

Metabolic syndrome in the Hong Kong community: the United Christian Nethersole Community Health Service (UCNCHS) primary healthcare programme 2001–2002

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ABSTRACT

Introduction: With recognition of the important role of central obesity in metabolic syndrome (MES), the International Diabetes Federation (IDF) has proposed a revised definition for MES in early 2005. Information of MES in Chinese by IDF criteria is limited.

Methods: This was a cross-sectional observation survey. A sample of 7,473 subjects (2,660 men and 4,813 women) was examined. They presented voluntarily in the period between August 2001 and September 2002 for health assessment at the three health centres of the United Christian Nethersole Community Health Service.

Results: The mean age (SD) was 50.4 (10.6) years (range 19–93 years, median 48.0 years). Among them, 30 percent had central obesity, 34 percent had low high-density lipoprotein cholesterol, 20 percent had high triglyceride, 47 percent had high blood pressure, and 23 percent had dysglycaemia. The age-standardised percentage of MES by NCEP and IDF criteria were 18.3 and 13.9 percent, respectively.

Conclusion: MES is not uncommon among Hong Kong Chinese. Further studies on the management and prevention of MES are indicated.

Keywords: International Diabetes Federation, Hong Kong Chinese, metabolic syndrome, obesity, waist circumference

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INTRODUCTION

Obesity is nowadays reaching epidemic proportions in

many developed countries.⁽¹⁾ It is strongly associated with most cardiovascular disease (CVD) risk factors such as dyslipidaemia and dysglycaemia.⁽²⁾ Metabolic syndrome (MES) is a medical condition with clustering of risk factors for CVD and diabetes mellitus, and the clustering is greater by chance alone.⁽³⁾ Since MES is rather complicated in terms of its aetiology and pathogenetic mechanisms, its definition was not unified. There are several definitions for MES according to different authorities who look into MES at different angles.^(4–6) The definition suggested by National Cholesterol Education Program (NCEP) Expert Panel (ATP III) in 2001 is relatively simple and hence, most widely used.⁽⁶⁾ With recognition of the important role of central obesity in MES, the International Diabetes Federation (IDF) has proposed a revised definition for MES in early 2005.⁽⁷⁾ In this new definition, central obesity (measured by waist circumference) is an essential component of MES. Centrally obese subjects are defined as having MES if they also have two or more of the following conditions: low high-density lipoprotein cholesterol (HDL-C), high triglyceride (TG), high blood pressure (BP) and abnormal glycaemic state.⁽⁷⁾ Information on MES using this new IDF definition is limited. We studied 7,473 Chinese subjects who were recruited from the community of Hong Kong. We aimed to report the severity of the problem of MES as defined by the new IDF criteria in Hong Kong Chinese. We also compared these figures with that defined by the NCEP criteria and analysed the implications.

METHODS

United Christian Nethersole Community Health Service (UCNCHS) is a self-funded, non-profit making organisation in Hong Kong with the objective of health promotion through primary healthcare and education. All Hong Kong citizens join our UCNCHS health-screening program through word of mouth, publicity via the media, community centres, hospitals, as well as public health education and promotion activities in the

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Table I. Clinical characteristics of the 7,473 subjects.

	Total (n = 7,473)	Men (n = 2,660)	Women (n = 4,813)
Age (years)	50.4 ± 10.6	51.0 ± 11.5	50.1 ± 10.0
Smokers, n (%)	759 (10.2)	587 (22.1)	172 (3.6)
Drinkers, n (%)	98 (1.3)	82 (3.1)	16 (0.3)
Systolic BP (mmHg)	124 ± 21	127 ± 20	122 ± 21
Diastolic BP (mmHg)	80 ± 12	83 ± 11	78 ± 11
Weight (kg)	60.0 ± 11.1	67.6 ± 10.5	55.8 ± 9.0
BMI (kg/m ²)	23.5 ± 3.5	24.1 ± 3.3	23.1 ± 3.6
Waist (cm)	79.1 ± 9.7	85.0 ± 8.5	75.8 ± 8.7
Triglyceride (mmol/L)	1.3 ± 1.2	1.5 ± 1.5	1.2 ± 0.9
HDL-C (mmol/L)	1.3 ± 0.3	1.2 ± 0.3	1.3 ± 0.3
LDL-C (mmol/L)	3.7 ± 1.0	3.9 ± 0.8	3.6 ± 1.1
Fasting PG (mmol/L)	5.4 ± 1.1	5.5 ± 1.3	5.3 ± 1.0
Diabetes, n (%)	356 (4.8)	158 (5.9)	198 (4.1)
MES by NCEP, n (%)	1,716 (23.0)	658 (24.7)	1,058 (22.0)
MES by IDF, n (%)	1,312 (17.6)	471 (17.7)	841 (17.5)

All p-values comparing men and women: < 0.001

BP: blood pressure; HDL-C: high-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; PG: plasma glucose; MES: metabolic syndrome; NCEP: National Cholesterol Education Program; IDF: International Diabetes Federation.

community. Subjects present themselves voluntarily from different districts all over Hong Kong. A modest fee for the screening programme was charged (average HK\$700 or approximately US\$90). In this study, we analysed 7,473 subjects with detailed clinical information who were recruited in the period between August 2001 and September 2002.

Smokers and drinkers were defined as those were currently smoking or drinking, respectively. Their socio-economic status (SES) classification according to occupation is summarised as follows:

Occupational group 1: social classes I and II, professional or managerial.

Occupational group 2: social class III, non-manual.

Occupational group 3: social class III, manual.

Occupational group 4: social classes IV and V, unskilled.

Occupational group 5: housewife or retired.

Demographical data, including height, weight and waist circumference (WC), were documented following a standard protocol with the subject in light clothing without shoes. Body mass index (BMI) was calculated as weight (in kg) divided by the square of height (in metres). WC (in cm) was measured midway between the lower costal edge and upper iliac crest. After sitting for at least five minutes, blood pressure (BP) was measured in the right arm with a standard mercury sphygmomanometer. The Korotkoff sound V was taken as the diastolic BP.

Blood samples were taken after an eight hour fast for measurement of plasma glucose (PG), TG, total cholesterol and HDL-C. Total cholesterol (enzymatic method), TG (enzymatic method) and HDL-C (enzymatic method based on the selective solubilising effect of proprietary detergent to the different lipoproteins) were measured on a Dimension RxL automated analyser (Dade Behring Inc, CITY?, USA) using reagent kits supplied by the manufacturer of the analyzer. Low-density lipoprotein cholesterol (LDL-C) was calculated using Friedewald's formula.⁽⁸⁾ PG was measured by a hexokinase phosphorylation method (Dimension RxL, Dade Behring Inc, Holliston, MA, USA). Both the intra-assay and inter-assay coefficients of variation (CV) for PG were 2% at 6.6 mmol/L, respectively.

The percentages of MES as defined by the NCEP and IDF criteria were reported. Percentage of diabetes mellitus was also calculated, which was defined as past history of diabetes mellitus or fasting PG ≥ 7.0 mmol/L.⁽⁹⁾ The obesity parameter in NCEP criteria was modified according to the suggested guidelines by IDF and World Health Organisation (WHO) Western Pacific Region to define central obesity.⁽¹⁰⁾ The diagnostic criteria for MES are listed as follows:

- 1) IDF criteria⁽⁷⁾ – WC ≥ 80 cm in women or ≥ 90 cm in men plus 2 or more of the following:
 - a) low HDL-C = HDL-C < 1.3 mmol/L in women or < 1.0 mmol/L in men;

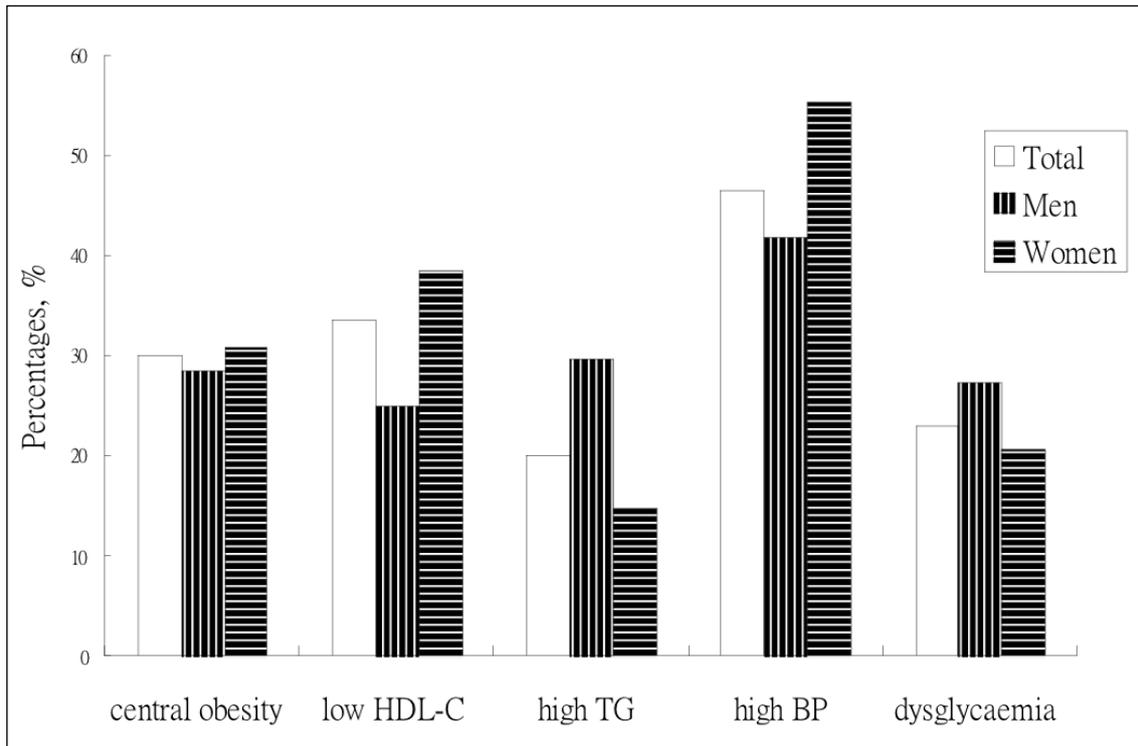


Fig. 1 Bar chart shows percentages of the individual component of metabolic syndrome in the 7,473 subjects. HDL-C, high-density lipoprotein cholesterol; TG, triglyceride; BP, blood pressure.

- b) hypertriglyceridaemia = TG \geq 1.7 mmol/L;
 - c) hypertension = known hypertensives or BP \geq 130/85 mmHg;
 - d) dysglycaemia = fasting PG \geq 5.6 mmol/L or known to have diabetes mellitus.
- 2) NCEP criteria⁽⁶⁾ – three or more of the following conditions:
- a) obesity = WC > 90 cm in men or > 80 cm in women;
 - b) hypertriglyceridaemia = TG \geq 1.7 mmol/L;
 - c) low HDL-C = HDL-C < 1.0 mmol/L in men or < 1.3 mmol/L in women;
 - d) hypertension = known hypertensives or BP \geq 130/85 mmHg;
 - e) dysglycaemia = fasting PG \geq 5.6 mmol/L or known to have diabetes mellitus.

Statistical analyses were performed using the Statistical Package for Social Science version 10.0 (SPSS Inc, Chicago, IL, USA) software on an IBM compatible computer. All results were expressed as mean \pm SD or n (%) where appropriate. Student's t-test and the chi-square test were used for between group comparisons. A p-value < 0.05 (two-tailed) was considered to be significant. Age-standardised prevalence rates of MES were calculated using direct standardization with the overall Hong Kong

population distribution by age and sex according to the 2000–2001 Hong Kong census.⁽¹¹⁾

RESULTS

Of the 7,473 subjects, there were 2,660 (35.6%) men and 4,813 (64.4%) women. The mean age (\pm SD) was 50.4 \pm 10.6 years (range 19–93 years, median 48.0 years) (men: range 19–93 years, median 49.0 years; women: range 19–90 years, median 48.0 years). Concerning their occupation, 29.6% men and 10.3% women were professional or managerial (SES group 1), 18.0% men and 27.2% were clerical (SES group 2), 18.3% men and 0.9% women were manual skilled (SES group 3), 6.0% men and 3.9% women were manual non-skilled (SES group 4), 26.7% men and 56.0% women were housewife or retired (SES group 5), 1.4% men and 1.2% women were unemployed and 0.1% of men and women were students.

The clinical characteristics are summarized in Table I. In particular, the crude percentages of MES by NCEP and IDF criteria were 23.0% and 17.6%, respectively. The crude percentage of diabetes was 4.8% (men vs. women: 5.9% vs. 4.1%, $p < 0.001$). The percentages of individual component of MES are summarised in Fig. 1. Of the 7,473 subjects, 30% had central obesity, 34% had low HDL-C, 20% had high TG, 47% had high BP and 23% had dysglycaemia.

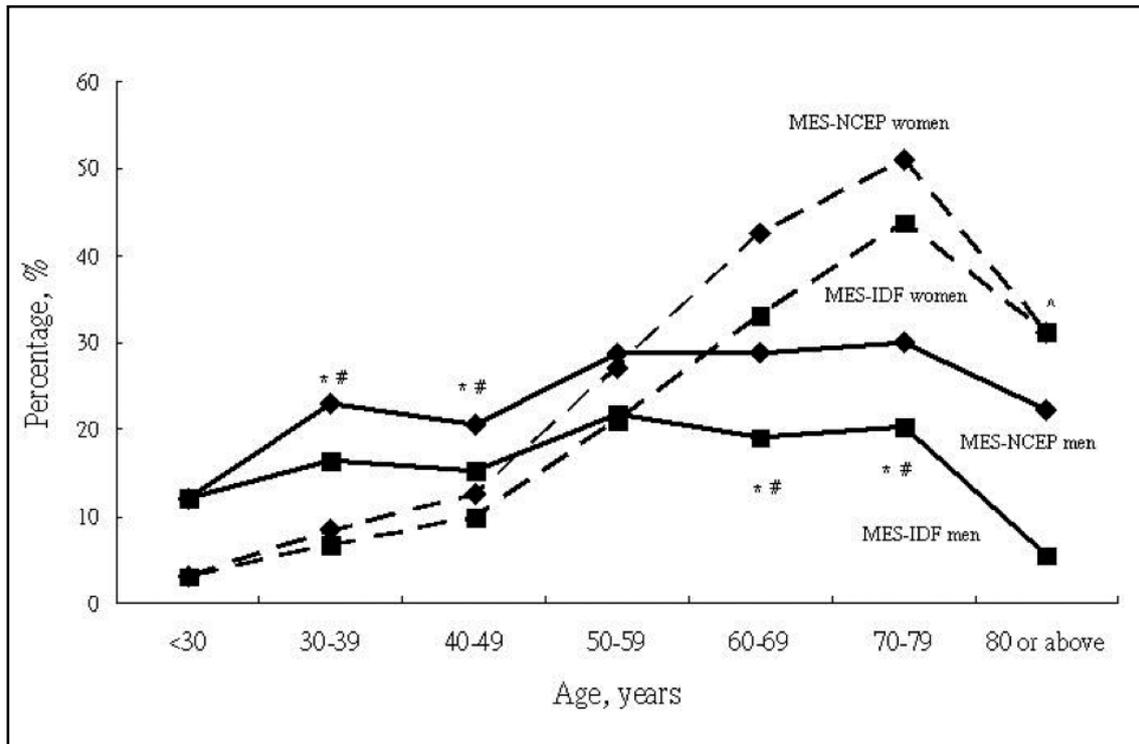


Fig. 2 Graph shows the prevalence of metabolic syndrome in the 7,473 subjects according to their age and gender. NCEP: National Cholesterol Education Program; IDF: International Diabetes Federation. p-values comparing men and women: * < 0.001 and ^ < 0.05 for IDF criteria, # < 0.001 for NCEP criteria.

Table II. Age standardised prevalence of metabolic syndrome according to NCEP or IDF criteria.

	Total	Men	Women
NCEP criteria (%)	18.32	21.29	16.24
IDF criteria (%)	13.90	15.99	13.39

NCEP: National Cholesterol Education Program; IDF: International Diabetes Federation.

The MES percentages of the 7473 subjects according to their age and gender are shown in Fig. 2. In particular, the percentage of MES was higher in men aged < 40 years and higher in women in the older age group (> 60 years). Otherwise, the MES peaked at age 70–79 years in both men and women. On average, the percentage of MES defined by NCEP criteria was 4% higher than that defined by IDF criteria. Based on the 2000–2001 Hong Kong census statistics of the overall Hong Kong population data, the age-standardised percentages of MES as defined by NCEP or IDF criteria are summarised in Table II. The age-standardised percentages of MES by NCEP and IDF criteria were 18.3% and 13.9%, respectively.

DISCUSSION

MES was defined systemically for the first time by WHO in 1998.⁽⁴⁾ The European Group for the Study of Insulin Resistance (EGIR) also proposed a similar definition in 1999.⁽⁵⁾ Both of these criteria involve the measurement of insulin resistance (IR) while in the WHO criteria, albuminuria was one of the potential components of MES. In real practice, IR and albuminuria are not routinely measured. So, both WHO and EGIR criteria for MES were not that useful clinically. The NCEP expert panel in 2001 proposed a definition for MES using simple clinical measurements including WC, fasting PG, TG, HDL-C and BP.⁽⁶⁾

With the NCEP criteria, a high rate of MES has been reported in various parts of the world. The National Health and Nutrition Examination Survey (NHANES) (1988–1994) reported an age-adjusted prevalence of 23.7% of MES in US adult population, affecting 47 million subjects.⁽¹²⁾ Based on the WHO (1998), EGIR and NCEP criteria, we have reported among Hong Kong Chinese working population of relatively young age (median age 37.0 years, range 18–66 years) that the prevalence of MES varied from 8.9% to 13.4%.⁽¹³⁾ Using the same cohort, we found little difference in the clinical characteristics among subjects with MES defined by these three

criteria, suggesting the inclusion of IR and albuminuria by the WHO and EGIR definitions did not always imply an increase in the discriminative value, at least in a community-based cohort of young adults.⁽¹³⁾

While the new IDF criteria for MES was based on the same parameters used in the NCEP criteria, the former identified central obesity as an essential component for MES. The relative merits of these two criteria have yet to be fully settled. With the NHANES (1999–2002) database, Ford reported the prevalence of MES in 3,601 American adults to be 34.5% and 39.0% based on the NCEP and IDF criteria, respectively.⁽¹⁴⁾ The increase in the prevalence by the IDF criteria is simply due to a reduction in the definition of central obesity with WC from 102 cm for men and 88 cm for women (NCEP criteria) to 94 cm and 80 cm respectively (IDF criteria, for Caucasians). Among Chinese, if we use a unified definition for central obesity (i.e. 90 cm for men and 80 cm for women in waist measurement) for both NCEP and IDF criteria, the rate of MES by IDF criteria should always be less than that by NCEP criteria due to the fact that the variation of percentage in NCEP criteria comes from a combination of three out of five parameters, while it is only two out of four parameters by IDF criteria (central obesity is pre-fixed in IDF criteria). The difference of the two percentages based on different criteria are representing the group of subjects who have three or more of the medical conditions other than central obesity, namely, low HDL-C, high TG, high BP and dysglycaemia. In our study, this group of subjects is relatively common in men, especially in the elderly, but is uncommon in women. They probably represent people who have coexisting lipid abnormalities, glycaemic abnormalities and/or high BP due to incidental coexistence, or other non-obesity or “non-metabolic” related causes such as ageing and mental stress.⁽¹⁵⁻¹⁸⁾

The crude percentage of MES (by NCEP criteria) in Hong Kong Chinese in this cohort is 23.0%. Among those aged between 19 and < 70 years, the crude percentage was 7.1%–37.1%. From a study done by our team in the early 1990s among subjects aged 18–66 years,⁽¹³⁾ the crude percentage of MES in working age group in Hong Kong was 9.6%. Although the present study is not directly comparable to this cohort, the mark difference in the two percentages of MES (up to three-fold increase in ten years) is alarming. This figure suggests a rapid upsurge in the problem of MES in Hong Kong. In accord to this, the NHANES reported a rise of 10.8% (from 23.7% to 34.5%) in the prevalence of

MES in the U.S. from the years 1988–1994 to 1999–2002.^(12,14)

Data of the present study has to be interpreted with caution since it is a description of a self-selected population. However, due to limitation of the local healthcare system, a systematic randomised cross-sectional representative sampling is difficult to be obtained. Our study is also limited by the voluntary basis of our subjects. Volunteers are usually more health conscious and may not completely represent the overall population. Nevertheless, our subjects are community-based, of a reasonable large sample size and cover a large range of people of different ages. We believe the study results can give us a useful insight into the problem of MES in Hong Kong. In conclusion, the age-standardised percentage of MES defined by IDF criteria in Hong Kong Chinese was 16.0% in men and 13.4% in women, which was approximately 4% less than that defined by NCEP criteria. There is a tendency of upsurge in the problem of MES in Hong Kong. Further studies on the management and prevention of MES are urgently needed.

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