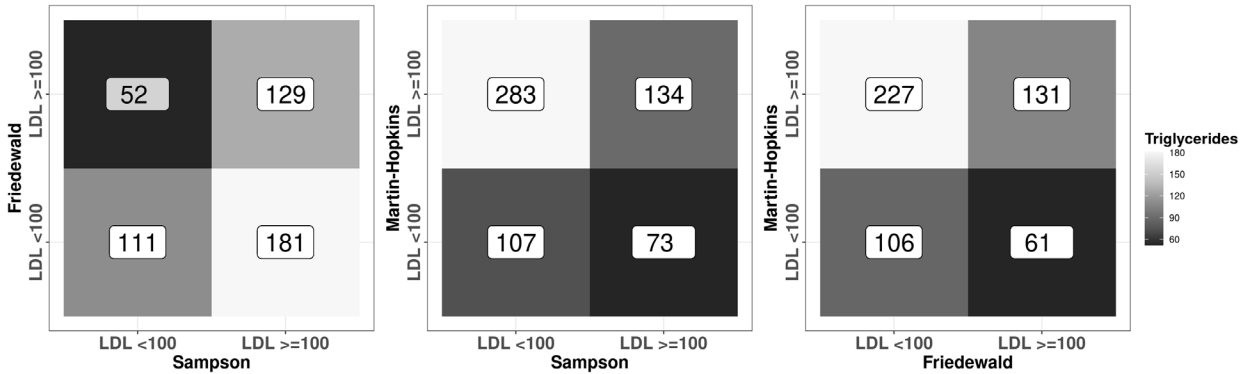


Supplementary Fig. 5 Comparison of low-density lipoprotein cholesterol (LDL-C) for diabetic patients with triglycerides < 400 mg/dL and low 10-year atherosclerotic cardiovascular disease risk (ASCVD) < 7.5%. (A) Concordance and discordance around LDL values of 100 mg/dL and (B) median triglyceride level for each quadrant.

A



B



Supplementary Fig. 6 Comparison of low-density lipoprotein cholesterol (LDL-C) at the 190 mg/dL threshold by equation.

