Optimizing the Respiratory Health of Soldiers During Pasture Burning

Erica McGinley, BSN, RN
MPH Field Experience Report
Kansas State University
November 12, 2015

Introduction

Missouri Western State University

Saint Joseph, Missouri

Bachelor in the Science of Nursing

Spring 2009

Master of Public Health
Infectious and Zoonotic Diseases

Fall 2013:
Fundamental Methods of Biostatistics: MPH 701 (3 credit hours)
Global Health Issues: DMP 844 (3 credit hours)
Introduction to Epidemiology: MPH 754 (3 credit hours)

Summer 2014:
Globalization, Cooperation & the Food Trade: DMP 888 (1 credit hour)
Fundamental Concepts in Emerging Pathogenic Disease: DMP 770 (3 credit hours)

Spring 2015:
Principles of Veterinary Immunology: DMP 705 (3 credit hours)
Intermediate Epidemiology: DMP 854 (3 credit hours)

Spring 2014:
Environmental Toxicology: DMP 806 (2 credit hours)
Administration of Health Care Organizations: MPH 720 (3 credit hours)
Social and Behavioral Bases of Public Health: MPH 818 (3 credit hours)

Fall 2014:
Principles of Animal Disease Control: ASI 540 (3 credit hours)
Genetics of Microorganisms: BIOL 675 (3 credit hours)
Multidisciplinary Thought and Presentation: DMP 815 (3 credit hours)

Summer 2015:
Capstone: MPH 840 (6 credit hours)
Completed 240 contact hours with the Department of Public Health, Fort Riley, KS

Total program hours: 42

Field Experience

Department of Public Health
7665 Normandy Drive
Fort Riley, KS

“To promote health and wellness, and to prevent disease and injury of Soldiers and military retirees, their families, and Army Civilian employees at Fort Riley through Environmental Health, Industrial Hygiene, Occupational Health, Army Hearing Program, and Army Public Health Nursing services.”

-Mission Statement

Fort Riley Department of Public Health

Departments:

- Industrial Hygiene: ergonomic assessments, noise dosimetry testing, indoor air quality surveys, personal protective equipment, storage of sterile products
- Environmental Health: vector-borne diseases, hazardous waste disposal, chemical labeling and storage, food inspections at Child Development Centers (CDC) and Dining Facilities, infestation investigation, storm shelter structures, water sampling
- Army Public Health Nursing: CDC inspections, sexually transmitted infection (STI) counseling, disease outbreak investigations, tobacco cessation program, community partnerships
- Army Wellness Center: metabolic testing, stress management, nutrition education, body composition, physical fitness testing

Departments

- Army Hearing Program: hearing tests, fitting for hearing protection, visiting sites such as the air field
- Occupational Health: immunizations, tuberculosis (TB) screening, EKGs, pulmonary functions tests (PFTs), vision screening, hearing tests, vital signs
- Veterinary Services: food inspections, routine exams of pets, collaboration with bite incidents
- Health Promotion Officer: maintaining and developing programs and policies to improve the health of the military population, evaluating the effectiveness of current health promotion policies and projects, and engaging the community in wellness promotion

Field Experience

Presenting to Army Public Health Nursing Department
June 4, 2015

Field Experience

Irwin Army Community Hospital Safety Day
May 21, 2015

Field Experience Project

- Fort Riley has a population of approximately 53,000
  - This includes active duty members, their family members, retirees, and contracted civilian workers
- Fort Riley is located within a unique region known as the Flint Hills
- Every spring (March, April, and May) some degree of pasture burning occurs in this region
  - The by-products are known to cause injury to human health

Image courtesy of ucsusa.org

The Flint Hills

Map courtesy of eoearth.org

Photo courtesy of The Nature Conservancy

"Prairie fire is as fundamental to the Great Plains as the sun, soil, wind, grazers, and grass. It influences grass composition; allows for more nutritious growth on which cattle can graze; and, when applied regularly, prevents trees from intruding into native prairie grasses."

-Prairie Fire: A Great Plains History

Prairie Plants

- The lengthy root systems of prairie plants are adapted for adverse conditions
  - Prairie fires affect the plant above ground
  - The grass roots below remain in tact and ready to produce new plants
- This is an endangered ecosystem; approximately 4% of original prairie grasslands remain in existence today

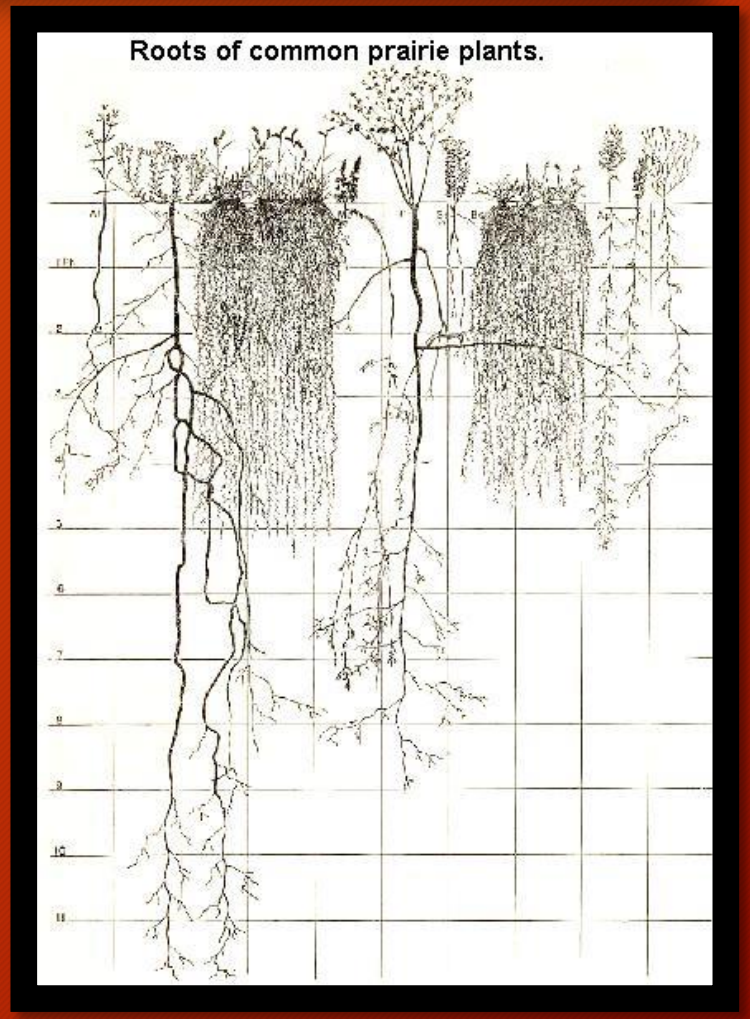
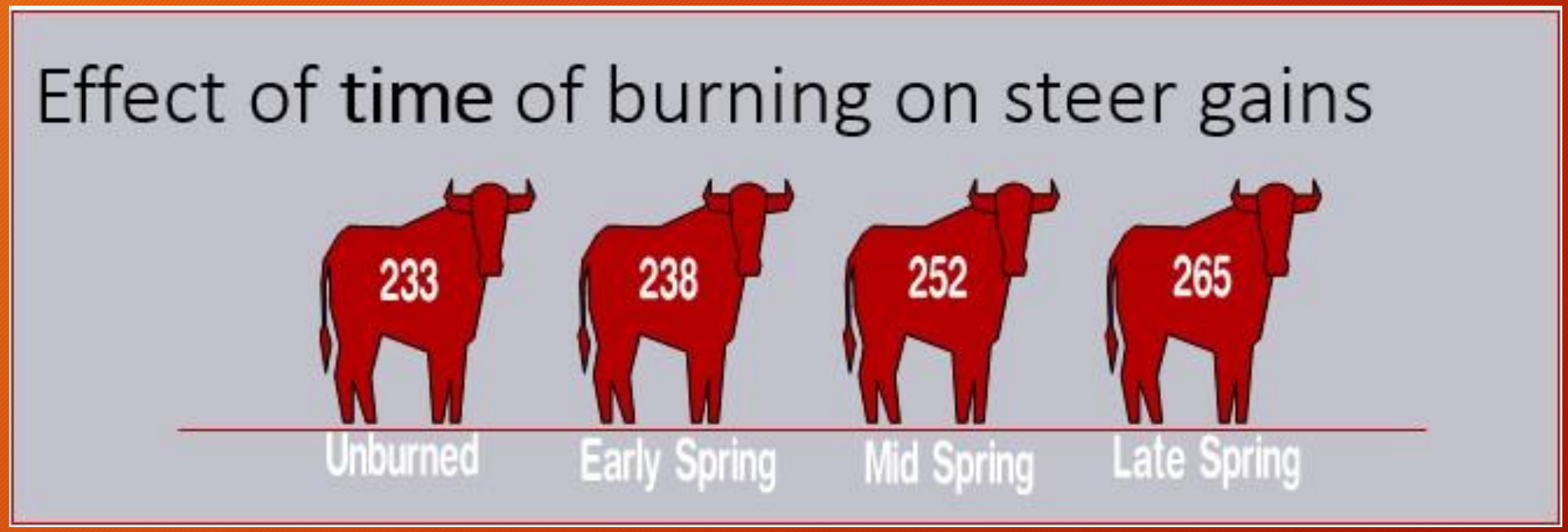


Photo courtesy of the University of Minnesota

Prescribed Fire

Photo courtesy of kidscowsandgrass.com

Cattle Gains



Graphic courtesy of Kansas State University

An Exceptional Event

- Environmental Protection Agency's (EPA) Exceptional Event Rule
  - 72 FR 13560, March 22, 2007
  - An exceptional event is defined 40 CFR 50.14 (c)(3)(iv)

    as an event that:
  - affects air quality
  - is not reasonably controllable or preventable
  - is caused by human activity that is unlikely to recur at a particular location or is a natural event
- April 6, 12, and 13, 2011 ozone exceeded the National Ambient Air Quality Standard (NAAQS) for 8-hour ozone at several air quality monitors
- April 29, 2011 ozone exceedances for 8-hour ozone were recorded in the Wichita area

Kansas monitors with 8-hour ozone concentrations exceeding 0.075 ppm in April 2011

Monitor	AQS Site Code	Date in 2011	Observed 8-Hour Ozone Concentration (ppm)
Mine Creek	201070002	April 6	0.076
Peck	201910002	April 6	0.082
Wichita Health Department	201730010	April 6	0.079
KNI-Topeka	201770013	April 12	0.084
Konza Prairie	201619991	April 12	0.078
Konza Prairie	201619991	April 13	0.079
Peck	201910002	April 29	0.077
Sedwick	201730018	April 29	0.082

Chart courtesy of KDHE Exceptional Events Report

Smoke Management Plan (SMP)

Photo courtesy of farmprogress.com

- The EPA has the authority to exclude data from use in exceedance determinations regarding NAAQS violations
- This may be applied to the use of prescribed fire if the state has met certain criteria
  - Part of the criteria requires the state to adopt and implement a smoke management plan
- The Kansas Department of Health and Environment (KDHE) formally adopted its SMP on December 2010

Monitoring at Konza Prairie

Photo courtesy of keep.konza.ksu.edu

- KDHE and owners of the Konza requested the EPA stop monitoring air quality at the site
  - Debate about data use for research vs. regulatory purposes
  - Concern for negative impact on the local economy vs. public health
- Director of the Konza Prairie biological station noted that there is a concern about exceedances in ozone during burn season but the real source is material carried in by the wind from other regions

Respiratory Health

- Ozone

  -Develops when oxides of nitrogen react with hydrocarbons and other volatile compounds with sunlight present

  - Can exacerbate allergies, asthma, and emphysema
  - Has the ability to decrease lung function in seemingly healthy people
  - Demonstrates the capability of causing illness in large numbers of the general public

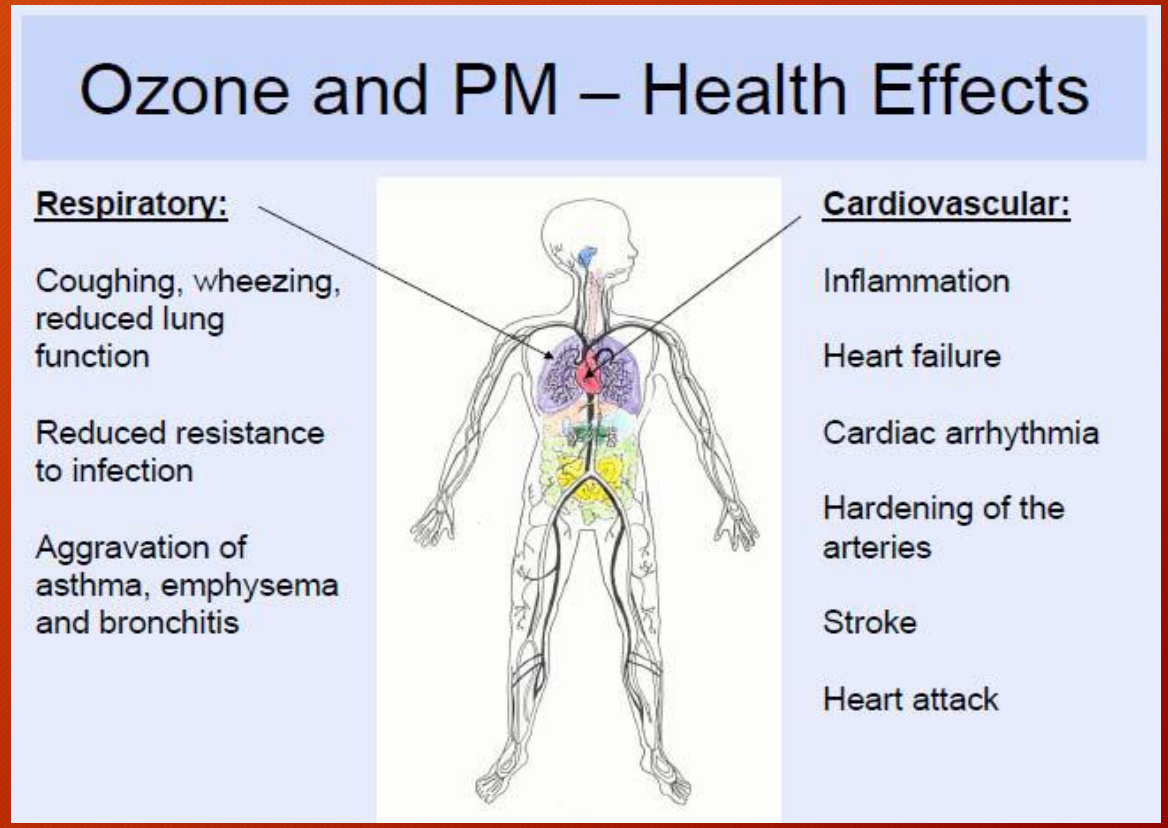


Image courtesy of KDHE

Respiratory Health

- Particulate Matter (PM)

  -A mixture of solid, liquid, or solid and liquid particles of organic or inorganic substances suspended in the air

  PM 10: diameter <10 µm (course fraction)

  PM 2.5: diameter <2.5 µm (fine fraction)

  Diameter <0.1 µm (ultra-fine fraction)

- Exposure leads to a wide range of acute and chronic conditions

- Long-term exposure to moderate amounts of PM leads to a reduction in life expectancy by several months

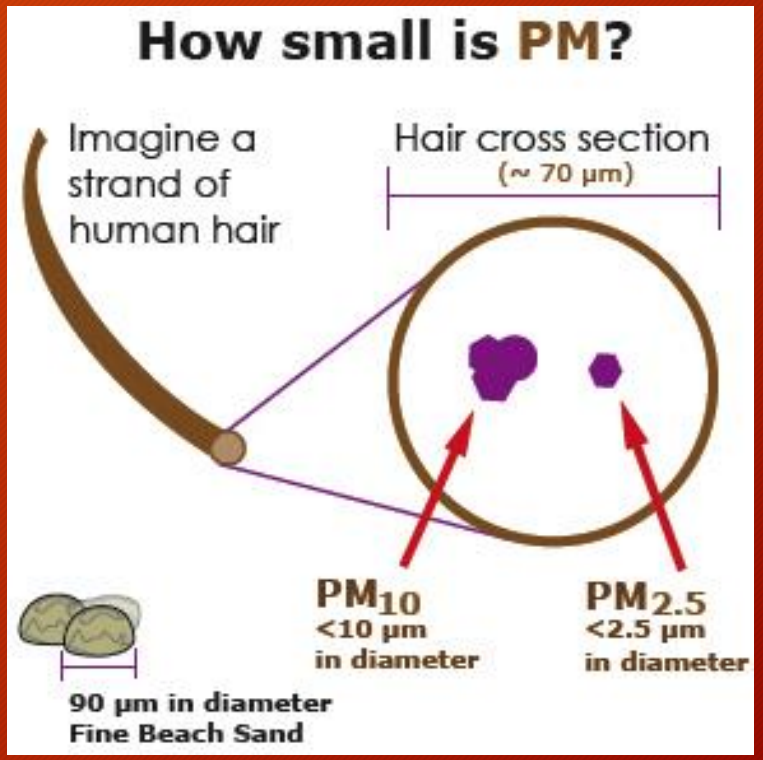


Photo courtesy of downwindersatrisk.org

Implications for Soldiers

- Many of their duties are performed outdoors

Photo courtesy of goarmy.com

- Pasture burning poses a unique public health concern
  - Is there a correlation between hospital admissions for respiratory-related illness in this population and pasture burning?
  - If so, what rules and regulations can be implemented to optimize respiratory health?

Photo courtesy of archive.armytimes.com

Konza Monitoring Station

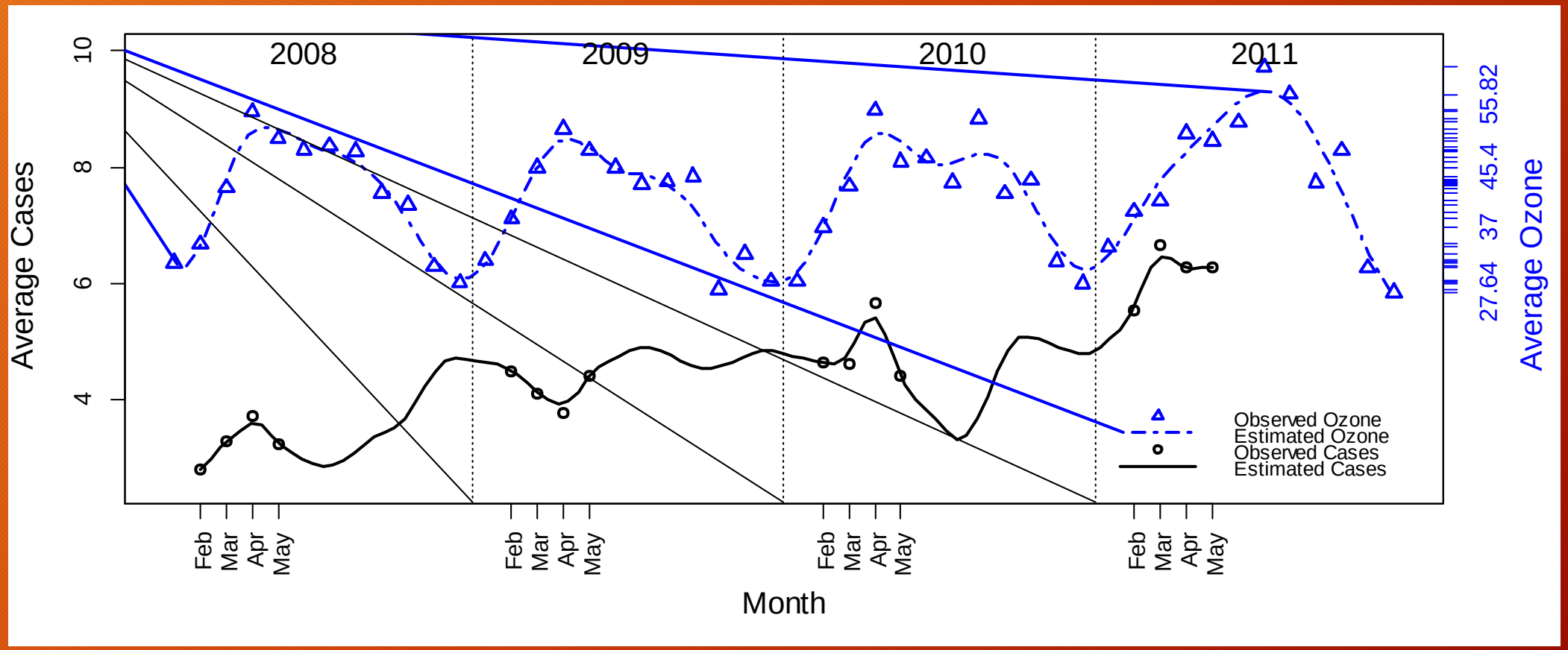
Air Quality Sites

Map courtesy of Google Earth

ICD-9 Codes

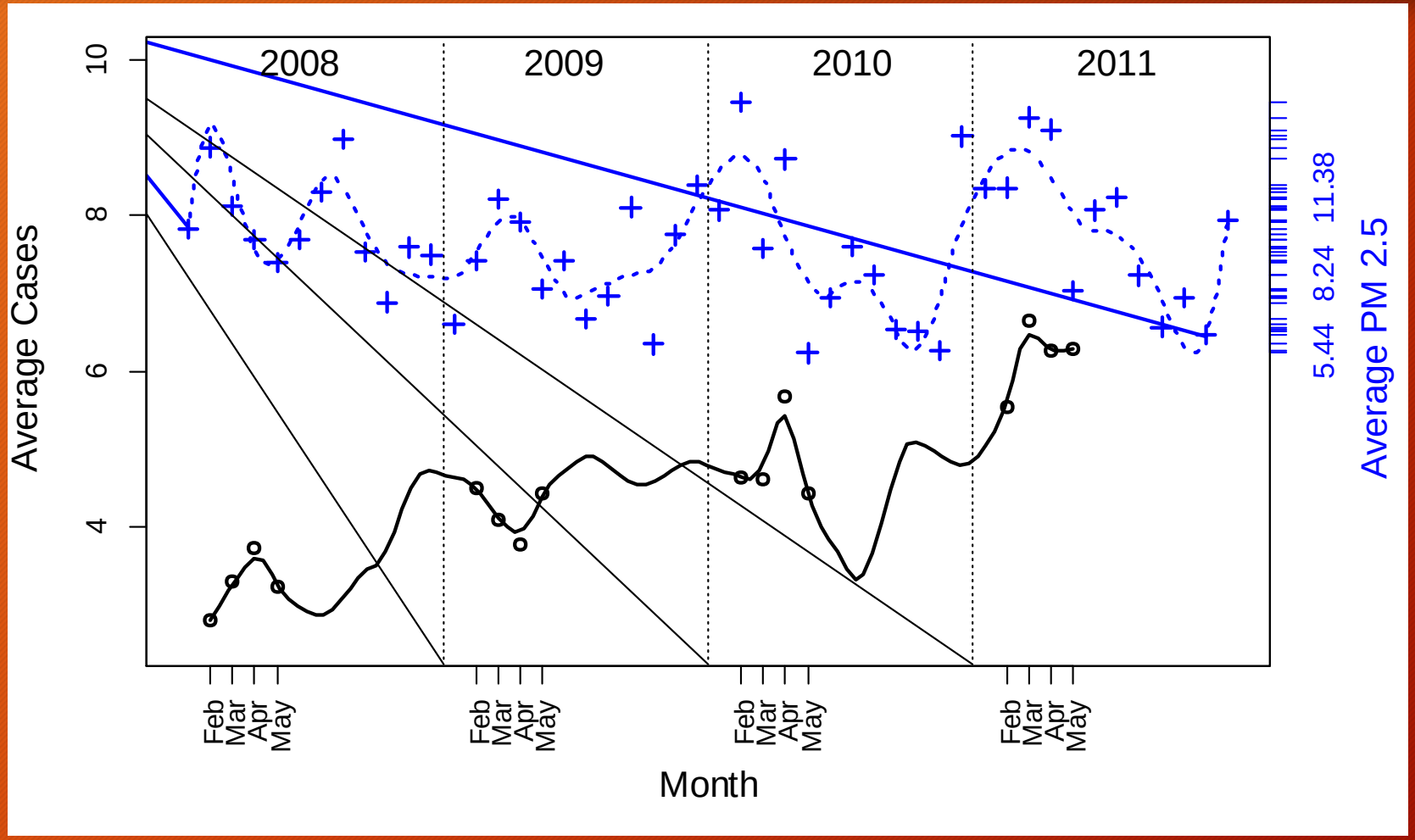
Medical Code	Respiratory Condition
460-466, 477, 480-487	Respiratory infection (including upper)
466	For children (as it may be difficult to distinguish from asthma): acute bronchitis and bronchiolitis
480-486	Pneumonia
480	Viral pneumonia
481	Pneumococcal pneumonia
482	Other bacterial pneumonia
483	Pneumonia due to other unspecified organism
485	Bronchopneumonia organism unspecified
486	Pneumonia organism unspecified
490-492, 494-496	Chronic Obstructive Pulmonary Disease (COPD)
491	Bronchitis
492	Emphysema
493	Asthma
508	Respiratory conditions due to other and unspecified external agents
786	Other respiratory symptoms
786.05	Shortness of breath
786.07	Wheeze
786.1	Stridor (whistling)
786.2	Cough
786.5	Chest Pain

Average Cases with Ozone

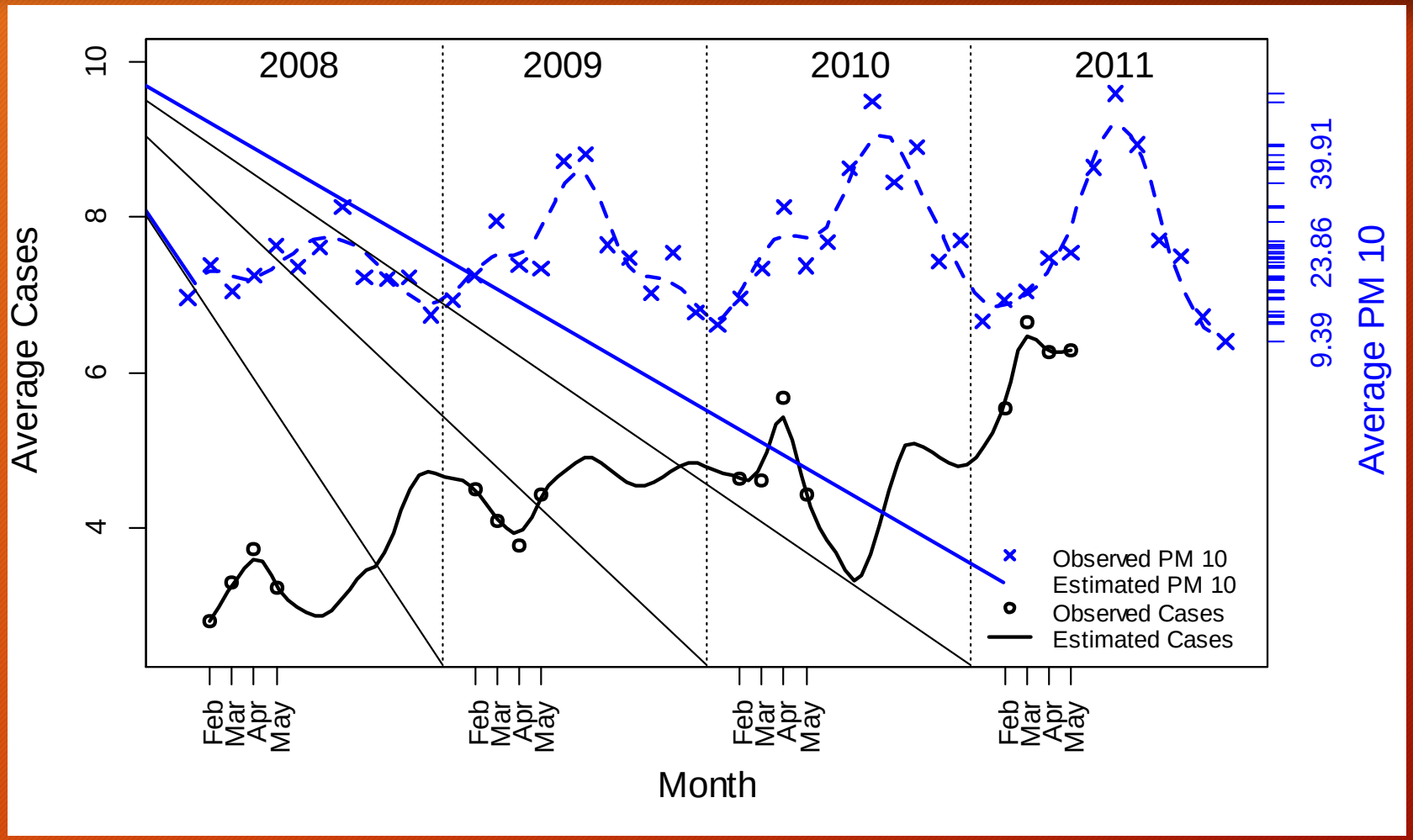


* Average ozone in PPB

Average Cases with PM 2.5



Average Cases with PM 10



Linear Mixed Model Analysis

Effect	Year	Estimate	Standard Error	DF	t Value	Pr > |t|
Intercept		4.0193	0.1811	3	22.19	0.0002
Year	2008	-2.8881	0.1251	6	-23.09	<.0001
Year	2009	-1.9406	0.3098	6	-6.26	0.0008
Year	2010	-1.3228	0.1640	6	-8.07	0.0002
Year	2011	0	.	.	.	.
Ozone		0.03191	0.007937	6	4.02	0.0070
PM 2.5		0.04616	0.02121	6	2.18	0.0724
PM 10.0		0.009947	0.02465	6	0.40	0.7005

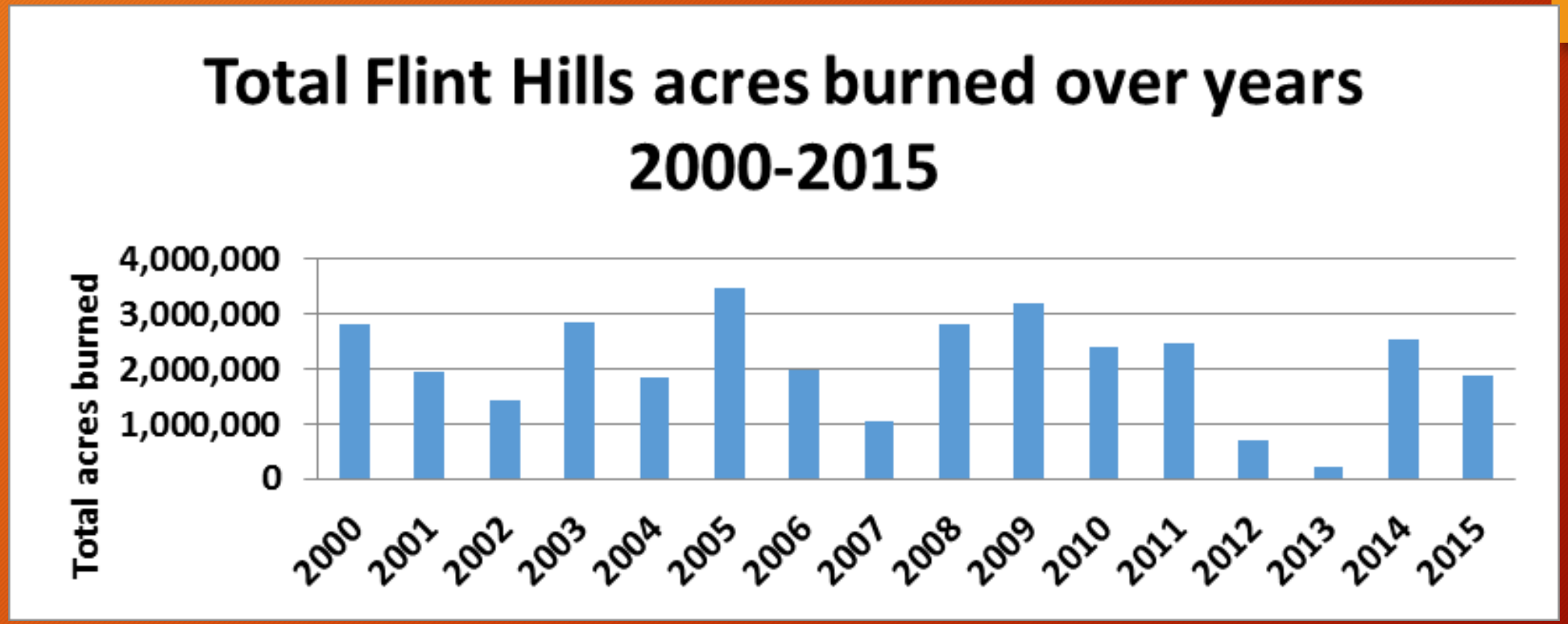


Chart courtesy of KDHE

Discussion

- Average acres burned and increase in respiratory illness did not coincide
  - Investigate other potential respiratory irritants
- Population at Fort Riley is demographically unique
- Missing demographic data
- Air quality data from separate locations

Discussion

- Pollen allergy forecast
  - Allergy and burn seasons occur simultaneously
    - Consider Eastern Red Cedar
- Future study for comparison
  - Fort Riley respiratory counts with Fort Carson
- Air quality data from February, March, April, and May
  - More inclusive study with year-round data

Conclusions

- Air quality data used in this report did not contain any exceedances or violations by Environmental Protection Agency (EPA) standards
- Exceptional event from EPA
  - No other violations in the state of Kansas
- Kansas Department of Health and Environment (KDHE) Smoke Management Plan (SMP)

Conclusions

- Education for the public on small engine use and emissions
  - Lawn mowers
  - Personal vehicles
- Alternate plans for soldiers on visibly hazy days
- Flint Hills Smoke Management website
  - http://www.ksfire.org
    - Tools for land managers
    - Education for burn decisions

Core Courses

- Environmental health sciences: established connections between the environment and human health as well as potential solutions when problems arise
- Social and behavioral sciences: provided an in-depth understanding of the complexities of human behavior
- Biostatistics: laid the foundation for understanding the basic principles of analyzing data
- Epidemiology: cultivated a process for critically thinking about complex public health issues and interpreting data appropriately
- Health services administration: directly related to my field experience and the collaborative health care efforts made in the local community

Questions?

Acknowledgments

- Dr. Robert Larson
- Dr. Wei-Wen Hsu
- Dr. Deborah Canter
- Dr. John Blair
- Rosemary Ramundo
- Dr. Carol Blocksome
- Dr. Paul Benne
- Fort Riley Public Health Department Staff

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