

Adults Hospitalized with Pneumonia in the USA: Incidence, Epidemiology & Mortality

Julio A. Ramirez, MD, FACP

Professor of Medicine and Chief, Infectious Diseases Division

University of Louisville School of Medicine

Louisville, Kentucky, USA

Pneumonia Hospitalizations in USA

1. UofL Pneumonia Study: Design

2. Pneumonia: Incidence

3. Pneumonia: Epidemiology

4. Pneumonia: Mortality

Pneumonia Hospitalizations in USA

1. UofL Pneumonia Study: Design

2. Pneumonia: Incidence

3. Pneumonia: Epidemiology

4. Pneumonia: Mortality

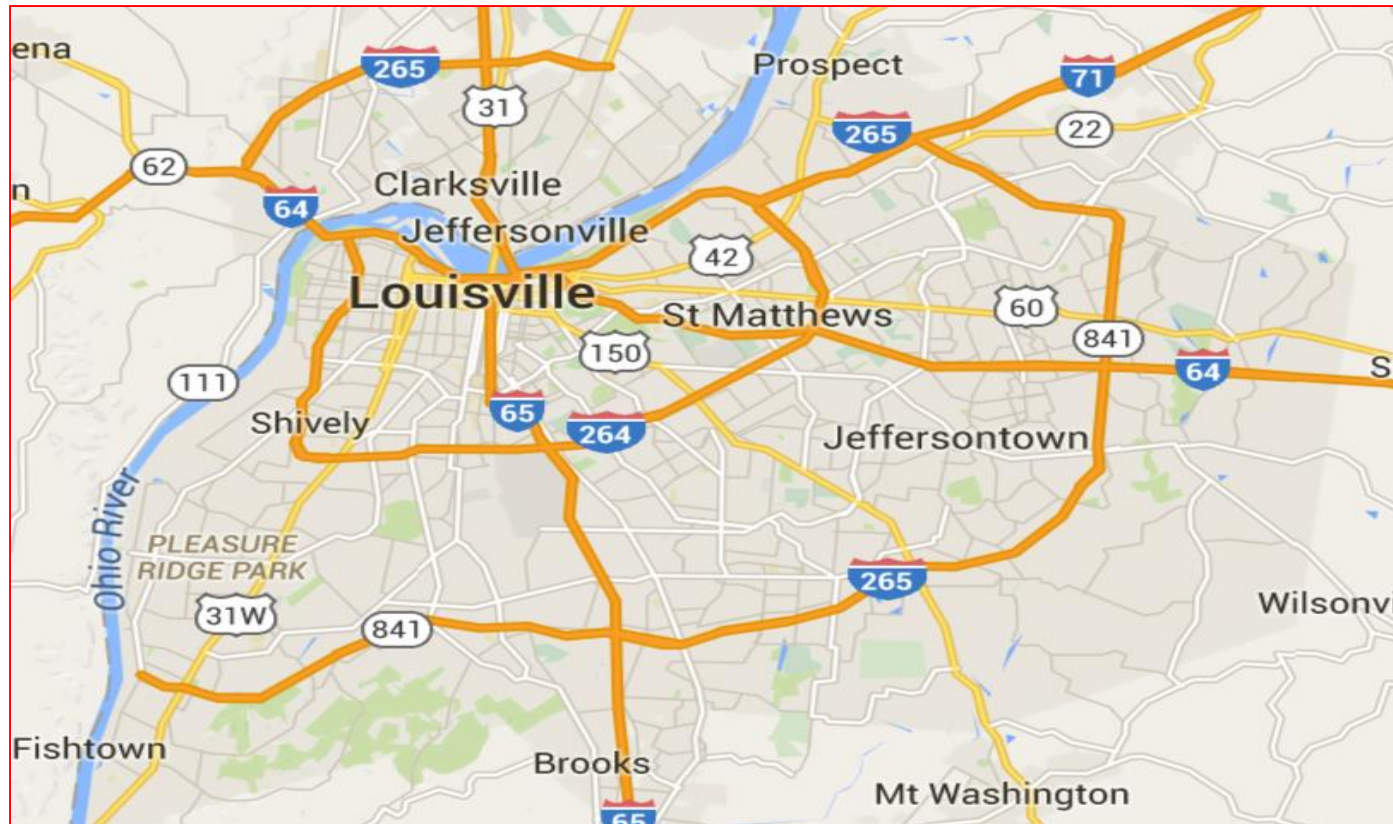
University of Louisville Pneumonia Study

City of Louisville, Kentucky, USA



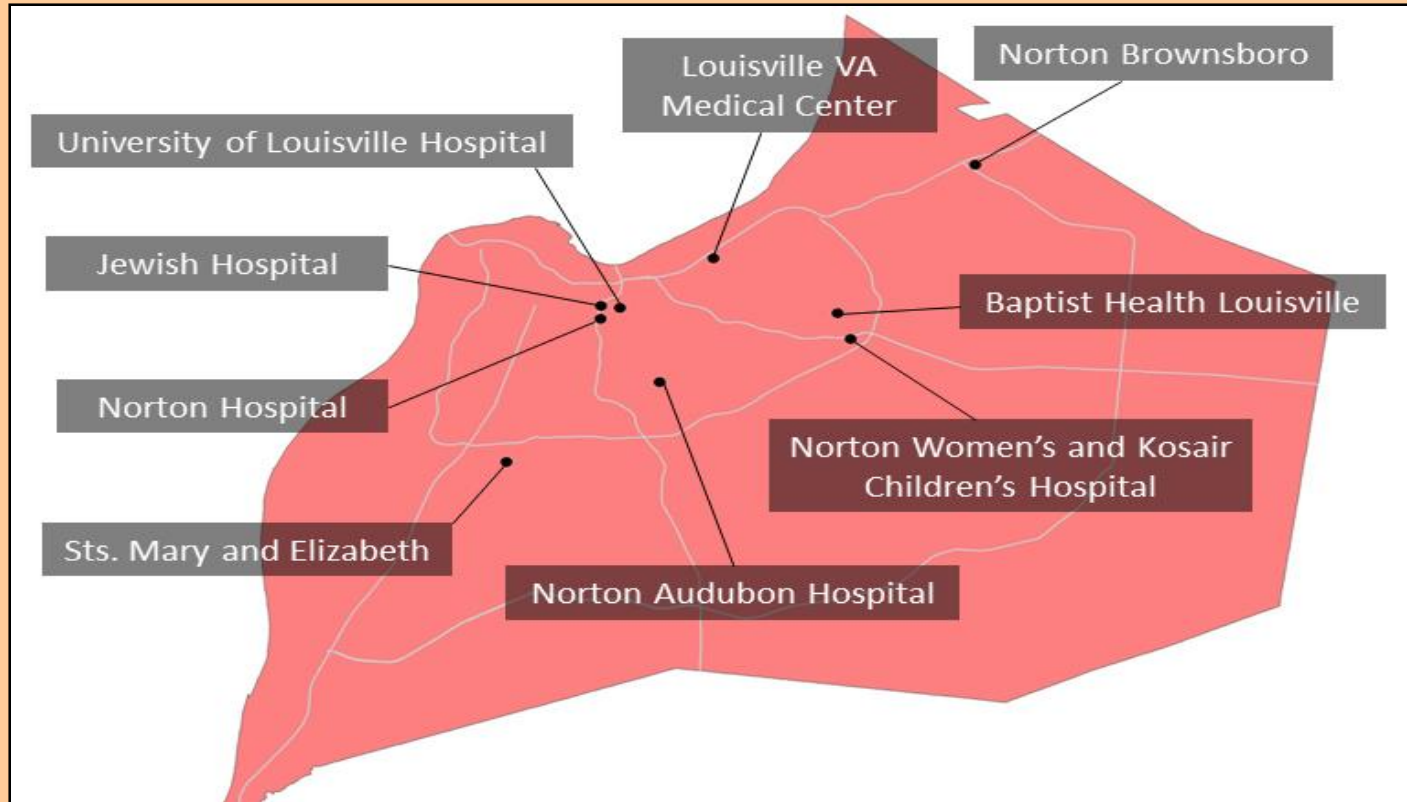
University of Louisville Pneumonia Study

City of Louisville, Kentucky



University of Louisville Pneumonia Study

City of Louisville, Kentucky



Louisville Total Population: 746,906
Adult Population: 587,499
Adults Hospitals: 9

University of Louisville Pneumonia Study

Louisville Adult Population: 587,499



UofL Hospital



VA Hospital



Jewish Hospital



Norton Hospital



Baptist East Hospital



Suburban Hospital



Audubon Hospital



Brownsboro Hospital



St Mary's Hospital

University of Louisville Pneumonia Study

Study Design: Prospective population-based cohort study of all hospitalized adults with CAP who were residents in the city of Louisville, from June 1st 2014 to May 31st 2016

University of Louisville Pneumonia Study

Study Design: Prospective population-based cohort study of all hospitalized adults with CAP who were residents in the city of Louisville, from June 1st 2014 to May 31st 2016

Criteria to Define CAP:

- 1. Presence of a new pulmonary infiltrate**
- 2. At least one of the following a) new or increased cough or sputum production, b) fever or hypothermia, c) leukocytosis or leukopenia**
- 3. No alternative diagnosis at the time of hospital discharge that justified the presence of criteria 1 and 2**

University of Louisville Pneumonia Study

Study Design: Prospective population-based cohort study of all hospitalized adults with CAP who were residents in the city of Louisville, from June 1st 2014 to May 31st 2016

Criteria to Define CAP:

- 1. Presence of a new pulmonary infiltrate**
- 2. At least one of the following a) new or increased cough or sputum production, b) fever or hypothermia, c) leukocytosis or leukopenia**
- 3. No alternative diagnosis at the time of hospital discharge that justified the presence of criteria 1 and 2**

Exclusion Criteria: With the intent to enroll only hospitalized patients with CAP who lived in Louisville, and who were counted in the 2010 U.S. Census, patients were excluded if they:

- 1) Did not have a permanent or valid Louisville address**
- 2) Did not have a valid Social Security Number (SSN)**
- 3) Were in the correctional system**

Pneumonia Hospitalizations in USA

1. UofL Pneumonia Study: Design

2. Pneumonia: Incidence

3. Pneumonia: Epidemiology

4. Pneumonia: Mortality

UofL Pneumonia Study: Incidence

Total Hospitalizations: 186,384

**All adults, all-cause hospitalizations in Louisville
during the two-year study period**

**Hospitalizations
Year One: 93,275
June 1st 2014 to
May 31st 2015**

**Hospitalizations
Year Two: 93,109
June 1st 2015 to
May 31st 2016**

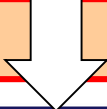
UofL Pneumonia Study: Incidence

Total Hospitalizations: 186,384

All adults, all-cause hospitalizations in Louisville
during the two-year study period

Hospitalizations
Year One: 93,275
June 1st 2014 to
May 31st 2015

Hospitalizations
Year Two: 93,109
June 1st 2015 to
May 31st 2016



**Annual Number of Adult Patients
Hospitalized with CAP: 3,725**

UofL Pneumonia Study: Incidence

Adult Population in the US: 245,201,108



Adult Population in the City of Louisville: 587,499



Number of Patients
Hospitalized with CAP:
3,725

UofL Pneumonia Study: Incidence

Adult Population in the US: 245,201,108

Adult Population in the City of Louisville: 587,499

Number of Patients
Hospitalized with CAP:
3,725

Incidence of patients
hospitalized with CAP:
649 Patients/100,000 population

UofL Pneumonia Study: Incidence

Adult Population in the US: 245,201,108

Adult Population in the City of Louisville: 587,499

Number of Patients
Hospitalized with CAP:
3,725

Incidence of patients
hospitalized with CAP:
649 Patients/100,000 population

Annual number of patients
hospitalized with CAP:
1,591,825 Patients

UofL Pneumonia Study: Incidence

Adult Population in the US: 245,201,108

Adult Population in the City of Louisville: 587,499

Number of Patients
Hospitalized with CAP:
3,725

9%

Number of Hospitalizations
due to CAP:
4,272

Incidence of patients
hospitalized with CAP:
649 Patients/100,000 population

Annual number of patients
hospitalized with CAP:
1,591,825 Patients

UofL Pneumonia Study: Incidence

Adult Population in the US: 245,201,108

Adult Population in the City of Louisville: 587,499

Number of Patients
Hospitalized with CAP:
3,725

9%

Number of Hospitalizations
due to CAP:
4,272

Incidence of patients
hospitalized with CAP:
649 Patients/100,000 population

Incidence of hospitalizations
due to CAP:
706 Cases/100,000 population

Annual number of patients
hospitalized with CAP:
1,591,825 Patients

UofL Pneumonia Study: Incidence

Adult Population in the US: 245,201,108

Adult Population in the City of Louisville: 587,499

Number of Patients
Hospitalized with CAP:
3,725

9%

Number of Hospitalizations
due to CAP:
4,272

Incidence of patients
hospitalized with CAP:
649 Patients/100,000 population

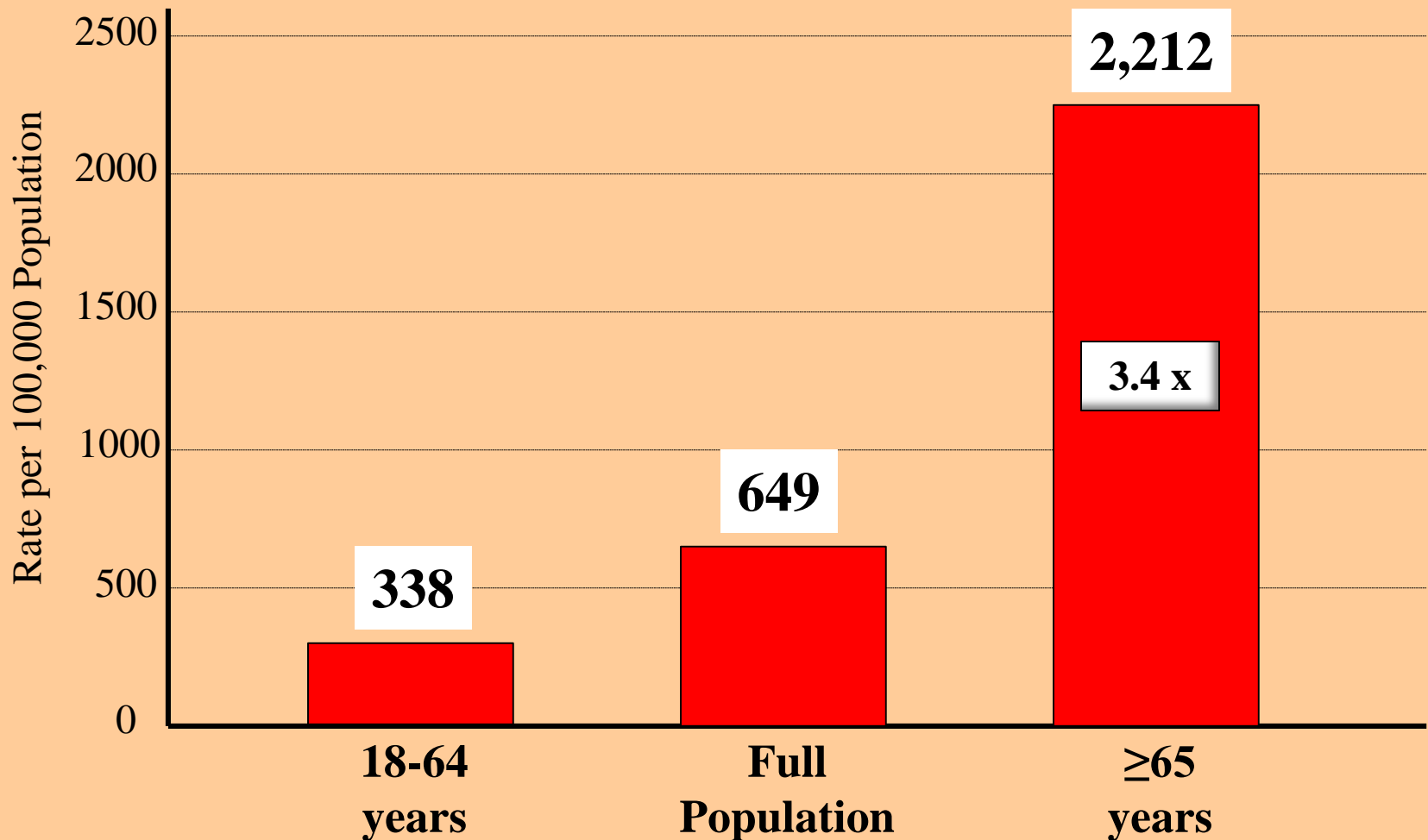
Incidence of hospitalizations
due to CAP:
706 Cases/100,000 population

Annual number of patients
hospitalized with CAP:
1,591,825 Patients

Annual Number of
hospitalizations due to CAP:
1,731,121 Hospitalizations

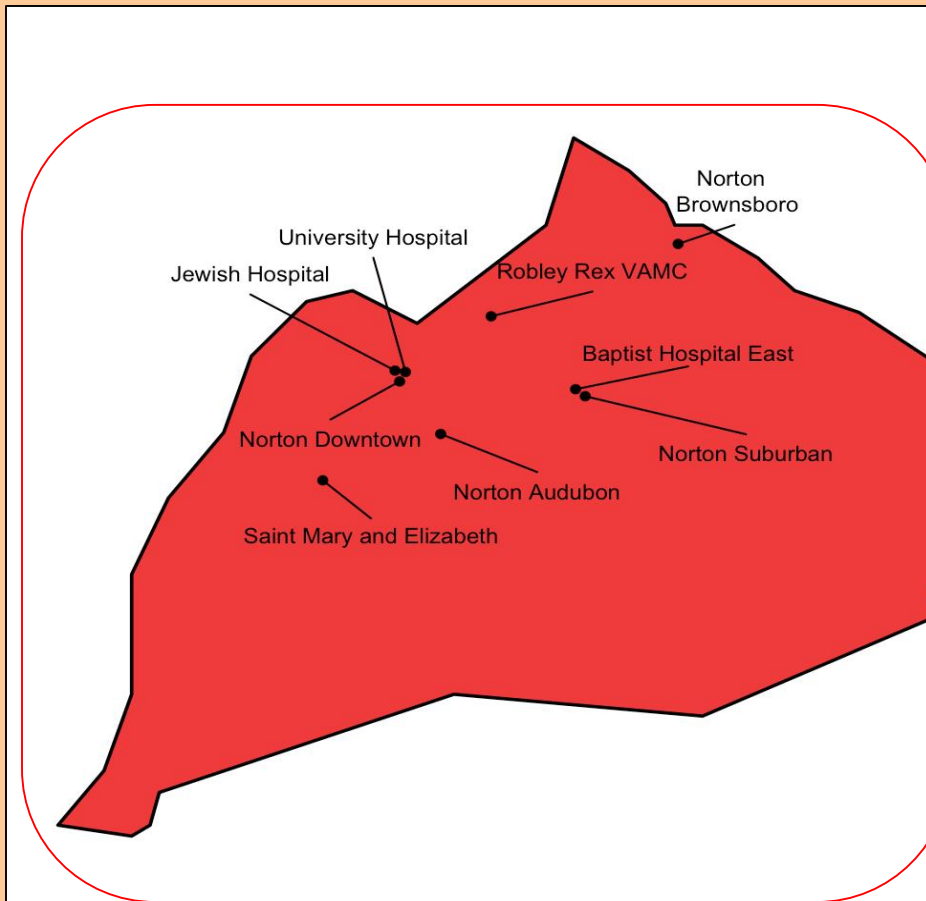
UofL Pneumonia Study: Incidence

Pneumonia Incidence: Impact of Age



UofL Pneumonia Study: Incidence

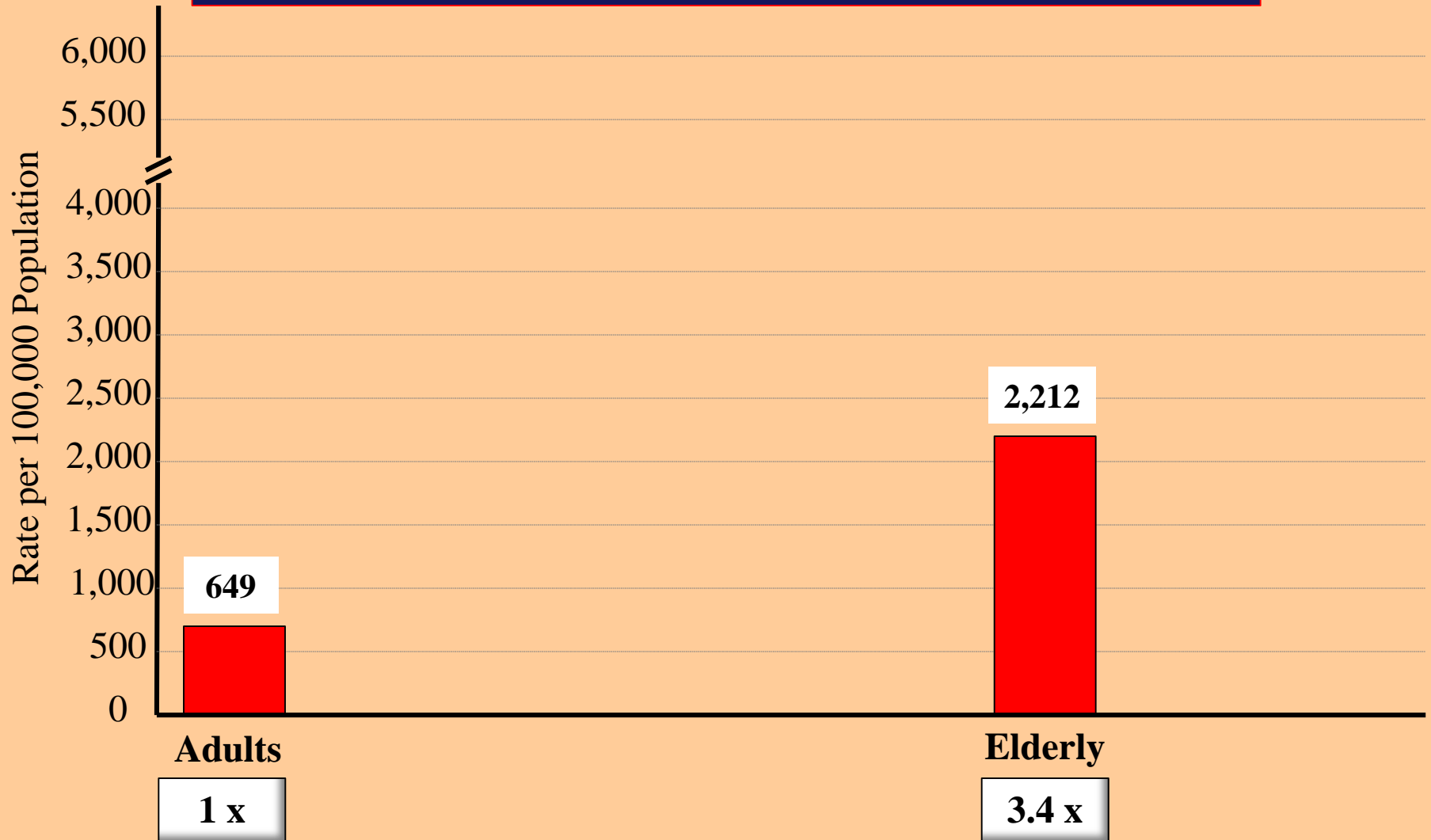
Pneumonia Incidence: Impact of Comorbidities



Louisville Health Department	
Obese	193,875
Smoking	142,587
Diabetes	67,269
CHF	30,727
COPD	29,792
Stroke	23,500

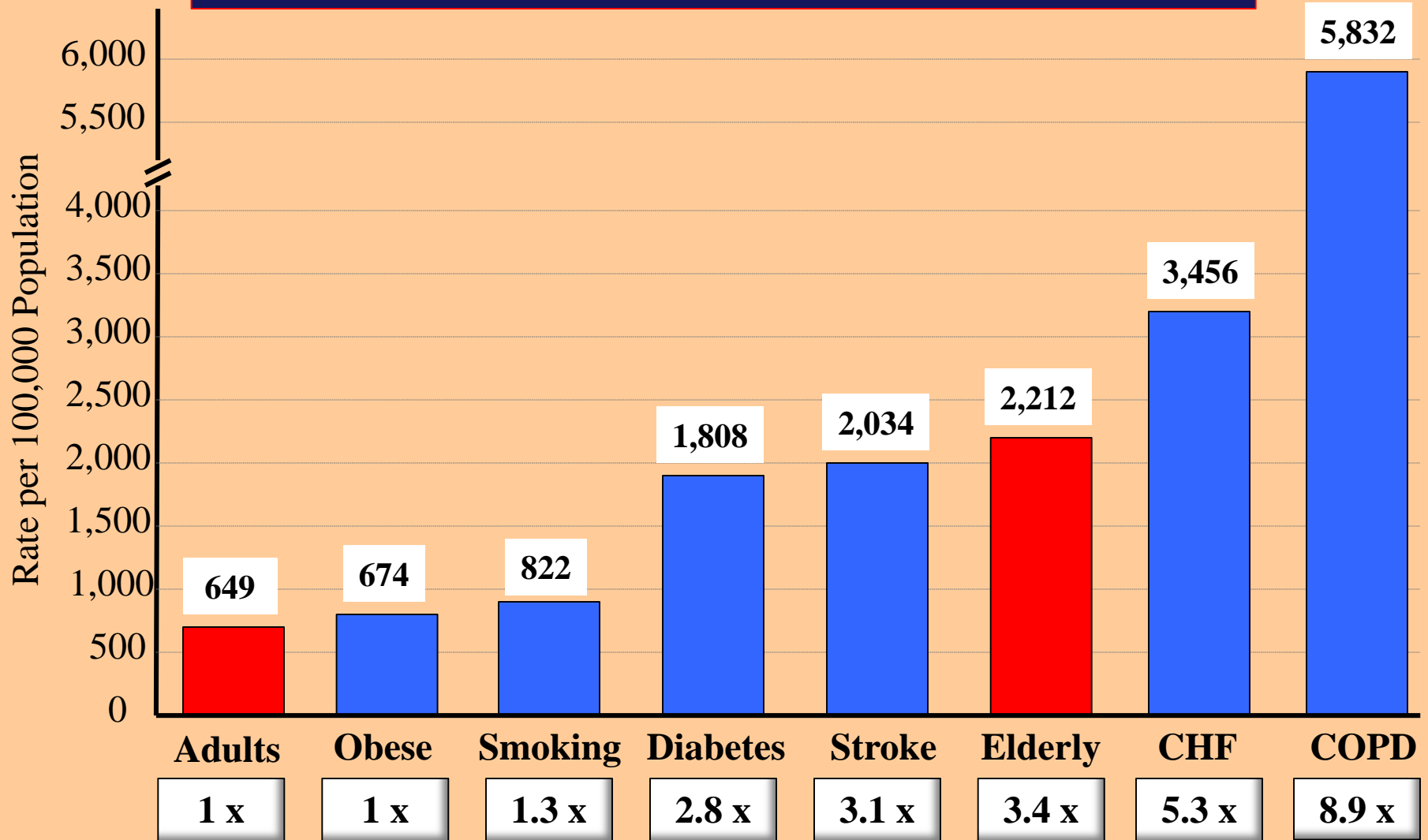
UofL Pneumonia Study: Incidence

Pneumonia Incidence: Impact of Comorbidities



UofL Pneumonia Study: Incidence

Pneumonia Incidence: Impact of Comorbidities



Pneumonia Hospitalizations in USA

1. UofL Pneumonia Study: Design

2. Pneumonia: Incidence

3. Pneumonia: Epidemiology

4. Pneumonia: Mortality

Geospatial Epidemiology

City of Louisville, KY



Jefferson County: Census Tracts

 Census Tracts

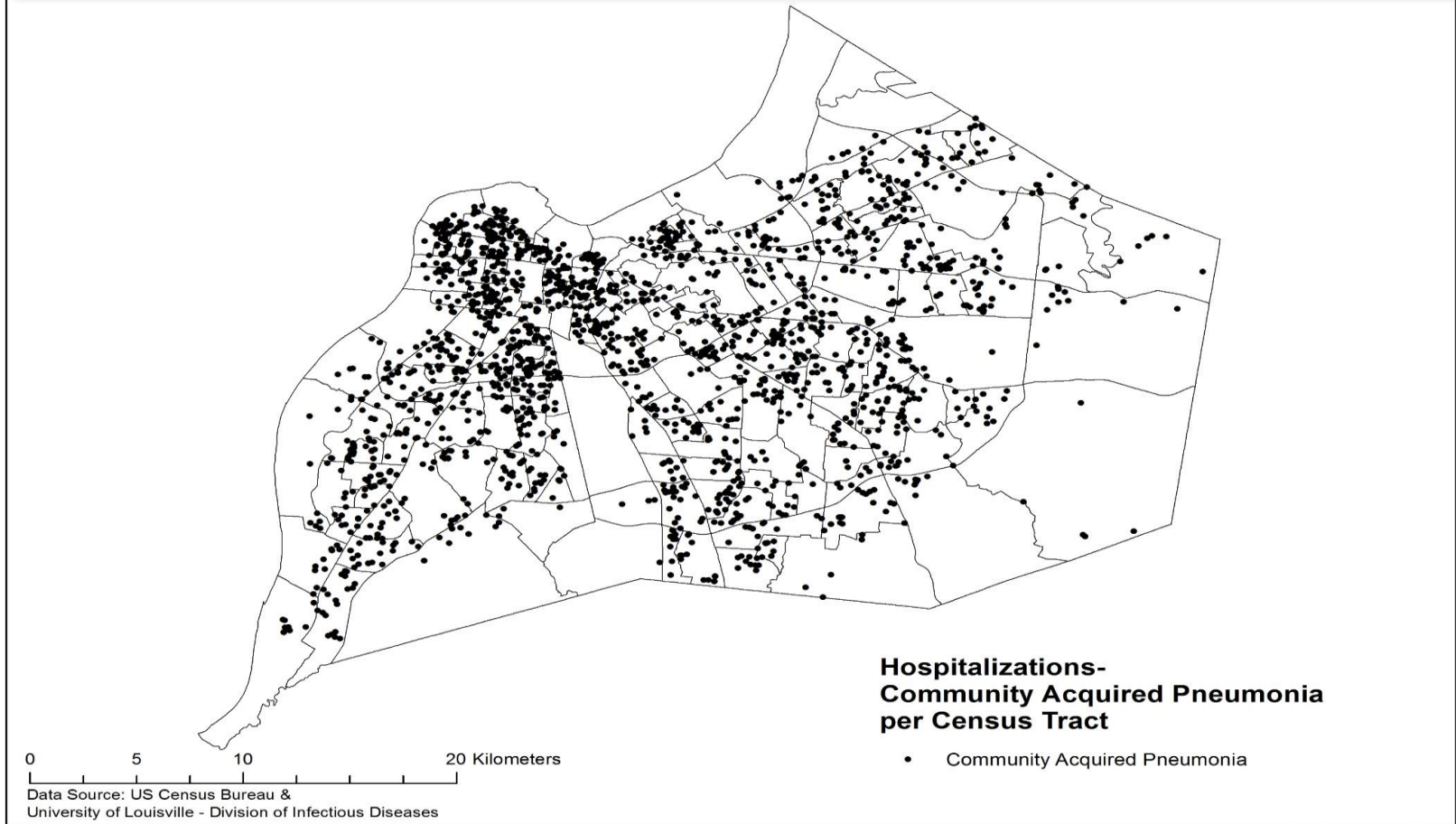
0 5 10 20 Kilometers

Data Source: US Census Bureau &
University of Louisville - Division of Infectious Diseases

Map Author: Brian Guinn

Geospatial Epidemiology

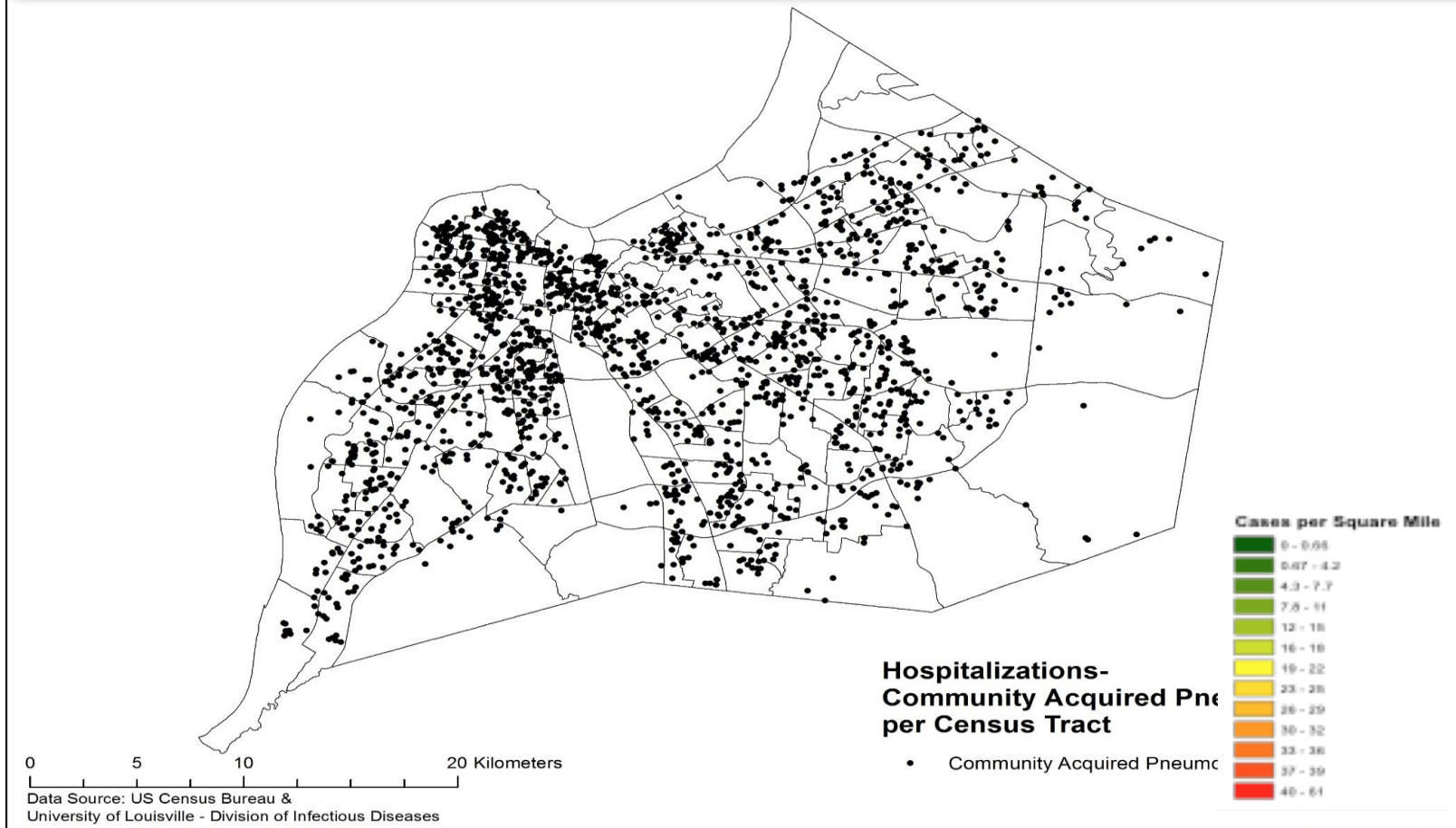
City of Louisville: Distribution of CAP



Map Author: Brian Guinn

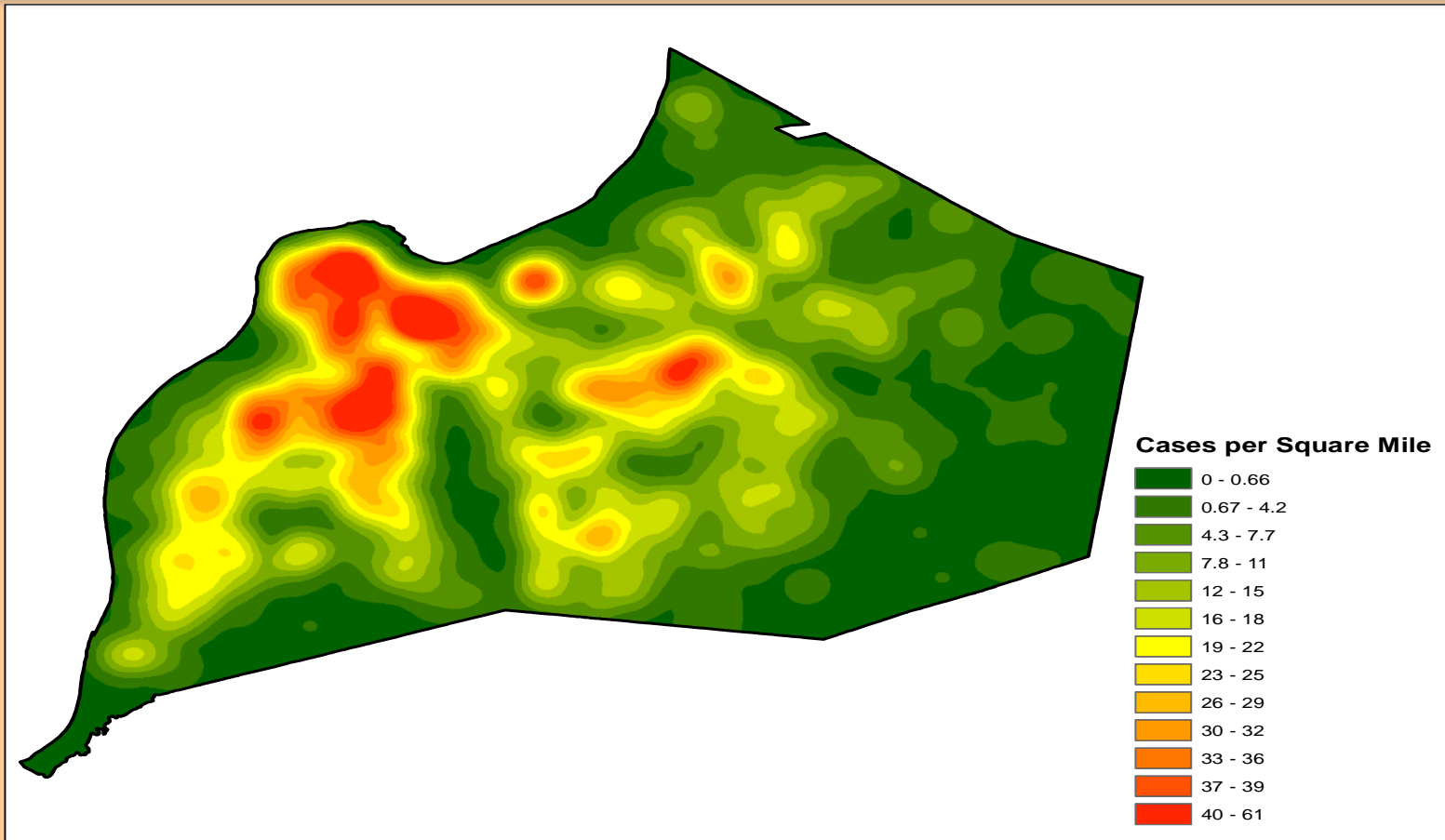
Geospatial Epidemiology

City of Louisville: Distribution of CAP



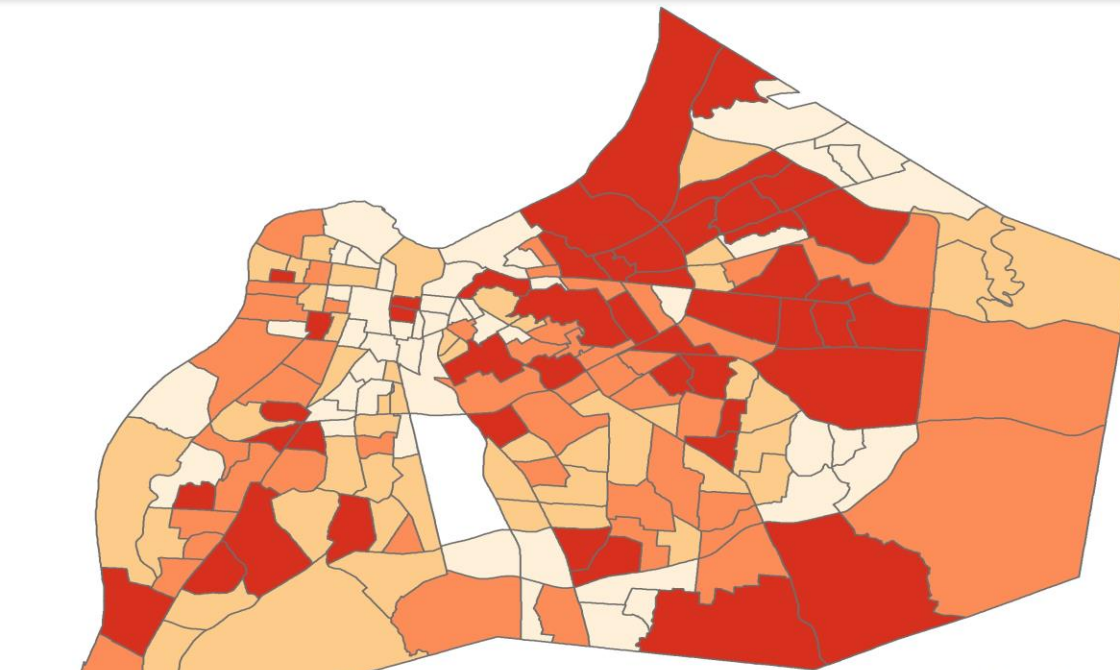
Geospatial Epidemiology

City of Louisville: Distribution of CAP



Geospatial Epidemiology

City of Louisville: Elderly Population



**Percent Population \geq 65 Years of Age
per Census Tract**



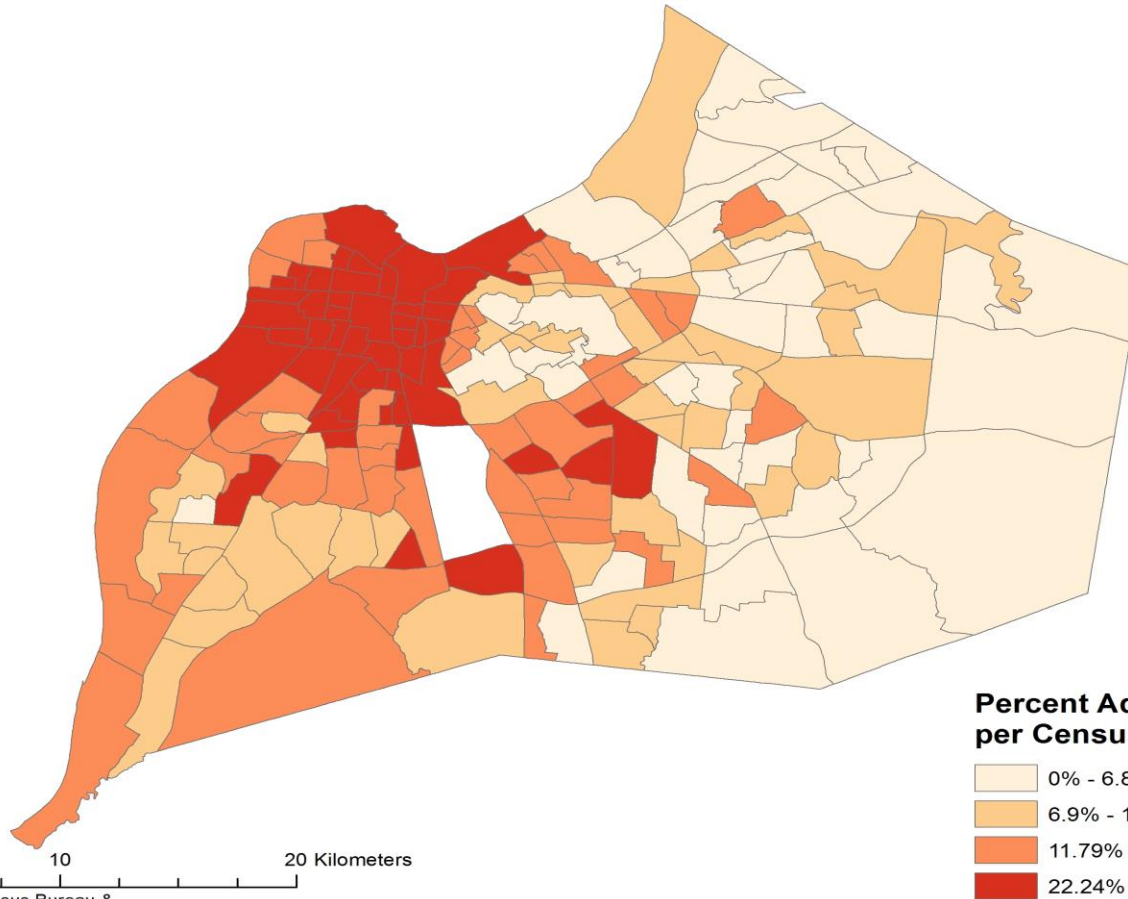
0 5 10 20 Kilometers

Data Source: US Census Bureau &
University of Louisville - Division of Infectious Diseases

Map Author: Brian Guinn

Geospatial Epidemiology

City of Louisville: Adult Poverty



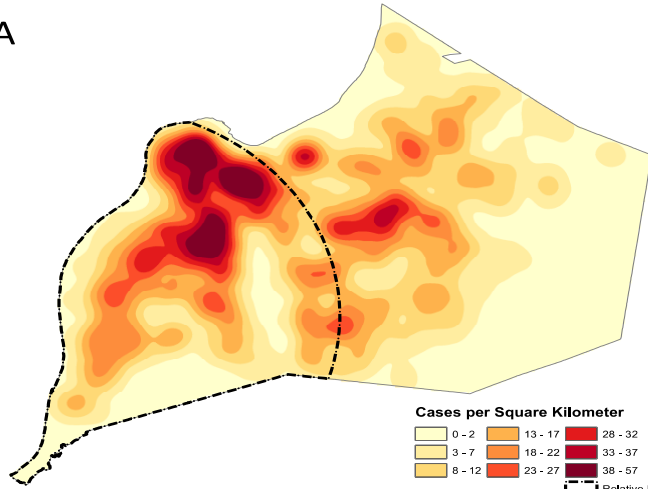
0 5 10 20 Kilometers

Data Source: US Census Bureau &
University of Louisville - Division of Infectious Diseases

Map Author: Brian Guinn

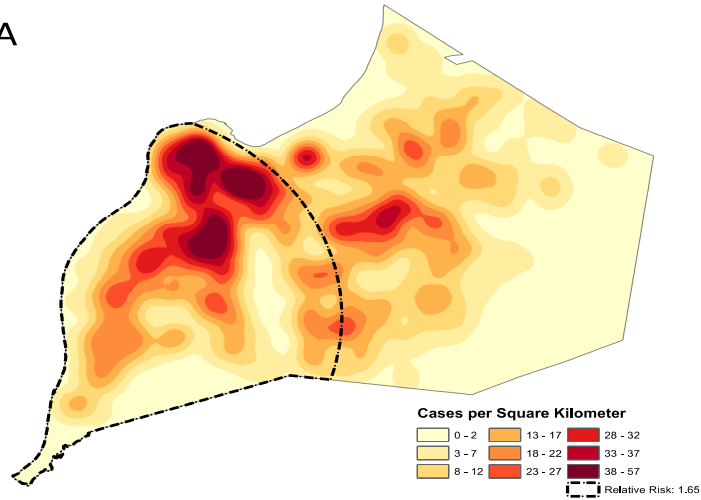
Geospatial Epidemiology

A

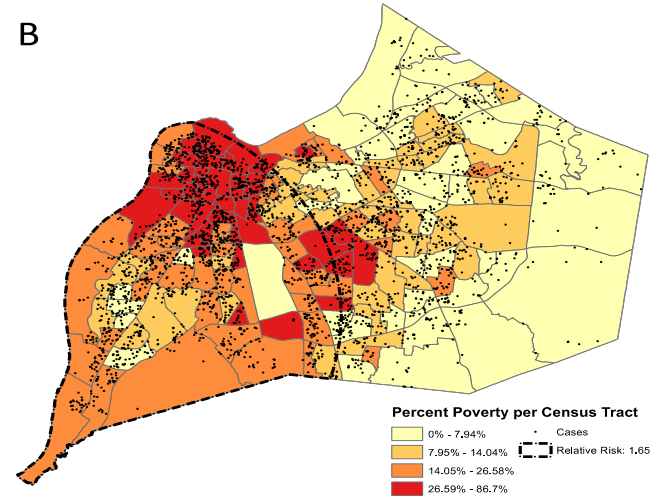


Geospatial Epidemiology

A

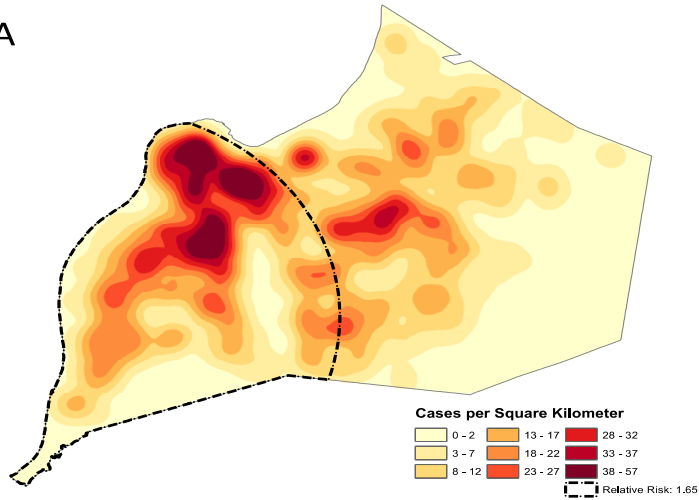


B

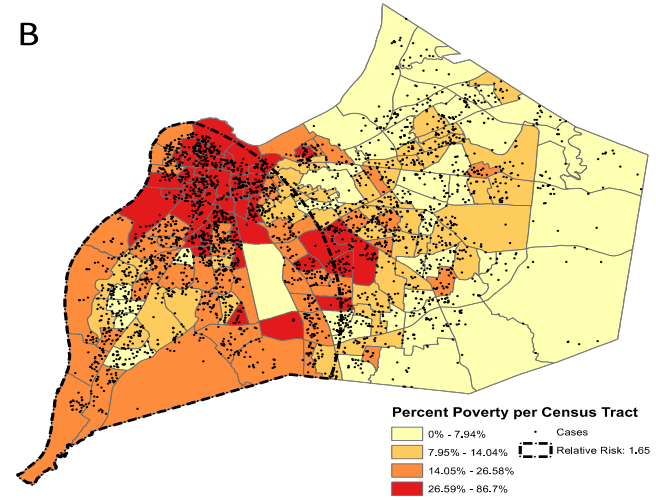


Geospatial Epidemiology

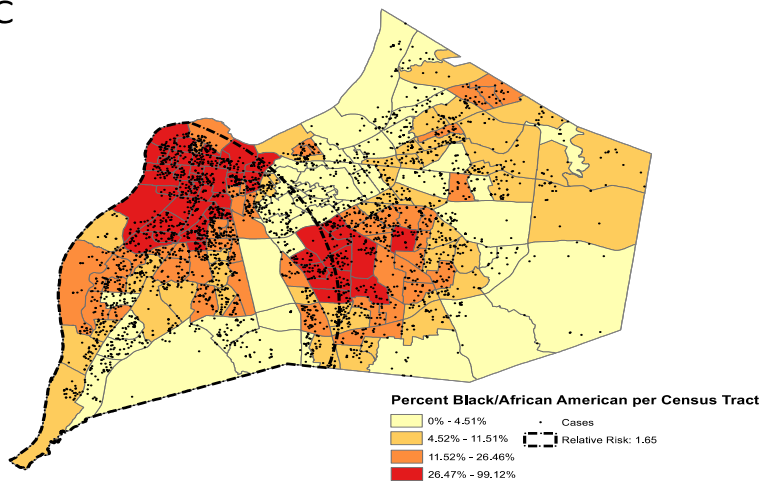
A



B

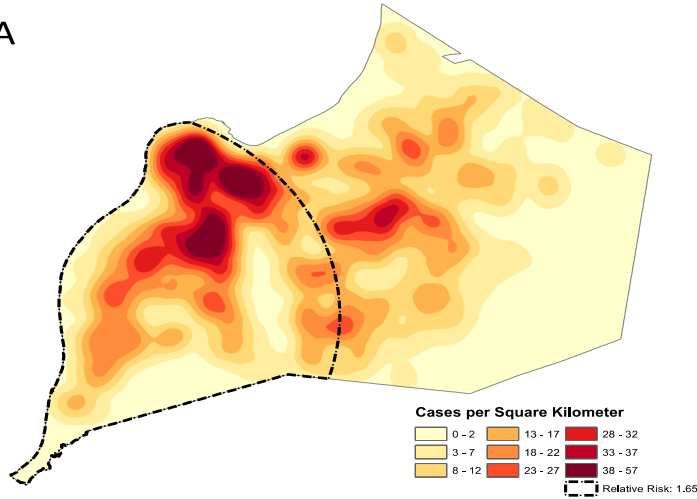


C

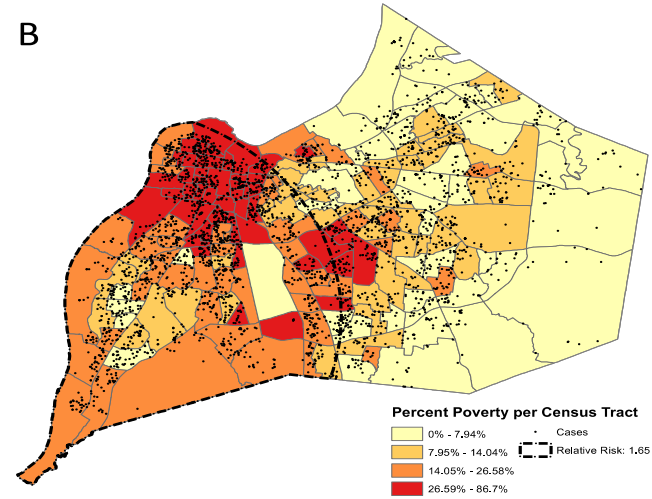


Geospatial Epidemiology

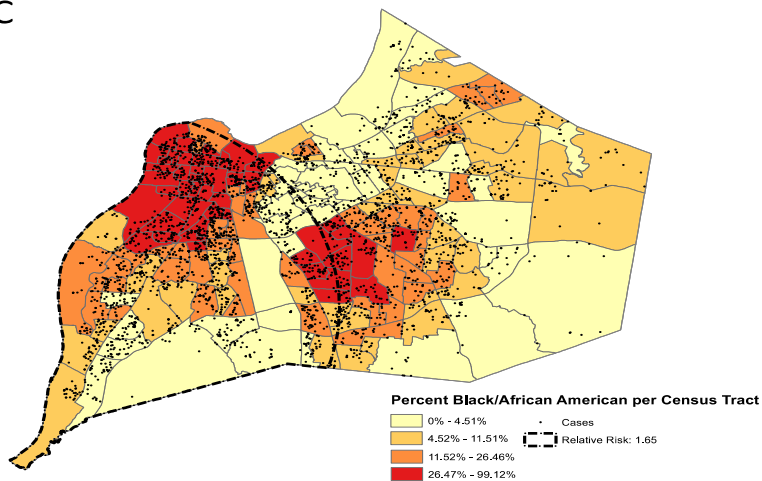
A



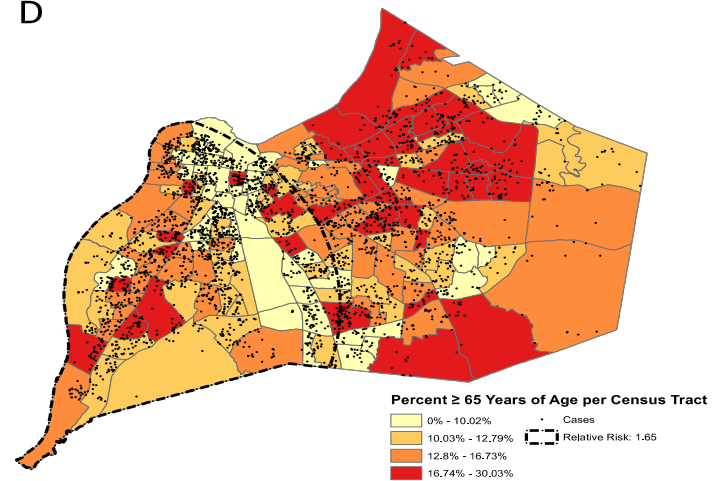
B



C



D



Geospatial Epidemiology

Health Disparities in Pneumonia Risk & Income Level

Poverty & Pneumonia

Poor nutrition
Poor housing conditions
Poor air quality
Increased rates of smoking
Lack of medical insurance
Suboptimal access to medical care
Suboptimal preventive medicine
Low educational level
Poor job

Socioeconomic status contribute to an individual risk to develop pneumonia

Pneumonia Hospitalizations in USA

1. UofL Pneumonia Study: Design

2. Pneumonia: Incidence

3. Pneumonia: Epidemiology

4. Pneumonia: Mortality

Pneumonia Mortality

Rank	Cause of Death	Number
1	Heart Disease	611,105
2	Cancer	584,881
3	Chronic Pulmonary Disease	149,205
4	Accidents	130,557
5	Stroke	128,978
6	Alzheimer's Disease	84,767
7	Diabetes	75,578
8	Pneumonia	56,979

Data based on “underlying cause of death” reported on death certificates

Pneumonia Mortality

CAP Mortality:
Days after diagnosis

**Clinical
Deterioration**

CAP A

**Clinical
Improvement**

1 2 3 4 5 6

7 Days



Pneumonia Mortality

CAP Mortality:
Days after diagnosis

Clinical
Deterioration

CAP A

Clinical
Improvement

Acute Myocardial Infarction in Hospitalized Patients
with Community-Acquired Pneumonia

Julio Ramirez,¹ Stefano Aliberti,^{1,6} Mehdi Mirsaeidi,¹ Paula Peyrani,¹ Giovanni Filardo,^{3,4} Asad Amir,¹ Bryan Moffett,²
Josh Gordon,² Francesco Blasi,⁶ and Jose Bordon^{1,5}

Ramirez J et al. *Clin Infect Dis*. 2008;47:182-7

1 2 3 4 5 6

7 Days

Pneumonia Mortality

CAP Mortality:
Days after diagnosis

CAP Mortality:
Weeks after diagnosis

Clinical
Deterioration

CAP A

Clinical
Improvement

B

Clinical
Deterioration

Clinical
Improvement

1 2 3 4 5 6

7 Days

2 3 4

Weeks

Pneumonia Mortality

CAP Mortality:
Days after diagnosis

CAP Mortality:
Weeks after diagnosis

Clinical
Deterioration

Clinical
Improvement

Clinical
Deterioration

Clinical
Improvement

CAP (-) 6,347

Long Term
Survival:
5 years

CAP (+) 624

CAP A

B

1 2 3 4 5 6

7 Days

2 3 4

Weeks

Pneumonia Mortality

CAP Mortality:
Days after diagnosis

CAP Mortality:
Weeks after diagnosis

Clinical
Deterioration

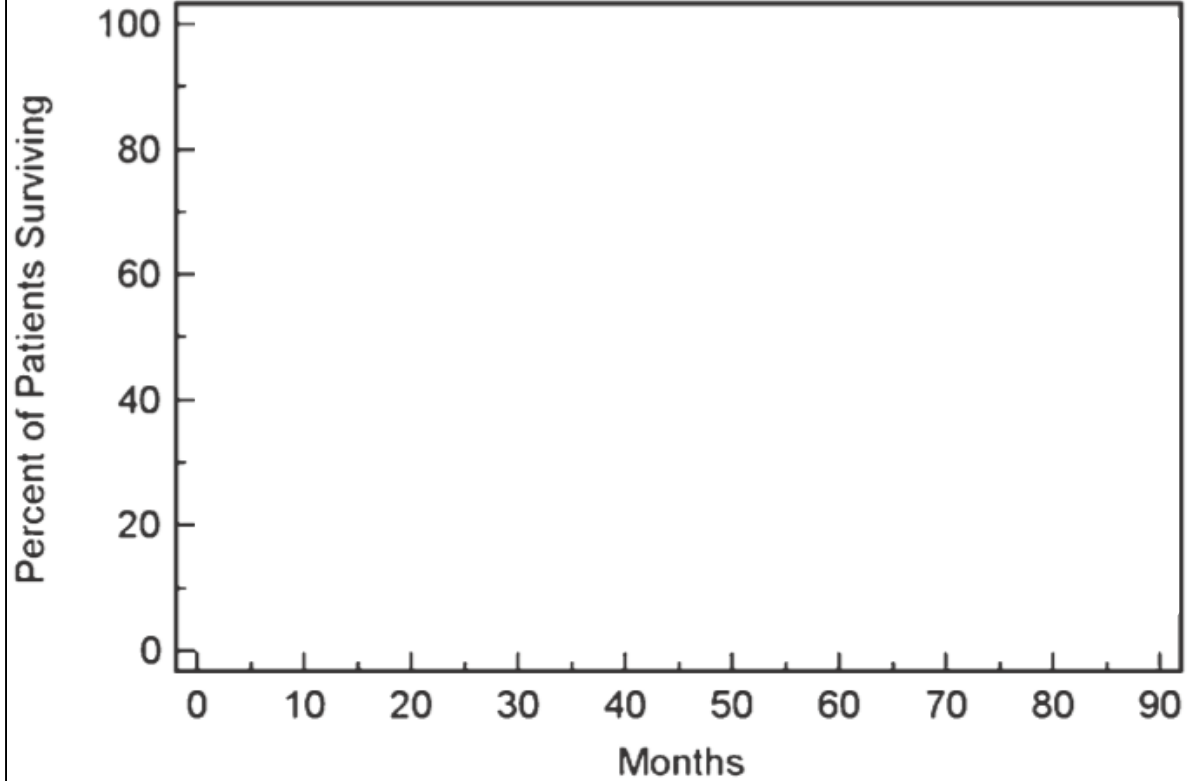
Clinical
Improvement

CAP A

1 2 3 4 5 6

7 Days

Weeks



Pneumonia Mortality

CAP Mortality:
Days after diagnosis

CAP Mortality:
Weeks after diagnosis

Clinical
Deterioration

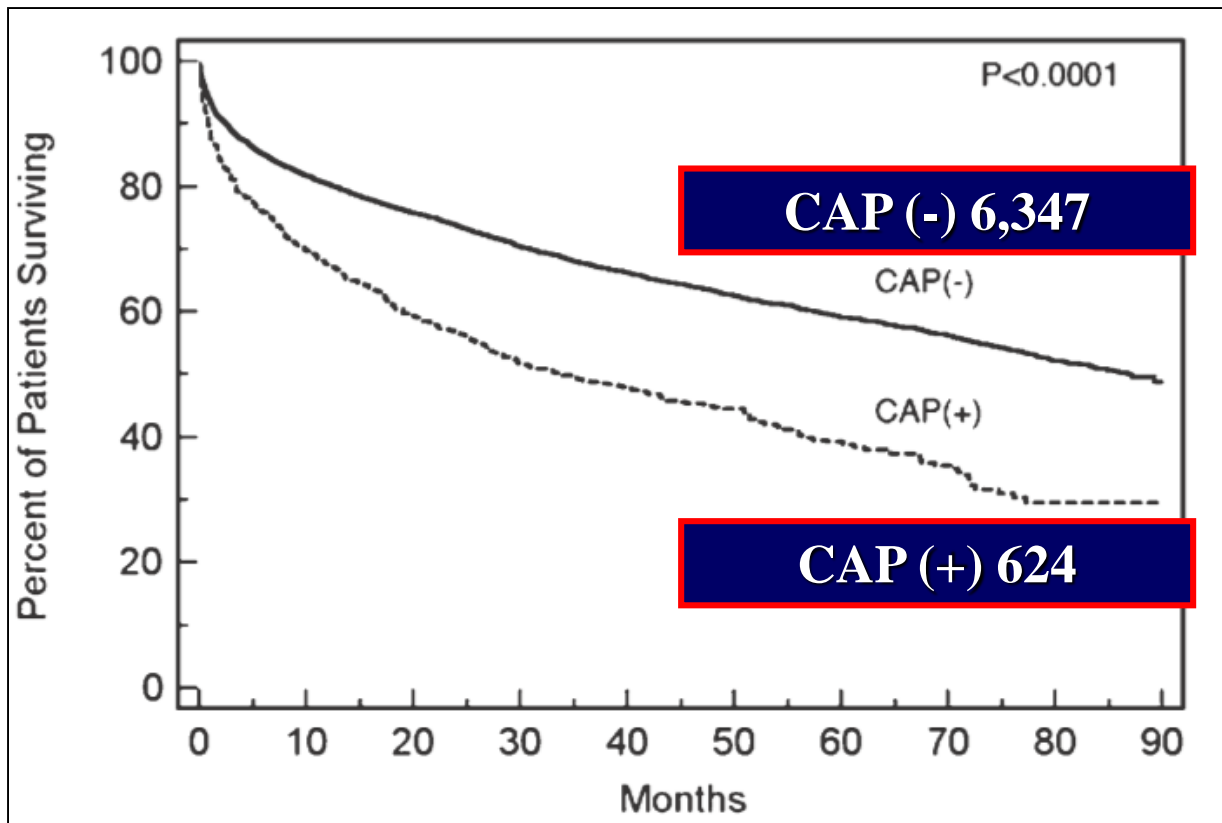
Clinical
Improvement

CAP A

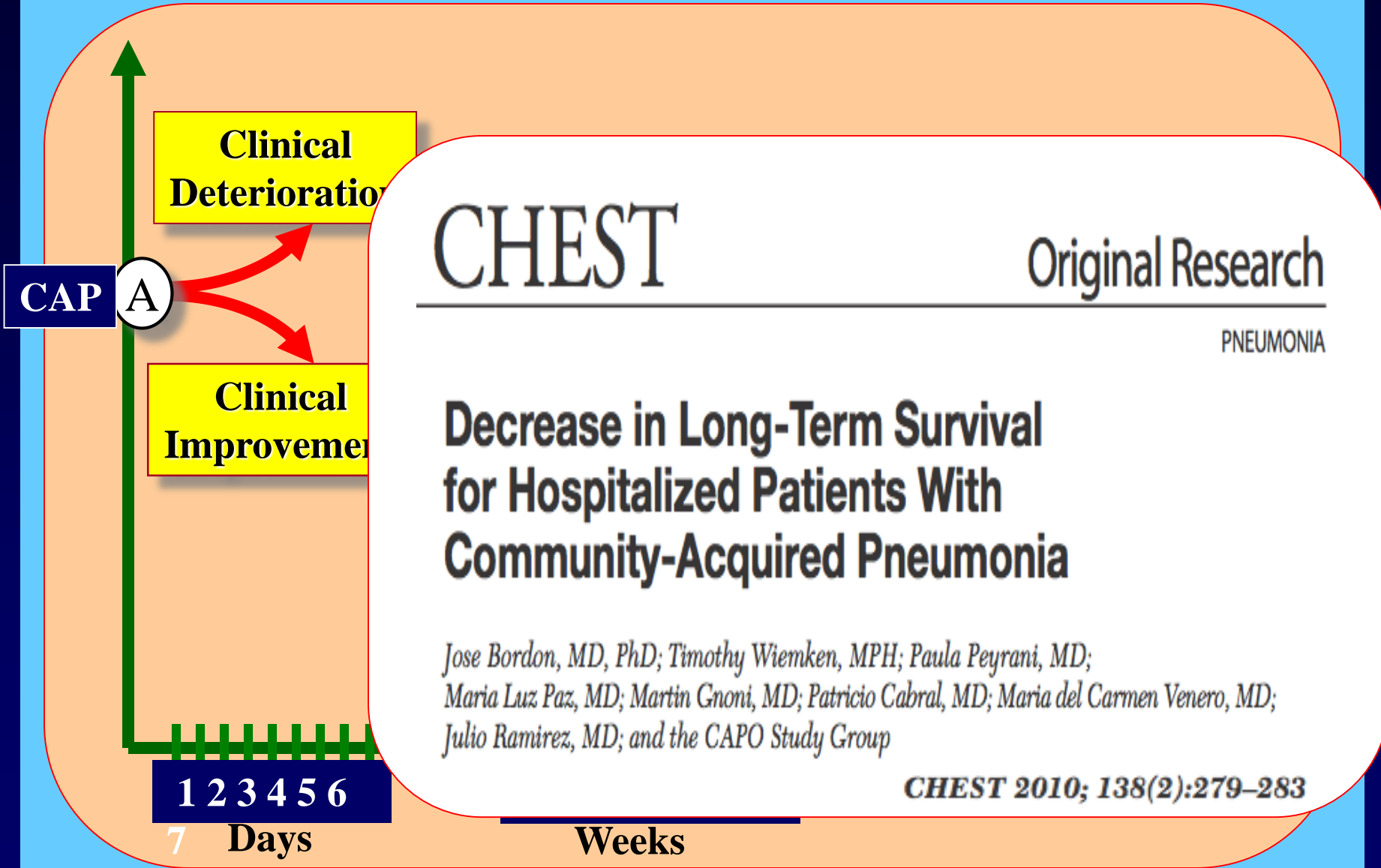
1 2 3 4 5 6

7 Days

Weeks



Pneumonia Mortality



CHEST

Original Research

PNEUMONIA

Decrease in Long-Term Survival for Hospitalized Patients With Community-Acquired Pneumonia

*Jose Bordon, MD, PhD; Timothy Wiemken, MPH; Paula Peyrani, MD;
Maria Luz Paz, MD; Martin Gnani, MD; Patricio Cabral, MD; Maria del Carmen Venero, MD;
Julio Ramirez, MD; and the CAPO Study Group*

CHEST 2010; 138(2):279–283

Pneumonia Mortality

CAP In-Hospital
Mortality

CAP 30-day
Mortality

CAP 1-year
Mortality

Clinical
Deterioration

CAP

A

Clinical
Improvement

B

Clinical
Deterioration

Clinical
Improvement

C

Clinical
Deterioration

Clinical
Improvement

1 7 10

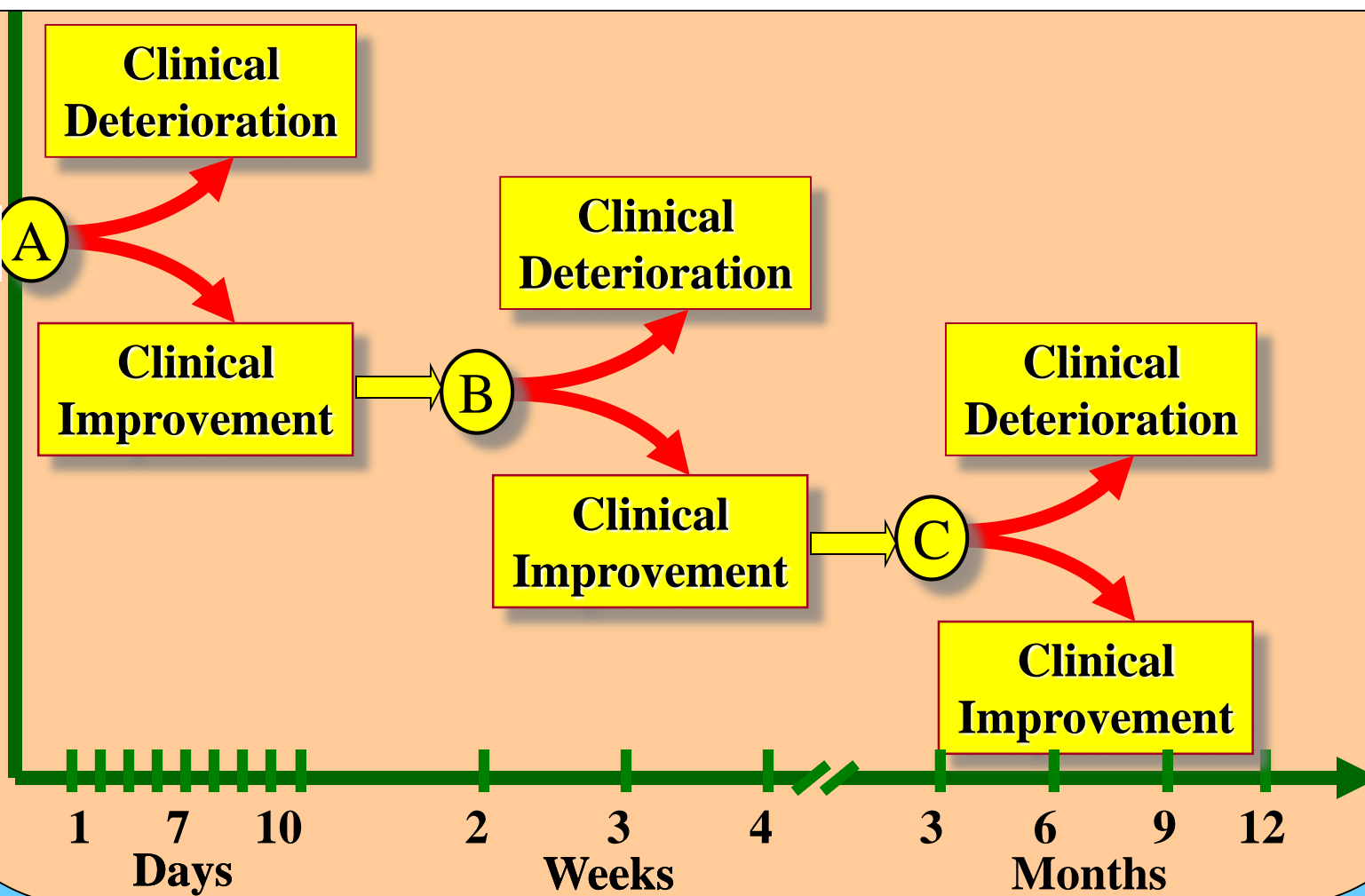
Days

2 3 4

Weeks

3 6 9 12

Months



Pneumonia Mortality

**US Adult Population requiring hospitalization:
1,591,825 Patients/year**

	Mortality	Deaths per year
In Hospital	6.5 %	
30-Day	13.0 %	
6-month	23.4 %	
1-year	30.6 %	

**CDC: Pneumonia is the eight cause of death in the US,
with a reported number of 56,979 death per year**

Pneumonia Mortality

**US Adult Population requiring hospitalization:
1,591,825 Patients/year**

	Mortality	Deaths per year
In Hospital	6.5 %	103,469
30-Day	13.0 %	206,938
6-month	23.4 %	372,488
1-year	30.6 %	487,099

**CDC: Pneumonia is the eight cause of death in the US,
with a reported number of 56,979 death per year**

Pneumonia Mortality

CAP In-Hospital
Mortality

CAP 30-day
Mortality

CAP 1-year
Mortality

Clinical Deterioration 6.5 %

Clinical Deterioration 13.0 %

Clinical Deterioration 30.6 %

Clinical Improvement

Clinical Improvement

Clinical Improvement

CAP 100%

A

B

C

1 7 10

Days

2 3 4

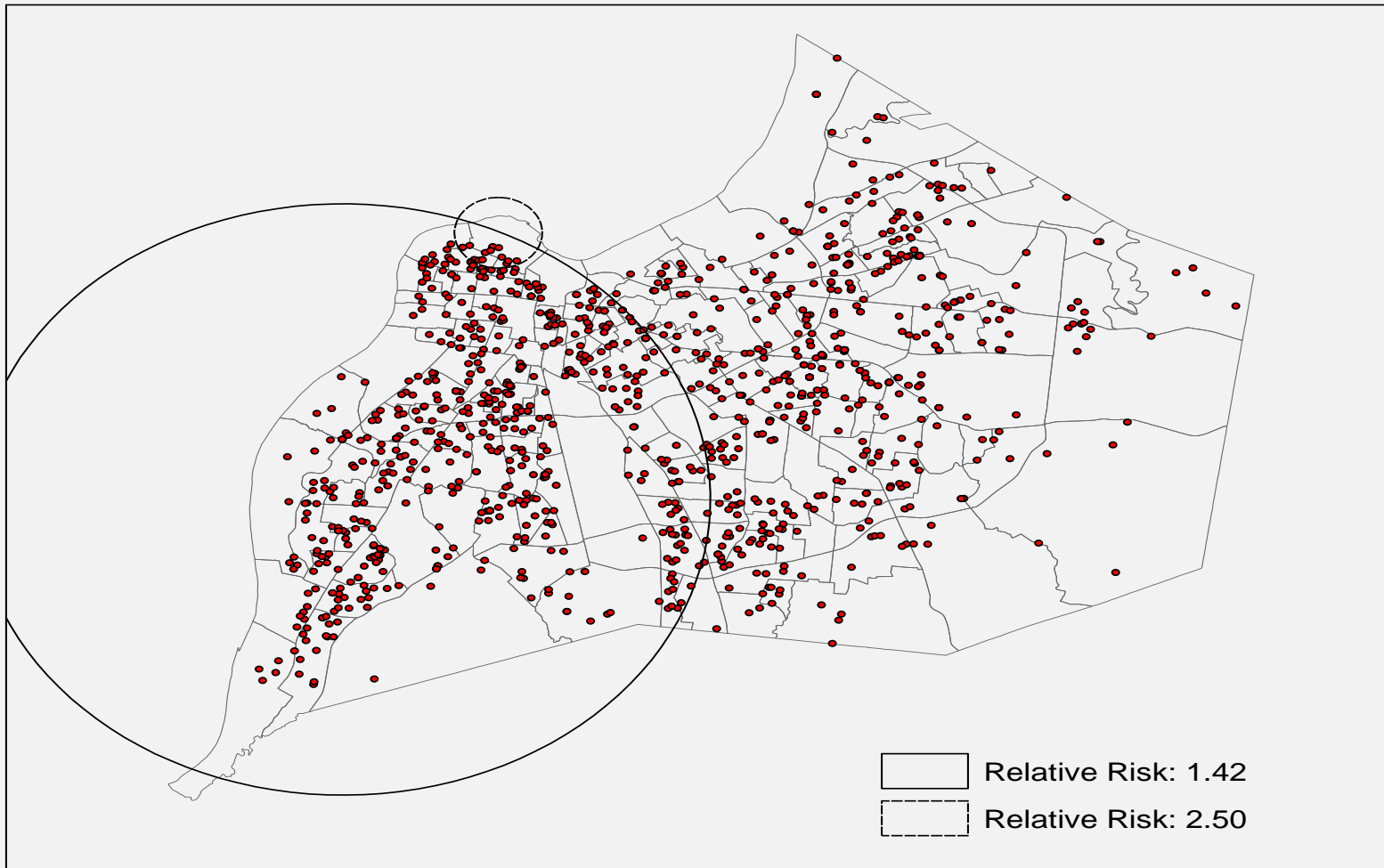
Weeks

3 6 9 12

Months

Pneumonia Mortality

University of Louisville Pneumonia Study: One Year Mortality



Pneumonia Hospitalizations in USA

1. UofL Pneumonia Study: Design

2. Pneumonia: Incidence

3. Pneumonia: Epidemiology

4. Pneumonia: Mortality

