



The Deadly Intersection of Heat and Overdose: Understanding the Impact of Extreme Heat, Substance Use, and Overdose Risk

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Learning Objectives

- Describe how extreme heat physiologically interacts with opioids and stimulants to increase the risk of overdose, overamping, and mortality.
- Identify temporal, seasonal, and geographic patterns associated with overdose mortality during periods of extreme heat in Clark County, Nevada.
- Understand strategies that individuals and organizations can use to recognize warning signs and reduce risk during extreme heat events.



The Intersection of Extreme Heat and Overdose Mortality: A Spatiotemporal Analysis in Clark County, NV

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Building the Case in Four Parts

Part I: Testing for Long-Term Temperature and Overdose Death Trends

Part II: Testing for Spatial Hotspots of Risk

Part III: Testing for Seasonal Variation in Overdose Deaths

Part IV: Testing for Associations Between Temperature and Overdose

Part I: Time

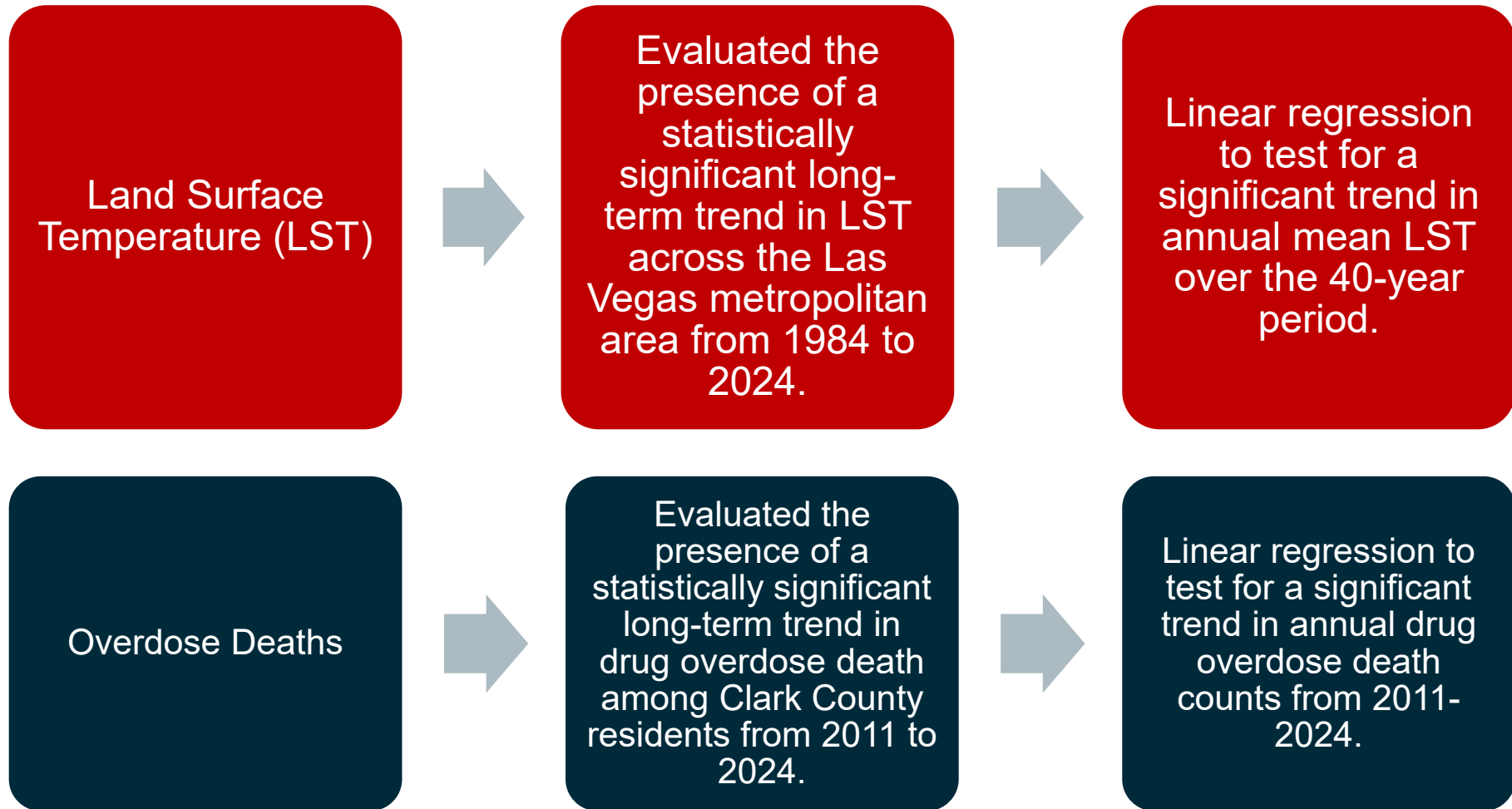
Testing for Long-Term Temperature and Overdose Death Trends

Our Starting Question:

Is there a real, upward trend in temperature and overdoses?

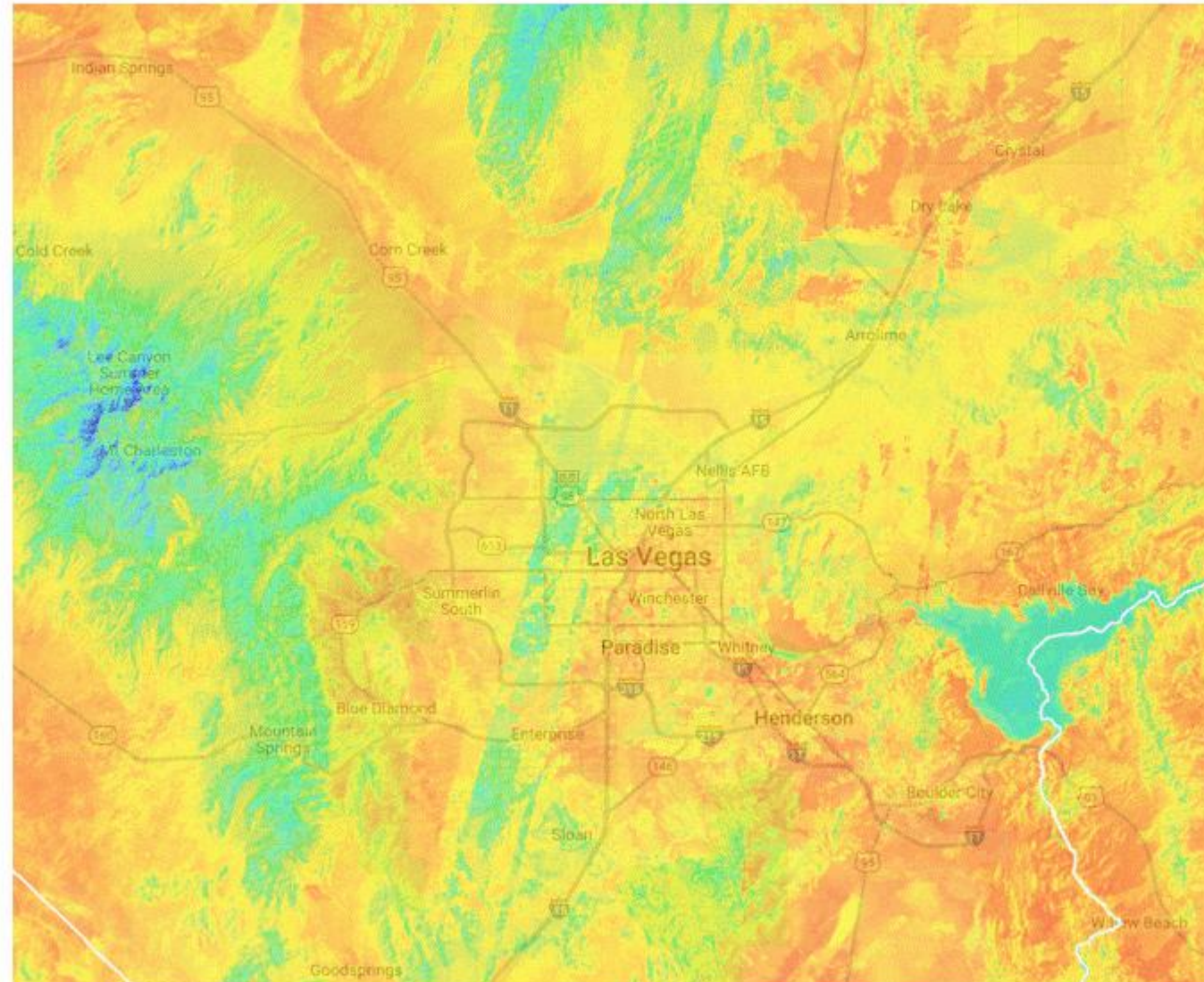
Or are the changes we see just random chance?

Methods: Testing for Long-Term Temperature Trends (1984–2024)

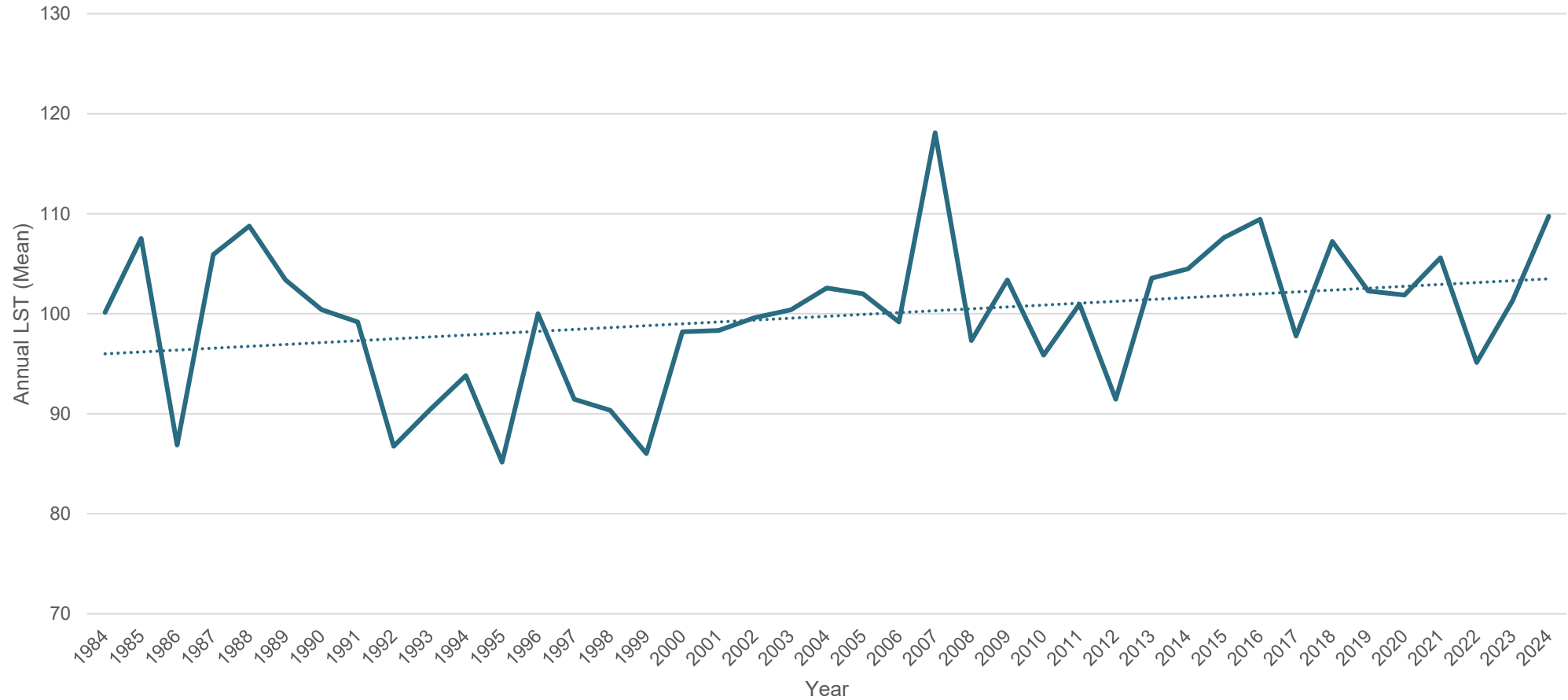


Long-Term Trend in Las Vegas Land Surface Temperature (1984– 2024)

1984



Long-Term Trend in Las Vegas Land Surface Temperature (1984–2024)



Las Vegas is Getting Hotter



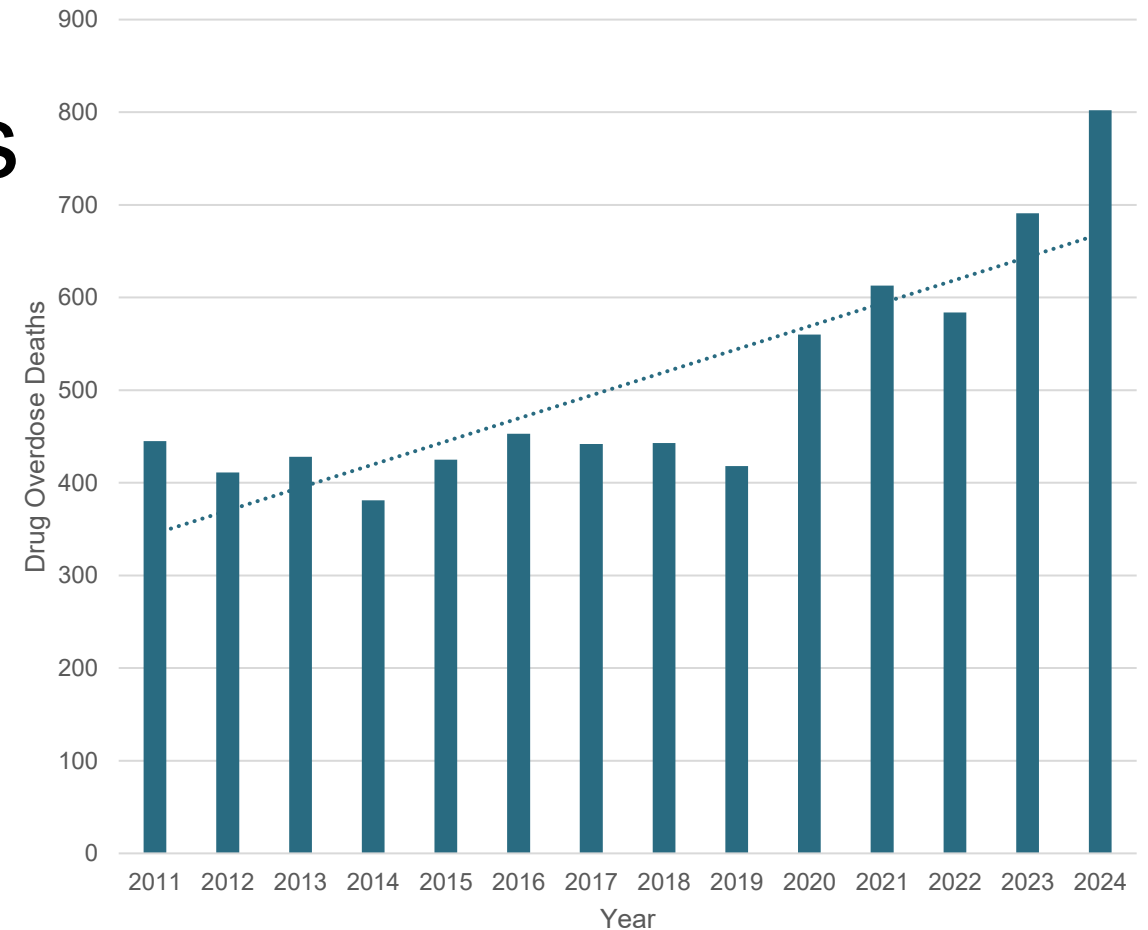
+7.5°F
total Increase in
surface temperature
(1984-2024)

+0.19°F
per year

**Finding: A Significant Warming
Trend**

Drug Overdose Deaths Among Clark County Residents, 2011-2024

From 2011-2024, there has been an 80.22% increase in overdose deaths among Clark County residents.



Drug Overdose Deaths Are Rising Sharply

+80.22%

Increase in
Overdose Deaths
(2011-2024) .

25

additional deaths
each year

**Finding: This is a significant
upward trend.**

Our Starting Question:

Is there a real, upward trend in temperature and overdoses? Yes!

Or are the changes we see just random chance?

Interpretation: Two Crises on a Collision Course

The parallel upward LST trends are not random fluctuations; they are persistent and worsening public health challenges for Clark County.

The strong linear model for overdose deaths confirms a consistent and sharp increase over the past decade, establishing a growing underlying crisis.



PART II: Space

Testing for Spatial Hotspots of Risk

Our Starting Question:

Is there a real clustering
of hotspots?

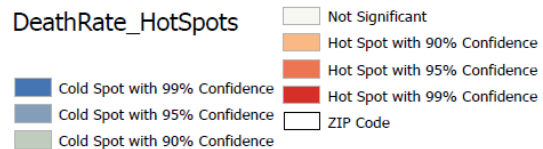
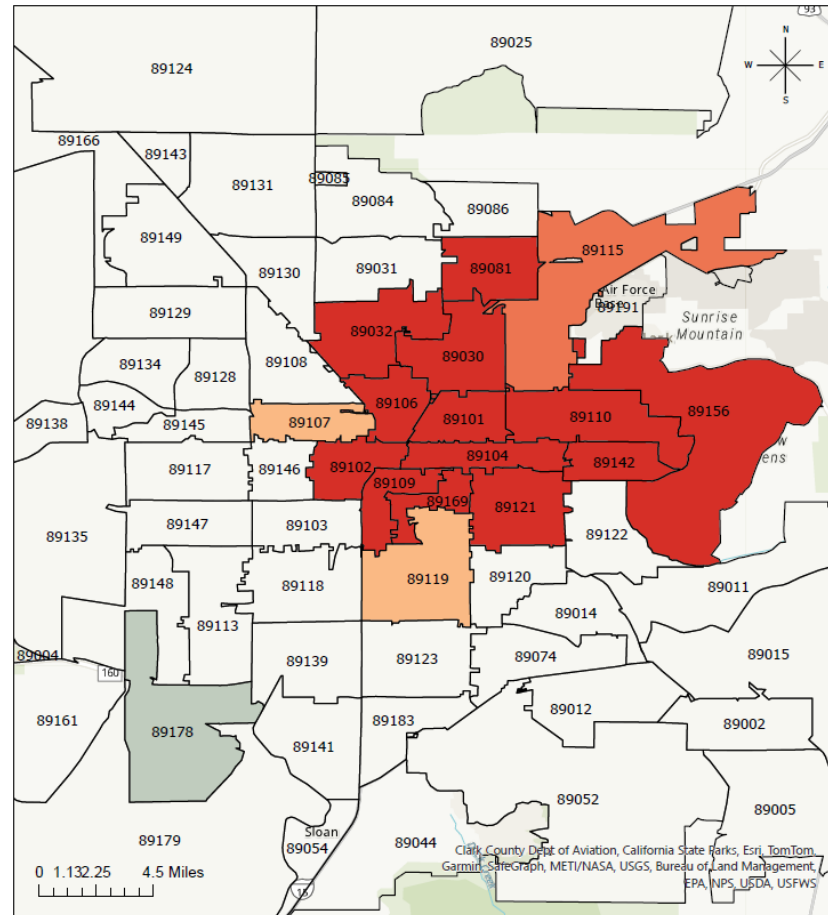
Or are the events we see
just random chance?

Methods

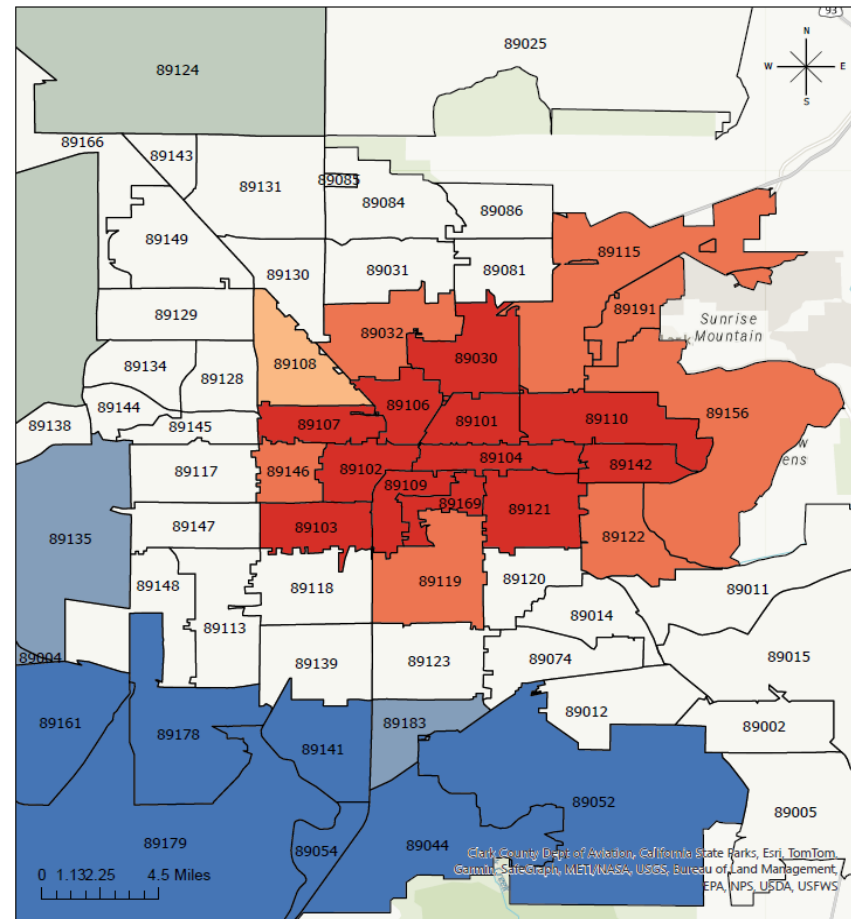
- Analyzed Overdose Deaths by ZIP Code (EDRS Data, 2024)
- Analyzed Heat & Health Index by ZIP Code (CDC Data, 2024)
- Getis-Ord Gi* to identify statistically significant clusters



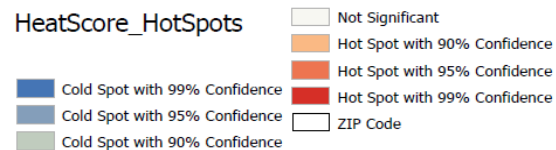
Results: Overdose Hotspots



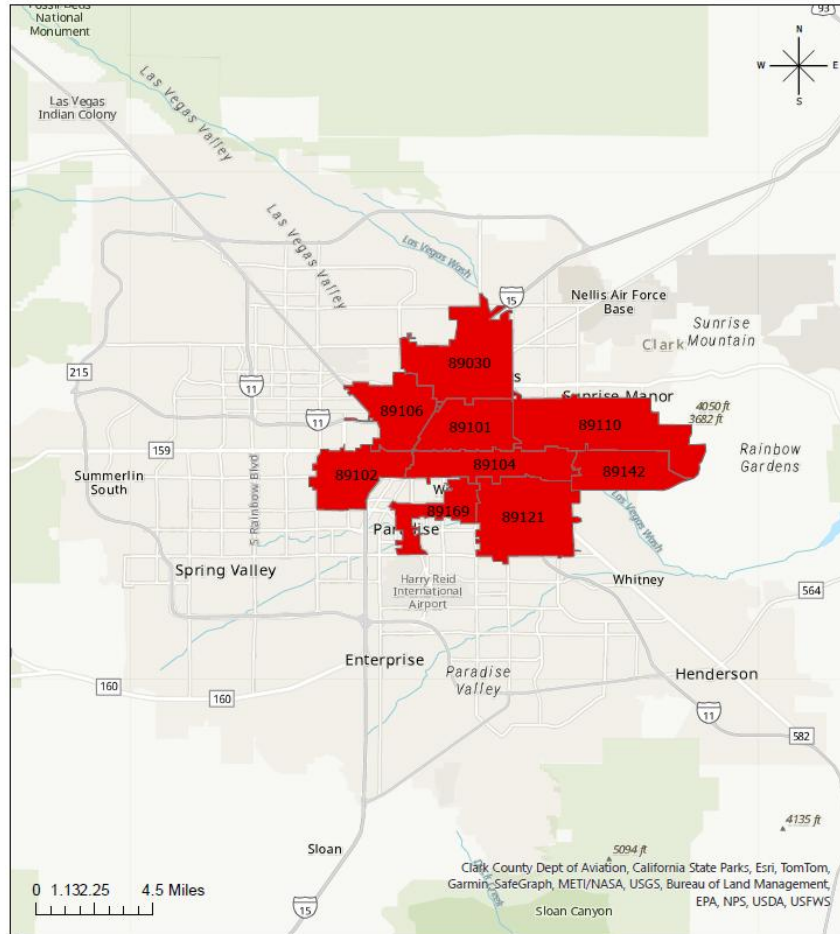
Results: Heat Vulnerability Hotspots



HeatScore_HotSpots



A Double Threat: Where Heat & Overdose Hotspots Overlap



Convergence of Hot Spots

89030

89101

89102

89104

89106

89110

89121

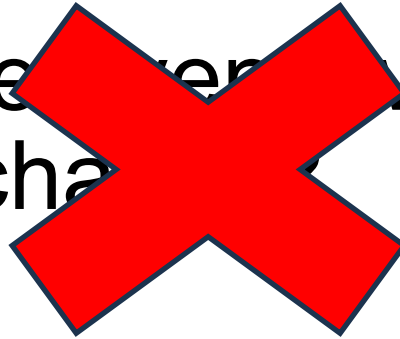
89142

89169

Our Starting Question:

Is there a real clustering of hotspots? Yes!

Or are the patterns we see just random chance?



Interpretation: Identifying Zones of Compounded Risk

The spatial overlap of hotspots pinpoints specific communities where environmental heat stress and the overdose crisis physically intersect.

These areas of compounded vulnerability are the highest priority for integrated public health interventions that address both environmental and behavioral health risks simultaneously.



PART III: Seasonality

Testing for Seasonal Variation in Overdose Deaths

Our Starting Question:

Do drug overdose deaths follow a seasonal pattern?

Or are the events we see just random chance?

Methods: Testing for Seasonal Variation in Overdose Fatalities (2018–2024)

This analysis examined whether the distribution of overdose fatalities varied significantly across the four meteorological seasons:

- Winter (Dec–Feb)
- Spring (Mar–May)
- Summer (Jun–Aug)
- Fall (Sep–Nov)

A Chi-Square Test of Independence was used to evaluate whether overdose death counts are uniformly distributed across seasons or show evidence of seasonal concentration.



Summer is the Deadliest Season

Summer Peak is Statistically Significant for:



Summer Peak for All Overdoses (Statistically Significant)



Summer Peak for All Opioids (Statistically Significant)



Strong Summer Peak for Methamphetamine (Statistically Significant)

Summer Peak is present but not statistically significant for:



Fentanyl

Figure 1: Deviations of Seasons for All Drug Overdoses

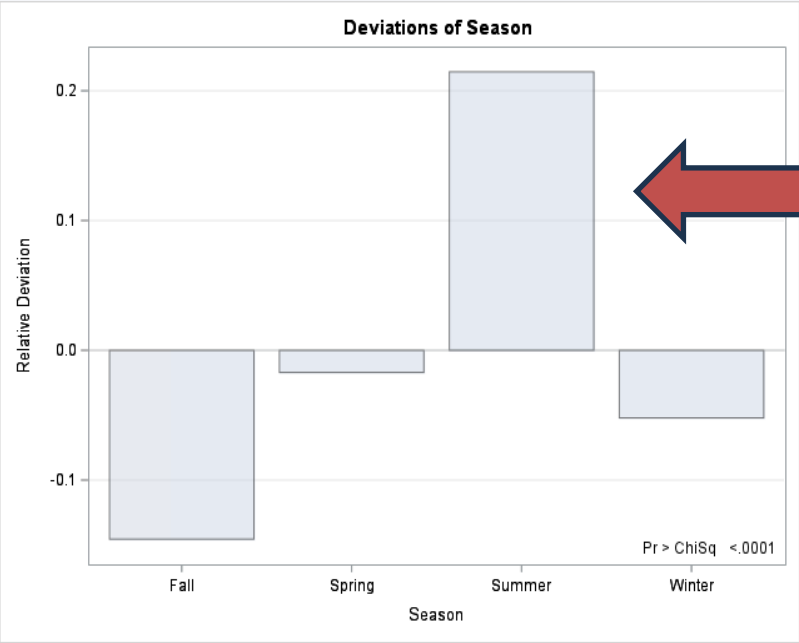


Figure 2: Deviations of Seasons for Fentanyl Overdoses

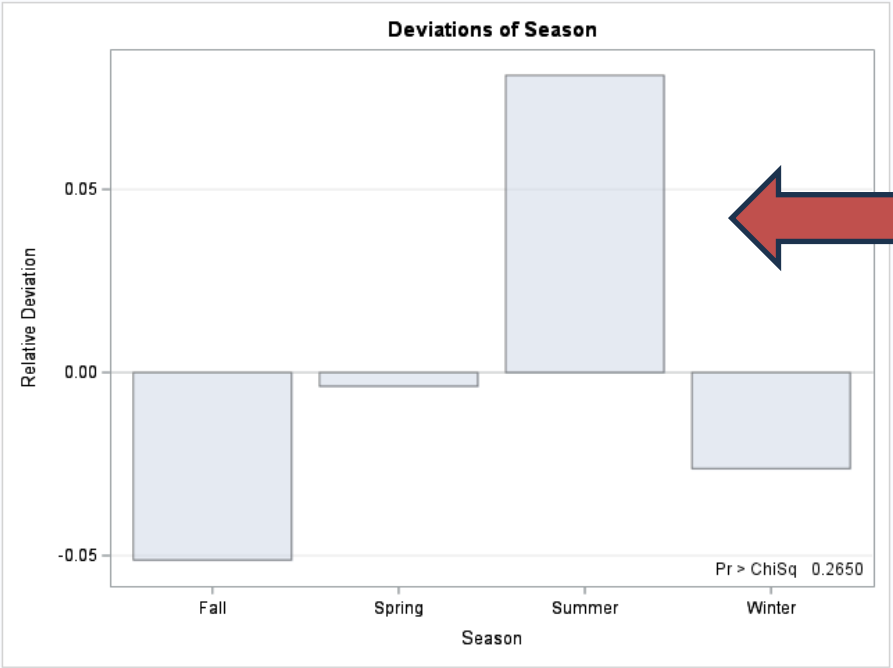
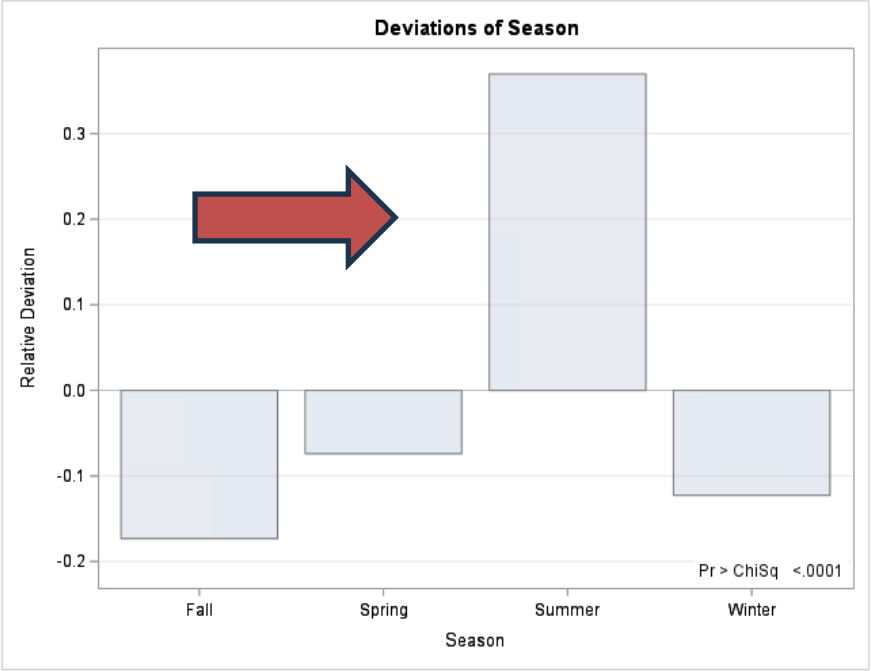


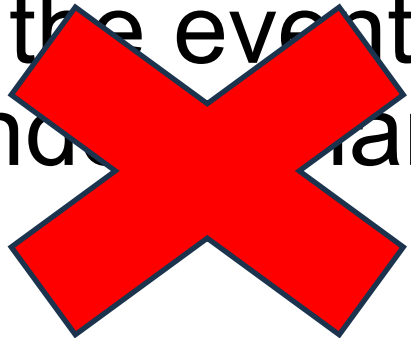
Figure 3: Deviations of Seasons for Methamphetamine Overdoses



Our Starting Question:

Do drug overdose deaths
follow a seasonal
pattern? Yes!

Or are the events we see
just random chance?



Interpretation: Summer is the Season of Highest Risk

The significant peak in overdose deaths during the summer months—especially for those involving methamphetamine—reveals a clear seasonal pattern of risk.

This finding highlights the urgent need for seasonal mitigation strategies and targeted outreach during periods of extreme heat.

PART IV: Causality

Testing for Associations Between Temperature and Overdose

Our Starting Question:

Is Heat Associated with
Overdose Risk?

Or are the events we see
just random chance?

Methods: Daily Association Between Heat and Overdose Risk (2018–2024)

To evaluate the relationship between heat and overdose mortality, a Poisson regression model was used to estimate the effect of daily maximum temperature on daily overdose death counts in Clark County.

Model Details:

•Outcome Variable:

Daily count of fatal overdoses (EDRS)

•Predictor Variable:

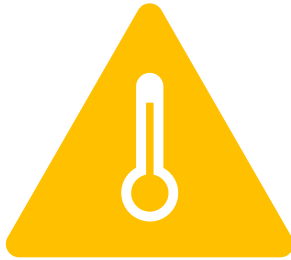
Daily maximum temperature (°F), sourced from the National Syndromic Surveillance Program (ESSENCE)

•Study Period:

January 1, 2018 – December 31, 2024

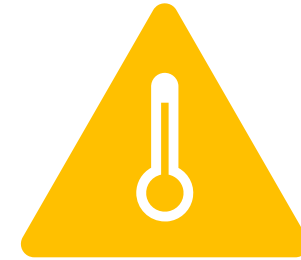


Yes. Hotter Days Are More Dangerous



+1°F increase in daily temperature, the risk of a fatal overdose goes up by 0.54%.

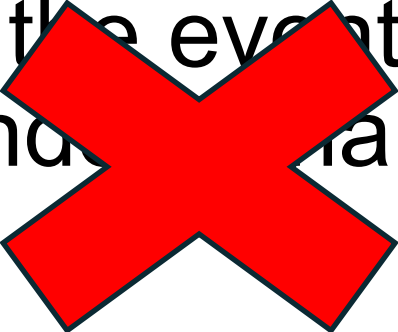
This is a highly statistically significant link.



Our Starting Question:

Is Heat Associated with
Overdose Risk? Yes!

Or are the events we see
just random chance?



Interpretation: Heat is a Direct Overdose Risk Factor

The daily analysis confirms a direct temporal connection between heat and overdose mortality, suggesting heat may exacerbate the physiological or behavioral factors leading to a fatal overdose.

Overdose prevention strategies must now evolve to include temperature as a dynamic environmental risk factor, especially in urban areas prone to extreme heat.

The Story in Four Parts

Part I: Overdose and heat risks are increasing over time



Part II: Overdose and heat risks are clustered in the same places



Part III: Overdose risk is highest in the summer



Part IV: Overdose risk increases as temperatures get hotter



Conclusion

These findings underscore the urgent need for integrated public health strategies that formally recognize extreme heat as a risk factor for fatal drug overdose.





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