

# Letters

## RESEARCH LETTER

### Prevalence of the Metabolic Syndrome in the United States, 2003-2012

The metabolic syndrome contributes to cardiovascular morbidity and mortality.<sup>1-4</sup> Data from the National Health and Nutrition Examination Survey (NHANES) 1999-2006 reported a metabolic syndrome prevalence of 34%.<sup>5</sup> Understanding updated prevalence trends may be important given the potential effect of the metabolic syndrome and its associated health complications on the aging US population. We investigated trends in the prevalence of the metabolic syndrome through 2012.

**Methods** | Using 2003-2012 NHANES data, a cross-sectional, stratified, multistage probability sample of the US population, we evaluated trends in the metabolic syndrome among adults (aged ≥20 years). NHANES was approved by the National Center for Health Statistics institutional review board and written consent was obtained from participants. During 2003-2012, the response rate was 69.5% to 77.3%. Self-reported race/ethnicity was evaluated to determine race-specific differences.

The metabolic syndrome was defined based on the National Cholesterol Education Program Adult Treatment Panel III, which was updated by the American Heart Association, as having 3 or more of the following: waist circumference greater than 102 cm in men or greater than 88 cm in women; serum level of triglycerides of 150 mg/dL or greater; high-density lipoprotein (HDL) cholesterol level of less than 40 mg/dL in men or less than 50 mg/dL in women; systolic/diastolic blood pressure of 130/85 mm Hg or greater or taking hypertension medi-

cations; or fasting plasma glucose level of 100 mg/dL or greater or taking diabetes mellitus medications.

Using sampling weights to provide prevalence estimates more likely to be representative of the US population, we stratified metabolic syndrome prevalence by sex, race/ethnicity, and age groups (20-39, 40-59, and ≥60 years). Prevalence estimates between groups were compared using  $\chi^2$  tests and prevalence across time was evaluated using non-parametric trend analyses. Statistical significance was met with 2-tailed  $P < .05$ . Statistical analyses were performed with Stata version 10 (StataCorp).

**Results** | From 2003 to 2012, overall prevalence of the metabolic syndrome in the United States was 33% (95% CI, 32.5%-33.5%), with significantly higher prevalence in women compared with men (35.6% vs 30.3%, respectively,  $P < .001$ ). When stratified by race/ethnicity, the highest prevalence of the metabolic syndrome was seen in Hispanics (35.4%; 95% CI, 34.2%-36.6%), followed by non-Hispanic whites (33.4%; 95% CI, 32.6%-34.2%) and blacks (32.7%; 95% CI, 31.5%-33.9%).

From 2003-2004 to 2011-2012, overall prevalence of the metabolic syndrome increased from 32.9% (95% CI, 31.6%-34.2%) in 2003-2004 to 34.7% (95% CI, 33.5%-36.0%) in 2011-2012 (Table). When evaluating trends from 2007-2008 to 2011-2012, overall prevalence of the metabolic syndrome remained stable from 36.1% in 2007-2008 to 34.7% in 2011-2012 ( $P = .14$ ; Table). During this period, metabolic syndrome prevalence trends among men and all race/ethnic groups remained stable, whereas prevalence among women decreased from 39.4% in 2007-2008 to 36.6% in 2011-2012 ( $P = .03$ ; Table).

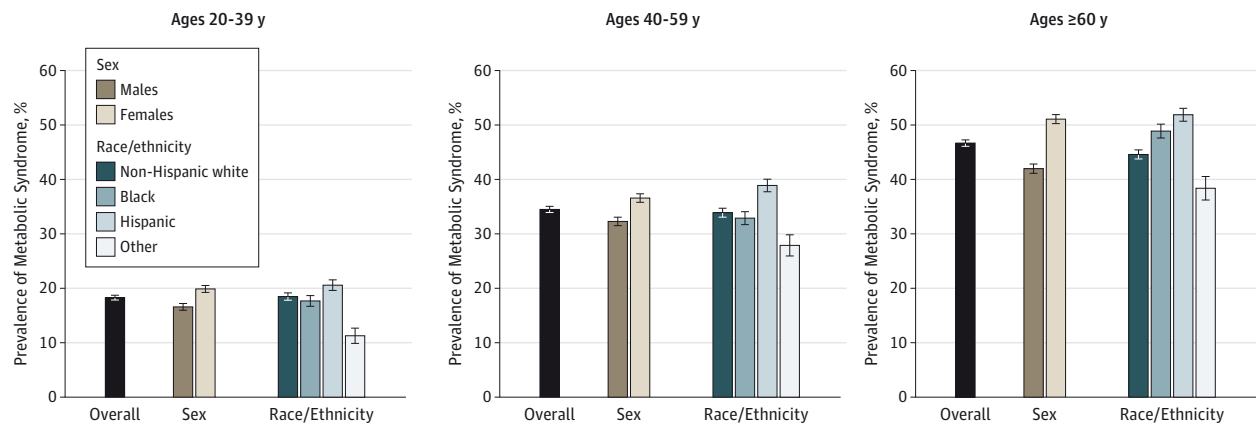
Increasing metabolic syndrome prevalence was seen with increasing age in all groups (Figure). Prevalence of the meta-

Table. Prevalence of the Metabolic Syndrome by Sex and Race/Ethnicity

|                    | No. (%) [95% CI]           |                            |                            |                            |                            | P Value for Trend <sup>a</sup> |           |
|--------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|--------------------------------|-----------|
|                    | 2003-2004                  | 2005-2006                  | 2007-2008                  | 2009-2010                  | 2011-2012                  | 2003-2004                      | 2007-2008 |
| Total              | 1651 (32.9)<br>[31.6-34.2] | 1290 (26.1)<br>[24.8-27.2] | 2137 (36.1)<br>[34.8-37.3] | 2116 (34.2)<br>[32.9-35.3] | 1931 (34.7)<br>[33.5-36.0] | <.001                          | .14       |
| Sex                |                            |                            |                            |                            |                            |                                |           |
| Men                | 746 (30.9)<br>[29.1-32.8]  | 546 (23.0)<br>[21.3-24.7]  | 949 (32.7)<br>[31.0-34.4]  | 924 (30.9)<br>[29.2-32.5]  | 898 (32.8)<br>[31.0-34.6]  | <.001                          | .97       |
| Women              | 905 (34.7)<br>[32.8-36.4]  | 744 (28.9)<br>[27.1-30.6]  | 1188 (39.4)<br>[37.6-41.1] | 1192 (37.2)<br>[35.5-38.9] | 1033 (36.6)<br>[34.9-38.4] | <.001                          | .03       |
| Race/ethnicity     |                            |                            |                            |                            |                            |                                |           |
| Non-Hispanic white | 914 (34.1)<br>[32.3-35.9]  | 630 (25.4)<br>[23.7-27.2]  | 1039 (37.7)<br>[35.9-39.5] | 968 (32.6)<br>[30.9-34.3]  | 763 (37.4)<br>[35.3-39.5]  | <.001                          | .52       |
| Black              | 301 (30.4)<br>[27.6-33.3]  | 304 (27.2)<br>[24.6-29.8]  | 412 (33.8)<br>[31.1-36.4]  | 394 (35.2)<br>[32.4-38.0]  | 516 (35.5)<br>[33.0-37.9]  | <.001                          | .38       |
| Hispanic           | 389 (34.3)<br>[31.5-37.0]  | 313 (27.2)<br>[24.6-29.7]  | 625 (36.8)<br>[34.6-39.1]  | 669 (37.9)<br>[35.7-40.2]  | 431 (38.6)<br>[35.7-41.4]  | <.001                          | .51       |
| Other              | 47 (21.4)<br>[15.9-26.8]   | 43 (21.5)<br>[15.7-27.2]   | 61 (24.6)<br>[19.1-29.9]   | 85 (24.5)<br>[19.9-29.0]   | 221 (23.4)<br>[20.7-26.1]  | .86                            | .64       |

<sup>a</sup> Trend comparisons from year ranges listed to 2011-2012.

Figure. Age-Specific Prevalence of the Metabolic Syndrome by Sex and Race/Ethnicity, 2003-2012



Error bars indicate 95% confidence intervals. Comparisons of prevalence estimates were performed using  $\chi^2$  tests; patients aged 20-39 years in each group were used as the reference. All comparisons yielded  $P < .001$ .

metabolic syndrome was 18.3% among those aged 20 to 39 years and increased to 46.7% among those aged 60 years or older. Among patients aged 60 years or older, more than 50% of women and Hispanics had the metabolic syndrome (Figure).

**Discussion** | Nearly 35% of all adults and 50% of those aged 60 years or older were estimated to have the metabolic syndrome, a concerning observation given the aging US population. Previous analyses of NHANES through 2006 demonstrated increasing rates of the metabolic syndrome, whereas our study suggests that the prevalence has remained stable overall since 2007 and declined in women.<sup>5</sup>

Greater awareness of the metabolic syndrome and its health consequences may have contributed to improvements in optimizing treatment of risk factors such as hypertension and diabetes. Furthermore, recent NHANES data demonstrate that obesity prevalence in the United States also appears to have stabilized, which also may contribute to the stabilizing prevalence of the metabolic syndrome.<sup>6</sup>

Limitations of our study include potential misclassification of individuals taking diabetes or hypertension medications for other reasons. In addition, our study did not evaluate differences in the prevalence of individual components of the metabolic syndrome.

Even though we used concurrent use of hypertension or diabetes medication as satisfying those components of the metabolic syndrome, only data for cholesterol medication in general were available for analyses and not specifically for treatment of triglycerides or HDL cholesterol. We did not include these to avoid overestimation of metabolic syndrome prevalence.

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**Author Contributions:** Dr Wong had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

**Study concept and design:** Bhuket, Wong.

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**Drafting of the manuscript:** Liu, Wong.

**Critical revision of the manuscript for important intellectual content:** All authors.

**Statistical analysis:** Torres, Wong.

**Administrative, technical, or material support:** Bhuket, Liu, Wong.

**Study supervision:** Wong.

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## COMMENT & RESPONSE

**Treatment for *Clostridium difficile* Infection in Adults**  
**To the Editor** *Clostridium difficile* infection is a common, serious diarrheal illness, and strains such as the virulent