The association of heavy metal exposure with metabolic syndrome among US adults

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BACKGROUND:

- Metabolic syndrome is the clustering of:
  - ❖ abdominal obesity,
  - ❖ elevated blood pressure,
  - ❖ elevated blood glucose,
  - ❖ elevated triglyceride and
  - ❖ reduced high-density lipoprotein cholesterol.
- It is a harbinger of heart disease, kidney disease, stroke, dementia, and mortality.
- A third of US adults have metabolic syndrome.
- Higher prevalence in ethnic minorities
- Identifying the associated factors and etiological agents for metabolic syndrome is cardinal to reducing the threat it poses.
- Studies evaluating the association of heavy metals and metabolic syndrome have yielded inconsistent findings.
- We evaluated:

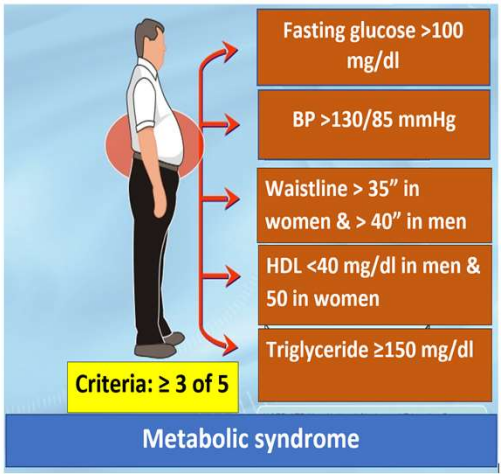
  1). the association of ethnicity/race with blood levels of mercury, cadmium, and lead; and

  2). the association of the blood levels of these metals with metabolic syndrome in a representative sample of US adults.

METHODS:

Study design and subjects

- Secondary data from the continuous US National Health and Nutrition Examination Survey (NHANES) cycles 1999-2018.
  - Included participants: age ≥ 20 years
  - Excluded pregnant women



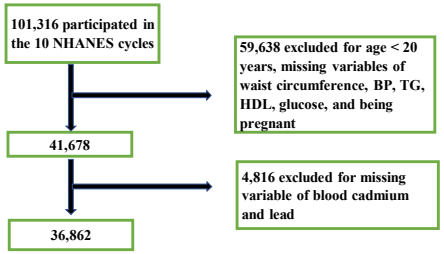


Figure 1. Flow chart of participants in the 1999/2000 to 2017/2018 continuous cycles of the National Health and Nutrition Examinations Survey studied

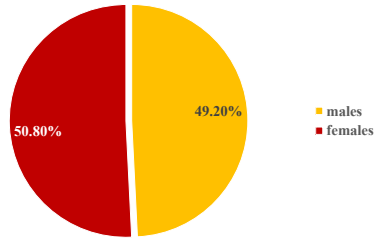


Figure 2. Distribution of sex among US adults in the National Health And Nutrition Examination Survey (NHANES) 1999-2018 cycles, (n = 36,862)

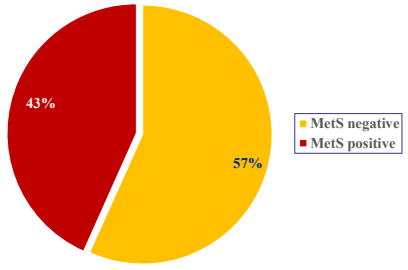


Figure 3. Prevalence of metabolic syndrome in US adults in the National Health And Nutrition Examination Survey (NHANES) 1999-2018 cycles, (n = 36,862)

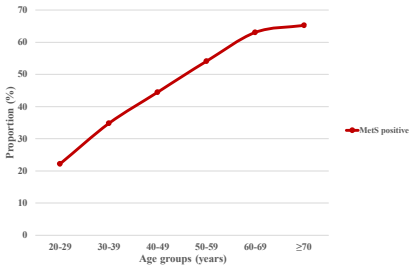


Figure 4. Prevalence of metabolic syndrome according to age group among US adults in the National Health And Nutrition Examination Survey (NHANES) 1999-2018 cycles, (n = 36,862)

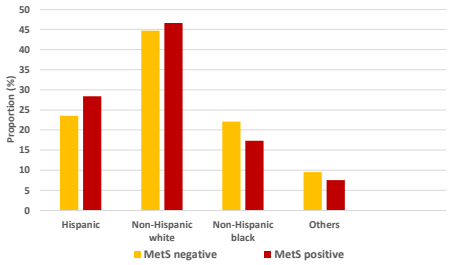


Figure 5. Distribution of race/ethnicity according to metabolic syndrome in US adults in the National Health And Nutrition Examination Survey (NHANES) 1999-2018 cycles, (n = 36,862)

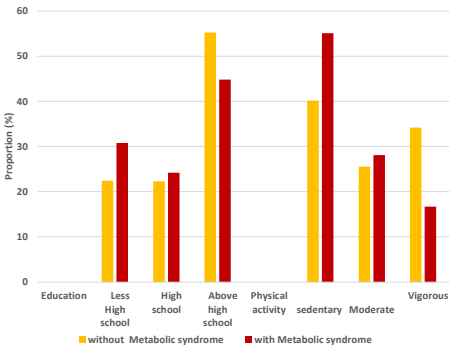


Figure 6. Distribution of educational attainment and physical activity according to metabolic syndrome in US adults in the National Health And Nutrition Examination Survey (NHANES) 1999-2018 cycles, (n = 36,862)

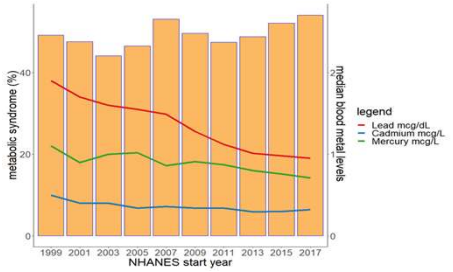


Figure 7. Trends in the prevalence of metabolic syndrome and median blood levels of mercury, cadmium, and lead in the National Health and Nutrition Examination Survey (NHANES) 1999-2018

- Ethnic minorities had higher odds of having high blood levels of mercury, lead, and cadmium

Table 1. Association of blood mercury, cadmium, and lead levels with metabolic syndrome in US adults in the National Health and Nutrition Examination Survey (NHANES) 1999-2018 (n=36,862)

	Quartile 1 (<0.45 µg/L)	Quartile 2 (0.45 - < 0.86 µg/L)	Quartile 3 (0.86 - < 1.73µg/dL)	Quartile 4 (≥ 1.73 µg/dl)
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Mercury	1 (Ref)	0.99 (0.91-1.09)	1.00 (0.92-1.09)	1.18 (1.08-1.30)
Cadmium	1 (Ref)	0.95 (0.88-1.03)	0.98 (0.90-1.08)	1.20 (1.09-1.33)
Lead	1 (Ref)	1.06 (0.98-1.15)	1.06 (0.97-1.15)	1.02 (0.93-1.12)
Model is age, sex, race, education and poverty-income ratio adjusted; Model 2 is age, sex, race, education, poverty-income ratio, smoking and physical activity adjusted				

CONCLUSIONS:

- Blood levels of mercury, cadmium, and lead are on the decline in the US
- Ethnic/racial inequity exists with heavy metal exposure
- Though the prevalence of metabolic syndrome among U.S. adults is high, it has remained stable
- High blood mercury and cadmium are associated metabolic syndrome
- Blood lead is not associated with metabolic syndrome

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