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Supplementary Material

They're sicker than we think: an exploratory study profiling the cardio-metabolic health in a sample of adults with pre-diabetes in Aotearoa New Zealand

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SUPPLEMENTARY DATA

Supplementary Table S1. Definitions and formulae for MetS and MetS Z-scores used in this study

Criteria or Definition			Reference
2009 ATP III definition of MetS Any three or more of the following criteria must be present to be classified with MetS • waist circumference according to population-specific definitions as indicated below* • SBP ≥ 130 mm Hg or DBP ≥ 85 mm Hg or receiving antihypertensive treatment in conjunction with a history of hypertension • FPG ≥ 5.6 mmol/L • TG ≥ 1.7 mmol/L or receiving fibrates or nicotinic acid, • HDL-C ≤ 1.03 mmol/L in men, or 1.3 mmol/L in women or receiving fibrates or nicotinic acid.			Alberti *et al.,* 2009
*Ethnic-specific waist circumference thresholds applied for categorisation of MetS			Alberti *et al.,* 2009
	Men	Women	
Caucasian (applied to Māori, Pacific, European)	≥ 102 cm	≥ 88 cm	
Asian (applied to all Asians except those specified below)	≥ 90 cm	≥ 80 cm	
Japanese	≥ 85 cm	≥ 90 cm	
Chinese	≥ 85 cm	≥ 80 cm	
MetS Z-score based on waist circumference (MetS-Z-WC) • Non-Hispanic White Male = −5.4559 + 0.0125 * Waist circumference (cm) − 0.0251 * HDL-C (mg/dl) + 0.0047 * SBP + 0.8244 * ln(TG (mg/dl)) + 0.0106 * FPG (mg/dl) • Non-Hispanic White Female = −7.2591 + 0.0254 * Waist Circumference − 0.0120 * HDL-C (mg/dl) + 0.0075 * SBP (mm Hg) + 0.5800 * ln(TG (mg/dl)) + 0.0203 * FPG (mg/dl)			Gurka *et al.,* 2018
MetS Z-score based on BMI (MetS-Z-BMI) • White male: -4.8316 + 0.0315 * BMI (kg/m^2) - 0.0272 * HDL-C (mg/dl) + 0.0044 * SBP + 0.8018 * ln(TG (mg/dl)) + 0.0101 * FPG (mg/dl) • White female: -6.5231 + 0.0523 * BMI (kg/m^2) - 0.0138 * HDL-C (mg/dl) + 0.0081 * SBP + 0.6125 * ln(TG (mg/dl)) + 0.0208 * FPG (mg/dl)			Gurka *et al.,* 2018

MetS, Metabolic syndrome*; HbA$_{1c,}$* Glycated haemoglobin; *FPG,* fasting plasma glucose; *NZSSD,* New Zealand Society for the Study of Diabetes; *ATP III,* Adult treatment panel, *HDL-C,* high-density lipoprotein cholesterol; *SBP,* systolic blood pressure; *TG,* triglycerides; *BMI,* body mass index

Alberti KGMM, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JI, Donato KA, Fruchart J-C, James WPT, Loria CM, Smith SC (2009) Harmonizing the metabolic syndrome. *Circulation* **120**, 1640–1645. doi:10.1161/CIRCULATIONAHA.109.192644.

Gurka MJ, Filipp SL, Musani SK, Sims M, DeBoer MD (2018) Use of BMI as the marker of adiposity in a metabolic syndrome severity score: derivation and validation in predicting long-term disease outcomes. *Metabolism* **83**, 68–74. doi:10.1016/j.metabol.2018.01.015.

Supplementary Table S2. Descriptive statistics for continuous baseline variables by total group and sex

	All			Females			Males		
Variable	**Mean (SD)**	**Median (IQR)**	**Min to Max**	**Mean (SD)**	**Median (IQR)**	**Min to Max**	**Mean (SD)**	**Median (IQR)**	**Min to Max**
n[a]	153			73			80		
Age, years	59.6 (8.8)	60.1 (53.1 to 66.3)	37.5 to 80.3	60 (8.3)	61.7 (55.3 to 65.4)	38.8 to 77.6	59.4 (9.4)	58.7 (51.7 to 68.0)	37.5 to 80.3
Anthropometric									
Weight, kg	85.9 (20.8)	82.3 (73 to 97)	43.9 to 165.6	78.2 (19.2)	75.4 (63.9 to 88.1)	43.9 to 150.5	93 (19.8)	88.7 (80 to 103.1)	60.3 to 165.6
Waist, cm	102.7 (14.8) *n*=152	102.3 (92.3 to 110.7)	66 to 157.1	97.4 (15.1)	96.6 (86.0 to 106.8)	66.0 to 142.0	107.5 (12.7) *n*=79	106.5 (98.8 to 115.2)	81 to 157.2
BMI, kg/m^2	30.4 (6)	29.8 (26 to 33.5)	19.3 to 52.4	30.1 (6.5)	29.5 (25.4 to 34.2)	19.3 to 48.2	30.7 (5.5)	29.9 (26.6 to 32.8)	22.4 to 52.2
Systolic BP, mm Hg	136.2 (16) *n*=152	136 (125 to 144)	99 to 193	136.4 (17.7)	135 (125 to 150)	99 to 193	136 (14.4) *n*=79	137 (126 to 144)	104 to 182
Diastolic BP, mm Hg	81.1 (11.3) *n*=152	82 (74 to 87.5)	56 to 124	78.2 (10.6)	79 (72 to 84)	56 to 116	83.9 (11.3) *n*=79	84 (76 to 90)	63 to 124
Blood									
Total Cholesterol, mmol/L	5.0 (1.3)	4.9 (4.1 to 5.8)	2 to 9	5.5 (1.4)	5.3 (4.5 to 6.5)	2.7 to 9.0	4.6 (1)	4.5 (3.9 to 5.3)	2 to 7.4
LDL-C, mmol/L	3.2 (1.1)	3.1 (2.4 to 4.0)	0.5 to 6.2	3.6 (1.2)	3.5 (2.7 to 4.4)	1.5 to 6.2	2.9 (0.9)	2.7 (2.2 to 3.5)	0.5 to 5.2
HDL-C, mmol/L	1.2 (0.3)	1.2 (1 to 1.4)	0.5 to 2.2	1.4 (0.3)	1.3 (1.1 to 1.5)	0.6 to 2.2	1.1 (0.2)	1 (0.9 to 1.2)	0.5 to 1.9
Triglycerides, mmol/L	1.4 (0.6)	1.2 (1 to 1.7)	0.5 to 3.3	1.3 (0.5)	1.2 (1.0 to 1.4)	0.5 to 2.9	1.4 (0.6)	1.3 (0.8 to 1.9)	0.5 to 3.3
TC/HDL-C ratio	4.4 (1)	4.1 (3.4 to 5.1)	2.2 to 7.3	4.2 (1.2)	4 (3.3 to 5)	2.2 to 7.7	4.4 (1)	4.3 (3.6 to 5.2)	2.4 to 6.3
FPG, mmol/L	6.7 (1.3) *n*=151	6.4 (6.0 to 7.1)	4.2 to 14.2	6.5 (0.9)	6.3 (6.0 to 6.9)	4.2 to 9.6	7 (1.5) *n*=78	6.6 (6.1 to 7.4)	5.2 to 14.2
Insulin, pmol/L	104.1 (88.6)	85.3 (51.8 to 124.4)	15.5 to 734.2	98.8 (101.3)	83.6 (43.4 to 112.7)	15.6 to 734.2	109 (75.5)	88.1 (59.1 to 134.7)	15.5 to 400.3
HOMA-IR*	4.5 (4.2) *n*=151	3.5 (2.1 to 5.4)	0.4 to 36.7	4.3 (4.9)	3.3 (1.7 to 4.8)	0.4 to 36.7	4.8 (3.4) *n*=78	4 (2.4 to 5.8)	0.5 to 16.1
HbA_{1c}, mmol/mol	45.9 (4.0) *n*=144	46 (43 to 48)	36 to 60	45.4 (4.3) *n*=67	45 (43 to 48)	36 to 60	46.4 (3.6) *n*=77	46 (44 to 49)	40 to 58

Variable	All			Females			Males		
	Mean (SD)	**Median (IQR)**	**Min to Max**	**Mean (SD)**	**Median (IQR)**	**Min to Max**	**Mean (SD)**	**Median (IQR)**	**Min to Max**
n [a]	153			73			80		
Dietary intake (daily)									
Total fibre, g	25.6 (8.7)	24.3 (19.1 to 31.1)	9.7 to 53.1	24.4 (8.1)	22.4 (18.9 to 29.2)	10 to 50.9	26.7 (9)	26.5 (19.3 to 31.8)	9.7 to 53.1
Total energy, per 1000 kj	8.6 (2.3)	8.3 (6.9 to 10.3)	3.5 to 1.7	7.8 (1.9)	7.5 (6.4 to 8.9)	3.5 to 13.2	9.34 (2.4)	9.0 (7.5 to 11.3	3.8 to 17.2

[a] Denominator applies unless otherwise specified, [b] Insulin resistance was assessed using the homeostatic model assessment for insulin resistance (HOMA-IR) and calculated using the formula by Matthews and colleagues 1985

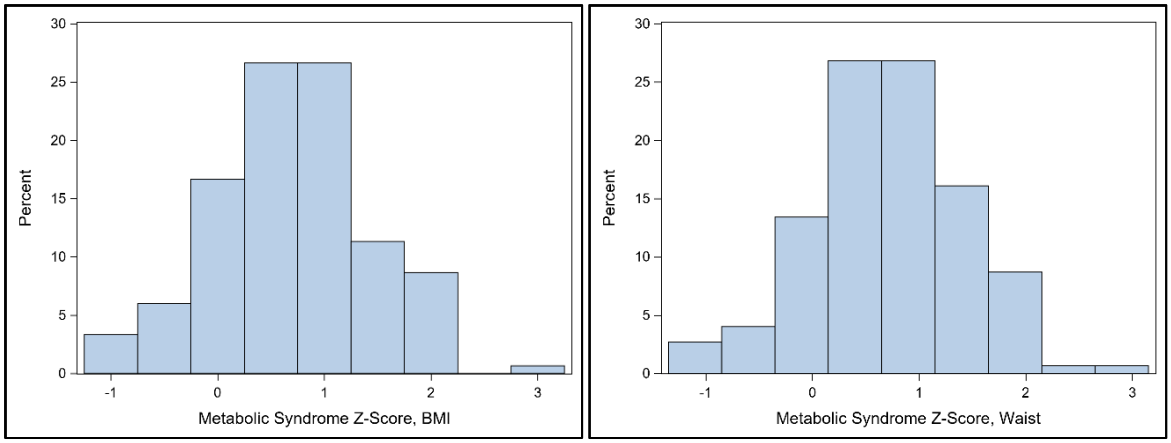
SD, standard deviation; *IQR,* interquartile range; *BMI* body mass index, *BP,* Blood pressure; *LDL-C,* low-density lipoprotein cholesterol *HDL-C,* High-density lipoprotein cholesterol; *TC,* Total cholesterol; *FPG,* Fasting plasma glucose; *HOMA-IR,* Homeostatic model assessment for insulin resistance; $HbA_{1c,}$ Glycated haemoglobin

Matthews DR, Hosker JR, Rudenski AS, Naylor BA, Treacher DF, Turner RC, et al. Homeostasis model assessment: insulin resistance and fl-cell function from fasting plasma glucose and insulin concentrations in man. Diabetologia. 1985;28:412–9

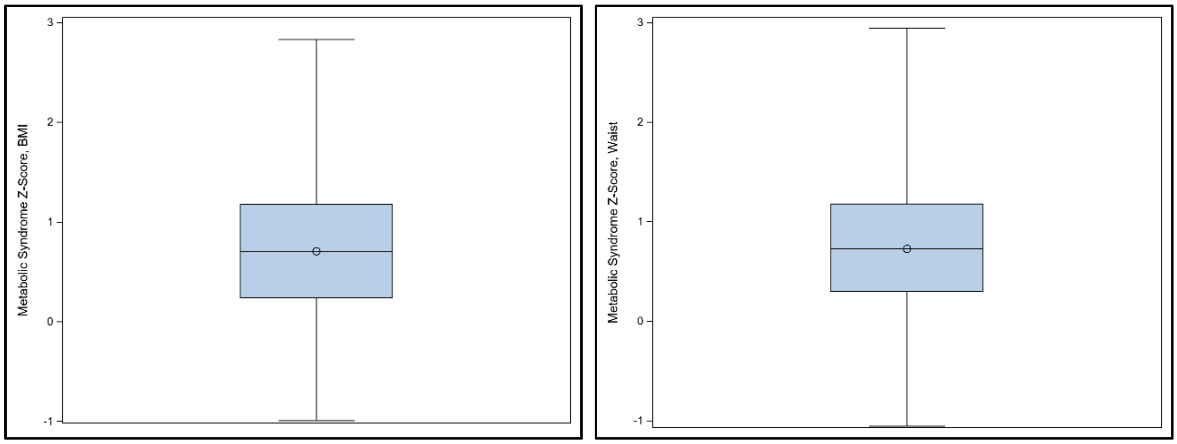
Supplementary Table S3. Descriptive statistics for MetS-Z-BMI scores for study population and according to subgroups

	n	Mean (SD)	Median (IQR)	Min to Max
All	150	0.71 (0.72)	0.70 (0.24 to 1.18)	-0.99 to 2.83
Sex				
Female	73	0.72 (0.74)	0.75 (0.26 to 1.18)	-0.99 to 2.83
Male	77	0.69 (0.70)	0.67 (0.23 to 1.15)	-0.89 to 2.12
Ethnic groups				
European	77	0.71 (0.79)	0.64 (0.21 to 1.22)	-0.92 to 2.83
Māori/Pacific	31	0.94 (0.64)	0.98 (0.61 to 1.31)	-0.89 to 2.02
Asian	42	0.53 (0.57)	0.59 (0.23 to 0.88)	-0.99 to 1.77
HbA_{1c} groups				
< 45 mmol/mol	54	0.38 (0.66)	0.47 (0.05 to 0.75)	-0.99 to 2.08
≥ 45 mmol/mol	87	0.92 (0.69)	0.95 (0.35 to 1.33)	-0.63 to 2.83

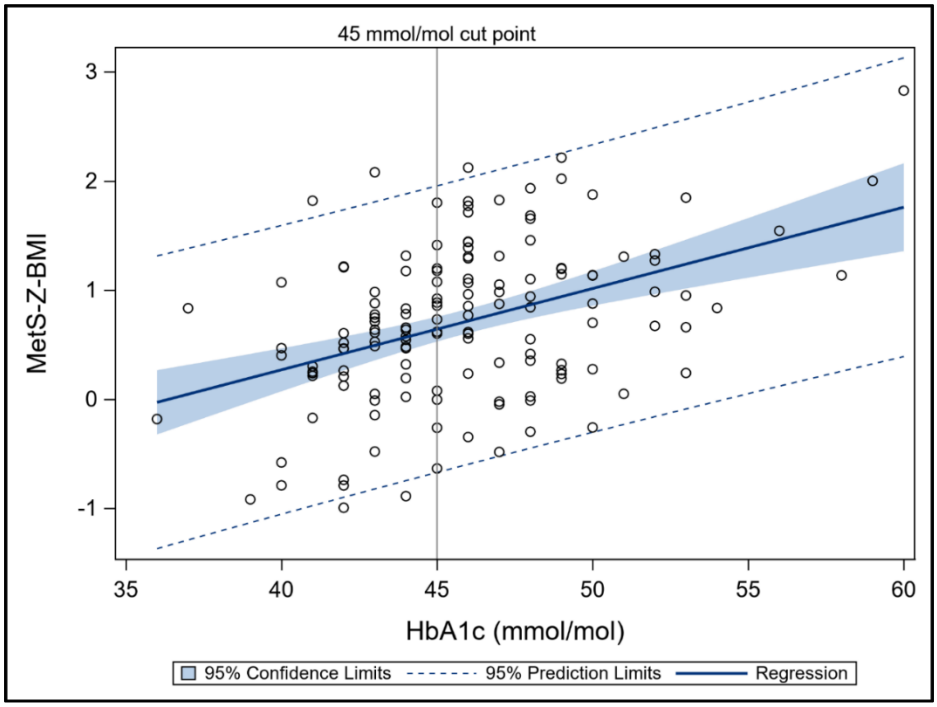
SD, standard deviation; *IQR,* interquartile range; *BMI,* body mass index; *HbA_{1c},* glycated haemoglobin



Supplementary Figure S1. Histograms for MetS-Z-scores based on waist circumference and BMI



Supplementary Figure S2. Box plots for MetS Z-scores based on waist circumference and BMI



Supplementary Figure S3. Linear regression of MetS-Z on HbA_{1c}