

# Prevalence of the Metabolic Syndrome Among Adult New Zealanders of Polynesian and European Descent

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The metabolic syndrome describes the clustering of risk factors for diabetes and cardiovascular disease (1). New Zealand Polynesians of both Maori and Pacific descent have high rates of components for the metabolic syndrome: type 2 diabetes (2), obesity (2), hypertension (3), dyslipidemia (4), and coronary heart disease (5,6). There have been no previous reports of the prevalence of the metabolic syndrome in New Zealand since the release of the Adult Treatment Panel (ATP) III criteria (7). In this study, we compare the prevalence of the metabolic syndrome by ATP III criteria among New Zealanders of European and Polynesian descent.

## RESEARCH DESIGN AND METHODS

Residents from a household census in South Auckland were randomly selected using a sampling framework stratified by age, sex, and ethnic group as previously described (2). At each house, questionnaires were completed; weight, height, and waist were measured; and a random venous sample was taken for glucose measurement (into fluoride; spun, chilled, and assayed within 3 h). Those without known diabetes and either a random glucose  $\geq 6.5$  mmol/l within 2 h of a meal or  $\geq 6$  mmol/l  $\geq 2$  h after a meal (defined as "screen positives"), as well as a random control group (28% of other subjects; defined as "screen negatives") were invited for a 75-g oral glucose tolerance test (OGTT). At the

OGTT, fasting samples were also taken for lipids (total, HDL, and LDL cholesterol and triglycerides) and measured on a Hitachi 747 analyzer (Hitachi, Tokyo, Japan) (interassay coefficient of variation 2.2, 4.8, and 3.3%, respectively, except LDL cholesterol, which was calculated using the Friedewald equation). Resting blood pressure was taken as the mean of two measurements using a standard mercury sphygmomanometer (with large cuff where necessary) following a standardized approach and before the 2-h glucose sampling.

The ATP III criteria (2) for the metabolic syndrome were considered to have been met when three or more of the following factors were present: waist circumference  $>102$  cm for men or  $>88$  cm for women, elevated blood pressure (treated hypertension or systolic blood pressure  $\geq 130$  mmHg and/or diastolic blood pressure  $\geq 85$  mmHg as mean of two readings), elevated triglycerides ( $\geq 1.7$  mmol/l), decreased HDL ( $<1.04$  mmol/l for men or  $<1.29$  mmol/l for women), elevated fasting glucose ( $\geq 6.1$  mmol/l), or diabetes. The study was approved by the University of Auckland Ethics Committee, and subjects gave informed consent.

Randomization and statistics were undertaken using SPSS for Windows (version 12.0; SPSS, Chicago IL). Comparisons of proportions were made using the  $\chi^2$  test. Calculations of the prevalence of each constituent of the metabolic syn-

drome by ATP III criteria and overall were made by direct standardization to the proportion of subjects who were screen negative or positive with Excel 2000 (Microsoft) as follows: (screen positive with characteristic at OGTT)  $\times$  (% screened who were screen positive)/screen positive attending OGTT + (screen negative with characteristic at OGTT)  $\times$  (% screened who were screen negative)/screen negative attending OGTT.

**RESULTS**—As previously reported, the initial household survey had a 91% response with 2,737 interviewed, of whom 314 had known diabetes. Of the 2,423 invited to participate without known diabetes, 1,562 (64.5%) were screened in their home. Subsequent attendance at OGTT was 68.4% (327 of 478) among screen-positive and 67.2% (207 of 308 invited) among screen-negative subjects. Mean age was  $50 \pm 5$  (Europeans),  $49 \pm 5$  (Maori), and  $49 \pm 5$  years (Pacific) ( $P = 0.029$ ) in the 40- to 59-year age-group and  $68 \pm 6$ ,  $66 \pm 5$ , and  $67 \pm 5$  years, respectively, in the 60- to 79-year age-group ( $P < 0.001$ ).

The prevalence of known diabetes, obesity, and low HDL was significantly higher among Polynesians in both age-groups (Table 1). Maori, but not Pacific, subjects consistently had a higher blood pressure, although this difference was not significant among women aged 60–79 years. The prevalence of hypertriglyceridemia was highest among Maori and Pacific people, except among women aged 40–59 years. The presence of an elevated fasting glucose or new diabetes diagnosis was significantly more likely among Maori and Pacific women aged 40–59 years and nonsignificantly higher among men of these ethnic groups.

Among those aged 40–59 years, a very small proportion of Maori and Pacific subjects showed no components of the metabolic syndrome and a much higher proportion (approximately half) had three or more components, making them eligible for metabolic syndrome diagno-

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**Abbreviations:** ATP, Adult Treatment Panel; OGTT, oral glucose tolerance test.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

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Table 1—Prevalence of the metabolic syndrome by ATP III criteria (three or more items) and its components

	Men			Women		
	European	Maori	Pacific Islander	European	Maori	Pacific Islander
<b>Aged 40–59 years</b>						
Known diabetes	17/276 (6.2%)	29/239 (12.1%)	45/338 (13.3%)	9/315 (2.9%)	40/350 (11.4%)	53/410 (12.9%)
Known hypertension	30/191 (15.7%)	32/157 (20.4%)	39/231 (16.9%)	27/238 (11.3%)	55/242 (22.7%)	46/302 (15.2%)
BMI >30 kg/m <sup>2</sup> (%)	28.6	72.4	71.6	34.7	64.3	81.6
High waist circumference (%)	36.2	63.9	66.4	41.8	75.2	91.8
OGTT attenders (n)*	38	41	66	48	69	98
High blood pressure (%)	54.6	81.5	72.3	45.4	74.0	58.6
Triglycerides ≥1.7 mmol/l (%)	37.6	58.3	69.4	42.6	40.0	31.9
Decreased HDL (%)	32.1	63.5	53.9	45.2	76.7	66.8
Hyperglycemia (%)	13.3	36.4	30.2	8.6	12.2	28.2
ATP III items (%)						
None	31.6	5.9	8.4	19.0	8.0	8.6
One	19.9	13.1	12.3	26.3	6.7	12.6
Two	23.7	28.2	30.8	41.3	33.5	33.3
Three or more	24.6	52.8	48.5	13.4	51.8	45.5
<b>Aged 60–79 years</b>						
Known diabetes	12/158 (7.6%)	15/94 (16.0%)	31/138 (22.5%)	18/187 (9.7%)	16/97 (16.5%)	29/135 (21.6%)
Known hypertension	31/120 (25.8%)	22/60 (36.7%)	28/106 (26.4%)	47/140 (33.6%)	25/70 (35.7%)	24/101 (23.8%)
BMI >30 kg/m <sup>2</sup> (%)	20.2	58.9	52.2	32.0	60.0	69.5
High waist circumference (%)	36.9	56.4	53.2	52.8	76.2	91.6
OGTT attenders (n)*	37	16	28	48	19	27
High blood pressure (%)	77.2	92.3	54.7	78.7	81.5	67.0
Triglycerides ≥1.7 mmol/l (%)	21.4	61.2	45.5	27.8	45.4	44.1
Decreased HDL (%)	31.2	67.0	65.4	19.8	52.6	59.9
Hyperglycemia (%)	18.9	48.8	25.5	19.5	21.0	17.4
ATP III items (%)						
None	13.9	7.7	10.9	7.2	9.3	5.8
One	26.5	12.8	23.6	31.4	18.1	11.5
Two	37.9	12.8	25.5	30.4	27.3	38.8
Three or more	21.7	66.7	39.9	31.0	45.4	43.9

Due to rounding, percentages may not total exactly 100%. High waist circumference: >102 cm for men and >88 cm for women; high blood pressure: ≥130/85 mmHg or known hypertension; hyperglycemia: new diabetes or fasting blood glucose ≥6.1 mmol/l; decreased HDL: HDL <1.04 mmol/l for men and <1.29 mmol/l for women. \*OGTT attenders: data adjusted for the proportion who were screen positive and screen negative by direct standardization.

sis. Among those aged 60–79 years, there was no significant difference in the overall distribution of the components or prevalence of the metabolic syndrome among women ( $P = 0.350$ ). The prevalence of the metabolic syndrome was higher among men ( $P = 0.005$ ).

**CONCLUSIONS** — Among Maori and Pacific peoples aged  $\geq 40$  years, the total prevalence of the metabolic syndrome and known diabetes was  $>50\%$ , with  $\sim 80\%$  having at least two components of the metabolic syndrome (also associated with a significantly increased risk of cardiovascular disease [8]). The prevalence of the metabolic syndrome by ATP III criteria among men of European descent aged  $\geq 40$  years has been reported to range from 12% across the eight DECODE (Diabetes Epidemiology: Collaborative Analysis of Diagnostic Criteria in Europe) studies (8), to 28.8% (35–75 years) in Canada (9), and to 30–40% in the U.S. (10). These New Zealand data are clearly most comparable to those in North America. Among women of European descent in Canada aged 35–75 years, the prevalence of the metabolic syndrome was 14.3% (9), and in Europe, the prevalence increased from 5.2% among those aged 40–49 years to 16.8% among those aged  $\geq 70$  years (8). In the U.S., the prevalence of the metabolic syndrome increased from  $\sim 19\%$  among women aged 40–49 years to a peak of  $\sim 45\%$  in those aged 70–79 years (10). There have been no reports of the prevalence of the metabolic syndrome among Polynesians elsewhere, but the age-specific prevalences among Maori and Pacific people were comparable to Mexican Americans (10,11), Arab Americans (12), and Native Americans (9,13) but higher than those among South Asians (9), East Asians (9,14,15), and African Americans (10).

These findings are limited by the

small numbers in each stratum and the stratified nature of the attendance at OGTT, and this probably explains the lack of statistical significance for some components (e.g., new diabetes). The criteria for obesity are also an issue among Polynesians (16).

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