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TESTING FOR CORRELATIONS BETWEEN TOXIC RELEASE INVENTORY EXPOSURE AND SUICIDE PREVALENCE IN UTAH USING SPATIAL ANALYSIS

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Increased suicide risk among adults have included multiple risk factors such as familial genealogy, socioeconomic and cultural derivatives. Some studies suggest that physical environmental exposure (e.g., increased land surface temperature and change in air pollution levels) is correlated with an increase in the prevalence of suicide (Qin et al. 2013; Raggeutt et al. 2017; Sun et al. 2020). However, the relationship between environmental exposure and suicide risk has been relatively under-explored suggesting a gap in the literature. This research project used Toxic Release Inventory (TRI) facility level data – a dataset that includes information about specific toxic chemicals that may cause adverse health effects to humans and/or the environment (U.S. EPA 2021).

Population data at the census tract level to test for correlations between TRI exposure and suicide prevalence from 2007-2019: (1) counts of TRI facilities per census tract; and (2) total pounds of emissions released into the air per census tract. We collected TRI facility data for the state of Utah (2007-2019) from the Environmental Protection Agency's TRI Explorer (U.S. EPA 2021) and collected 2010 decennial population estimates for all census tracts in Utah (n=588) from the National Historical Geographic Information System (Manson et al. 2021). Suicides were ascertained through the Utah Office of the Medical Examiner. Residential addresses at the time of death were geocoded and the total number of suicides from 2007-2019 were summed by census tract, and interpreted per 100,000 persons. Using ArcGIS Pro, TRI facility points were overlaid on all census tracts in Utah. The number of facilities as well as the total pounds of emissions from those facilities were summed together for the years 2007-2019 for all census tracts in Utah. We conducted bivariate correlations between the two exposure variables and suicide prevalence. We found that the correlation coefficient for pounds of air emissions per tract with suicide prevalence was 0.03 (p=0.41), and the correlation coefficient for TRI counts per tract with suicide prevalence was 0.13 (p=0.002). Using GeoDa, we conducted bivariate local indicator of spatial association (LISA) analyses to identify statistically significant ($p \leq 0.05$) clusters (Anselin 1995), informing how TRI exposure is associated with suicide prevalence (e.g., high exposure-high suicide prevalence, low-exposure-low suicide prevalence). By using GeoDa, we were able to visualize our results through bivariate cluster maps. Our bivariate analyses found that High-High clusters are most common in Salt Lake County for both the count of facilities and pounds of air emissions, while a High-High cluster also exists in Carbon County. Low-Low cluster patterns are similar for both exposures. Similarly, the northern and southern parts of the state, as well as the southwest and southeast portions show there are no statistically significant clusters. This study conducted a spatial cluster analysis, testing for correlations in the presence of TRI facilities, air emitted from TRI sites, and suicide prevalence. TRI facility

counts were more strongly correlated to suicide prevalence than pounds of air emissions. This suggests a potential influence of the physical existence of TRI sites on suicide risk rather than the emissions of chemicals themselves. Results also suggest a need for broader analyses of environmental exposure and its relationship with suicide prevalence in Utah. Multivariable analysis should be explored to consider confounding the relationship between exposure to TRI sites and suicide prevalence. Future analyses may also consider the toxicity of specific chemicals and how that may influence suicide risk.