

1-18-2019

Hazardous Waste Site Proximity and Type 2 Diabetes: From Youths to Adults

Theresa Ann Johnson

Walden University, tjdivine1@gmail.com

Follow this and additional works at: <https://scholarworks.waldenu.edu/symposium2019>

Recommended Citation

Johnson, Theresa Ann, "Hazardous Waste Site Proximity and Type 2 Diabetes: From Youths to Adults" (2019). *2019 Program & Posters*. 22.

<https://scholarworks.waldenu.edu/symposium2019/22>

This Book is brought to you for free and open access by the Research Symposium at ScholarWorks. It has been accepted for inclusion in 2019 Program & Posters by an authorized administrator of ScholarWorks. For more information, please contact ScholarWorks@waldenu.edu.

Hazardous Waste Site Proximity and Type 2 Diabetes: From Youths to Adults

Theresa A. Johnson, PhD, PA-C

Problem

Hazardous waste (e.g., dioxins, organochlorine pesticides, arsenic), have been associated with diabetes, are widespread, and remain in the environment with potential for human exposure via contaminated water, soil, livestock, fish, or household products. Environmentally safe limits of these toxicants are uncertain. Using geocoordinates to assess the potential influence of remote hazardous waste site (HWS) exposure on the type 2 diabetes (T2DM) disease burden has not been explored.

Purpose

In this correlational study, I investigated the relationship between residing closer to compared to residing further away from a HWS and risks of prediabetes/T2DM while controlling the effect of abnormal body mass index (BMI), age, sex, and race/ethnicity on the relationship.

Significance

The results forge opportunities for the development of environmental health evaluation tools that may be used in clinical practice as part of diabetes risk assessment.

Non-Hispanic Whites represented 24.7% of the study population, yet some had an 82.1% reduced risk for prediabetes or T2DM. These results may challenge public health professionals to invoke discussions about the potential role of HWS in defining patterns of social inequalities in T2DM.

Social Change Implications

The study results may promote positive social change through a dialogue about social and environmental justice, and the geographic distribution of HWS.

Theory or Framework

The study was grounded in the **ecosocial theory** concept of embodiment; incorporating biology, lived experiences, social and ecological circumstances, and exogenous exposure pathways, in determining patterns of disease distribution. **Hill's** (1965) biological plausibility criteria aligned with the probability of abnormal A1c outcomes from exposure to endocrine disrupting chemicals (EDCs).

Relevant Scholarship

Incidence of T2DM has increased in youths in the last 10 years. In 2015, 30.3 million people in the U.S. were diagnosed with T2DM and an estimated 34% were unaware that they were prediabetic (CDC, 2018).

Persistent organic pollutants (POPs) have endocrine disrupting capabilities and diabetogenic potential in humans at exposure dose levels considered to be low levels of exposure (Gore et al., 2015).

POPs have appeared related to increase hospitalization rates for diabetes (Kouznetsova et al., 2006). And in 2013, 72 epidemiologic studies concluded strong association between organochlorine compounds and T2DM (Taylor et al., 2013).

HWS on the NPL contain chemicals with suspected risk for human health (<https://www.epa.gov/superfund>).

Geocoordinates enhance the strength of the remote exposure assessment in comparison to census tract or ZIP code data (Liese et al., 2010).

There is a latency effect of dioxin and PCBs elimination in adipose tissue. (Stockholm, 2016).

Research Questions

RQ1. Within select counties of NJ, PA, NY and CA, as an aggregate, are there significant differences in the abnormal A1c $\geq 5.7\%$ between study subjects residing ≤ 1 mile of a HWS compared to study subjects residing > 1 mile from a HWS within their county of residency?

RQ2. For the study subjects residing within select counties of NJ, PA, NY and CA, as an aggregate, what is the effect of the moderators abnormal BMI, age, sex, and race/ethnicity on the relationship between residing ≤ 1 mile or > 1 mile of a HWS and A1c $\geq 5.7\%$?

Participants

A convenience sample ($N = 1,724$), from the Continuous National Health and Nutrition Examination Survey (NHANES), included residents from counties in NJ, PA, NY and CA who were surveyed by NHANES between 2005-2012.

- These states contained the largest number of HWS on the National Priorities List (NPL) of Superfund sites as of November 2016.

All participants had A1c values $\geq 5.7\%$ (included pre-diabetes and T2DM), an abnormal BMI, and a remote exposure observation.

Procedures

HWS geocoordinate (latitude and longitude) data for NJ, PA, NY and CA was compiled from the NPL Superfund website.

NHANES demographic, body measures, and glycohemoglobin (A1c) public data files were merged with NHANES residential geocoordinate restricted data and HWS geocoordinate data, and stored on a secure server.

Analysis

Mann-Whitney U test and binary logistic regression were used to investigate the relationships among the variables.

Findings

Overweight and obese participants (BMI ≥ 28.95 kg/m²) were 1.8 times and older persons (≥ 58 YO) were 2.1 times more likely to be prediabetic or have T2DM.

Non-Hispanic Whites residing further away from a HWS within their county had an 82.1% reduced risk of having prediabetes or T2DM compared with the same group residing closer to a HWS.

Interpretation

These results support current research that documents obesity and increased age as risk factors for pre-diabetes and T2DM, and that reduce risk of disease outcome is associated with further residential distance from HWS.

The findings implicate the influence of race/ethnicity in relationship to remote HWS exposure and T2DM outcomes.

Limitations

Potential limitations included:

- All pathways of direct or remote exposure to HWS (school, work, having lived in another country), not controlled.
- Non-disclosure of HWS linked to residence.
- Continuous geocoordinate data on subjects not disclosed.
- Land area of subjects residence unknown, limiting geocoordinate distance calculations.
- Analysis of mean group differences limited to two large aggregate groups.

Recommendations

Future researchers may consider:

- A remote exposure variable that includes border distance between HWS and the subject's residence.
- Correlating the number of HWS and contents of HWS with scaled geocoordinates and A1c values to broaden the investigation.
- Comparison of mean exposure group differences within counties and between states which may promote geographic mapping of the relationship between HWS and abnormal A1c values.

Acknowledgements

Raymond W. Thron, Committee Chair
Vasileios Margaritis, Committee Member
Scott O. McDaniel, University Research Reviewer