



# Environmental Heavy Metal Exposure and Chronic Disease Among Iraqi Refugees

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## Introduction

Chronic diseases such as diabetes, cardiovascular disease, and lung disease has costed the United States \$3.3 trillion dollars in health care expenditures every year. With such a financial burden on the healthcare system, it is vital to understand the factors that contribute to chronic disease states so that preventative measures are taken. Various studies have linked chronic heavy metal exposure to chronic diseases and groups at high risk for heavy metal exposure include refugee populations. While there have been abundant studies on the effects of trauma in refugee health, few have investigated the link between environmental factors, such as heavy metal exposure, and chronic disease among adult refugees. Therefore this study will aim to:

1. Determine the levels of lead, cadmium, and manganese in a subset of refugees at one time point post-relocation.
2. Determine chronic disease prevalence through survey data.
3. Determine whether “baseline” measurements of heavy metal concentrations are predictive of chronic disease prevalence.
4. Determine the dose response between heavy metal exposure and chronic diseases.

The proposed research is relevant to public health because the results can guide primary care physicians towards the appropriate screening procedures and lessen the healthcare disparity in a vulnerable population.

## Purpose

The objective of this study is to understand the relationship between heavy metal exposure and chronic disease states in resettled refugees.

## Design/ Subjects

This is a cross-sectional study where 48 Iraqi men were surveyed at 1 month, 1-year, and 2-years post-relocation to Dearborn, Michigan. The survey used 191 questions to assess for perceived environmental exposure to heavy metals, diagnosed chronic diseases, traumatic events, and mental health status. Survey answers utilized a Likert scale. Whole blood samples were collected at 1-year post-relocation and the levels of lead, cadmium, and manganese were measured. Results were aggregated into a de-identified data set.

## Definitions/Variables

- Chronic disease index: Log-transformed variable that combined positive survey response to diabetes, hypertension, heart disease, cholesterol.
- Painload: Positive survey response to headaches, arthritis, and muscle or tendon disease
- Metal index: : Log-transformed variable that combined levels of lead, cadmium, and manganese in whole blood samples at 1-year post-relocation.

## Analyses

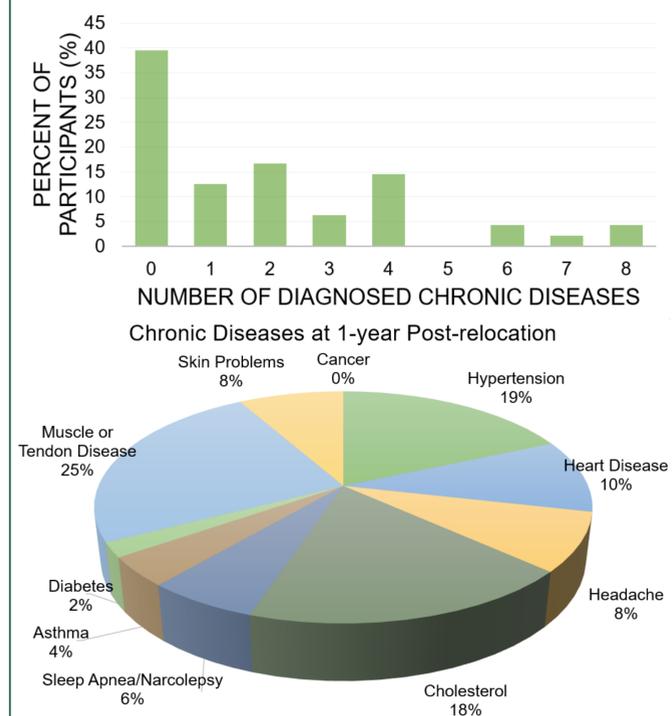
Data analysis was performed on our de-identified database using Statistical Package for Social Sciences (SPSS), Version 25. Descriptive statistics was used to summarize the data. Pearson correlation was used to assess for a correlation between chronic diseases, painload, and metal index. Spearman correlation was used to assess the associations between ordinal variables such as perceived environmental exposures and metal index. T-test was used to analyze the relationship between the metal index and chronic diseases. Two-sided P values < 0.05 and a Z-score >1.95 was considered significant.

## Charts/Graphs

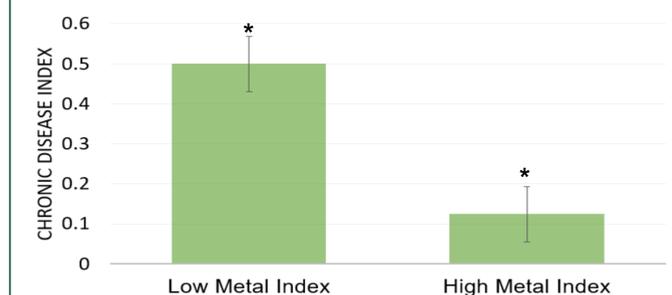
### Average Heavy Metal Concentrations in Whole Blood Samples

Heavy Metals	Iraqi Refugee Population (ug/dL)	General U.S. Population (ug/dL)
Lead	0.328	0.820
Cadmium	0.011	0.032
Manganese	0.235	0.930

### Chronic Disease Prevalence at 1-Year Post-relocation



### Chronic Disease Index vs Metal Index



## Results

Participants had an average age of 36 (±11) years. Whole blood samples collected at 1-year post-relocation had an average of 0.328 ± 0.295 µg/dL lead, 0.011 ± 0.011 µg/dL cadmium and 0.235 ± 0.195 µg/dL manganese. Their heavy metal levels were not elevated in comparison to their American counterparts.

60% (29) had at least one chronic illness when surveyed at 1-year post-relocation, with muscle/tendon disease, hypertension, and high cholesterol constituting the highest burden among this population. There was no significant increase in chronic disease prevalence between 1-year and 2-year post-relocation.

The metal index was separated into “high” and “low” concentration by the median value of the metal index range. Interestingly, the participants in the “Low Metal Index” category showed a higher burden of chronic diseases, 0.50 ± 0.15, versus the participants in the “High Metal Index” category with a chronic disease index of 0.13 ± 0.06 (P<0.05). When individual metal concentration was assessed for this trend with the chronic disease index, concentrations of lead and manganese showed the same trend. Participants within the “Low Lead” category had a higher chronic disease index of 0.43 ± 0.14 in contrast to the “High Lead” category with a chronic disease index of 0.13 ± 0.07 (P<0.05). “Low Manganese” had a chronic disease index of 0.5 ± 0.15 while participants in the “High Manganese” category with a chronic disease index of 0.13 ± 0.07 (P<0.05).

The metal index showed a weak association with painload surveyed at 2 years post-relocation, with a Pearson’s correlation of -0.33 (P < 0.05).

## Discussion

Although the data did show that heavy metal concentrations have an association with chronic disease prevalence, it demonstrated a trend that is opposite to what is supported by the current literature. This data suggests that higher heavy metal concentrations is associated with lower chronic disease burdens.

Limitations includes the cross-sectional nature of this study, which prevents us from making inferences on longitudinal trends. In addition to this, the collected data on chronic disease states and perceived environmental exposures was based on survey data, which can be prone to social desirability bias.

## Conclusions

Higher concentrations of manganese and lead is associated with a decreased diagnoses of chronic diseases among newly relocated Iraqi refugees. Even after 2-years post-relocation, higher heavy metal concentrations had an inverse relationship with headaches, arthritis, and tendon disease.

## References

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