Oregon Public Health Association Conference

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Investigating the association between fine particulate (PM 2.5) from 2017 wildfires in Oregon and rates of hospital admissions for cardiovascular, respiratory and cerebrovascular outcomes

Eleni Mora, MPH; Carol Trenga, MS, PhD; Makenzy Jacobson

Oregon Environmental and Public Health Program at the Oregon Health Authority

OREGON ENVIRONMENTAL PUBLIC HEALTH TRACKING

Oregon Health Authority

Agenda

- Objective
- Methods
- Results
- Conclusion

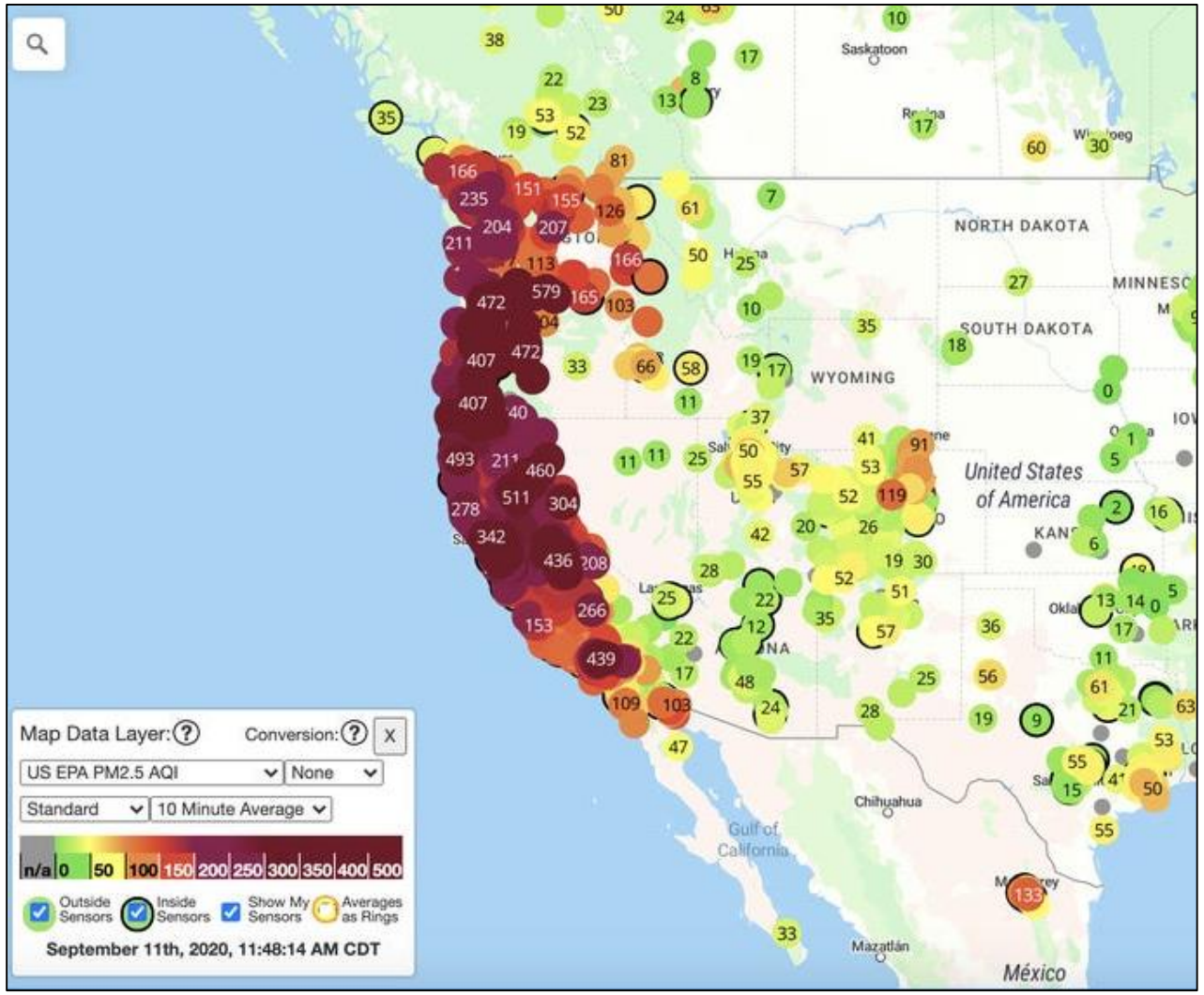


Image source: https://www.insider.com/west-coast-hazardous-air-quality-worst-on-earth-wildfire-smoke-2020-9

Objectives

- The objective of this analysis was to apply a more rigorous statistical investigation to explore the health effects of wildfires in Oregon.

- Method would also ideally be more streamlined and expedient than traditional case-crossover analyses.

NEWS

Chetco Bar Fire: How a small blaze erupted into Oregon's largest wildfire

Zach Urness Statesman Journal

Published 7:23 a.m. PT Sep. 29, 2017 | Updated 3:17 p.m. PT Sep. 30, 2017

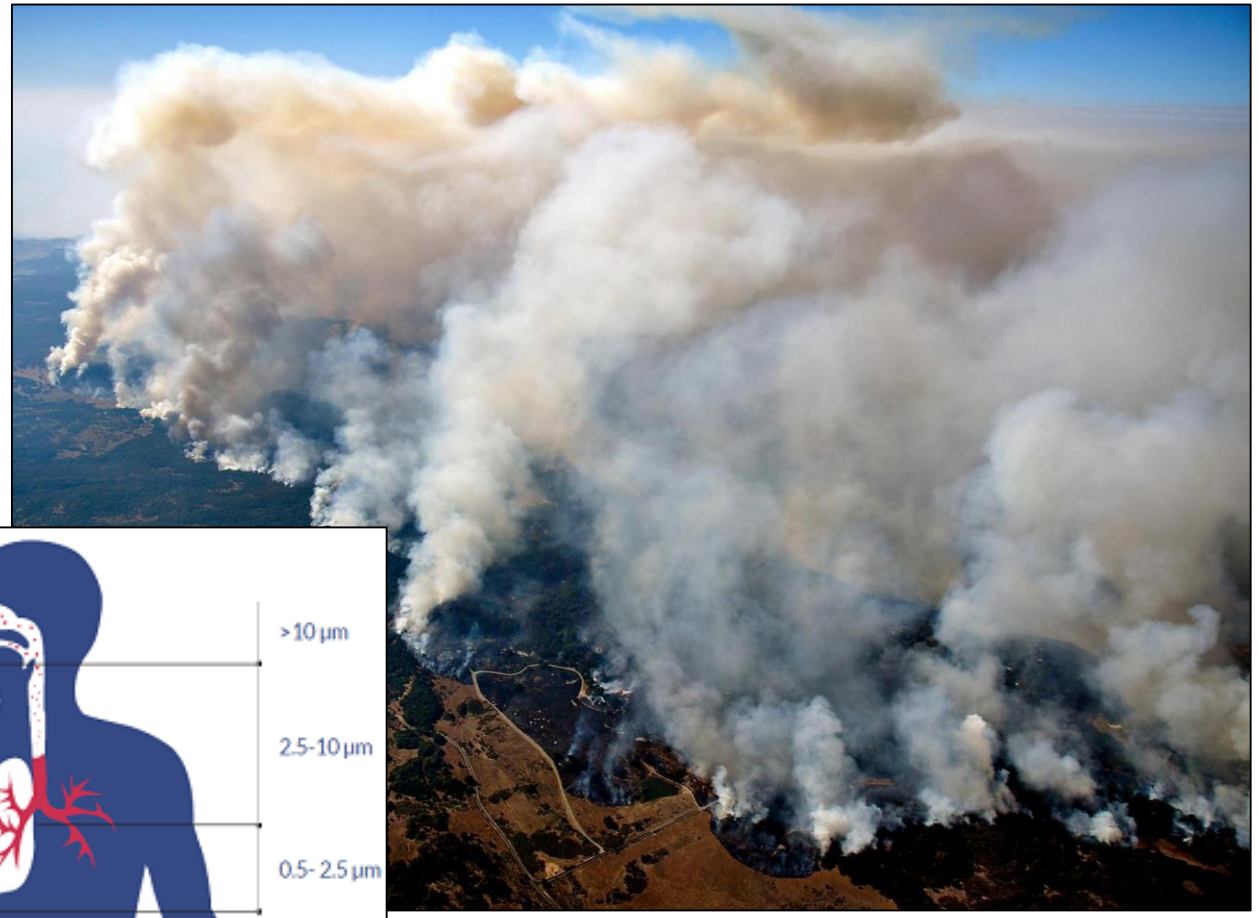
Health Outcomes

Workgroup identified 21 ICD-10 codes associated with health outcomes suspected to be impacted by wildfires.

Cardiovascular	Cerebrovascular	Respiratory
• Acute myocardial infarction • Arrhythmia • Cardiac arrest • Heart failure • Ischemic heart disease • Peripheral vascular disease • Pulmonary embolism	• Cerebrovascular • Ischemic stroke/TIA	• Acute bronchitis • Acute lower respiratory infection • Asthma • COPD • Upper respiratory infection

Fine Particulate Matter (PM 2.5)

- Proxy for wildfires
- Documented health effects
- Ongoing questions
  - Dose response
  - Temporal and spatial resolution
  - Species differentiation



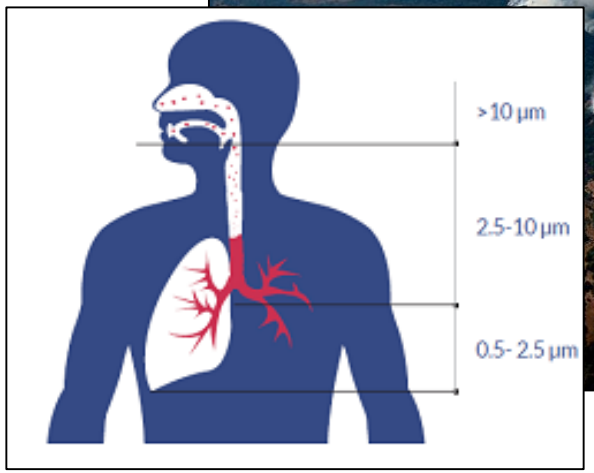
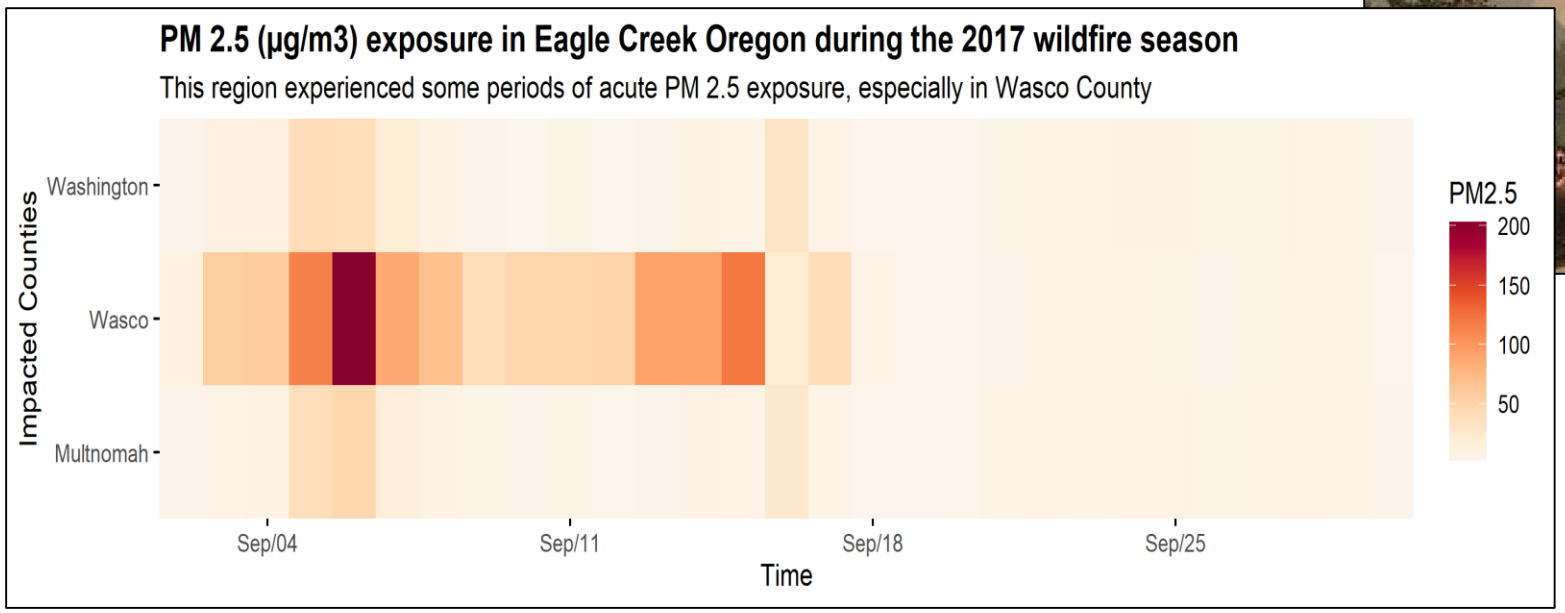


Image credit: https://www.who.int/airpollution/household/pollutants/combustion/en/

Eagle Creek wildfire

Observed dates: 2017-09-02 until 2017-09-30

Expected dates: 2017-06-03 until 2017-07-01



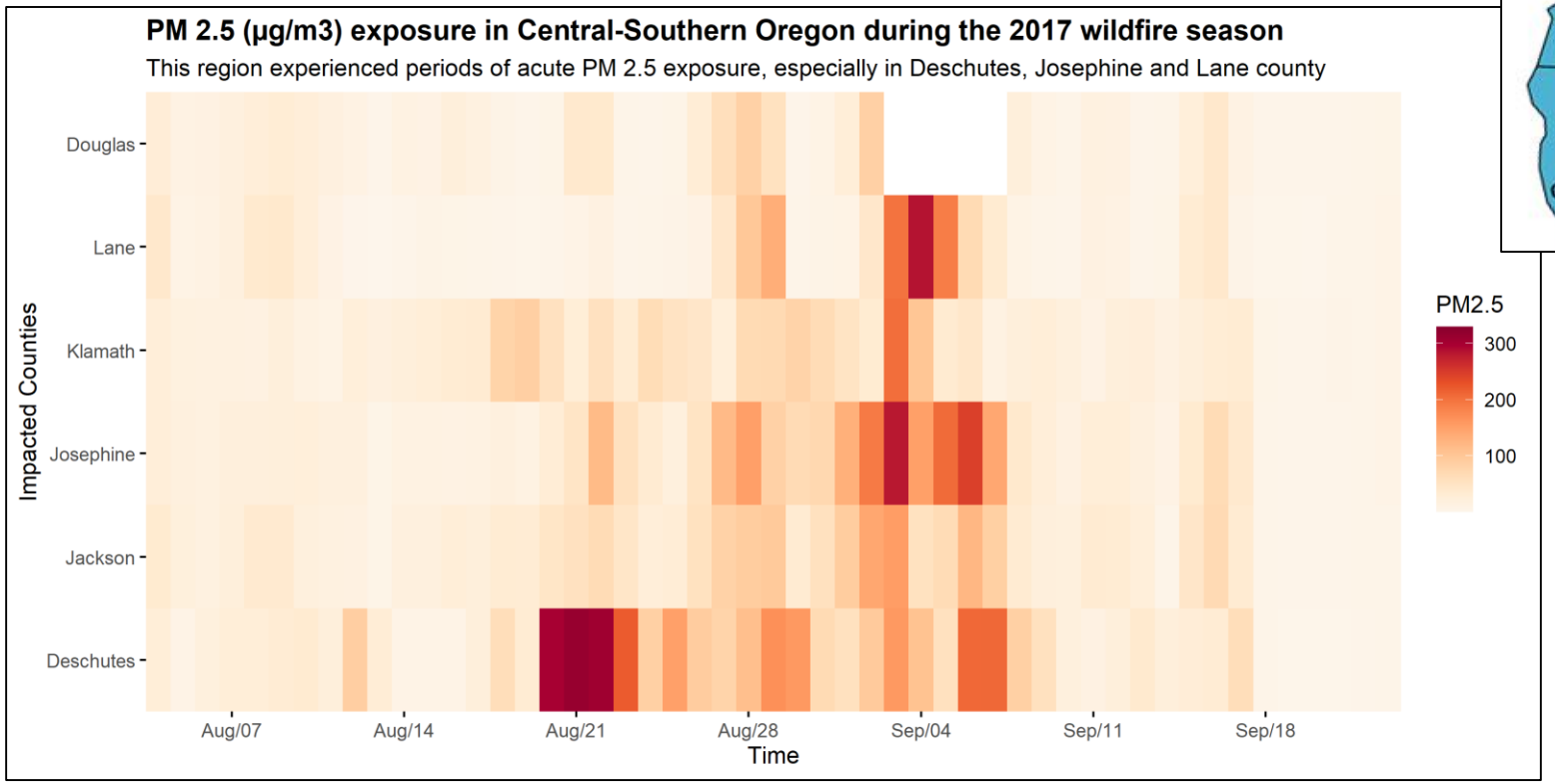
Map created using mapchart.net

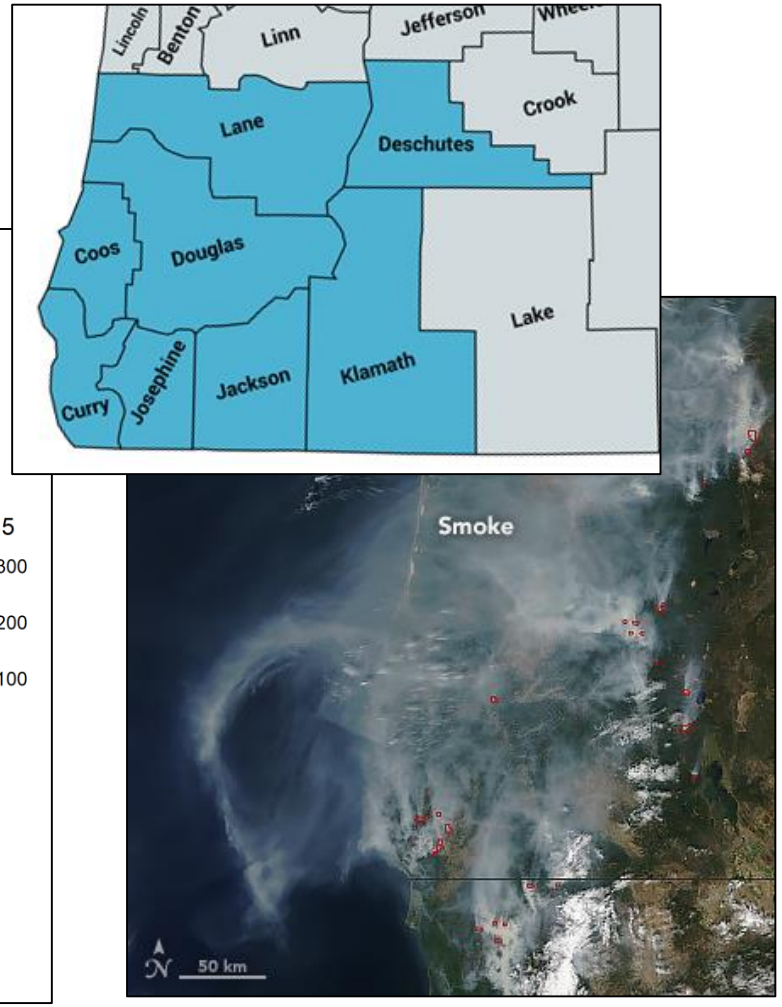
Photo credit: US Forest Service

Central-Southern Conflagration

Observed dates: 2017-08-04 until 2017-09-30

Expected dates: 2017-06-09 until 2017-07-29





Our Analysis

H_0: PM 2.5 has no effect on count of hospital visits, by county.

H_A: PM 2.5 has an effect on count of hospital visits, by county.

Examined this with a Poisson regression:

$$\left[\frac{count_{observed}}{count_{expected}}\right]_{county} = \beta_0 + \beta_1[PM\ 2.5]_{obs} + \beta_2[County\ x] \ldots$$

n counties yields n-1 binary covariates for county

Poisson Regression: Eagle Creek

All Respiratory – Emergency Department

Predictors	*Adjusted rate ratios*	*95% CI*	*P value*
Intercept	0.01	0.01 – 0.01	**<0.001**
Mean Exposure PM 2.5	1.02	1.01 – 1.04	**0.007**
Washington	4.32	3.08 – 5.97	**<0.001**
Wasco	0.62	0.02 – 6.35	0.749

Poisson Regression: Central-Southern

All Cardiovascular – Emergency Department

Predictors	*Incidence Rate Ratios*	*CI*	*p*
Intercept	0.05	0.04 – 0.07	**<0.001**
Mean PM 2.5	1.00	1.00 – 1.00	**0.014**
Douglas	4.52	3.08 – 6.66	**<0.001**
Jackson	1.30	0.94 – 1.82	0.117
Josephine	3.40	2.33 – 4.95	**<0.001**
Klamath	5.10	3.46 – 7.49	**<0.001**
Lane	0.05	0.03 – 0.07	**<0.001**

Poisson regression: Central-Southern

All Respiratory – Emergency Department

Predictors	*Incidence Rate Ratios*	*CI*	*p*
Intercept	0.19	0.12 – 0.27	**<0.001**
Mean PM 2.5	1.00	1.00 – 1.01	**<0.001**
Douglas	0.58	0.34 – 0.98	**0.041**
Jackson	0.43	0.29 – 0.65	**<0.001**
Josephine	0.88	0.55 – 1.41	0.585
Klamath	0.66	0.37 – 1.16	0.154
Lane	0.14	0.09 – 0.21	**<0.001**

Conclusion and Next Steps

Mixed significance	Effect modification	Outcome as count
Replicate analysis with other wildfires*	Add county-characteristic covariates	Explore population-standardized IR as outcome
Improve exposure surface	Aggregate PM 2.5 differently	Increase count catchment area
Explore different geographic resolution	Different lag times	Different outcome altogether
Aggregate PM 2.5 differently		

Acknowledgements

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Dartmouth College

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Questions?

Thank you and stay safe