



Rural risk environments, opioid-related overdose, and infectious diseases: a multidimensional, spatial perspective



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Background

Much remains unknown about rural risk environments, despite a growing opioid crisis in these areas. Multiple factors may contribute to the increased burden of opioid use in rural areas, including increased prescribing and access to illicit drugs, decreased access to treatment and harm reduction services, and increased underlying socioeconomic vulnerability.

'Risk environment' frameworks posit that drug-related harm is a product of influences from social, physical, economic, and political environments (1,2,3). We extend the risk environment framework to characterize rural southern Illinois and describe the relations of risk environments, opioid-related overdose, Hepatitis C, and sexually transmitted infection rates between 2015 and 2017.

Data

The study area was comprised of the 16 southern-most counties of Illinois included in the Delta Regional Authority (DRA). Over two dozen risk environment variables are summarized across zip-code (n=128) or county levels (n=16) based on availability and theoretical relevance. Health outcomes include fatal and nonfatal opioid-related overdose, Hepatitis C, and sexually transmitted infection rates from 2015 to 2017. Nonfatal overdose incidence was additionally stratified by type (analgesic, heroin, and all including non-specified opiate).

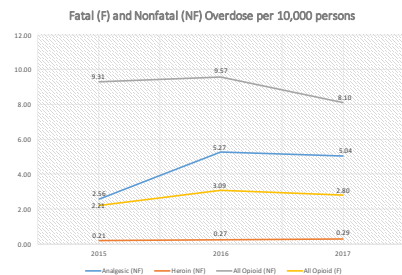


Figure 1. Overdoses per 10,000 persons by type from 2015 to 2017. Sources: Vital Records, ED Discharge.

Spatial Trends of Disease in Southern Rural Illinois

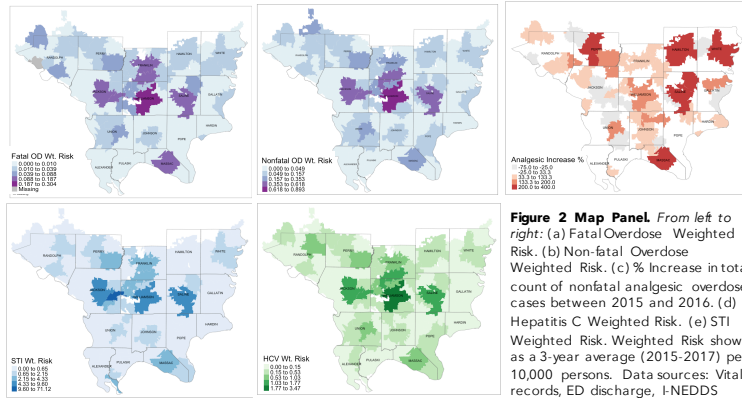


Figure 2 Map Panel. From left to right: (a) Fatal Overdose Weighted Risk. (b) Non-fatal Overdose Weighted Risk. (c) % Increase in total count of nonfatal analgesic overdose cases between 2015 and 2016. (d) Hepatitis C Weighted Risk. (e) STI Weighted Risk. Weighted Risk shown as a 3-year average (2015-2017) per 10,000 persons. Data sources: Vital records, ED discharge, I-NEDDS

Methods

We calculated data attribute associations and characterized spatial and temporal dimensions of longitudinal health outcomes and the rural risk environment. Association of data attributes and spatial relationships were examined using correlation tests, choropleth mapping, and hot spot analyses (ie. local spatial autocorrelation test).

We then use a "regional typology analysis" to generate data-driven risk regions and compare health outcomes across computed regions to aid in interpreting sub-county level findings as they may inform specific public health interventions.

Results

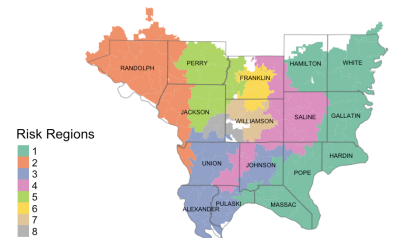


Figure 3. Above: Data-driven Risk Regions or risk typologies developed using a Max-P regionalization of all environmental indicators at the zip code area level.

Table 1. Left: Corresponding data descriptive statistics by Risk Region. Significant results of ANOVA test of means for each variable of interest shown, comparing the indicator in the region and all other zip code areas in other regions: p <0.10, *p<0.05, **p<0.01, ***p<0.001.

Pervasive risk hotspots were identified in more populated locales with higher rates of overdose and HCV incidence, whereas emerging risk areas were isolated to more rural locales that had experienced an increase in analgesic opiate overdoses and generally lacked harm-reduction resources.

At-risk areas were characterized with underlying socioeconomic vulnerability but in differing ways, reflecting a nuanced and shifting structural risk landscape.

Conclusion

Rural risk environment vulnerabilities and associated opioid-related health outcomes are multifaceted and spatially heterogeneous

More research is needed to better understand how refining geographies to more precisely define risk can support intervention efforts and further enrich investigations of the opioid epidemic.

Limitations

Findings are representative of our study population, and are not meant to serve as a sample of the actual population. Small area findings are additionally subject to the ecological fallacy and reflection problem.

Calculated risk environment variables serve as best available proxies for the actual phenomenon of interest, in absence of more complete data. There are limitations to the health outcome data available, including reporting bias in attributing deaths to opioids using Vital Records data sources, coding limitations in hospital and ED discharge data, and testing bias for Hepatitis and STI prevalence.

References

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Acknowledgements

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