The Prevalence of Metabolic Syndrome Among Law Enforcement Officers Who Responded to the 9/11 World Trade Center Attacks

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Background *Law enforcement officers (LEOs) experience high rates of cardiovascular events compared with the general US population. Metabolic syndrome (MetS) confers an increased risk of cardiovascular disease and all-cause mortality. Data regarding MetS among LEOs are limited.*

Methods *We sought to determine the prevalence of MetS and its associated risk factors as well as gender differences among LEOs who participated in the World Trade Center (WTC) Law Enforcement Cardiovascular Screening (LECS) Program from 2008 to 2010. We evaluated a total of 2,497 participants, 40 years and older, who responded to the 9/11 WTC attacks.*

Results *The prevalence of MetS was 27%, with abdominal obesity and hypertension being the most frequently occurring risk factors. MetS and its risk factors were significantly higher among male compared to female LEOs, except for reduced HDL-cholesterol levels.*

Conclusions *MetS is a rising epidemic in the United States, and importantly, approximately one in four LEOs who worked at the WTC site after 9/11 are affected.* Am. J. Ind. Med. 59:752–760, 2016. © 2016 Wiley Periodicals, Inc.

KEY WORDS: Metabolic syndrome; law enforcement officers; World Trade Center

INTRODUCTION

Law enforcement is universally accepted as a high risk occupation. The perils of police work extend beyond the threat of death, bodily injury, and extreme physical and psychological stress to include increased risks of chronic diseases [Zimmerman, 2012]. Cardiovascular disease (CVD) prevalence in law enforcement officers (LEOs) is estimated to be as high as twice that of the general population [Violanti et al., 1998; Wright et al., 2011; Thayyil et al., 2012]. Due to the high-stress nature of the law enforcement profession, these individuals have increased CVD risk factors, and higher rates of morbidity and mortality.

In the United States, over a 10-year period, fatal heart attack accounted for approximately 7% of occupational deaths in law enforcement personnel [Hoffmann et al., 2007; Zimmerman 2012]. Occupation-specific risk factors are proposed to contribute to the development of CVD directly via several potentiating risk factors, such as physical and psychological stress, shift work, extended work hours, shorter sleep duration, lack of regular exercise, and poor dietary habits [Franke et al., 2002, 2010; Violanti et al., 2009].

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Metabolic syndrome (MetS) is a cluster of metabolic abnormalities that is associated with promotion of atherosclerosis and increased CVD risk. This syndrome is now a major public health challenge worldwide [Ford et al., 2004, 2010]. MetS is characterized by abnormal physiologic and anthropometric measurements (hypertension, increased waist circumference) and laboratory markers (hyperglycemia, hypertriglyceridemia, dyslipidemia). Recognition of MetS among LEOs has the potential to identify those who are at increased risk for CVD and subsequent higher morbidity and mortality [Alberti et al., 2009; Mottillo et al., 2010]. Since heart disease is the leading cause of death for men and women in the United States [NCHS, 2015], identification of all possible risk factors is vital to improve outcomes. MetS is a useful indicator of population-level CVD risk. The National Health and Nutrition Examination Survey (NHANES) 2003–2006, a cross-sectional health survey of a nationally representative sample of the US civilian population, workers and non-workers, revealed that an estimated 34% of US adults age 20 years and older met the criteria for MetS. The exact mechanisms of the complex pathways of MetS are not yet completely understood. Most individuals with MetS tend to be older, obese, sedentary, and have a degree of insulin resistance. These characteristics are inconsistent in active members of law enforcement. Studies of job strain have identified stress as a contributing factor to MetS and have proposed biologic plausability of linking stress mechanisms with heart disease [Chandola et al., 2006].

There is a presumptive occupational risk for CVD as well as high-intensity stress among LEOs. Data regarding MetS in this unique population are limited. Quantifying the prevalence of MetS among LEOs will provide indispensable data regarding modifiable CVD risk factors in LEOs. This information should lead to targeted programs to decrease disease burden in this unique population. In this primary manuscript from the World Trade Center Law Enforcement Cardiovascular Screening (WTC-LECS) Program, we sought to determine the prevalence of MetS, elements of its associated risk factors, as well as to determine gender differences in MetS, among a large cohort of LEOs. We further aim to compare the prevalence of MetS among WTC-LECS participants with United States general age-matched population.

METHODS

Subjects

LEOs who responded to the 9/11 attacks and were participants of the WTC Medical Monitoring and Treatment Program (now known as WTC Health Program) were invited to participate in a one-time comprehensive cardiac evaluation, WTC-LECS. Criteria for enrollment in the WTC-LECS was active or retired LEOs, aged 40 years and older, worked or

volunteered at the WTC site, and were asymptomatic for CVD at the time of enrollment. Participants from all clinics, who met criteria for enrollment, were recruited by outreach coordinators, fliers, and letters from March 2008 to June 2010. With limited funding, approximately 19% of LEOs who met criteria for enrollment participated in WTC-LECS. The study was approved by the Program for the Protection of Human Subjects, and written informed consent was obtained.

The NHANES program is a unique annual cohort comprised of household populations throughout the United States. It combines interviews, anthropometric measurements, physical examination, and laboratory testing. The NHANES cohort from 2003 to 2006 was used because of the timing this study was performed in as well as the availability of the necessary data for comparison.

Comprehensive Cardiac Evaluation

A one-time comprehensive cardiac evaluation of traditional CVD risk factors, including those in the widely used Framingham Risk Score [Wilson et al., 1998] was performed on each participant. The comprehensive evaluation includes six key components: (i) demographics and medical history questionnaire to determine CVD risk including hypertension, diabetes, smoking, and family history of premature coronary heart disease, as well as medication use, alcohol consumption and socio-economic status; (ii) exposure to the cloud on 9/11 and the subsequent clean-up; (iii) responses to validated questionnaires (Seattle Angina Questionnaire for chest pain, Dyspnea Questionnaire, Sexual Health Inventory for Men Questionnaire, Patient Health Questionnaire-9, Berlin Questionnaire for sleep apnea); (iv) anthropometric measurements (height, weight, body mass index (BMI), waist circumference (WC), systolic blood pressure (SBP), diastolic blood pressure (DBP), ankle brachial index (ABI); (v) laboratory blood analysis: fasting glucose, fasting lipid panel (total cholesterol [TC], high density lipoprotein cholesterol [HDL], low density lipoprotein cholesterol [LDL], triglyceride [TG]), testosterone/estrogen, ApoA1, ApoB, ApoB/A1, and high-sensitivity C-reactive protein (hsCRP) were obtained by trained clinic personnel, using standard techniques; and (vi) diagnostic testing: electrocardiogram (EKG), transthoracic echocardiogram (TTE), and cardiac computed tomography for calcium scoring (CACS). Data were reviewed by a board certified cardiologist after all test results were completed and a letter containing all test results and recommendations for further care by primary care physician (PCP), cardiologist, and/or pulmonologist.

Metabolic Syndrome Classification

MetS was defined according to the National Cholesterol Education Program Adult Treatment Panel guidelines

[Grundy et al., 2005] with modifications from the American Heart Association and the National Heart, Lung, and Blood Institute [Yoo and Franke, 2013]. MetS is comprised of five components and MetS is considered to be present if participants had three or more of the five components:

(1) abdominal obesity as defined by WC ≥40 inches for men or ≥35 inches for women,
(2) TG ≥150 mg/dl or on drug treatment for elevated TG,
(3) HDL<40 mg/dl in men and <50 mg/dl in women or on drug treatment for reduced HDL,
(4) SBP ≥ 130 mmHg or DBP ≥ 85 mmHg or on antihypertensive drug treatment in a patient with a history of hypertension,
(5) fasting glucose ≥100 mg/dl or on drug treatment for elevated glucose/diabetes.

Statistical Method

Analyses were performed using Stata version 11 (College Station, TX) and P values <0.05 were considered as significant. Continuous variables were compared between women and men using t tests and categorical variables were compared using chi square or Fisher tests, as appropriate. Logistic regression, adjusting for age and race/ethnicity, was used to find odds ratios for women to men sex differences in binary variables relating to anthropometric and laboratory measures, including components of MetS. Proportional odds regression was used to find corresponding summary odds ratios for ordered categorical variables. For continuous variables, normal regression models were used, adjusting for age and race/ethnicity, to find mean differences, women minus men. Logistic regression models were used to find odds ratios for the prevalence of MetS according to age groups, non-whites versus whites and BMI groups, again adjusting for age and race/ethnicity, where appropriate. The prevalence of MetS, and of the individual MetS components, was compared between our study population and data from NHANES 2003–2006 restricted to the fasting subset within the same age range (783 men, 813 women). Comparisons were performed after age standardization [Grundy et al., 2005], taking the WTC-LECS group as the reference group.

RESULTS

Baseline Characteristics

A total of 2,497 LECS participants were enrolled and evaluated. Participants were 85% male, 69% white with mean age of 47 years (Table I). Smoking was significantly higher among female LEOs compared with male LEOs (Table I). The mean length of time in law enforcement was 20 years, and 58% were active LEOs (Table II). Male LEOs had a significantly higher prevalence of hypertension, diabetes mellitus, and hyperlipidemia/dyslipidemia, compared with female LEOs (Table III). Mean values of BMI, WC, SBP, DBP, TG, and fasting glucose levels were significantly higher among male than female LEOs. Female LEOs had significantly higher mean total cholesterol, HDL and hsCRP levels than male LEOs (Table III).

Metabolic Syndrome Prevalence in WTC-LECS

The prevalence of MetS in the overall study population was 27% (Table IV). The most frequently occurring risk factors for MetS were hypertension (53%) and abdominal obesity (47%). Elevated fasting glucose was seen in only 13% of LEOs. MetS was significantly higher among male LEOs compared with female LEOs (28% vs. 20%, $P = 0.001$). Except for reduced HDL-cholesterol levels, risk factors for MetS were also higher among male LEOs. Nearly one-third of female LEOs had none of the MetS components compared with male LEOs (27% vs. 18%, $P < 0.001$).

As would be expected, the prevalence of MetS increased with increasing age and BMI in both men and women (Table V). The prevalence of MetS was significantly higher in whites than non-whites among women ($P = 0.001$), but not men. Analysis of employment status was performed. MetS was present in 32% of retired versus 24% of active LEOs. Among male LEOs, MetS was present in 34% of retired versus 25% of active LEOs. Among female LEOs, Mets was present in 26% versus 16% of active LEOs. Considering law enforcement status, the prevalence of MetS was significantly higher in retired LEOs than active LEOs among men ($P = 0.002$), but not women.

Metabolic Syndrome Prevalence Comparison

There was a lower prevalence of MetS among WTC-LECS LEOs (27%) compared with the national sample from NHANES (45%). In contrast to our study population, the NHANES group did not show a significant gender difference in MetS. Only 18% of women in the NHANES group had zero components of MetS. The prevalence of MetS remained lower in our population than in the national sample ($P < 0.001$) after age-standardization (Fig. 1). Furthermore, for each of 3, 4, or 5 metabolic components, the prevalence was lower in WTC-LECS LEOs than in NHANES.

TABLE I. Demographics Characteristics of WTC-LECS Study Population

Variable	Overall (N = 2497) (%)	Men (N = 2122) (%)	Women (N = 375) (%)	*P*-value
Age (years)				
Mean	47	47	47	0.20
<45	855 (34)	754 (36)	101 (27)	0.005
45–48	814 (33)	675 (32)	139 (37)	
49+	828 (33)	693 (33)	135 (36)	
Race/Ethnicity				
African American	301 (12)	202 (10)	99 (26)	<0.0001
American Indian or Alaska Native	14 (1)	10 (0.5)	4 (1)	
Asian	34 (1)	29 (1)	5 (1)	
Hispanic	400 (16)	312 (15)	88 (24)	
Native Hawaiian/Pacific Islander	6 (0.2)	5 (0.2)	1 (0.3)	
Other	27 (1)	21 (1)	6 (2)	
White	1707 (69)	1536 (73)	171 (46)	
Marital status				
Single	350 (14)	211 (10)	139 (38)	<0.0001
Married/Partner	1817 (74)	1669 (80)	148 (40)	
Divorced	230 (9)	162 (8)	68 (19)	
Other	52 (2)	41 (2)	11 (3)	
Smoking				
Current	134 (5)	102 (5)	32 (9)	<0.0001
Ex-smoker	614 (25)	501 (24)	113 (30)	
Never	1719 (70)	1492 (71)	227 (61)	
Alcohol intake (drinks/week)				
Glass of wine per week	2.3	2.4	2.1	0.29
Glass of beer per week	3.8	4.0	1.7	<0.0001
Glass of hard liquor per week	1.6	1.6	1.2	0.14

Continuous variables are expressed as mean; categorical variables are expressed as number of patients (%).

DISCUSSION

MetS is a costly health problem which impacts productivity in the workplace. It is estimated that an adult with MetS incurs annual health costs compared to average health costs [Boudreau et al., 2009]. To our knowledge, our study represents one of the largest cohorts of male and female, ethnically diverse LEOs investigating the prevalence of MetS and its risk factors. We showed that 27% of the WTC-LECS cohort fulfilled the criteria for MetS. Abdominal obesity and hypertension were the most frequent risk factors for MetS. These findings have a significant impact on the health and wellness of LEOs, as MetS confers an increased risk of CVD and all-cause mortality [Mottillo et al., 2010].

There is a growing interest in MetS among LEOs, but prior available data are limited. In a study by Yoo and Franke [2013], 33% (n = 110) of active LEOs (82% white males) from the Iowa Department of Public Safety had MetS [Yoo and Franke, 2013]. Hartley et al. [2011] evaluated 410 active police officers (304 men, 106 women) from the Buffalo, New York, Police Department, where the overall prevalence of MetS was 26.1%. In the Spokane Heart Study, data from 130 Spokane, WA, police officers (130 men, 9 women) showed an overall 36.9% prevalence of MetS [Hartley et al., 2012]. Of note, the Spokane cohort was a relatively older population (50% of male and 22% of female LEOs were age 50 years and older).

NHANES data, which includes both workers, retired workers, and unemployed persons, does not demonstrate gender differences in prevalence of MetS. Prior international studies of Mets have shown gender differences in prevalence of MetS, with increased prevalence among women. Although few population studies have evaluated workers specifically, one study of health workers in Nigeria found that women were significantly more likely to have MetS than men [Adeoye et al., 2015]. In contrast, our study detected a greater prevalence of MetS among male compared with female LEOs in our cohort. Likewise, there were differences in the prevalence of each of the individual risk factors for MetS by gender, with the exception of reduced HDL cholesterol levels. Male LEOs had a higher prevalence of abdominal obesity, hypertension, elevated fasting glucose

TABLE II. Education and Occupation of WTC-LECS Study Population

Variable	Overall (N = 2497) (%)	Men (N = 2122) (%)	Women (N = 375) (%)	*P*-value
Length of time in law enforcement (years)				
Mean	20	20	19	0.0002
Maximum	51	44	51	
<10	28 (2)	21 (2)	7 (4)	0.008
11–15	152 (12)	125 (11)	27 (16)	
16–20	503 (39)	427 (38)	76 (44)	
21+	611 (47)	549 (49)	62 (36)	
Current law enforcement status				
Active	1440 (58)	1232 (59)	208 (56)	<0.0001
Retired	670 (27)	544 (26)	126 (34)	
Unemployed	20 (1)	14 (1)	6 (2)	
Other	343 (14)	313 (15)	30 (8)	
Education				
Less than 12 years	8 (0.3)	7 (0.3)	1 (0.3)	0.52
High school / GED	427 (18)	373 (18)	54 (15)	
College <4 years	1147 (47)	969 (47)	178 (49)	
College 4+ years	848 (35)	717 (35)	131 (36)	

Continuous variables are expressed as mean; categorical variables are expressed as number of patients (%).

TABLE III. Medical History, Anthropometric, and Laboratory Analyses of WTC-LECS Study Population

Variable	Overall (N = 2497)	Men (N = 2122)	Women (N = 375)	Adjusted effect size[a] Estimate	95%CI	*P*-value
Hypertension[b]	1390 (56%)	1248 (59%)	142 (38%)	0.3	(0.3,0.4)	<0.001
Diabetes mellitus[b]	339 (14%)	301 (14%)	38 (10%)	0.6	(0.4,0.8)	0.005
Hyperlipidemia/Dyslipidemia[b]	1470 (59%)	1269 (60%)	201 (54%)	0.8	(0.7,1.0)	0.91
Family history of premature coronary heart disease	590 (25%)	489 (25%)	101 (28%)	1.6	(1.2,2.1)	<0.001
Body mass index (kg/m^2)						
Mean	30	30	29	−1.8	(−2.4,−1.3)	<0.001
<25	283 (11%)	185 (9%)	98 (26%)	0.4	(0.5,0.7)	<0.001
25–30	1056 (42%)	921 (43%)	135 (36%)			
>30	1152 (46%)	1012 (48%)	140 (38%)			
Abdominal obesity (WC) (inches)	39	40	36	−3.7	(−4.3,−3.1)	<0.001
Systolic blood pressure (mmHg)	126	127	119	−8.5	(−10.2,−7.0)	<0.001
Diastolic blood pressure (mmHg)	80	81	76	−5.2	(−6.3,−4.1)	<0.001
Total cholesterol (mg/dl)	197	196	201	6.5	(2.3,10.7)	<0.003
LDL cholesterol (mg/dl)	122	122	122	0.4	(−3.4,4.1)	0.85
HDL cholesterol (mg/dl)	50	48	61	12.4	(10.9,13.9)	<0.001
Triglycerides (mg/dl)	127	132	95	−31.7	(−41.3,−22.1)	<0.001
Fasting glucose (mg/dl)	87	87	84	−4.5	(−7.1,−2.0)	<0.001
hsCRP (mg/L)	3.2	3.0	4.4	1.4	(0.7,2.0)	<0.001

HDL, high density lipoprotein; LDL, low density lipoprotein; hsCRP, high sensitivity C-reactive protein; CI, confidence interval.
Continuous variables are expressed as the mean; binary and categorical variables are expressed as number (%).
[a]Women to men odds ratio for binary and categorical variables; women minus men mean difference for continuous variables; adjusted for age and race/ethnicity.
[b]Self-reported, on medication, or medical chart documentation.

TABLE IV. Prevalence of Metabolic Syndrome in the WTC-LECS Study Population

Variable	Overall (N = 2456)	Men (N = 2091)	Women (N = 365)	Adjusted effect size[a] Estimate	95%CI	P-value
Abdominal Obesity	1198 (47%)	987 (47%)	211 (58%)	1.5	(1.2,1.9)	<0.001
TG						
Elevated TG	677(28%)	632 (30%)	45 (12%)	0.4	(0.3,0.5)	<0.001
Drug treatment for elevated TG[b]	128 (5%)	122 (3%)	6 (2%)	0.3	(0.1,0.9)	0.04
Either	752 (31%)	703 (34%)	49 (13%)	0.3	(0.2,0.5)	<0.001
HDL cholesterol						
Reduced HDL	643 (26%)	543 (26%)	100 (27%)	1.1	(0.9,1.5)	0.28
Drug treatment for reduced HDL[b]	92 (4%)	87 (4%)	5 (1%)	0.3	(0.1,1.1)	0.06
Either	694 (28%)	592 (28%)	102 (28%)	1.0	(0.8,1.3)	0.93
Blood pressure						
Elevated SBP	952 (39%)	871 (42%)	81 (22%)	0.4	(0.3,0.5)	<0.001
Elevated DBP	784 (32%)	712 (34%)	72 (20%)	0.5	(0.3,0.7)	<0.001
Hypertension, drug treatment for HTN[b]	477 (19%)	419 (20%)	58 (16%)	0.9	(0.6,1.4)	0.7
Either	1311 (53%)	1181 (56%)	130 (36%)	0.4	(0.3,0.5)	<0.001
Fasting glucose						
Elevated fasting glucose	285(12%)	254 (12%)	31 (8%)	0.7	(0.5,1.1)	0.13
On drug treatment for elevated glucose[b]	112 (5%)	102 (5%)	10 (3%)	1.0	(0.4,2.6)	0.93
Either	323 (13%)	286 (14%)	37 (10%)	0.6	(0.4,0.9)	0.01
Number of MetS components						
0	482 (20%)	382 (18%)	100 (27%)	0.6	(0.5,0.7)	<0.001
1	661 (27%)	547 (26%)	114 (31%)			
2	649 (26%)	570 (27%)	79 (22%)			
3	402 (16%)	364 (17%)	38 (10%)			
4	197 (8%)	170 (8%)	27 (7%)			
5	65 (3%)	58 (3%)	7 (2%)			
Presence of ≥3	664 (27%)	592 (28%)	72 (20%)	0.6	(0.5,0.8)	0.001

DBP, diastolic blood pressure; HDL, high density lipoprotein; HTN, hypertension; MetS, metabolic syndrome; SBP, systolic blood pressure; TG, triglycerides; CI, confidence interval.

There were 41 participants with missing metabolic syndrome data. Summary statistics are number (percentage).

[a]Women to men odds ratio; adjusted for age and race/ethnicity.

[b]Self-reported, or medical chart documentation.

and triglyceride levels. An additional study of MetS in LEOs noted similar gender differences; the Buffalo cohort included 106 (26%) female LEOs. In their study, male LEOs were nearly four times more likely to have MetS than female LEOs (32.2% vs. 8.5%); and all five risk factors for MetS were higher among male LEOs [Yoo and Franke, 2013]. In the Spokane and Iowa cohorts, an insufficient number of female LEOs precluded detection of gender differences in MetS [Hartley et al., 2011, 2012]. Although both male and female LEOs demonstrate a high level of fitness when they complete their training, shift-work and change in health behaviors such as exercise and sleep duration may influence increase in abdominal obesity, hypertension, and hyperglycemia differently among men.

Although a striking more than one in four LEOs in WTC-LECS LEOS are affected by METs, this is still lower compared with the national prevalence of MetS (NHANES 2003–2006) [Ervin, 2009]. One possible explanation for the lower prevalence of MetS is the influence of the "healthy worker effect." It has been recognized that persons employed have a lower morbidity and mortality compared to the general population because relatively healthy individuals are likely to gain employment and to remain employed [McMichael, 1976]. The "healthy worker effect" is more apparent among those in physically demanding occupations or in occupations with specific physical fitness requirements in their hiring policies, such as many first responder occupations [Li and Sung, 1999]. Unemployed persons are more likely to have more sedentary behaviors. Sedentary behavior is associated with an increase in metabolic syndrome, and Ford et al. [2005] noted that in the U.S., those who engaged in sedentary behaviors of more than hours a day were more likely to have MetS, even after adjusting for other confounders [Ford et al., 2005]. LEOs must have at least a minimum level of health to be able to perform and maintain their duties, leading to lower

TABLE V. Odds Ratio for the Prevalence of Metabolic Syndrome in the WTC-LECS Study Population by Age, Race/Ethnicity, Body Mass Index, and Law Enforcement Status Stratified by Gender

	Men		Women	
	Odds ratio	P	Odds ratio	P
Age (years)[a]				
<45	1		1	
45–48	1.2 (0.9, 1.5)	0.16	1.6 (0.8, 3.3)	0.20
>48	1.2 (1.2, 1.9)	<0.001	2.6 (1.3, 5.4)	0.009
Race/Ethnicity[b]				
White	1		1	
Non-white	0.9 (0.7, 1.1)	0.4	1.7 (1.0, 3.0)	0.001
Body mass index (kg/m^2)[c]				
<25	1		1	
25–30	3.0 (1.5, 5.8)	<0.001	11.6 (1.5, 89.4)	0.019
>30	15.8 (8.2, 30.5)	<0.001	60.8 (8.1, 456.0)	<0.001
Retired[d]				
No	1		1	
Yes	1.4 (1.1, 1.8)	0.002	1.4 (0.7, 2.5)	0.32

Metabolic syndrome defined under Methods section.
[a]Adjusted for Race/Ethnicity (<45 years is the reference group).
[b]Adjusted for Age (White is the reference group).
[c]Adjusted for Race/Ethnicity and Age (<25 kg/m^2 is the reference group).
[d]Adjusted for Race/Ethnicity and Age (Not retired is the reference group).

rates of MetS compared with the general population. Additional evidence to support the healthy worker effect is that we noted a significantly higher prevalence in MetS in those who had retired from police work, adjusted for age.

Cossrow and Falkner [2004] showed that the prevalence of MetS varies between ethnic groups. Exploring this as a possible explanation for the lower prevalence of MetS in our WTC-LECS cohort, we note that NHANES was a random nationwide health survey. The US population, under the revised racial and ethnic classification, is 69% White, 12% Hispanic, and 12% African American [Perez and Hirschmann, 2009]. Our WTC-LECS cohort is 69% White, 16% Hispanic, and 12% African American. We find that it is highly unlikely that the differences in race/ethnicity could explain much of the differences we found comparing MetS and MetS components in LECS versus NHANES (age standardized to the WTC-LECS distribution).

Limitations

Foremost, similar to prior studies, this was a cross sectional analysis, which precludes the possibility of establishing causal relationships. Studies designed to assess the longitudinal trends in the prevalence of MetS and determine causal relationships between MetS and its risk factors among LEOs are needed. Secondly, although
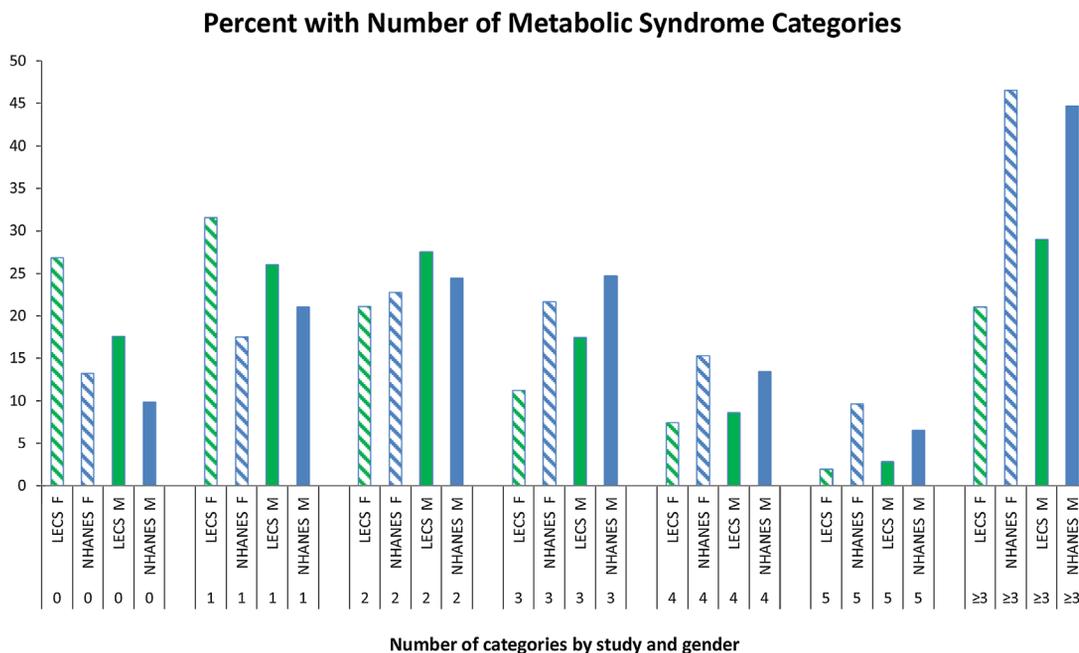

FIGURE 1. Comparison of metabolic syndrome and metabolic syndrome components in the study population (WTC-LECS) versus the National Health and Nutrition Examination Survey (NHANES) 2003–2006 stratified by gender. NHANES data was restricted to the fasting subset and results were age-standardized to the WTC-LECS distribution. Bars for women are shaded; bars for men are solid. Bars for LECS are in green; bars for NHANES are in blue.

the NHANES datasets are thorough and complete, the investigators were not able to assess variations between occupations, lifestyles, family history, education, and socioeconomic status. The possible impact of these factors on MetS prevalence in the general United States population is unknown. Finally, our cohort is a unique, relatively healthy, young occupational population with access to health care, which may somewhat reduce generalizability to the population at large. While the prevalence of MetS among WTC-LECS LEOs is lower than the general US population, an emphasis on lowering modifiable CVD risk factors through pharmacologic intervention and/or lifestyle changes should be encouraged especially since we observed our cohort to be under treated for MetS components. Further investigations should also focus on factors apart from MetS as contributors to the increased prevalence of CVD among LEOs.

Impact

MetS is a rising epidemic in the United States, and importantly, approximately one in four LEOs who worked at the WTC site after 9/11 are affected. This number of young, previously healthy workers affected by MetS is striking. In addition, we find a significant increase in MetS among males compared with female LEOs and the prevalence of MetS components are significantly different between gender. Although prior studies have demonstrated increased MetS among LEOs, the WTC-LECS is the largest cohort of LEOs to confirm this association. Importantly, we have shown a significant increase in MetS in those who have retired from active law-enforcement. Important strategies to educate and prevent development of MetS should be implemented in the workplace and upon retirement from law enforcement. Prevention or reversal of MetS through lifestyle changes and wellness programs has been shown to result in lower medical costs [Steinberg et al., 2015]. Finally, the prevalence of MetS is increasing worldwide, and further analyses from this unique population may provide important insights on physiologic mechanisms.

AUTHORS' CONTRIBUTIONS

Moline: Obtained funding, participated in design, acquisition and analysis of data; revision and approval of manuscript. McLaughlin: Participated in obtaining funding; responsible for study design and acquisition of data, participated in analysis of data, drafting, revising and approval of final manuscript. Sawit: Participated in design, acquisition and analysis of data; revision and approval of manuscript. Maceda: Participated in analysis of data, drafting, revising and approval of final manuscript. Croft: Participated in acquisition of data and approval of manuscript. Goldman: Participated in acquisition of data and approval of manuscript. Garcia: Participated in acquisition of data and approval of manuscript. Iyengar: Conducted data analysis; drafted, revised and approved final manuscript. Woodward: Conducted final data analysis, revised and approved manuscript.

ETHICS APPROVAL AND INFORMED CONSENT

The study was approved by the Icahn School of Medicine Program for Protection of Human Subjects and written informed consent was obtained.

DISCLOSURE (AUTHORS)

The authors report no conflicts of interest.

DISCLOSURE BY AJIM EDITOR OF RECORD

Steven Markowitz declares that he has no competing or conflicts of interest in the review and publication decision regarding this article.

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