# Association of gender-specific risk factors in metabolic and cardiovascular diseases: an NHANES-based cross-sectional study

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#### ABSTRACT

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In the present cross-sectional study, based on National Health and Nutrition Examination Survey (NHANES, 2007–2010) cohorts, various risk factors for metabolic syndrome (MetS) and cardiovascular diseases (CVDs) were analyzed (n=12,153). The variables analyzed include, demographics, comorbidities associated with MetS or CVD. behavioral and dietary factors, while the primary endpoints were the prevalence of MetS and CVD. The prevalence of MetS and CVD was slightly higher in males as compared with females (42.50% and 7.65% vs 41.29% and 4.13%, respectively). After controlling for confounding factors, advanced age, family history of diabetes mellitus (DM), overweight, and obesity were significantly associated with the likelihood of MetS, irrespective of gender differences. In males, the diagnosis of prostate cancer and regular smoking were additional risk factors of MetS, whereas, advanced age, family history of heart attack or angina, health insurance coverage, diagnosis of rheumatoid arthritis or depression, obesity and low calorie intake were identified as risk factors for CVD. In addition to the above risk factors, higher physical activity and vitamin D insufficiency were also found to increase the risk of CVD in females. Furthermore, obesity was a higher risk factor for MetS than CVD. Emerging risk factors for CVD identified in this study has major clinical implications. Of interest is the correlation of higher physical activity and the risk of CVD in women and the role of depression and lower calorie intake in general population.

#### INTRODUCTION



To cite: Zhang X-E, Cheng B, Wang Q, et al. J Investig Med Published Online First: [please include Day Month Year]. doi:10.1136/jim-2017-000434 Metabolic syndrome (MetS) is an important risk factor for the subsequent development of cardiovascular disease (CVD). MetS is a multiplex risk factor that arises from insulin resistance accompanying abnormal adipose deposition and function.<sup>1</sup> Clinical manifestations of MetS include hypertension, hyperglycemia, hypertriglyceridemia, reduced high-density lipoprotein cholesterol (HDL-C), and abdominal obesity.

MetS is a growing health concern globally<sup>2–5</sup> and is equally prevalent in men (24%) and women (22%) after adjusting for age.<sup>6</sup> However, there are several factors that are unique to women, including pregnancy, use of oral contraceptives, postpartum breast feeding, polycystic ovarian

## Significance of the study

## What is already known about this subject?

- After adjusting for age, the prevalence of metabolic syndrome is similar in men and women (22% and 24%, respectively).
- Patients with metabolic syndrome have a greater risk of developing diabetes mellitus and coronary heart disease later in life.
- The risk factors underlying metabolic syndrome and cardiovascular diseases are similar, and cardiovascular disease is often preceded by metabolic syndrome.

#### What are the new findings?

- The present analysis reveals risk factors that are not previously linked to cardiovascular disease, namely, the correlation of higher physical activity in women, and the role of depression and low calorie intake in the general population.
- Diagnosis of depression (adj. OR=2.46, 95% CI 1.13 to 5.36), higher physical activity (adj. OR=2.93, 95% CI 1.63 to 5.26), and low total calorie intake (adj. OR=2.40, 95% CI 1.07 to 5.67) were found to be highly associated with the development of cardiovascular disease in females, after controlling for confounding factors.
- In males, diagnosis of depression (adj. OR=1.80, 95% CI 1.09 to 2.92) and low total calorie intake (adj. OR=2.20, 95% CI 1.22 to 3.98) was shown to be strongly associated with the development of cardiovascular disease.

syndrome and so on.<sup>7</sup> We hypothesized that these additional factors may increase the risk of CVD in women with MetS and assessed the role of gender in the development of MetS and CVD in the present study.

In addition to adipose dysfunction and insulin resistance,<sup>8 9</sup> psychological characteristics also play a major role in the development of MetS. Anger, depression, and hostility had been shown to be associated with increased risk for MetS.<sup>10</sup> Recent reports indicate that MetS is significantly associated with lifetime major depression and the presence of any anxiety disorder.<sup>11 12</sup> Furthermore, there is compelling

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# Significance of the study

# How might these results change the focus of research or clinical practice?

- Increased total physical activity is thought to be associated with the reduced risk of coronary heart diseases, but in females, intense and strenuous exercise may have adverse effects.
- A low-calorie, high-fiber diet is often recommended to reduce the risk of metabolic syndrome and cardiovascular disease, but our results suggest that a low calorie intake may increase the risk. The underlying mechanism needs to be further investigated.
- Patients with depression need more support and attention, as it increases their risk in developing metabolic syndrome and cardiovascular disease.

evidence linking CVD with major depressive disorder and bipolar disorder.<sup>13</sup> <sup>14</sup> In recent epidemiological studies in the USA, the prevalence of CVD among adults with major depressive disorder was nearly threefold greater than those without mood disorders.<sup>15</sup>

The association of traditional risk factors like family history, poor dietary habits, sleep disorders, and inadequate physical activity in the development of MetS and CVD had been well established. However, recent reports indicate that new risk factors that were not previously associated with CVDs are becoming apparent with drastic changes in lifestyle and dietary habits among the general population across the globe. In light of this, we undertook a cross-sectional analysis of the population by utilizing the National Health and Nutrition Examination Survey (NHANES) database of Centers for Disease Control and Prevention (CDC) in the USA. We believed that modern lifestyle and dietary habits may lead to an increased risk of MetS and CHD.

Furthermore, though the risk factors underlying the MetS and CVD are similar, CVD is tightly associated with a variety of other behavioral and genetic factors. The present study was undertaken to analyze the risk factors for both diseases separately in order to delineate the commonalities and differences in the behavioral and dietary factors leading to the emergence of one or the other. Recognizing the underlying risk factors may help healthcare providers in identifying individuals prone to CVD at routine clinic visits and to further improve the public health policy.

#### **METHODS**

#### Design, subjects, and endpoints

This cross-sectional study was performed using data stored in the NHANES, CDC, National Center for Health Statistics (NCHS), and the US Department of Health and Human Services (http://www.cdc.gov/nchs/nhanes/) (year 2007~2010 cycles). All data from NHANES database were deidentified and hence, analysis of the data did not require Institutional Review Board approval or informed consent by subjects.

The present study sample consisted of NHANES participants above 20 years old (n=12,153). Subjects who were more than 80 years old was recorded as 80. Subjects with complete data for coronary heart disease, angina/angina pectoris, or heart attack were included in the analysis of CVDs (n=12,054). Individuals who did not participate in the fasting subsample were excluded from the analysis of the MetS (n=4920). The endpoints of the present study were the prevalence of MetS and CVDs. Criteria of MetS was based on guidelines developed by the 2001 National Cholesterol Education Program Adult Treatment Panel III (ATP III). ATP III MetS criteria were updated in 2005 in a statement from the American Heart Association/National Heart, Lung, and Blood Institute. Prevalence of CVDs included self-reported coronary heart disease, angina/ angina pectoris, and heart attack in the questionnaire of 'Medical condition' section.

## Study variables

The variables obtained for each disease group were patient demographics (age, gender, race/ethnicity, and marital status), family history (diabetes and heart attack/angina), socioeconomic status (education level, ratio of family income to poverty, and health insurance status), behavioral factors (body mass index (BMI), smoking history, alcohol use, physical activity, sleeping hours, postpartum breast feeding, and last childbearing age), dietary factors (vitamin D insufficiency, total daily calorie consumption, and total daily sugar consumption), and disease association (self-reported medical condition of rheumatoid arthritis, depression, asthma, osteoporosis, and prostate cancer). Details of each variable is discussed below.

## Metabolic syndrome

Current ATP III criteria<sup>16</sup> define MetS as the presence of any **three** of the following five traits:

- 1. abdominal obesity, defined as a waist circumference in men ≥102 cm (40 in) and in women ≥88 cm (35 in).
- serum triglycerides ≥150 mg/dL (1.7 mmol/L) or drug treatment for elevated triglycerides.
- serum HDL-C <40 mg/dL (1 mmol/L) in men and <50 mg/dL (1.3 mmol/L), in women or drug treatment for low HDL-C.
- 4. blood pressure ≥130/85 mm Hg or drug treatment for elevated blood pressure.
- 5. fasting plasma glucose  $\geq 100 \text{ mg/dL}$  (5.6 mmol/L) or drug treatment for elevated blood glucose.

## Demographic data

Subjects were administered the Family and Sample Person Demographics questionnaires at home by trained interviewers using a Computer-Assisted Personal Interviewing (CAPI) system. The CAPI system is programmed with built-in consistency checks to reduce data entry errors. CAPI also uses online help screens to assist interviewers in defining key terms used in the questionnaire.<sup>17</sup>

- Age, gender, race/ethnicity and marital status from the 'Demographic variables and sample weights' in the NHANES database were recorded.
- We separated the subjects by their gender into two categories, so as to identify the unique risk factors for each gender.
- Race/ethnicity was self-reported as Mexican American, other Hispanic, non-Hispanic white, non-Hispanic black, and other race, including multiracial. We further stratified them into three racial groups: non-Hispanic white,

Hispanic, non-Hispanic black, and others (including Mexican American and other races).

## **Family history**

► Family history of diabetes and heart attack/angina were self-reported using interviewer-administered questionnaires (medical conditions) from NHANES database.

## Socioeconomic status

- ► Education level, ratio of family income to poverty, and health insurance status were recorded using interviewer-administered questionnaires (demographic variables and sample weights) from NHANES database.
- Ratio of family income to poverty refers to the ratio of family income to poverty threshold. Range of values include 0–5. Value of 5 and greater were recorded as 5.

# **Behavioral factors**

Body mass index

- BMI data were recorded based on 'Body Measures' of NHANES Examination Protocol.<sup>18</sup> The body measurement data were collected, in the Mobile Examination Center (MEC), by trained health technicians.
- ▶ We further categorized data based on WHO criteria into: underweight (BMI <18.5 kg/m<sup>2</sup>), normal (BMI=18.5~24.9 kg/m<sup>2</sup>), overweight (BMI=25~29.9 kg/m<sup>2</sup>), and obese (BMI ≥30.0 kg/m<sup>2</sup>).

Smoking history

- Smoking status was recorded using interviewer-administered questionnaires (smoking – cigarettes use) from NHANES database.
- We further categorized the subjects into current regular smoker and never regular smoker.

Risky alcohol use

- The National Institute on Alcohol Abuse and Alcoholism in the USA has estimated the amount of alcohol consumption that can increase health risks.<sup>19</sup>
   For men under the age of 65:
- More than 14 standard drinks per week on average.
- More than four drinks on any day. Women and adults 65 years and older:
- More than seven standard drinks per week on average.
- More than three drinks on any day.

Physical activity: metabolic equivalent of task (MET) score

- MET score<sup>20</sup> was calculated from the provided data using the interviewer-administered questionnaires (physical activity) from NHANES database.
- MET score at 600 MET-min/week is considered having a moderate intensity of physical activity based on WHO recommendation, and we set this as the cut-off value in our study.

# Sleep duration

Participants were asked using the CAPI system at the comfort of their home, 'How much sleep do you usually get at night on weekdays or workdays?' The numbers of hours of sleep were recorded.

- ► National Sleep Foundation has updated their recommendations for daily sleep amounts across the lifespan, clarifying that the average recommended amount of hours 'may be appropriate,' but varies significantly among subjects, and new ranges for each age group were given.<sup>21</sup>
- Based on the National Sleep Foundation recommendation, we further categorized data into normal sleep duration, short sleep duration, and long sleep duration.

## Postpartum breast feeding

- These questions were administered at the MEC, by trained interviewers, using the CAPI system as a part of the MEC interview.
- Participants were asked, 'Did you breast feed your child or any of your children for at least one month?' in the questionnaire, and an answer of yes or no was obtained.

## Last childbearing age

- These questions were administered at the MEC, by trained interviewers, using the CAPI system as a part of the MEC interview.
- Participants were asked, 'How old were you at the time of your last live birth?' in the questionnaire, and the range of age was recorded.
- ▶ We categorized the age range into 20s, 30s, and more than 40s.

# Dietary factors

Vitamin D insufficiency

- Serum 25-hydroxyvitamin D (25 (OH)D) data were extracted based on 'Vitamin D' from NHANES Examination Protocol.
- ► There is no definite consensus on the value of vitamin D deficiency. After careful evaluation of literature, we set our cut-off value at <40 nmol/L.<sup>22</sup>
- ► The most widely used indicator of vitamin D status is the measurement of 25(OH)D in either serum or plasma. The National Institute of Standards and Technology (NIST) along with the National Institutes of Health's Office of Dietary Supplements developed a standard reference material for circulating vitamin D analysis and have suggested the use of liquid chromatography-coupled with tandem mass spectrometry (LC-MS/MS) measurement procedure developed by NIST.<sup>23 24</sup>

Total daily calorie and sugar consumption

- ► The in-person interview was conducted in a private room in the NHANES MEC. A set of measuring guides (various glasses, bowls, mugs, drink boxes and bottles, household spoons, measuring cups and spoons, a ruler, thickness sticks, bean bags, and circles) was available in the MEC dietary interview room for the participant to use for reporting the amounts of foods.
- ▶ NHANES collected data on study participants' use of dietary supplements for 30 days during the Dietary Supplements Section in the household interview. In 2007–2008, additional information on supplement and antacid use for the previous 24 hours was collected to provide data of the same timeframe as the food and beverage intake. With a similar protocol, the 24-hour

dietary supplement interview was collected following the 24-hour dietary recall. All NHANES examinees responding to the dietary recall interview were eligible for the dietary supplement and antacid use questions. Information was obtained on all vitamins, minerals, herbals, and other dietary supplements that were consumed during a 24-hour time period (midnight to midnight), including the name and the amount of dietary supplement taken.<sup>25</sup>

- Data of total daily calorie and total daily sugar consumption were extracted.
- Based on the dietary guidelines for Americans in 2010,<sup>26</sup> we categorized data into recommended intake, higher intake, and lower intake based on age and gender differences.

## **Diseases association**

- ► Different medical conditions were self-reported using the interviewer-administered questionnaires (medical conditions) from NHANES database.
- ► For identification of depression, we used 'Patient Health Questionnaire'<sup>27</sup> as our screener. Patient with score of 5 and greater is considered mild depression, while score of < five indicates no depression.
- The Depression Screener questions are from the Patient Health Questionnaire, a version of the Prime-MD diagnostic instrument. They are a self-reported assessment of the past 2 weeks, based on nine Diagnostic and Statistical Manual of Mental Disorders,Fifth Edition (DSM-IV) signs and symptoms from depression. The nine symptom questions are scored from '0' (not at all) to '3' (nearly every day). Depression severity can be defined by several cut points from the total score that ranges from 0 to 27.<sup>28</sup> A final follow-up question assesses the overall impairment of the depressive symptoms. The depression screener was conducted as part of the MEC interview questionnaire, using interviewer administered CAPI system in Spanish or English. No proxy or interpreters were permitted for these questions.

## STATISTICAL ANALYSIS

Demographic data, basic characteristics, and dietary intake were expressed as mean (SE) for continuous variables, or unweighted counts (weighted %) for categorical variables. Univariate and multivariate logistic regression analyses were performed to determine the potential factors associated with MetS and CVD. Variables having a p value < 0.05 in the univariate analysis were selected and further evaluated using multivariate logistic regression models with stepwise selection. All analyses included fasting subsample weight and stratum. Primary sampling units (PSUs) were per recommendations from NCHS to address oversampling, non-response, and non-coverage and to provide a nationally representative estimate. Statistic assessments were two sided and evaluated at the 0.05 level of significance. Statistical analyses were performed using the statistical software package SPSS complex sample module V.22.0.

#### RESULTS

## Demographics, behavioral and dietary factors

Our study population comprised of participants aged 20 years and older, included in the 2007 to 2010 NHANES

cohorts (n=12,153). Those with complete data for coronary heart disease, angina/angina pectoris, or heart attack were included in the analysis of CVDs (n=12,054). Individuals who did not participate in the fasting subsample were excluded from the analysis of the MetS (n=4920). Using NHANES fasting subsample weight, the analytic sample size was equivalent to a population-based sample size of 104,190,537 males and 110,589,267 females. Table 1 lists the characteristics, behavior and dietary intake of the participants according to gender differences. The mean age among the 2343 men was 45.84 years and among the 2577 women was 47.69 years. The prevalence of MetS and CVD were 42.50% and 7.65% for males and 41.29% and 4.13% for females, respectively.

## Potential risk factors for MetS and CVD in males

The results of multivariate logistic regression analysis examining potential factors associated with MetS or CVD in males are shown in figure 1. Data from the univariate analysis indicate age, race, family history of diabetes mellitus (DM) and heart attack or angina, marital status, education level, health insurance status, rheumatoid arthritis, prostate cancer, BMI, physical activity, regular smokers, sleep duration, and daily calorie consumption were associated with MetS (data not shown). After adjusting for all potential factors, the results of multivariate analysis demonstrated that elderly subjects (adjusted OR=1.05, 95% CI 1.03 to 1.07), having a family history of DM (adjusted OR=1.39, 95% CI 1.02 to 1.89), or prostate cancer diagnosis (adjusted OR=2.27, 95% CI 1.09 to 4.72), or overweight (adjusted OR=3.65, 95% CI 2.37 to 5.62), or obesity (adjusted OR=16.22, 95% CI 10.71 to 24.56) or regular smoking (adjusted OR=1.77, 95%CI 1.27 to 2.46) were significantly associated with the likelihood of MetS among the male participants (figure 1A).

According to univariate analysis, age, race, family history of heart attack or angina, marital status, education level, health insurance status, rheumatoid arthritis, depression, osteoporosis, prostate cancer, BMI, physical activity, regular smoking, and sleep duration were associated with the likelihood of CVD in males. Moreover, elderlv (adjusted OR=1.09, 95% CI 1.08 to 1.11), having family history of heart attack or angina (adjusted OR=2.36, 95% CI 1.30 to 4.29), health insurance coverage (adjusted OR=0.40, 95% CI 0.17 to 0.93), diagnosis of rheumatoid arthritis (adjusted OR=2.45, 95% CI 1.32 to 4.55), depression (adjusted OR=1.80, 95%CI 1.09 to 2.92), obesity (adjusted OR=1.86, 95%CI 1.02 to 3.41), and low total calorie intake (adjusted OR=2.20, 95% CI 1.22 to 3.98) were likely to be more associated with the development of CVD in males after controlling for potential factors (figure 1B).

## Potential risk factors for MetS and CVD in females

The results of multivariate logistic regressions examining potential factors associated with MetS and CVD in females are shown in figure 2. After adjustment for all potential factors, the results of multivariate analysis demonstrated that elderly subjects (adjusted OR=1.08, 95% CI 1.06 to 1.10), having family history of DM (adjusted OR=1.70, 95% CI 1.20 to 2.41), overweight (adjusted OR=4.77,

 Table 1
 Characteristics of subjects (males, n=2343, weighted n=104,190,537; and females n=2577, weighted n=110,589,267) included in the NHANES database between 2007 and 2010

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Anginal pactoris1% (2.50)9% (1.64)Missing7% (7.53)7%Age (pers)45.84 (0.52)47.69 (0.42)BML n (%)77.13 (1.53)Race, n (%)Umderweight587 (2.64)77.0 (2.13)77.12 (2.15)Bree, n (%)233 (5.11)314 (5.06)Deerweight97.0 (2.24)77.12 (2.15)Other Isiganic Murie1141 (6.81)1220 (2.02)Obes79.0 (2.24)10.11 (5.20)Non-Hispanic Murie1141 (6.81)120 (2.02)Obes79.0 (2.24)10.11 (5.20)Non-Hispanic Murie1141 (6.81)120 (2.02)Missing36.1 (2.1)22.6 (3.9)Other acci-Inciding multincial1116 (5.3)118 (6.19)Physical activity, n (%)11.01 (5.20)Piso37.7 (3.5.3)12.06 (3.7)MET scores -60015.07 (7.7.33)12.64 (4.9.8)Non-Hispanic Murie12.06 (3.9)MET scores -60015.07 (7.7.33)12.64 (4.9.8)No14.04 (6.14)14.58 (0.65)MIS (1.9.9)No.11 (8.10)15.00 (8.10)No14.04 (6.14)14.58 (0.65)MIS (1.9.9)10.11 (8.10)10.01 (8.10)No2021 (2.65)23.07 (3.10)Non-regular snokes12.11 (8.7.0)41.01 (8.10)No2021 (2.65)23.07 (2.1.03)MIS (1.9.9)60.11.0115.60 (7.9.0)No2021 (2.65)23.07 (2.1.03)MIS (1.9.9)60.11.0115.60 (7.9.0)No2021 (2.65)23.07 (2.1.03)MIS (1.9.9)60.11.0116.80 (7.6.1)No2021 (2.65)25.07	Coronary heart disease	147 (4.98)	62 (1.70)	No	1483 (57.41)	
Heart attack         150 (4.60)         84 (2.57)         Behavioral factors           Are (yoars)         45.8 (0.52)         47.89 (0.42)         BML (r%)         20 (1.09)         47 (2.16)           Mexian American         429 (9.41)         486 (7.64)         Normal weight         57 (7.64)         777 (22.33)           Mexian American         429 (9.41)         348 (7.64)         Normal weight         57 (7.22)         20 (7.8)           Norm-Hispanic White         1141 (68.81)         1202 (69.22)         Oberee         777 (72.33)         1264 (43.94)           Norm-Hispanic White         497 (161.8)         1067 (27.20)         MET scores -5600         777 (72.33)         1264 (43.94)           Norm-Hispanic White         877 (261.8)         1067 (27.20)         MET scores -5600         777 (27.33)         1264 (43.94)           Nor         887 (261.8)         1067 (27.20)         MET scores -5600         1561 (72.50)         130 (53.80)           No         62 (2.61)         67 (2.17)         Attaches making (%)         5 (1.7)         40 (35.90)           No         62 (2.60)         67 (2.17)         Matcohism (%)         5 (61.2)         16 (8.0)           No         1278 (63.23)         73 (13.66)         322 (16.0)         127 (13.90)         148 (67.	Angina/angina pectoris	78 (2.50)	54 (1.64)	Missing	785 (40.38)	
Ape (sers)Ape (sers)Ape (sers)MM n (%)Mexican American429 (s.4)486 (7.64)Mormal weight20 (1.09)47 (2.16)Mesican American429 (s.4)134 (s.66)Deerweight910 (s.8)774 (2.86)Other Inspanic White114 (f.68)1202 (s.92)Obes790 (s.2.44)101 (s.5.2)Non-Hispanic White114 (f.68)1202 (s.92)Obes707 (2.7.3)1264 (43 s.94)Other rase-Indiring multinical111 (s.5)118 (f.19)Physical activity n (%)50 (1.2)1264 (43 s.94)Non-Hispanic Black174 (s.61)158 (f.19)MET scores -660157 (7.23)1264 (43 s.94)No1246 (f.61)1458 (f.63)MET scores -660157 (1.23)130 (5.5)No1246 (f.64)1458 (f.64)Missing (%)5 (1.18)40 (s.50)No1246 (f.63)127 (s.64)128 (f.64)148 (f.64)No6.2 (J.2)129 (f.23)Morregular smokers121 (f.65)67 (J.14)No2012 (f.65,0)67 (J.12)Alcohan, n (%)128 (f.64)158 (f.63)No1212 (f.65,0)727 (J.23)Missing (%)600 (J.15)667 (J.25)Martind Stromy (marture)156 (J.23)139 (J.23)Missing (f.6)600 (J.15)667 (J.25)Never marted367 (J.64)149 (J.58)Sleep duration n (%)157 (J.23)147 (G.63)Netter devision function150 (J.23)149 (J.23)Missing (f.6)90 (J.13)150 (J.23)Netter devision functio	Heart attack	150 (4.66)	84 (2.57)	Behavioral factors		
Bace, n(b)         Underweight         20, 00         47, 21.0           Motion American         429 (31)         46, 67.0         Normal weight         587, 62.640         723 (3.14)           Other Hispanic Mile         1141 (68.81         120, (92.22)         Obesc         790 (28.45)         774 (28.66)           Non-Hispanic Mile         409 (10.13)         457, (18.61)         Obesc         790 (28.45)         774 (28.60)           Other Ance-including multinoidal         1114 (68.61)         120, (92.22)         Obesc         797 (27.33)         1264 (43.94)           Tamily Intory-DoM, n(b)         MET scores : 500         757 (27.33)         1264 (43.94)           We Anderdon't Inow         62 (23.3)         52 (19.82)         Milissing (b)         56 (0.13)         1266 (15.80)           No         420 (28.65)         271 (94.81)         1057 (97.20)         Milissing (b)         56 (0.21)         126 (15.80)           No         62 (25.60)         271 (94.81)         80 (23.23)         Milissing (b)         56 (0.21)         126 (15.80)           No         2021 (86.54)         273 (94.42)         Milissing (b)         60 (21.80)         66 (25.60)           No         2021 (86.54)         273 (94.62)         Normal sleep duration, n (b)         126 (57.25)	Age (years)	45.84 (0.52)	47.69 (0.42)	BMI, n (%)		
Medican American479 (9.41)486 (7.64)Normal weight978 (7.6.40)774 (2.8.5)Other Hispanic Market1141 (68.81)1202 (69.22)Obese790 (32.84)1011 (35.26)Non-Hispanic Market409 (10.13)457 (11.89)Missing30 (34.57)12.94 (43.94)Tother race-incluing multiracial115 (57.15)118 (60.92)Missing (%)50.184 (42.94)Yes877 (61.81)1057 (97.20)MET scores >600751 (72.73)12.94 (43.94)Yes12.04 (21.43)1458 (60.82)Mtssing (%)50.184 (0.21)Reluseddor' know26.2 (1.38)771 (13.60)Non-regular snokers111 (45.70)941 (80.10)No202 (86.56)21.93 (42.34)Msoing (%)12.8 (5.16)15.30 (6.10)No202 (86.56)21.93 (42.34)Msoing (%)12.8 (5.16)15.30 (6.10)No202 (86.56)21.93 (42.30)Msoing (%)12.8 (5.16)15.30 (6.10)No202 (86.56)21.93 (42.34)Msoing (%)12.8 (5.16)15.30 (6.10)No202 (86.56)21.93 (42.30)Non-regular snokers12.6 (5.17)12.6 (5.17)Mariad Univoy Inpartner265 (10.8)75 (7.23)Missing (%)60 (2.18)66 (2.25)No16.8 (7.18)15.8 (7.5.13)12.6 (5.27)12.6 (5.17)12.6 (5.17)12.6 (5.17)Marikel May Unit partner368 (12.18)75 (7.23)Missing960 (3.13)960 (3.12)No16.8 (7.18)378 (12.8)12.6 (5.2)	Race, n (%)			Underweight	20 (1.09)	47 (2.16)
Other Mispanic         233 (5.11)         314 (5.06)         Overweight         910 (38.45)         774 (28.66)           Non-Hispanic Wahle         114 (68.81)         120 (69.22)         Obee         790 (32.44)         1011 (35.52)           Other race-including multificatal         111 (6.55)         118 (6.19)         Physical activity, n (%)         Texate-including multificatal         112 (46.12)         126 4(3.24)         126 4(3.24)         126 4(3.24)         126 4(3.24)         126 4(3.24)         126 4(3.24)         126 4(3.24)         126 4(3.24)         126 4(3.24)         126 4(3.24)         126 4(3.24)         126 4(3.24)         126 4(3.24)         126 4(3.24)         93 (13.80)         No         128 (51.08)         371 (13.60)         Non-regular smokers         1211 (48.70)         941 (38.01)           Ne         262 (10.85)         371 (13.60)         No nergular smokers         1212 (51.83)         126 4(3.24)         126 (43.24)         126 (43.24)         128 (45.74)         Widoweddioreddisore	Mexican American	429 (9.41)	486 (7.64)	Normal weight	587 (26.40)	723 (33.14)
Non-Hispanic white         1141 (68.81)         1202 (92.22)         Obese         99 (22.82)         011 (13.25)           Non-Hispanic White         36 (12.3)         22 (0.7)           Tamily histonyDM, n (%)	Other Hispanic	253 (5.11)	314 (5.06)	Overweight	910 (38.45)	774 (28.66)
Non-fiscanic black         409 (0.13)         457 (1.89)         Missing         62 (1.29)         62 (1.29)           Other race-including multiradia         111 (6.5)         118 (6.19)         Physical activity, n(%)         130 (6.2, 30)         1264 (43, 94)           Yes         877 (61, 8)         1067 (72, 70)         MET scores >600         177 (27, 33)         1264 (43, 94)           No         1404 (61, 40)         1458 (60, 20)         Missing (%)         50 (17, 50)         130 (55, 66)           Reluseddort Incow         62 (2.43)         52 (1.98)         Cigarettes smoking, n(%)         4 (0.21)           Yes         255 (0.25)         37 (17, 360)         Morregular smokers         1126 (51, 16, 30 (18, 00)           No         66 (2.60)         67 (2.17)         Alcoholsm, n(%)         50 (2.2)         26 (0.99)           Mariedidart Incow         66 (2.60)         67 (2.17)         Alcoholsm, n(%)         1884 (76, 47)           WindowedBioroceReparated         367 (9.40)         1408 (60, 59)         No         1868 (76, 18)         1884 (76, 47)           WindowedBioroceReparated         367 (9.40)         10.03         Short sleep duration         102 (69, 69)         117 (3.81)           Perfusedidort Incow         0 (0.00)         1 (0.13)         Short sleep duration<	Non-Hispanic white	1141 (68.81)	1202 (69.22)	Obese	790 (32.84)	1011 (35.26)
Other race-including multirecial         111 (6.5)         118 (6.19)         Physical activity, n (%)           Family history-DM, n (%)         MET scores <600         750 (7.2.3)         126 (4.3.9.4)           Vis         0.400 (61.40)         1458 (60.82)         (MET scores <600         750 (7.2.3)         126 (4.3.9.4)           No         0.400 (61.40)         1458 (60.82)         (MET scores <600         50 (1.8.7)         40.021           Reluxed/doir Vinow         6.2 (2.43)         5.2 (1.98)         (Cigarettes smokers)         121 (1.8.70)         941 (38.01)           Yes         255 (0.2.5)         271 (13.60)         Non regular smokers         121 (51.61)         1630 (61.60)           No         2012 (65.4)         273 (91.43)         Monisnig (%)         6.00 (21.6)         6.67 (22.57)           Marital status, n (%)         Yes         55 (2.2.2)         26 (0.91)         Missing (%)         6.00 (21.6)         6.67 (22.57)           Never marital         387 (94.6)         409 (15.03)         Short sleep duration         950 (23.2)         170 (23.8)           Never marital status, n (%)         Yes         373 (12.65)         272 (12.9)         170 (23.8)           Refused/don't know         368 (12.8)         739 (22.62)         Missing (%)         6000 (21.6)	Non-Hispanic black	409 (10.13)	457 (11.89)	Missing	36 (1.23)	22 (0.78)
Family history-DM, n (%)         VHET scores >600         777 (27.3)         1264 (43.94)           Yes         877 (68.18)         1067 (37.20)         MET scores >600         756 (72.50)         1308 (55.86)           No         1040 (61.40)         1458 (60.82)         MET scores >600         50 (72.50)         930 (55.86)           Family history-heart attack/angins, n (%)         E62 (10.85)         371 (13.60)         Non-regular smokers         1126 (51.16)         1630 (61.80)           No         2012 (66.54)         2139 (84.23)         Missing (%)         6 (0.14)         6 (0.19)           Refused/don't how         6 (2.60)         6 7 (2.17)         Alcoholism, n (%)         22 (2.2)         26 (0.99)           Mariad status, n (%)         Yes         S5 (2.22)         26 (0.99)           Mising dividy with patther         1588 (68.36)         1408 (0.59)         No         1688 (76.18)         1884 (76.47)           Widdowed/dowcd/separated         387 (19.46)         469 (15.98)         Sleep duration, n (%)         990 (93.13)         990 (93.13)         990 (93.13)         990 (93.13)         990 (93.13)         990 (93.13)         990 (93.13)         990 (93.13)         990 (93.13)         990 (93.13)         990 (93.13)         990 (93.13)         990 (93.13)         990 (93.13)         99	Other race-including multiracial	111 (6.55)	118 (6.19)	Physical activity, n (%)		
Yes         87 (2 6.1 8)         1067 (7.2. 0)         MET scores >600         151 (7.2. 0)         1309 (5.5 8)           No         1404 (61.40)         1458 (08.02)         Missing (%)         5 (0.1 8)         4 (0.2 1)           Relused/don't know         62 (2.4 3)         52 (1.5 9)         Cigarettes smokers         1211 (45.70)         941 (38.01 8)           Yes         2012 (86.5 4)         2139 (84.2 3)         Missing (%)         6 (0.1 4)         6 (0.1 9)           Refused/don't know         2012 (86.5 4)         2139 (84.2 3)         Missing (%)         5 (0.1 8)         5 (0.2 9)           Marial status, (%)         Yes         5 (2.2 1)         8 (69.3 6)         1408 (60.5 9)         No         1688 (76.1 8)         1884 (76.47)           Widowed/divorced/sparated         368 (12.1 8)         759 (23.2 9)         Missing         600 (21.6 0)         172 (87.7 2)         1479 (61.8 3)           Refused/don't know         0 (0.0 0)         1 (0.1 3)         Short sleep duration         1960 (33.1 3)         980 (44.3 2)           Neer marial         111 (6.6 0)         325 (6.2 2)         Long sleep duration         1960 (31.3 1)         980 (44.3 2)           Leustain intigrade         371 (26.2 3)         557 (23.9 1)         742 (50.0 1)         Foreanal sleep duration	Family history–DM, n (%)			MET scores <600	777 (27.33)	1264 (43.94)
No         1404 (61.40)         1458 (62.2)         Missing (%)         5 (0.18)         4 (0.21)           Refusedidon't know         62 (2.43)         52 (1.93)         Cigarettes smoking, n (%)         1211 (48.70)         941 (88.01)           Yes         265 (10.85)         371 (13.60)         Mon-regular smokers         1126 (51.16)         1630 (61.80)           No         2012 (86.54)         2139 (84.23)         Missing (%)         6 (0.14)         6 (0.19)           Maried/living with patter         1588 (68.36)         1408 (60.59)         No         1688 (76.18)         1884 (76.47)           Widowed/dovcedseparated         366 (12.18)         759 (23.29)         Missing         600 (21.60)         60 (21.50)           Refused/dovcedseparated         368 (12.18)         759 (23.29)         Missing         600 (21.60)         602 (23.52)           Refused/dovcedseparated         369 (12.18)         759 (23.29)         Missing         960 (93.13)         990 (24.32)           Refused/dovcedseparate         379 (12.62)         11 (10.13)         Short sleep duration         960 (93.13)         990 (24.32)           Refused/dovcedseparate         371 (13.60)         270 (23.9)         Missing         0.00.00         10.03)           Partityrade         371 (16.67)	Yes	877 (36.18)	1067 (37.20)	MET scores >600	1561 (72.50)	1309 (55.86)
Refused/don't know         62 (2.43)         52 (1.98)         Cigarettes snoking, n (%)         941 (48.70)         941 (48.70)           Family history-heart attack/angina, n (%)         265 (10.85)         371 (13.00)         Non-regular snokers         1211 (48.70)         941 (61.01)           No         2012 (86.54)         2139 (84.23)         Missing (%)         6 (0.14)         6 (0.19)           Refusedidon't know         66 (2.55)         1408 (60.59)         No         1688 (76.18)         1884 (76.47)           Mindinal status, n (%)         Type (79.72)         26 (0.99)         No         1688 (76.18)         1884 (76.47)           Neerr maried         368 (12.18)         759 (22.29)         Missing         50 (22.2)         26 (0.29)           Refusedidon't know         0 (0.00)         1 (0.13)         Short sleep duration         1205 (67.2)         1479 (61.85)           Refusedidon't know         0 (0.00)         1 (0.13)         Short sleep duration         1200 (75.89)         11 (8.31)           9-11thgrade         371 (5.60)         255 (6.22)         Long sleep duration         1209 (40.01)         10.02           164 shoton grad/GED or equivalent         56 (28.72)         555 (28.00)         Not breast fied any child         1009 (40.60)           2016 graduator above	No	1404 (61.40)	1458 (60.82)	Missing (%)	5 (0.18)	4 (0.21)
Family Intory-heart attack/angina, n (%)         Ver         Regular smokers         1211 (48.70)         941 (38.01)           Yes         265 (10.85)         371 (13.60)         Non-regular smokers         1126 (51.6)         1630 (61.80)           No         2012 (86.54)         2139 (84.23)         Missing (%)         5 (0.22)         26 (0.99)           Marited Vinow         66 (2.60)         67 (2.17)         Alcoholism, n (%)         55 (2.22)         26 (0.99)           Marited Vinow         66 (2.60)         67 (2.17)         Missing         600 (21.60)         667 (22.55)           Marited Vinow         036 (0.59)         No         1688 (76.18)         1884 (76.47)           Widoweddivored/separated         386 (12.18)         759 (23.29)         Missing         600 (21.60)         667 (22.55)           Never married         387 (19.46)         10 (0.13)         Short sleep duration         1960 (34.32)           Education level, n (%)          Vinosing         0.00.01         1173 (31.01)           Jess than ninth grade         311 (6.66)         325 (62.2)         Long sleep duration         1960 (40.60)           Jorne college or AA degree         571 (28.07)         742 (30.00)         Not breast fed any child         1039 (40.60)           College grad	Refused/don't know	62 (2.43)	52 (1.98)	Cigarettes smoking, n (%)		
Yes         265 (10.8)         371 (13.00)         Non-regular smokers         1126 (51.16)         1630 (61.80)           No         2012 (66.5)         2139 (84.2)         Missing (%)         6 (0.14)         6 (0.14)           Refused/don't know         66 (2.50)         67 (2.17)         Alcoholism, n(%)         55 (2.22)         26 (0.99)           Maried/Ming with partner         1588 (63.3)         1408 (05.9)         No         1688 (76.18)         1888 (76.47)           Widowed/divored/separated         386 (12.18)         759 (23.29)         Missing         000 (21.60)         667 (22.57)           Retused/don't know         386 (12.18)         759 (23.29)         Missing         960 (39.13)         980 (34.21)           Least shan ninth grade         311 (6.66)         325 (6.22)         Long sleep duration         107 (2.95)         117 (3.81)           9-11 thygrade         379 (12.62)         411 (12.7)         Missing (%)         0 (0.00)         1479 (61.82)           Some college or AA degree         571 (28.07)         742 (30.00)         Breast fed any child         190 (40.60)           College graduate or above         505 (28.22)         587 (23.41)         Post partner         352 (13.7)           Refused/don't know         1691 (71.6)         1994 (83.01)	Family history-heart attack/angina, n (%)			Regular smokers	1211 (48.70)	941 (38.01)
No         2012 (86.54)         2139 (84.23)         Missing %b)         6 (0.19)           Refused/don't know         66 (2.60)         67 (27)         Alcoholism, n (%)           Marital situs, n (%)         Yes         55 (2.22)         26 (0.99)           Marited/filing with partner         1588 (88.36)         1408 (60.59)         No         1688 (76.18)         1884 (76.47)           Widowed/divorced/sparated         368 (12.18)         759 (23.29)         Missing         600 (39.13)         980 (34.32)           Never marited         387 (19.46)         409 (15.98)         Sleep duration         107 (2.57)         1479 (61.85)           Less than ninth grade         311 (6.66)         325 (6.22)         Long sleep duration         107 (2.57)         1479 (61.85)           Jess than ninth grade         311 (6.66)         325 (6.22)         Long sleep duration         107 (2.57)         1479 (61.85)           Jess than ninth grade         311 (6.67)         557 (23.00)         Breast fed any child         1090 (40.60)           College graduate or above         505 (28.72)         556 (28.00)         Not resets fed any child         322 (16.07)           Som college or AA degree         571 (28.07)         742 (30.00)         Breast fed any child         322 (16.07)           Som college	Yes	265 (10.85)	371 (13.60)	Non-regular smokers	1126 (51.16)	1630 (61.80)
Refused/on't know         66 (2.60)         67 (2.17)         Alcoholism, n (%)           Marital status, n (%)         Yes         55 (2.21)         0 26 (0.97)           Marital status, n (%)         1080 (6.52)         No         1688 (7.61)         1884 (7.62)           Marital status, n (%)         368 (12.18)         1759 (23.29)         Missing         600 (21.60)         667 (22.55)           Never marited         387 (19.40)         409 (15.98)         Sileep duration, n (%)         780 (33.12)         980 (34.12)         980 (34.12)         1479 (61.83)           Refused/fork how         0 (0.00)         1 (16.66)         325 (62.20)         Long sleep duration         107 (2.95)         117 (3.81)           9-11 thgrade         379 (12.62)         547 (23.40)         Postpartum breast feeding, n (%)         100.02         10.03)           Refused/don't know         10.02         7 (0.10)         Never pregnant         322 (16.01)         1812 (29.60)           Refused/don't know         10.02         7 (0.10)         Never pregnant         322 (16.70)         1812 (29.60)           Refused/don't know         10.02         7 (0.10)         Never pregnant         322 (16.70)         222 (16.70)         232 (16.70)         232 (16.70)         232 (16.70)         232 (16.70)         2	No	2012 (86.54)	2139 (84.23)	Missing (%)	6 (0.14)	6 (0.19)
Marial status, n (%)         Yes         55 (2.22)         26 (0.99)           Maried/living with partner         158 (68.36)         1408 (60.59)         No         1688 (76.18)         1848 (76.47)           Widowed/divored/separated         368 (12.18)         759 (23.29)         Missing         600 (21.60)         667 (22.55)           Never married         387 (19.46)         409 (15.98)         Sleep duration, n (%)         600 (39.13)         980 (34.32)           Education level, n (%)         Normal sleep duration         107 (25.55)         117 (3.81)           9-11 thgrade         379 (12.62)         411 (12.27)         Missing         0 (0.00)         1 (0.03)           Fight school grad/GED or equivalent         570 (23.92)         587 (23.41)         Postpartum breast feeding, n (%)         1190 (40.60)           College graduate or above         505 (28.72)         505 (28.00)         Not breast fed any child         1812 (29.60)           Refused/don't know         1 (0.02)         7 (0.10)         Never pregnant         322 (16.07)           Family poverly income ratio*         169 (77.16)         1994 (83.01)         Never pregnant         322 (16.07)           Refused/don't know         1 (0.02)         7 (2.10)         Age at last live birth within surance         322 (16.07)	Refused/don't know	66 (2.60)	67 (2.17)	Alcoholism, n (%)		
Married/living with partner         1588 (68.36)         1408 (60.59)         No         1688 (76.18)         1884 (76.47)           Widowed/divorced/separated         368 (12.18)         759 (23.29)         Missing         060 (21.6)         067 (22.57)           Never married         387 (19.40)         409 (15.98)         Sileep duration (%)         960 (39.13)         980 (34.32)           Education level, n (%)         Normal sleep duration         190 (30.51)         1479 (61.82)           1 Less than ninth grade         311 (6.6)         325 (6.22)         Long sleep duration (%)         110.31           9-11 thyrade         379 (12.62)         411 (12.27)         Missing         0 (0.00)         1 (0.32)           9-11 thyrade         379 (12.62)         587 (23.41)         Postpartum breast feed any child         190 (40.60)           Gollege graduate or above         506 (23.2)         562 (28.00)         Not breast fed any child         122 (15.01)           Refused/dn't know         1.020         7 (0.10)         Never pregnant         522 (16.70)           Refused/dn't know         1.021         7.01 (0.91)         Never pregnant         522 (16.70)           Refused/dn't know         1.021         1.009         Age at last live birth within 305 (3.27)         592 (36.75)	Marital status, n (%)			Yes	55 (2.22)	26 (0.99)
Widoweddivorced/separated         368 (12.18)         759 (23.29)         Missing         600 (21.60)         667 (22.55)           Never married         387 (19.46)         409 (15.98)         Sleep duration (%)         sleep duration (%)           Refused/on't know         0 (0.00)         1 (0.13)         Short sleep duration         1276 (57.92)         1479 (61.85)           Less than ninth grade         311 (6.66)         325 (6.22)         Long sleep duration         107 (2.95)         117 (3.81)           9 -11 thgrade         379 (12.62)         587 (23.41)         Postpartum breast feeding, n (%)         1090 (40.60)           Some college or AA degree         571 (28.07)         742 (30.00)         Breast fed any child         1090 (40.60)           College graduate or above         505 (28.72)         550 (28.00)         Not breast fed any child         322 (16.07)           Refused/don't know         1 (0.02)         7 (0.10)         Never pregnant         322 (16.07)           Refused/don't know         1 (91 (77.16)         1994 (83.01)         Never pregnant         322 (16.07)           Ade covered by health insurance         1691 (77.16)         1994 (83.01)         Never pregnant         90 (2.61)           Secored by health insurance         1691 (77.16)         1994 (83.01)         Never pregnant	Married/living with partner	1588 (68.36)	1408 (60.59)	No	1688 (76.18)	1884 (76.47)
Never married         387 (19.46)         409 (15.98)         Sleep duration, n (%)           Refucation level, n (%)         0 (0.00)         1 (0.12)         Short sleep duration         960 (39.13)         980 (34.32)           Education level, n (%)         Normal sleep duration         1276 (57.92)         1479 (16.33)           Less than ninth grade         379 (12.62)         411 (12.27)         Missing         0 (0.00)         1 (0.33)           9-11 thgrade         379 (12.62)         411 (12.27)         Missing         0 (0.00)         1 (0.03)           9-11 thgrade         576 (23.92)         555 (28.01)         Postpartum freast feeding, n (%)         1090 (40.60)           College graduate or above         505 (28.72)         505 (28.00)         Not breast fed any child         1090 (40.60)           Refused/don't know         1 (0.02)         7 (0.10)         Never pregnant         322 (16.07)           Family poverly income ratio*         1 50.12 (0.5)         20 (0.00)         Missing         333 (13.7)           Post elabth insurance         647 (22.72)         582 (16.90)         Age at last live birth within ado s         952 (36.7)?           Refused/don't know         5 (0.12)         1 (0.09)         Age at last live birth within ado s         952 (36.7)?           No         19	Widowed/divorced/separated	368 (12.18)	759 (23.29)	Missing	600 (21.60)	667 (22.55)
Refused/don't know         0 (0.00)         1 (0.13)         Short sleep duration         960 (39.13)         980 (34.32)           Education level, n (%)         Normal sleep duration         1276 (57.92)         1479 (61.85)           Less than ninth grade         311 (6.66)         325 (6.22)         Long sleep duration         107 (2.95)         117 (3.81)           9-11 thgrade         379 (12.62)         411 (12.27)         Missing         0 (0.00)         1 (0.3)           High school grad/GED or equivalent         576 (23.92)         587 (23.41)         Postpartum breast feeding, n (%)         1 (0.00)           College graduate or above         505 (28.72)         505 (28.00)         Not breast fed any child         1 (29.60)           Refused/don't know         1 (0.02)         7 (0.10)         Never pregnant         3 22 (16.07)           Family poverty income ratio*         3.12 (0.05)         2.90 (0.60)         Missing         323 (13.67)           Refused/don't know         1 691 (77.16)         1994 (83.01)         Never pregnant         322 (16.07)           Not covered by health insurance         1691 (77.16)         1994 (83.01)         Age at last live birth within         92 (23.67)           Refused/don't know         5 (0.12)         120.5         Age at last live birth within         92 (2.61)	Never married	387 (19.46)	409 (15.98)	Sleep duration, n (%)		
Education level, n (%)         Normal sleep duration         1276 (57.92)         1479 (61.83)           Less than ninth grade         317 (6.66)         325 (6.22)         Long sleep duration         107 (2.95)         117 (3.17)           9-11 thgrade         379 (12.62)         437 (23.47)         Missing         0.0.00         10.03           High school grad/GED or equivalent         576 (23.27)         742 (30.00)         Breast fed any child         1090 (40.61)           College graduate or above         505 (28.72)         505 (28.00)         Note breast fed any child         122 (26.60)           Refused/don't know         10.02         7 (0.10)         Never pregnant         322 (16.07)           Family poverty income ratio         3.12 (0.05)         2.90 (0.60         Missing         322 (16.07)           Refused/don't know         1691 (77.16)         1994 (83.01)         Never pregnant         322 (16.07)           Not covered by health insurance         647 (22.7)         582 (16.90)         Age at last live birth within         322 (16.07)           No covered by health insurance         114 (3.42)         172 (4.81)         Missing         482 (18.31)           No         198 (88.22)         2.126 (85.45)         Dietary factors         482 (18.31)           Yes         114 (3.42) <td>Refused/don't know</td> <td>0 (0.00)</td> <td>1 (0.13)</td> <td>Short sleep duration</td> <td>960 (39.13)</td> <td>980 (34.32)</td>	Refused/don't know	0 (0.00)	1 (0.13)	Short sleep duration	960 (39.13)	980 (34.32)
Less than ninth grade         311 (6.66)         325 (6.22)         Long sleep duration         107 (2.95)         117 (3.81)           9-11 thgrade         379 (12.62)         411 (12.27)         Missing         0 (0.00)         1 (0.03)           High school grad/GED or equivalent         576 (23.92)         587 (23.41)         Postpartum breast feeding, n (%)         1090 (40.60)           Some college or AA degree         551 (28.72)         742 (30.00)         Breast fed any child         1090 (40.60)           College graduate or above         505 (28.72)         505 (28.00)         Not breast fed any child         812 (29.60)           Refused/don't know         1 (0.02)         7 (0.10)         Never pregnant         322 (16.07)           Family poverty income ratio*         3.12 (0.05)         2.90 (0.06)         Missing         322 (16.07)           Covered by health insurance         1691 (77.16)         1994 (8.01)         Never pregnant         322 (16.07)           Refused/don't know         5 (0.12)         1 (0.09)         Age at last live birth within surance         322 (16.07)           Refused/don't know         5 (0.12)         1 (0.09)         Age at last live birth within surance         90 (2.61)           Yes         114 (3.42)         172 (4.81)         Missing         482 (18.10)      <	Education level, n (%)			Normal sleep duration	1276 (57.92)	1479 (61.85)
9-11thgrade       379 (12.62)       411 (12.27)       Missing       0 (0.00)       1 (0.03)         High school grad/GED or equivalent       576 (23.92)       587 (23.41)       Postpartum breast feding, n (%)       U         Some college or AA degree       571 (28.07)       742 (30.00)       Breast fed any child       1002       812 (29.60)         College graduate or above       505 (28.27)       505 (28.00)       Not breast fed any child       322 (16.07)         Family poverty income ratio*       3.12 (0.05)       2.90 (0.06)       Missing       323 (13.74)         Health insurance       1691 (77.16)       1994 (83.01)       Never pregnant       322 (16.07)         Not covered by health insurance       647 (22.72)       582 (16.90)       Age at last live birth within surance       322 (16.07)         Refused/don't know       5 (0.12)       1 (0.09)       Age at last live birth within surance       90 (2.61)         No       114 (3.42)       172 (4.81)       Missing       482 (18.31)         No       1998 (88.22)       2216 (85.45) <i>Dietary factors</i> 90 (2.61)         No       1998 (88.22)       2126 (85.45) <i>Dietary factors</i> 90 (2.61)         No       1998 (88.22)       2126 (85.45) <i>Dietary factors</i> 90 (2.61)     <	Less than ninth grade	311 (6.66)	325 (6.22)	Long sleep duration	107 (2.95)	117 (3.81)
High school grad/GED or equivalent         576 (23.92)         587 (23.41)         Postpartum breast feeding, n (%)           Some college or AA degree         571 (28.07)         742 (30.00)         Breast fed any child         1090 (40.60)           College graduate or above         505 (28.72)         505 (28.00)         Not breast fed any child         812 (29.60)           Refused/don't know         1 (0.02)         7 (0.10)         Never pregnant         322 (16.07)           Barliy poverty income ratio*         3.12 (0.05)         2.90 (0.06)         Missing         332 (10.7)           Health insurance         1691 (77.16)         1994 (83.01)         Never pregnant         322 (16.07)           Not covered by health insurance         647 (22.72)         582 (16.90)         Age at last live birth within         952 (36.75)           Refused/don't know         5 (0.12)         1 (0.09)         Age at last live birth within         90 (2.61)           No         1998 (88.22)         2126 (85.45)         Dietary factors         90 (2.61)           No         1998 (88.22)         2126 (85.45)         Dietary factors         10.00)           No         1998 (88.22)         2126 (85.45)         Dietary factors         10.61 (1.61)         562 (16.90)           Yes         3131 (13.51)         594 (20	9~11thgrade	379 (12.62)	411 (12.27)	Missing	0 (0.00)	1 (0.03)
Some college or AA degree       571 (28.07)       742 (30.00)       Breast fed any child       1090 (40.60)         College graduate or above       505 (28.72)       505 (28.00)       Not breast fed any child       812 (29.60)         Refused/don't know       1 (0.02)       7 (0.10)       Never pregnant       322 (16.07)         Family poverty income ratio*       3.12 (0.05)       2.90 (0.06)       Missing       353 (1.37)         Health insurance       1691 (77.16)       1994 (83.01)       Never pregnant       322 (16.07)         Covered by health insurance       1691 (77.16)       1994 (83.01)       Never pregnant       322 (16.07)         Not covered by health insurance       647 (22.72)       582 (16.90)       Age at last live birth within 300 (50.25)       731 (26.27)         Refused/don't know       5 (0.12)       1 (0.09)       Age at last live birth more than 40 s       90 (2.61)         No       1998 (82.22)       212 (68.54)       Dietary factors       482 (18.31)         No       1998 (88.22)       212 (65.45)       Serum 25-hydroxyvitamin       450 (14.16)       562 (16.96)         No       1998 (88.22)       212 (65.45)       Serum 25-hydroxyvitamin       1712 (77.78)       1816 (75.51)         Persosion, n (%)       331 (13.51)       594 (20.75)       M	High school grad/GED or equivalent	576 (23.92)	587 (23.41)	Postpartum breast feeding, n (%)		
College graduate or above       505 (28.72)       505 (28.00)       Not breast fed any child       812 (29.60)         Refused/don't know       1 (0.02)       7 (0.10)       Never pregnant       322 (16.07)         Family poverty income ratio*       3.12 (0.05)       2.90 (0.06)       Missing       323 (13.74)         Health insurance status, n (%)       Last childbearing age, n (%)       322 (16.07)         Covered by health insurance       1691 (77.16)       1994 (83.01)       Never pregnant       322 (16.07)         Not covered by health insurance       647 (22.72)       582 (16.90)       Age at last live birth within 20's       592 (36.75)         Refused/don't know       5 (0.12)       1 (0.09)       Age at last live birth within 20's       990 (2.61)         Refused/don't know       5 (0.12)       1 (0.09)       Age at last live birth more than 40's       90 (2.61)         No       114 (3.42)       172 (4.81)       Missing       482 (18.31)         No       1998 (88.22)       2126 (85.45)       Dietary factors       482 (16.96)         No       1998 (88.22)       2126 (85.45)       Serum 25-hydroxyvitamin       1712 (77.80)       1816 (75.51)         Depression, n (%)       Serum 25-hydroxyvitamin       1712 (77.81)       1816 (75.51)       246 (27.77) <td< td=""><td>Some college or AA degree</td><td>571 (28.07)</td><td>742 (30.00)</td><td>Breast fed any child</td><td></td><td>1090 (40.60)</td></td<>	Some college or AA degree	571 (28.07)	742 (30.00)	Breast fed any child		1090 (40.60)
Refused/don't know         1 (0.02)         7 (0.10)         Never pregnant         322 (16.07)           Family poverty income ratio*         3.12 (0.05)         2.90 (0.06)         Missing         353 (13.74)           Health insurance status, n (%)         Last childbearing age, n (%)         Last childbearing age, n (%)         322 (16.07)           Covered by health insurance         1691 (77.16)         1994 (83.01)         Never pregnant         322 (16.07)           Not covered by health insurance         647 (22.72)         582 (16.90)         Age at last live birth within 2005 (26.75)         522 (36.75)           Refused/don't know         5 (0.12)         1 (0.09)         Age at last live birth within 2005 (26.75)         731 (26.27)           Yes         114 (3.42)         172 (4.81)         Missing         90 (2.61)           No         1998 (88.22)         2126 (85.45)         Dietary factors         482 (18.31)           No         1998 (88.22)         2126 (85.45)         Dietary factors         181 (6.75)           No         1998 (88.22)         2126 (85.45)         Serum 25-hydroxyvitamin 2005 (14.16)         562 (16.96)           Peression, n (%)         131 (15.10)         594 (20.75)         Missing         181 (8.05)         199 (75.3)           No         187 (81.10)         17	College graduate or above	505 (28.72)	505 (28.00)	Not breast fed any child		812 (29.60)
Family poverty income ratio*         3.12 (0.05)         2.90 (0.06)         Missing         353 (13.74)           Health insurance status, n (%)         Last childbearing age, n (%)         Isst childbearing age, n (%)         322 (16.07)           Not covered by health insurance         1691 (77.16)         1994 (83.01)         Never pregnant         322 (16.07)           Not covered by health insurance         647 (22.72)         582 (16.00)         Age at last live birth within 205 (205 (205 (205 (205 (205 (205 (205	Refused/don't know	1 (0.02)	7 (0.10)	Never pregnant		322 (16.07)
Health insurance status, n (%)       Last childbearing age, n (%)         Covered by health insurance       1691 (77.16)       1994 (83.01)       Never pregnant       322 (16.07)         Not covered by health insurance       647 (22.72)       582 (16.90)       Age at last live birth within 205       952 (36.75)         Refused/don't know       5 (0.12)       1 (0.09)       Age at last live birth within 300 so       731 (26.27)         Refused/don't know       5 (0.12)       172 (4.81)       Missing       90 (2.61)         Never pregnant	Family poverty income ratio*	3.12 (0.05)	2.90 (0.06)	Missing		353 (13.74)
Covered by health insurance         1691 (77.16)         1994 (83.01)         Never pregnant         322 (16.07)           Not covered by health insurance         647 (22.72)         582 (16.90)         Age at last live birth within 20s         952 (36.75)           Refused/don't know         5 (0.12)         1 (0.09)         Age at last live birth within 30 s         731 (26.27)           Rheumatoid arthritis, n (%)	Health insurance status, n (%)			Last childbearing age, n (%)		
Not covered by health insurance         647 (22.72)         582 (16.90)         Age at last live birth within $20  \text{s}$ 952 (36.75) $20  \text{s}$ Refused/don't know         5 (0.12)         1 (0.09)         Age at last live birth within $30  \text{s}$ 731 (26.27) $30  \text{s}$ Rheumatoid arthritis, n (%)         http://doi.org/social         http://doi.org/social         90 (2.61) $30  \text{s}$ Yes         114 (3.42)         172 (4.81)         Missing         482 (18.31)           No         1998 (88.22)         2126 (85.45)         Dietary factors         482 (16.90) $2.40  \text{c}^{-1}$ No         1998 (88.22)         2126 (85.45)         Serum 25-hydroxyvitamin $2.40  (14.16)$ 562 (16.90) $2.40  \text{c}^{-1}$ No         1998 (88.22)         2126 (85.45)         Serum 25-hydroxyvitamin $2.40  (14.16)$ 562 (16.90) $2.40  \text{c}^{-1}$ Pepression, n (%)         131 (3.51)         594 (20.75)         Missing         181 (8.05)         199 (7.53)           No         1878 (81.10)         1745 (70.77)         Total daily calorie consumption, n ( $3.20  (14.16)  (1$	Covered by health insurance	1691 (77.16)	1994 (83.01)	Never pregnant		322 (16.07)
Refused/don't know         5 (0.12)         1 (0.09)         Age at last live birth within 30 s         731 (26.27) 30 s           Rheumatoid arthritis, n (%)         Age at last live birth more than 40 s         90 (2.61) than 40 s         90 (2.61)           Yes         114 (3.42)         172 (4.81)         Missing         482 (18.31)           No         1998 (88.22)         2126 (85.45)         Dietary factors         114 (3.42)           No         1998 (88.22)         2126 (85.45)         Dietary factors         114 (3.42)           No         1998 (88.22)         2126 (85.45)         Serum 25-hydroxyvitamin D <40	Not covered by health insurance	647 (22.72)	582 (16.90)	Age at last live birth within 20 s		952 (36.75)
Rheumatoid arthritis, n (%)       Age at last live birth more than 40 s       90 (2.61)         Yes       114 (3.42)       172 (4.81)       Missing       482 (18.31)         No       1998 (88.22)       2126 (85.45)       Dietary factors       50 (2.61)         Missing       231 (8.35)       279 (9.73)       Vitamin D insufficiency, n (%)       562 (16.96)         No       1998 (88.22)       2126 (85.45)       Serum 25-hydroxyvitamin box 450 (14.16)       562 (16.96)         No       1998 (88.22)       2126 (85.45)       Serum 25-hydroxyvitamin box 450 (14.16)       562 (16.96)         Depression, n (%)       Image: Serum 25-hydroxyvitamin box 450 (14.16)       562 (16.96)       576 (21.96)         Yes       331 (13.51)       594 (20.75)       Missing       181 (8.05)       199 (7.53)         No       1878 (81.10)       1745 (70.77)       Total daily calorie consumption, n (%)       199 (7.53)         Missing       134 (5.39)       238 (8.48)       Higher total calorie intake       577 (29.11)       515 (21.96)         Asthma, n (%)       Image: Serum 25-hydroxy 10 (16.00)       Image: Serum 25-hydrox 10 (16.00)       130 (38.27)       1325 (48.66)         Yes       131 (5.70)       246 (9.56)       Lower total calorie intake       1030 (38.27)       1325 (48.66)	Refused/don't know	5 (0.12)	1 (0.09)	Age at last live birth within 30 s		731 (26.27)
Yes         114 (3.42)         172 (4.81)         Missing         482 (18.31)           No         1998 (88.22)         2126 (85.45)         Dietary factors         Image: Constraint of the second	Rheumatoid arthritis, n (%)			Age at last live birth more than 40 s		90 (2.61)
No         1998 (88.22)         2126 (85.45)         Dietary factors           Missing         231 (8.35)         279 (9.73)         Vitamin D insufficiency, n (%)           No         1998 (88.22)         2126 (85.45)         Serum 25-hydroxyvitamin D <40	Yes	114 (3.42)	172 (4.81)	Missing		482 (18.31)
Missing         231 (8.35)         279 (9.73)         Vitamin D insufficiency, n (%)           No         1998 (88.22)         2126 (85.45)         Serum 25-hydroxyvitamin D <40	No	1998 (88.22)	2126 (85.45)	Dietary factors		
No         1998 (88.22)         2126 (85.45)         Serum 25-hydroxyvitamin D <40         450 (14.16)         562 (16.96)           Depression, n (%)         Serum 25-hydroxyvitamin D >40         1712 (77.78)         1816 (75.51)           Yes         331 (13.51)         594 (20.75)         Missing         181 (8.05)         199 (7.53)           No         1878 (81.10)         1745 (70.77)         Total daily calorie consumption, n (%)         V           Missing         134 (5.39)         238 (8.48)         Higher total calorie intake         577 (29.11)         515 (21.96)           Asthma, n (%)         Image: Serum 10 (100 (100 (100 (100 (100 (100 (100	Missing	231 (8.35)	279 (9.73)	Vitamin D insufficiency, n (%)		
Depression, n (%)         Serum 25-hydroxyvitamin D >40         1712 (77.78)         1816 (75.51)           Yes         331 (13.51)         594 (20.75)         Missing         181 (8.05)         199 (7.53)           No         1878 (81.10)         1745 (70.77)         Total daily calorie consumption, n (%)            Missing         134 (5.39)         238 (8.48)         Higher total calorie intake         577 (29.11)         515 (21.96)           Asthma, n (%)         Recommended total calorie         677 (29.92)         665 (26.66)         65 (26.66)           Yes         131 (5.70)         246 (9.56)         Lower total calorie intake         1030 (38.27)         1325 (48.66)	No	1998 (88.22)	2126 (85.45)	Serum 25-hydroxyvitamin D <40	450 (14.16)	562 (16.96)
Yes         331 (13.51)         594 (20.75)         Missing         181 (8.05)         199 (7.53)           No         1878 (81.10)         1745 (70.77)         Total daily calorie consumption, n (%)         Image: Constraint of the second c	Depression, n (%)			Serum 25-hydroxyvitamin D >40	1712 (77.78)	1816 (75.51)
No         1878 (81.10)         1745 (70.77)         Total daily calorie consumption, n (%)           Missing         134 (5.39)         238 (8.48)         Higher total calorie intake         577 (29.11)         515 (21.96)           Asthma, n (%)         Recommended total calorie intake         677 (29.92)         665 (26.66)           Yes         131 (5.70)         246 (9.56)         Lower total calorie intake         1030 (38.27)         1325 (48.66)	Yes	331 (13.51)	594 (20.75)	Missing	181 (8.05)	199 (7.53)
Missing         134 (5.39)         238 (8.48)         Higher total calorie intake         577 (29.11)         515 (21.96)           Asthma, n (%)         Recommended total calorie intake         677 (29.92)         665 (26.66)           Yes         131 (5.70)         246 (9.56)         Lower total calorie intake         1030 (38.27)         1325 (48.66)	No	1878 (81.10)	1745 (70.77)	Total daily calorie consumption, n	(%)	
Asthma, n (%)         Recommended total calorie intake         677 (29.92)         665 (26.66)           Yes         131 (5.70)         246 (9.56)         Lower total calorie intake         1030 (38.27)         1325 (48.66)	Missing	134 (5.39)	238 (8.48)	Higher total calorie intake	577 (29.11)	515 (21.96)
Yes         131 (5.70)         246 (9.56)         Lower total calorie intake         1030 (38.27)         1325 (48.66)	Asthma, n (%)			Recommended total calorie intake	677 (29.92)	665 (26.66)
	Yes	131 (5.70)	246 (9.56)	Lower total calorie intake	1030 (38.27)	1325 (48.66)

#### Table 1 Continued

	Males (n=2343)	Females (n=2577)		Males (n=2343)	Females (n=2577)
No	2201 (93.57)	2320 (89.97)	Missing	59 (2.70)	72 (2.72)
Missing	11 (0.73)	11 (0.47)	Total sugar daily consumption, n (	%)	
Osteoporosis, n (%)			Higher total sugar daily intake	1622 (70.91)	1905 (74.81)
Yes	34 (1.11)	275 (9.59)	Recommended total sugar daily intake	256 (10.74)	256 (9.96)
No	2307 (98.77)	2287 (89.79)	Lower total sugar daily intake	406 (15.65)	344 (12.51)
Missing	2 (0.12)	15 (0.61)	Missing	59 (2.70)	72 (2.72)

\*205 of males and 231 of females did not fill in family poverty income status.

AA, associate degrees; BMI, body mass index; DM, diabetes mellitus; GED, tests of general educational development; MET, metabolic equivalent of task; NHANES, National Health and Nutrition Examination Survey.

95% CI 3.30 to 6.89), and obesity (adjusted OR=17.77, 95% CI 10.88 to 29.03) were significantly associated with the likelihood of MetS in female patients (figure 2A). Moreover, elderly subjects (adjusted OR=1.09, 95% CI 1.06 to 1.11), having family history of heart attack or angina (adjusted OR=2.11, 95% CI 1.15 to 3.88), diagnosis of depression (adjusted OR=2.46, 95% CI 1.13 to 5.36), obesity (adjusted OR=2.56, 95% CI 1.18 to 5.54), having higher physical activity (adjusted OR=2.93, 95% CI 1.63 to 5.26), vitamin D insufficiency (adjusted OR=2.68, 95% CI 1.40 to 5.13), and low total calorie intake (adjusted OR=2.40, 95% CI 1.07 to 5.67) were likely to be more associated with the development of CVD in females after controlling for confounding factors (figure 2B).

In a subgroup analysis, women were grouped by their MET score (MET <600 vs MET ≥600), and the results are shown in table 2. For the risk factors associated with CVD, age, rheumatoid arthritis, BMI, postpartum breast feeding, last childbearing age and vitamin D insufficiency may change the OR value for physical activity in women (from less than 1 in the univariate analysis to more than 1 in the multivariate analysis). We further tried to determine if these variables were associated with physical activity. The results indicate that rheumatoid arthritis, obesity, breast feeding, pregnancy and vitamin D insufficiency can alter the OR of MET score. The risk of CVD in women with higher physical activity (MET ≥600) is minimal; however, in the presence of the above risk factors, higher physical activity may in turn increase the risk of CVD (table 2).

#### Comparison of risk factors for MetS and CVD

Participants who were obese had a greater risk of developing MetS than CVD when compared with those with normal weight, after controlling for confounding factors (16.22 (95% CI 10.71 to 24.56) vs 1.86 (95% CI 1.02 to 3.41) in males and 17.77 (95% CI 10.88 to 29.03) vs 2.56 (95% CI 1.18 to 5.54) in females). Results indicate that obesity is a greater risk factor for MetS than CVD in both females and males.

## DISCUSSION

In the present study, the prevalence and risk factors of MetS and CVD were evaluated using deidentified data extracted from the 2007–2010 NHANES database. Though not significantly different, the prevalence of MetS and CVD was slightly higher in males as compared with females (42.50% and 7.65% vs 41.29% and 4.13%, respectively). Our results indicate that advanced age, family history of DM, overweight, and obesity were significantly associated with the likelihood of MetS in both males and females, after controlling for all potential confounding factors. Additionally, men diagnosed with prostate cancer (adjusted OR=2.27, 95% CI 1.09 to 4.72) or who were regular smokers (adjusted OR=1.77, 95%CI 1.27 to 2.46) also had a high risk for MetS. However, advanced age, family history of heart attack or angina, health insurance coverage, diagnosis of rheumatoid arthritis or depression, obesity, and low calorie intake were identified as risk factors for CVD in males (figure 1). Apart from these, higher physical activity (adjusted OR=2.93, 95%CI 1.63 to 5.26) and vitamin D insufficiency (adjusted OR=2.68, 95%CI 1.40 to 5.13) were also linked to an increased risk of CVD in females (figure 2). The increase in the risk of CVD is especially harmful in women with MET  $\geq 600$  and having other risk factors, like age, incidence of rheumatoid arthritis, obesity, breastfeeding, pregnancy and Vitamin D insufficiency (table 2). Furthermore, obesity was a higher risk factor for MetS than CVD.

The present analysis reveals and provides strong evidence for risk factors that are were not previously linked to CVD. Of particular interest is the association of high physical activity with the development of CVD in females. Based on the WHO recommendations, a MET score up to 600 MET-min/week is considered as moderate intensity of physical activity. Our results indicate that intense physical activity, that is, MET  $\geq$  600, carried a higher risk of CVD in women, after adjusting all relevant factors (figure 2). This is somehow different from what we expected. The risk of CVD in women with higher physical activity (MET  $\geq$ 600) should be minimal as one would expect. However, our analvsis revealed that in younger women, who were less obese, never pregnant and did not breastfeed, having lower incidence of rheumatoid arthritis, and lower vitamin D insufficiency, a higher physical activity can increase the risk of CVD (table 2).

The inverse relationship between exercise and the risk of CVD has been well established in healthy adults and in those diagnosed with CVD.<sup>29-31</sup> Reports indicate that increased total physical activity was associated with reduced risk of coronary heart diseases in a dose-dependent manner,<sup>32</sup> and the risk is almost doubled in sedentary individuals compared with those performing high-intensity exercise. However,

Α				
Variables	Adjusted OR	95	% CI	Adjusted OR and 95%CI
Age	1.05	1.03	1.07	
Race (Mexican American vs. White)	0.83	0.54	1.29	
Race (Other Hispanic vs. White)	0.77	0.48	1.22	
Race (Black vs. White)	0.62	0.36	1.06	
Race (Others vs. White)	1.6	0.61	4.22	
Family history-DM (Yes vs. No)	1.39	1.02	1.89	
Family history- Heart attack / Angina (Yes vs. No)	1.31	0.73	2.36	
Marriage (Widowed/ Divorced/ Separated vs. Married)	1.22	0.72	2.06	
Marriage (Never married vs. Married)	1.09	0.57	2.09	
Education (9~11 <sup>th</sup> Grade vs. < 9th Grade)	1.12	0.64	1.97	
Education (High school Grad vs. < 9th Grade)	1.17	0.72	1.93	
Education (Some college vs. < 9th Grade)	0.88	0.58	1.35	
Education (College Graduate or above vs. < 9th Grade)	0.94	0.59	1.48	1 1 🕂 1 1
Health insurance (not covered vs. covered)	1.17	0.71	1.92	1 1 🏦 1 1
Rheumatoid arthritis (Yes vs. No)	1.72	0.86	3.42	
Prostate cancer (Yes vs. No)	2.27	1.09	4.72	
BMI (Underweight vs. Normal)	0.29	0.03	2.65	
BMI (Overweight vs. Normal)	3.65	2.37	5.62	
BMI (Obese vs. Normal)	16.22	10.71	24.56	
Physical activity (MET scores > 600 vs. <=600)	0.92	0.58	1.45	
Regular smokers (Yes vs. No)	1.77	1.27	2.46	
Sleep duration (Short vs. Normal)	1.37	0.96	1.94	
Sleep duration ( Long vs. Normal	1.03	0.49	2.15	
Calorie consumption (Higher vs. Recommended)	0.87	0.63	1.2	
Calorie consumption ( Lower vs. Recommended)	1.07	0.75	1.53	
				0.01 0.1 1 10 100

Variables	Adjusted OR	95%	6 CI
Age	1.09	1.08	1.11
Race (Mexican American vs. White)	1.21	0.54	2.7
Race (Other Hispanic vs. White)	0.96	0.5	1.83
Race (Black vs. White)	0.73	0.33	1.63
Race (Others vs. White)	1.98	0.66	5.92
Family history- Heart attack / Angina (Yes vs. No)	2.36	1.3	4.29
Marriage (Widowed/ Divorced/ Separated vs. Married)	1.26	0.79	2
Marriage ( Never married vs. Married)	1.68	0.53	5.27
Education (9~11 <sup>th</sup> Grade vs. < 9th Grade)	0.59	0.26	1.34
Education (High school Grad vs. < 9th Grade)	0.52	0.22	1.24
Education (Some college vs. < 9th Grade)	0.82	0.35	1.92
Education (College Graduate or above vs. < 9th Grade)	0.75	0.34	1.66
Health insurance (not covered vs. covered)	0.4	0.17	0.93
Rheumatoid arthritis (Yes vs. No)	2.45	1.32	4.55
Depression (Yes vs. No)	1.8	1.09	2.92
Osteoporosis (Yes vs. No)	1.51	0.44	5.16
Prostate cancer (Yes vs. No)	2.17	0.76	6.21
BMI (Overweight vs. Normal)	1.08	0.59	1.99
BMI (Obese vs. Normal)	1.86	1.02	3.41
Physical activity (MET scores > 600 vs. <=600)	0.91	0.56	1.48
Regular smokers (Yes vs. No)	1.4	0.96	2.04
Sleep duration (Short vs. Normal)	1.13	0.72	1.77
Sleep duration ( Long vs. Normal	1.02	0.45	2.33
Calorie consumption (Higher vs. Recommended)	0.73	0.36	1.47
Calorie consumption ( Lower vs. Recommended)	2.2	1.22	3.98

**Figure 1** The results of multivariate logistic regression model for the risk factors associated with (A) metabolic syndrome or (B) cardiovascular diseases in males. (A) Associated with metabolic syndrome: age, race, family history of DM and heart attack or angina, marital status, education level, health insurance status, rheumatoid arthritis, prostate cancer, BMI, physical activity, regular smokers, sleep duration, and daily calorie consumption were included in the multivariate logistic regression model. (B) Associated with cardiovascular diseases: age, race, family history of heart attack or angina, marital status, education level, health insurance status, rheumatoid arthritis, depression, osteoporosis, prostate cancer, BMI, physical activity, regular smoking, and sleep duration were included in the multivariate logistic regression model.

what is not clear is that the level of exercise and cardiovascular outcomes is always linear. While compelling evidence indicate that regular and moderate exercise is favorable in healthy subjects and those with CVD, recent data suggest that higher doses of physical and athletic activity are associated with adverse cardiovascular outcomes.<sup>33</sup> Intense and strenuous exercise may have adverse effects in individuals with underlying CV abnormalities<sup>34</sup> and on those with otherwise normal heart.<sup>35</sup> Our results confirm that indeed higher physical activity is associated with increased risk of CVD in women. However, why this association is not seen in men is unclear.

Α					
Variables	Adjusted OR	ed 95% CI			Adjusted OR and 95%CI
Age	1.08	1.06	11	Ĩ.	1 1 1
Race (Mexican American vs. White)	0.97	0.54	1.76		
Race (Other Hispanic vs. White)	1	0.54	1.84		
Race (Black vs. White)	0.79	0.49	1.29		
Race (Others vs. White)	1.34	0.56	3.19		
Family history-DM (Yes vs. No)	1.7	1.2	2.41		
Family history- Heart attack / Angina (Yes vs. No)	0.84	0.53	1.32		
Marriage (Widowed/ Divorced/ Separated vs. Married)	0.87	0.53	1.32		
Marriage (Never married vs. Married)	0.66	0.38	1.16		
Education (9~11 <sup>th</sup> Grade vs. < 9th Grade)	1.2	0.63	2.28		
Education (High school Grad vs. < 9th Grade)	1.22	0.58	2.6		
Education (Some college vs. < 9th Grade)	0.81	0.41	1.58		
Education (College Graduate or above vs. < 9th Grade)	0.55	0.25	1.24		
Family poverty income status	0.96	0.84	1.09		
Phaumataid arthritis (Vas us, Na)	0.78	0.34	1.14		
Depression (Vas us No)	1.32	0.42	2.00		
Asthma (Ves vs. No)	1.02	0.47	2.09		
Osteoporosis (Yes vs. No)	0.99	0.55	1.79		
BMI (Underweight vs. Normal)	0.33	0.05	2.34		
BMI (Overweight vs. Normal)	4.77	3.3	6.89		-
BMI (Obese vs. Normal)	17.77	10.88	29.03		
Physical activity (MET scores > 600 vs. <=600)	0.84	0.62	1.13		
Regular smokers (Yes vs. No)	1.07	0.79	1.44		*
Sleep duration (Short vs. Normal)	1.3	0.97	1.75		-
Sleep duration ( Long vs. Normal	0.8	0.32	1.95		
Postpartum breastfeeding (Not breastfed vs. Breastfed)	1.12	0.77	1.62		
Postpartum breastfeeding (Never pregnant vs. Breastfed)	1.24	0.79	1.96		
Last childbearing age (Within 30s vs. Within 20s)	0.95	0.66	1.35		
Last childbearing age (More than 40s vs. Within 20s)	1.26	0.8	1.99		
Vitamin D insufficiency (25[OH]D<40 vs. >=40)	1.13	0.75	1.7		- 1 같 ! !
Calorie consumption (Higher vs. Recommended)	1.17	0.78	1.77		「「「「「」」「」」
Calorie consumption ( Lower vs. Recommended)	1.36	0.92	2		
Sugar consumption (Higher vs. Recommended)	1.1	0.63	1.91		
Sugarconsumption ( Lower vs. Recommended)	0.99	0.42	2.34	0.01	
 B					
Variables		Adjusted	95%	6 CI	Adjusted OR and 95%CI
		OR			
Age		1.09	1.06	1.11	1 1 単二 1 1
Family history- Heart attack / Angina (Yes vs. N	o)	2.11	1.15	3.88	
Marriage (Widowed/ Divorced/ Separated vs. M	arried)	1.22	0.77	1.94	나는 나는 그렇게 나는 나는 것이 좋아.
Marriage (Never married vs. Married)		0.53	0.1	2.96	
Education $(9 \sim 11^{\text{th}} \text{Grade vs.} < 9 \text{th Grade})$		2.26	0.71	7.14	
Education (High school Grad vs. < 9th Grade)		2.9	0.9	9.35	
Education (Some college vs. < 9th Grade)		1.45	0.59	3.55	
Education (College Graduate or above vs. < 9th	Grade)	0.83	0.24	2.81	
Family poverty income status		0.9	0.72	1.13	
Health insurance (not covered vs. covered)		1.27	0.45	3.59	
Rheumatoid arthritis (Yes vs. No)		1.75	0.67	4.61	
Depression (Yes vs. No)		2.46	1.13	5.36	
Asthma (Yes vs. No)		1.27	0.5	3.26	
Osteoporosis (Yes vs. No)		1.5	0.73	3.09	
BMI (Overweight vs. Normal)		1.05	0.56	1.98	
BMI (Obese vs. Normal)		2.56	1.18	5.54	
Physical activity (MET scores > 600 vs. <=600)		2.93	1.63	5.26	
Sleep duration (Short vs. Normal)		1.19	0.61	2.31	
Sleep duration (Long vs. Normal		1.08	0.45	2.61	
Postpartum breastfeeding (Not breastfed vs. Brea	astfed)	0.77	0.36	1.66	
Postpartum breastfeeding (Never pregnant vs. Bi	eastfed)	0.49	0.17	1.46	
Last childbearing age (Within 30s vs. Within 20s	3)	0.54	0.23	1.25	
Last childbearing age (More than 40s vs. Within	20s)	0.39	0.05	3.12	
Vitamin D insufficiency (25[OH]D<40 vs. >=40	)	2.68	1.4	5.13	
Calorie consumption (Higher vs. Recommended	)	0.7	0.22	2.27	
Calorie consumption ( Lower vs. Recommended	)	2.4	1.07	5.67	

**Figure 2** The results of multivariate logistic regression model for the risk factors associated with metabolic syndrome or cardiovascular diseases in females. (A) Associated with metabolic syndrome: age, race, family history of DM and heart attack or angina, marital status, education level, family poverty income status, health insurance status, rheumatoid arthritis, depression, asthma, osteoporosis, BMI, physical activity, postpartum breastfeeding, last childbearing age, sleep duration, and daily calorie and sugar consumption were included in the multivariate logistic regression model. (B) Associated with cardiovascular disease: age, family history of heart attack or angina, marital status, education level, family poverty income status, health insurance status, rheumatoid arthritis, depression, asthma, osteoporosis, BMI, physical activity, sleep duration, postpartum breast feeding, last childbearing age, vitamin D insufficiency, and daily calorie consumption were included in the multivariate logistic regression model. BMI, body mass index.

Another interesting association that emerged from the cross-sectional analysis of NHANES data is the link between low total daily calorie consumption and higher prevalence of CVD, which was evident in subjects, irrespective of their gender. Lifestyle modifications, including dietary change, is the most advocated strategy for the prevention and management of MetS and CVD. A low-calorie, high-fiber diet is often recommended to reduce the risk of diabetes and CVD.<sup>36</sup> Caloric restriction is known to be a strong activator of protective metabolic pathways, thereby leading to lower blood pressure, improved blood lipids, and reduced inflammatory markers,<sup>37</sup> in addition

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results reveal that the hig
physical activity (MET ≥
certain risk factors, sugg
ging risk factors in the
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5 than in CVD, irrespectiv
risk factors of MetS and
titying patients who need
or intensive monitoring.
conclusion, the current re
ence for the association of
high physical activity in wo
breviously linked to MetS a
studies are necessary to val
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beting interests None declared.
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p < 0.001).<sup>44</sup> The strong association of depression with MetS and CVD directs our attention to the newly emerging

> risk factors, in addition to the traditional risk factors. Though the cross-sectional study design is a limitation, the present study has major clinical implications. The key findi activity in women and low caloi sociated with a high risk for CVI patient education strategies. Our ther risk of CVD associated 600) is seen only in women with esting the role of new and with development of CVD. Our eme ty is a major risk factor in resul e of gender. The analysis of Met key CVD will help physicians in aggressive lifestyle modificaiden tion

> sults provide cross-sectional In evid many emerging risk factors, like omen and low calorie intake, nd CVD. However, prospecnot p tive idate these findings.

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 Table 2
 The association between the risk factors associated
 with cardiovascular disease and physical activity in females, stratified by METS 600.

····,			
Variables	MET ≥600	MET <600	p Value
Age (years)	43.9 (0.55)	52.4 (0.53)	<0.001*
Rheumatoid arthritis, n (%)			0.022*
Yes	78 (4.3)	94 (6.8)	
No	1133 (95.7)	989 (93.2)	
BMI, n (%)			< 0.001*
Underweight	25 (2.5)	22 (1.8)	
Normal	430 (38.9)	293 (26.5)	
Overweight	409 (29.8)	365 (27.8)	
Obese	440 (28.8)	567 (43.9)	
Postpartum breast feeding,			<0.001*
n (%)			
Breast fed	568 (48.4)	521 (45.4)	
Not breast fed	348 (28.6)	462 (41.6)	
Never pregnant	201 (23.0)	120 (13.0)	
Last childbearing age, n (%)			< 0.001*
Never pregnant	201 (24.3)	120 (13.7)	
Within 20s	460 (41.6)	491 (49.2)	
Within 30s	354 (31.4)	375 (33.2)	
More than 40s	33 (2.7)	57 (3.9)	
Vitamin D insufficiency, n (%)			<0.001*
25(OH)D <40	244 (14.0)	317 (23.9)	
25(OH)D >40	986 (86.0)	827 (76.1)	

\*indicates a significant factor, p<0.05.

BMI, body mass index.

to reduction in oxidative damage.<sup>38</sup> Despite the reported positive effect of low calorie intake, our results indicate that low calorie intake was associated with a higher risk of CVD. However, a detailed analysis on the role of each dietary content was not undertaken in this study. In studies elsewhere, it has been shown that vitamin D deficiency in children may increase the risk of CVD.<sup>39</sup> Other reports suggest that associations between vitamin D and cardiometabolic risk among healthy, non-diabetic adults are largely mediated by adiposity.<sup>40</sup> Although a gender difference in MetS was not observed in our study, a report based on the 2012 Korean National Health and Nutrition Examination Survey (KNHANES) data indicate that serum 25 (OH)D levels were inversely associated with MetS in men, while it did not show any association with MetS in women.<sup>41</sup> Regardless, our report is in agreement with others, where regular physical activity along with a healthy eating profile and a better serum vitamin profile is shown to reduce the incidence of MetS and its risk components.<sup>42</sup>

Apart from the nutritional and exercise factors, the present data also highlight the role of psychological characteristics of subjects in the development of MetS and CVD. Remarkably, several recent reports have suggested that psychological characteristics, especially depression, hostility, and anger, may increase risk for the MetS.<sup>10 43</sup> Results from the 2007-2014 KNHANES reveal that MetS was more prevalent in women with a prior diagnosis of depression than those without diagnosed depression (26.20% vs 19.07%,

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