

Diagnosis of Metabolic Syndrome in United States Adults: Data from the Study to Help Improve Early Evaluation and Management of Risk Factors Leading to Diabetes (SHIELD)

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Abstract

Background: Several health organizations have promulgated guidance for diagnosis of metabolic syndrome (MetSyn), a cluster of interrelated, modifiable cardiovascular and metabolic risk factors. Clinical utility of this concept is dependent upon recognition of the component risk factors and timely diagnosis.

Aim: To estimate self-reported, physician-diagnosed MetSyn in US adult population, and to compare this estimate with US prevalence confirmed by clinical findings.

Methods: As part of 5-year, longitudinal SHIELD study, a 12-item screening questionnaire was mailed in 2004 to 200,000 households selected as representative of US adult population. Questionnaires were returned by 127,420 households (63.7% response rate). In SHIELD, post-weighting on demographic characteristics was used to match the returned sample to US census data, and the proportion of individuals reporting a diagnosis of MetSyn was calculated. For comparison, physical findings and laboratory data from the National Health and Nutrition Examination Survey (NHANES) 1999–2002 were used to determine estimated prevalence of MetSyn using Adult Treatment Panel III diagnostic criteria (*JAMA* 2001;285:2486–2497).

Results: Only 0.6% of the SHIELD population (N=211,097 adults) reported being diagnosed with MetSyn (mean age 32.6 yrs; 73.8% women; 56.1% with BMI ≥ 30 kg/m²). In contrast, 8.2% reported diagnosed diabetes. Estimates from NHANES (N=4257) indicate that 25.9% and 9.0% of US adult population had MetSyn and diabetes, respectively.

Conclusions: Diagnosis of MetSyn in SHIELD was considerably lower than NHANES-estimated prevalence, suggesting that recognition of MetSyn is limited. Professional and public education efforts to raise awareness of the health risks associated with MetSyn could potentially benefit a substantial portion of the adult population. Annual results from SHIELD may provide greater insight and clarity around MetSyn and other metabolic diseases.

Introduction

The presence of metabolic syndrome is associated with increased long-term risk for both atherosclerotic CVD and type 2 diabetes mellitus and, therefore, requires attention in clinical practice.¹

Several international and national health organizations have promulgated guidance for diagnosis of MetSyn. For example, NCEP ATP III has defined MetSyn as the presence of 3 out of 5 of a cluster of interrelated, modifiable cardiovascular and metabolic risk factors.²

Because its components are readily measurable as part of clinical practice, MetSyn provides an efficient approach for clinicians to assess risk during a standard office visit. However, the clinical utility of the MetSyn concept requires recognition of the component risk factors used in the syndrome's diagnostic criteria and timely diagnosis.

Early awareness of MetSyn may increase the potential for preventing disease progression by alerting patients to the implications for long-term disease risk and the lifestyle changes required to reduce the risk.

As part of the Study to Help Improve Early evaluation and management of risk factors Leading to Diabetes (SHIELD), a 5-year longitudinal survey in the US population, the self-reported prevalence of physician-diagnosed MetSyn, diabetes, and related conditions was assessed.

Objectives

Estimate the proportion of self-reported, physician-diagnosed MetSyn and associated conditions in the US adult population in SHIELD

Compare self-reported prevalence of MetSyn from SHIELD with laboratory test-confirmed prevalence from the National Health and Nutrition Examination Survey (NHANES) to determine if the concept of MetSyn has penetrated the general public's awareness

Methods

SHIELD

A screening survey was mailed to a stratified random sample of 200,000 US households (part of the NFO household panel) in April 2004, and 127,420 households returned usable surveys (response rate = 63.7%). The NFO is a market research firm that maintains a survey panel of more than 600,000 households throughout the US, constructed to represent the US population in terms of geographic residence, age of head of household, and household size and income.

The screener questionnaire consisted of 12 questions developed by a diversified panel of medical experts (the SHIELD Study Group). The questionnaire was completed by the head of household, who answered for up to 4 adult household members (≥ 18 years of age).

Judging that respondents to a self-administered questionnaire would be unlikely to recall their actual FPG, BP, or lipid levels, respondents were asked if they had ever been diagnosed as having or were currently taking prescription medications for diabetes, high BP, or cholesterol problems. Respondents were also asked to provide their waist size, as well as weight and height, which were used to calculate BMI.

The data from SHIELD were used to calculate proportions of the US adult population with abdominal obesity or reporting a diagnosis of MetSyn, diabetes, hypertension, or dyslipidemia.

NHANES

Data from SHIELD were compared with similar data collected from the fourth round of NHANES (1999–2002).^{3,4} NHANES produces nationally representative data about the health and nutritional status of the US civilian noninstitutionalized population. NHANES has the added value of including both self-reported risk factors as well as clinical evaluation and laboratory testing to confirm diagnoses and to identify undiagnosed risk factors.

Because the NHANES data includes laboratory values along with diagnoses and treatments, it can be used with a weighting system to estimate actual national prevalence of various conditions.

NHANES data on adults ≥ 18 years old (N=4257) were analyzed to determine the prevalence of MetSyn, diabetes, hypertension, dyslipidemia, and abdominal obesity.

Identifying Conditions

For SHIELD, MetSyn, diabetes (type 1 and type 2, not gestational), hypertension, and dyslipidemia were identified through self-report that a healthcare professional had diagnosed the condition (ie, "conditions that you/other adult household members have ever been told you have by a doctor or nurse"). Abdominal obesity was measured as waist circumference ≥ 102 cm in men or ≥ 88 cm in women. BMI was calculated using self-reported height and weight.

For NHANES, the following definitions were used:

MetSyn was identified using the NCEP ATP III diagnostic criteria.² Individuals were considered to have MetSyn if clinical criteria and laboratory test results indicated at least 3 of the following 5 factors: waist circumference ≥ 102 cm in men and ≥ 88 cm in women, serum TG ≥ 150 mg/dL, HDL-C < 40 mg/dL in men and < 50 mg/dL in women, BP $\geq 130/85$ mm Hg, or serum glucose ≥ 110 mg/dL.

Diabetes includes both previously diagnosed and undiagnosed diabetes mellitus (type 1 or type 2). Diagnosed diabetes is based on self-report (ie, answered yes to "Has a doctor ever told you that you have diabetes?"). Undiagnosed diabetes is defined using the criterion of FPG > 125 mg/dL.

Hypertension was defined as either having elevated BP (systolic pressure ≥ 140 mm Hg or diastolic pressure ≥ 90 mm Hg) or taking antihypertensive medication. (BP is reported as the average of measurements taken; 78% of participants had 3 BP readings.)

Dyslipidemia was defined as any of the following: TC ≥ 240 mg/dL, TG > 200 mg/dL, LDL-C ≥ 160 mg/dL, or HDL-C < 40 mg/dL. No consideration of CHD risk factors was included in the definition of dyslipidemia.

Abdominal obesity was determined by waist circumference ≥ 102 cm in men or ≥ 88 cm in women.

Statistical Analysis

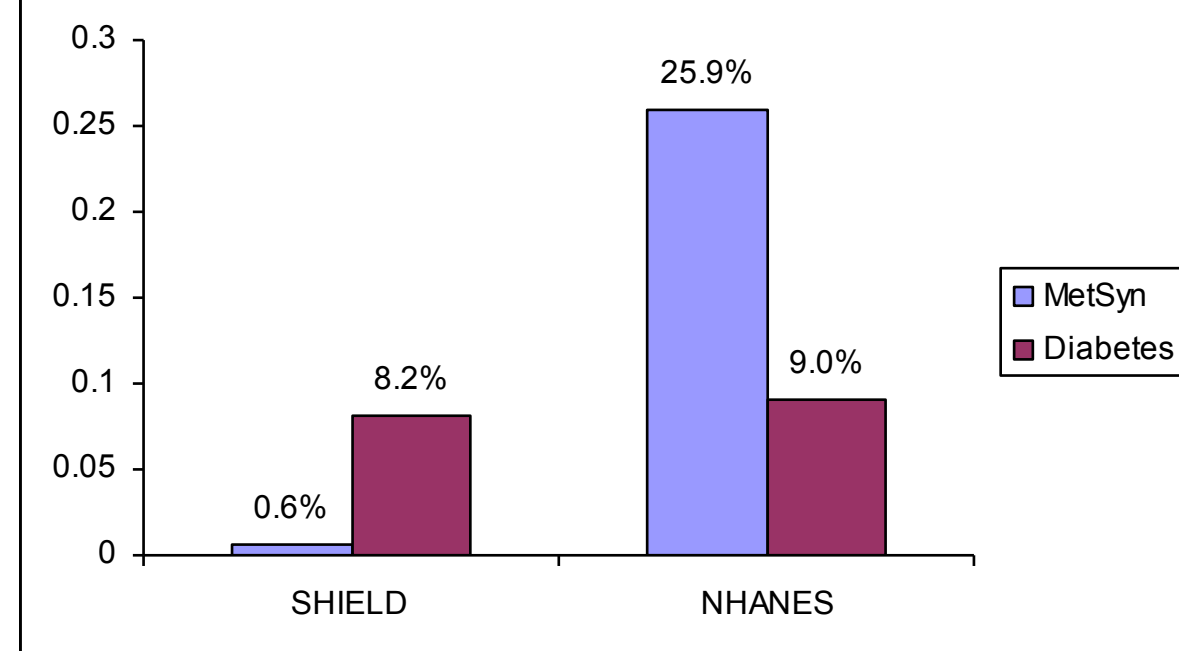
SHIELD data were post-weighted to correct for over- or under-sampling of some demographic groups. Age, gender, and other demographics were also used to up-weight the returned sample to US census.⁵

Overall prevalence estimates (self-reported plus laboratory-test confirmed) were calculated using NHANES sampling weights based on age, income, and race/ethnicity to represent the US adult population.

Analyses of NHANES data were performed using SUDAAN[®] release 9.0.⁶ Standard errors were estimated using SUDAAN[®] to account for both the complex sample design and the use of both interview and morning examination sample data in combination.^{4,6}

Results

Figure 1. Estimates of MetSyn and Diabetes from SHIELD (Self-Reported) and NHANES (Laboratory-Confirmed)



The estimated prevalence of MetSyn was substantially higher in NHANES compared with the self-reported estimate in SHIELD (Figure 1). Of the SHIELD population (N = 211,097), only 0.6% (N = 1273) reported being diagnosed with MetSyn. Estimates from NHANES (N=4257) indicate that 25.9% of the U.S. adult population had MetSyn according to NCEP ATP III criteria.

In contrast, the prevalence of diabetes reported in SHIELD (8.2%) was similar to that found in NHANES (9.0%; Figure 1).

Demographic characteristics of SHIELD respondents reporting a diagnosis of MetSyn were:

- mean age: 32.6 years
- 73.8% women
- 56.1% with BMI ≥ 30 kg/m²

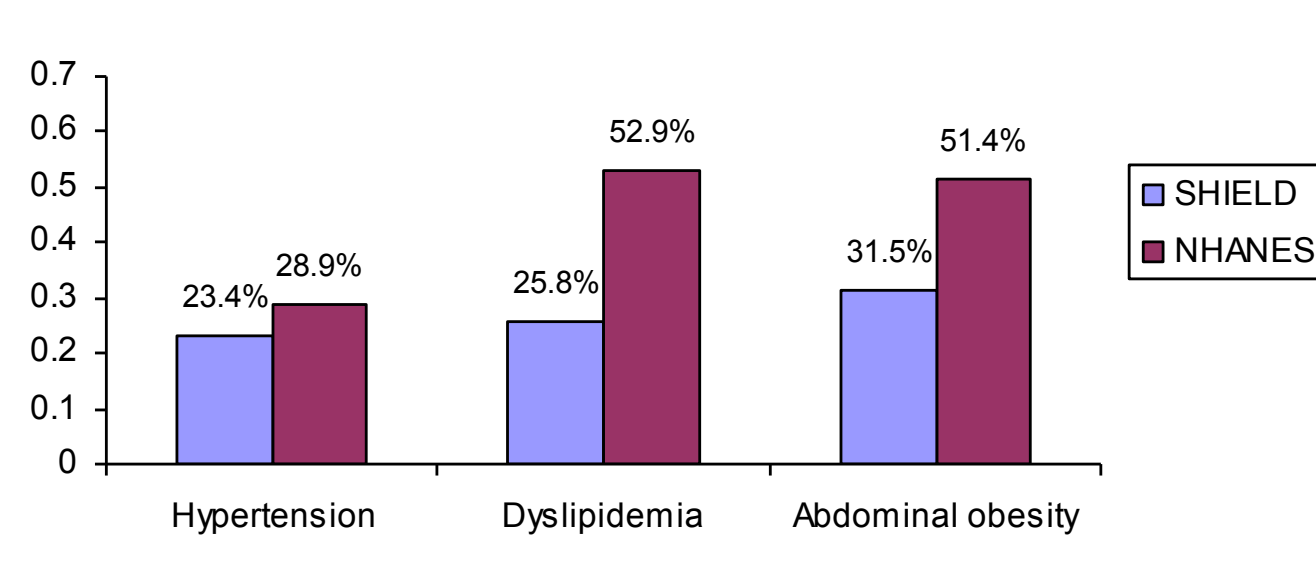
Table 1. SHIELD (Self-Reported) and NHANES (Laboratory-Confirmed) Estimates for MetSyn by Age and Gender

	Men		Women		Total	
	SHIELD	NHANES	SHIELD	NHANES	SHIELD	NHANES
Age 18–44	0.2	16.0	0.7	16.4	0.5	16.2
Age 45–64	0.4	33.7	1.1	33.7	0.8	33.7
Age ≥ 65	0.4	37.0	0.8	47.3	0.6	42.9
All Ages	0.3	24.4	0.9	27.5	0.6	25.9

Levels of reported MetSyn in SHIELD did not vary widely across age groups (Table 1). As expected, MetSyn was more prevalent at higher ages in NHANES.

In the SHIELD study, women were more likely to report MetSyn diagnosis, compared with men (Table 1). Prevalence estimates from NHANES were similar for men and women, except in individuals ≥ 65 years, where women were more likely to have MetSyn.

Figure 2. Estimates of Hypertension, Dyslipidemia, and Abdominal Obesity from SHIELD (Self-Reported) and NHANES (Laboratory-Confirmed)



Self-reported diagnosis rates from SHIELD were lower than NHANES prevalence estimates for each of the associated conditions (hypertension, dyslipidemia, and abdominal obesity), with hypertension estimates most similar (23.4% vs. 28.9%, respectively; Figure 2).

Limitations

The 600,000 households participating in the NFO panel had voluntarily elected to do so, leading to the possibility of bias due to self-selection.

Household panels also tend to under-represent the very wealthy and very poor segments of the population and do not include military or institutionalized individuals.⁷

The authors recognize that several national and international health organizations have promulgated guidelines for the diagnosis of MetSyn; however, the analysis of NHANES data by Ford et al. used ATP III guidelines.⁸

Clinical Implications

Given that the actual prevalence of MetSyn is considerably higher than observed by self-report, increased awareness of MetSyn and education on its association with CVD risk has the potential to benefit a substantial part of the US adult population.

Annual results from SHIELD may provide greater insight and clarity around MetSyn, associated risk factors, and other metabolic diseases.

Conclusions

Self-reported, physician-diagnosed MetSyn in SHIELD was considerably lower than NHANES-estimated prevalence (0.6% vs 25.9%, respectively). Because NHANES contains clinical measures and laboratory-confirmed data, the prevalence estimate from the NHANES data is more likely to reflect the true prevalence of MetSyn.

The lack of knowledge about MetSyn demonstrated in SHIELD suggests that the concept has had limited penetration into the public's awareness.

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Abbreviations

ATP = Adult Treatment Panel; BMI = body mass index; BP = blood pressure; CHD = coronary heart disease; CVD = cardiovascular disease; FPG = fasting plasma glucose; HDL-C = high-density lipoprotein cholesterol; LDL-C = low-density lipoprotein cholesterol; MetSyn = metabolic syndrome; NCEP = National Cholesterol Education Program; NCHS = National Center for Health Statistics; NFO = National Family Opinion; NHANES = National Health and Nutrition Examination Survey; SHIELD = Study to Help Improve Early evaluation and management of risk factors Leading to Diabetes; TC = total cholesterol; TG = triglycerides