

Hot spots in mortality from drug poisoning in the United States, 2007-2009

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Objectives

Drug poisoning recently has overtaken motor vehicle crashes as leading cause of injury death in U.S.

Death rate of drug poisoning has increased 400% since 1999.

Apply spatial statistical tools in order to examine county level variation and highlight areas of the U.S where drug related poisoning deaths are higher or lower than the expected values.

Test the hypothesis that drug poisoning disproportionately affects rural areas compared to urban.

Goal=inform efforts to fight back against drug death epidemic.

Data Used

2007-2009 National Vital Statistics Multiple Cause of Death Files

Classified using the International Classification of Diseases (ICD)

Methods

Analysis used a two stage mixed effect model in order to calculate AADR(age adjusted death rates)

Generalized Linear and Latent Mixed Modeling (GLMM) produced county level random intercepts and fixed effects. Fixed effects included covariates(table 1)

Table 1
Covariates included in empirical Bayes estimate modeling of age-adjusted death rates due to drug poisoning in the U.S., 2007–2009.

Region of the country (Division: New England, Mid-Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, Pacific)	Median age
Latitude and longitude of county centroid	Percent black
Square miles	Percent white
Population size	Percent Hispanic
Residential density	Percent Asian
Percent rural	Percent other race
Percent of land that is farm	Percent with less than HS education
Median home value	Percent female headed households
Percent household public assistance	Number of MDs
Percent renter occupied housing	Number of hospitals
Percent households with dividend income	Percent on medicare
Percent English speaking	Percent on medicaid
Percent native	Number in jail
Percent households without earnings	Number in juvenile detention
Above the median arrests for drug-related crimes	Number homeless
Central, fringe, medium metropolitan, micropolitan, non-core/rural	Average percent humidity in July
Percent of deaths with pending causes	Above the median arrests for drug sale
Proportion of population reporting nonmedical prescription drug use	Percent unemployed

Methods

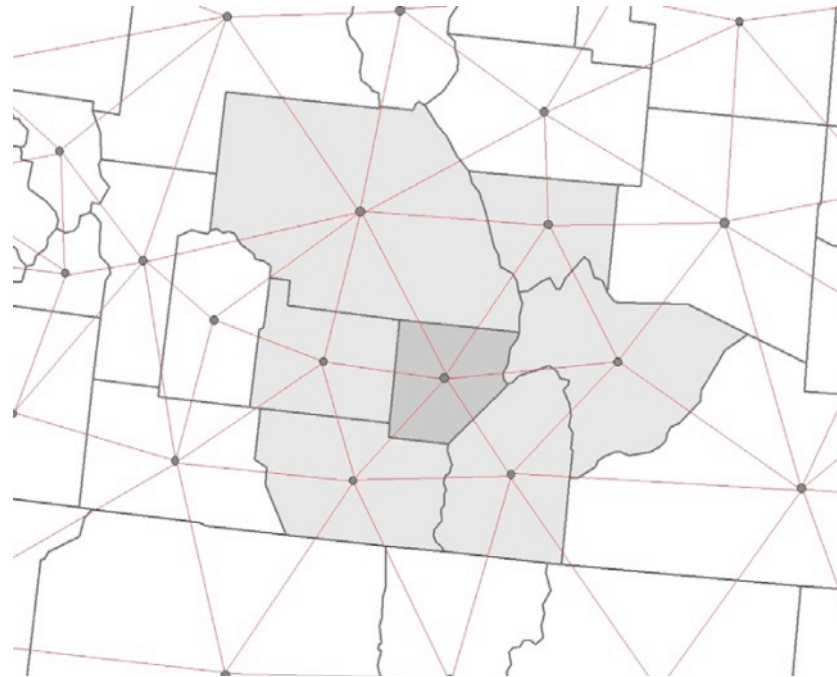
Global indexes of spatial autocorrelation were used to calculate the spatial dependence across counties of poisoning related deaths. =Global Moran's I

Delaunay triangulation was used to conceptualize spatial relationships by creating Voronoi triangles from county centroids.

Local indicators were used to identify areas of high or low drug poisoning AADR=Getis-Ord G_i^* statistic.

Sensitivity analysis using eight nearest neighbors were used to check supporting results of aforementioned analyses.

Delaunay triangulation and Voroni triangles



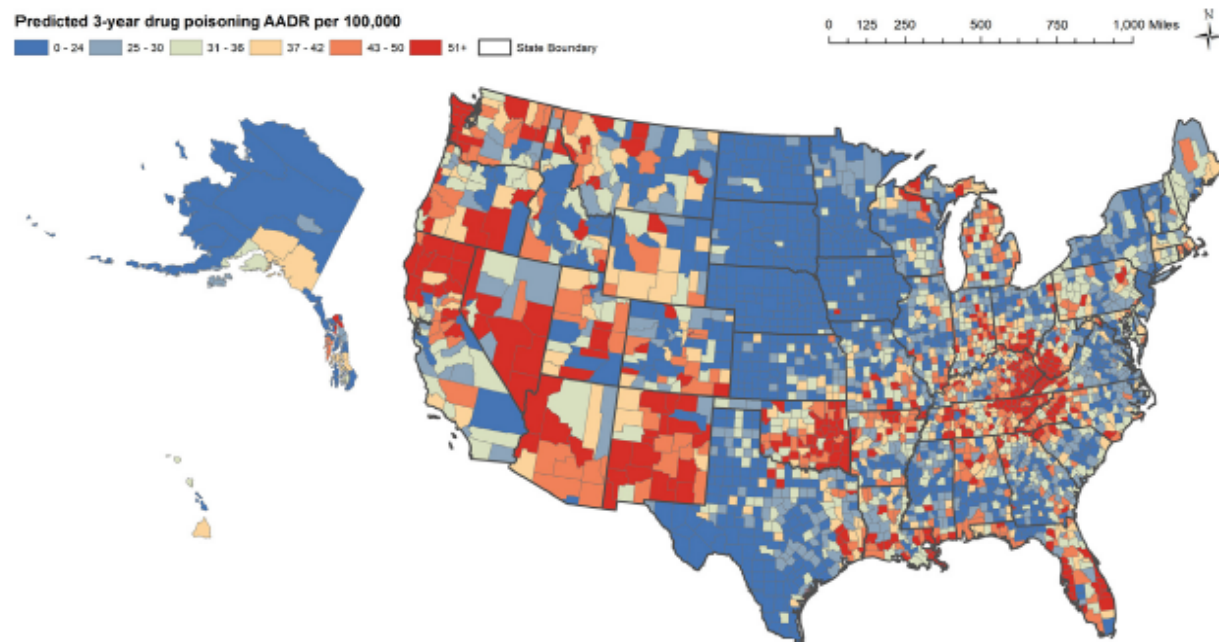


Fig. 2. Predicted drug poisoning ADR by county, 2007-2009.

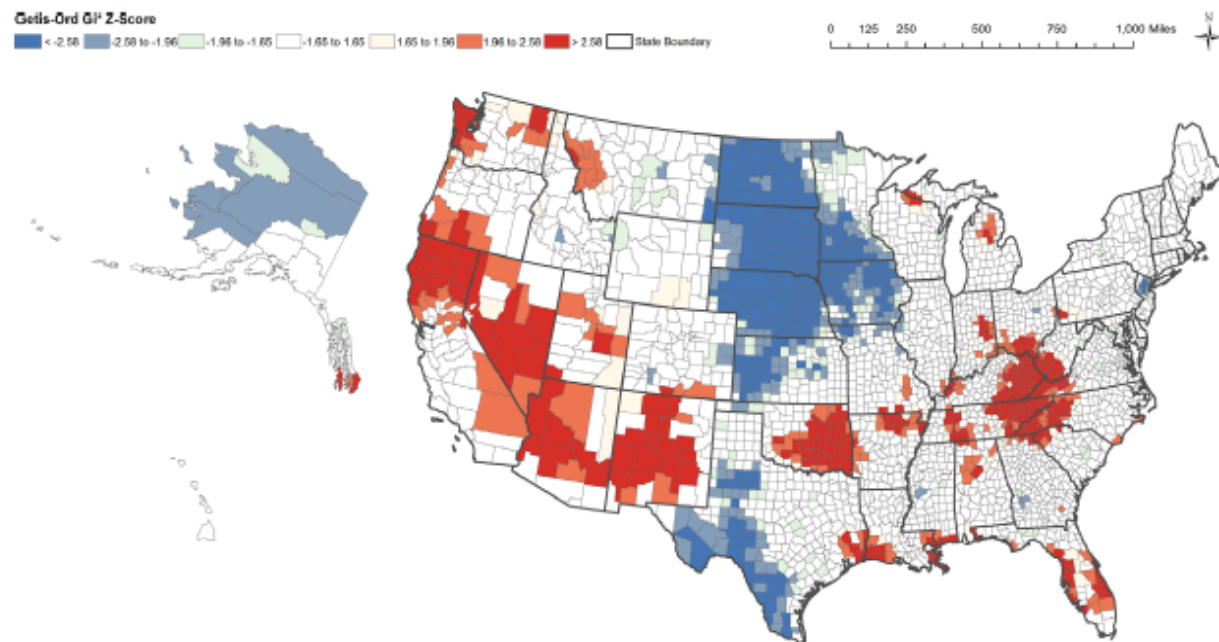


Fig. 3. Hot and cold spots in drug poisoning mortality, 2007-2009.

Results

Two maps, one representing predicted AADR drug poisoning for US counties between 2007-2009. Second representing hot and cold spots.

High and low mortality counties were shown to cluster

Results of Moran's I analysis showed spatial dependence.

Global Moran's I=0.55 Z score=53.53

The main hot spots were detected along the North Pacific coast, the Southwest, Oklahoma, Appalachia, and the Gulf Coast.

Cold spots were identified across the Central Plains, Texas and regions of Alaska.

Rural was shown to have both lowest and highest rates meaning previous research was not supported

Drug poisoning mortality more likely related to geographic factors rather than rural/urban classification

Conclusion

Well organized with a detailed appendix

Strong understandings of own limitations i.e. misallocating deaths

Proposed further study using different type of drugs instead of one grouping

Challenged previous research in regard to urban/rural relationship

Nearest neighbor analysis to verify results

Terminology not always clarified- may cause issues for readers unaware of basic GIS terminology.