

Epi 101: From Epigenetics to Population Health

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Epidemiology

- The study of the distribution and determinates of disease frequency
-MacMahon and Pugh, 1970
- Study of health and disease at a population level
- Observational-studies people as they are

Descriptive epidemiology



Health outcome

Descriptive epidemiology



Health outcome

“Health” broadly defined

- COVID-19
- Myocardial infarction
- Breast cancer

Descriptive epidemiology



Health outcome

“Health” broadly defined

- COVID-19
- Myocardial infarction
- Breast cancer
- Injury
- Successful aging
- Social isolation

What health outcome are you currently working on/hope to work on?

Descriptive epidemiology

How much?
How often?

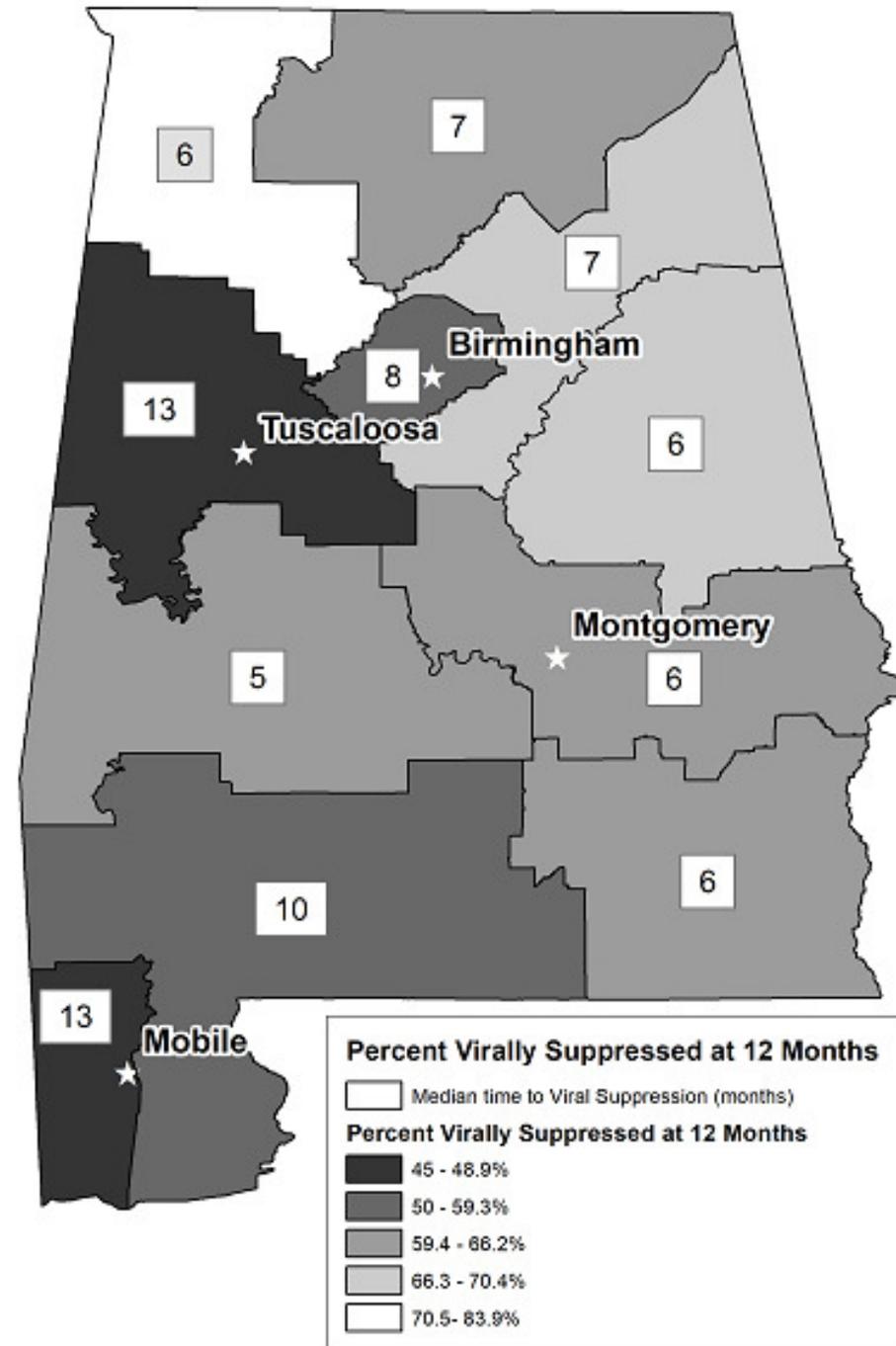


Health outcome

Quantifying outcomes

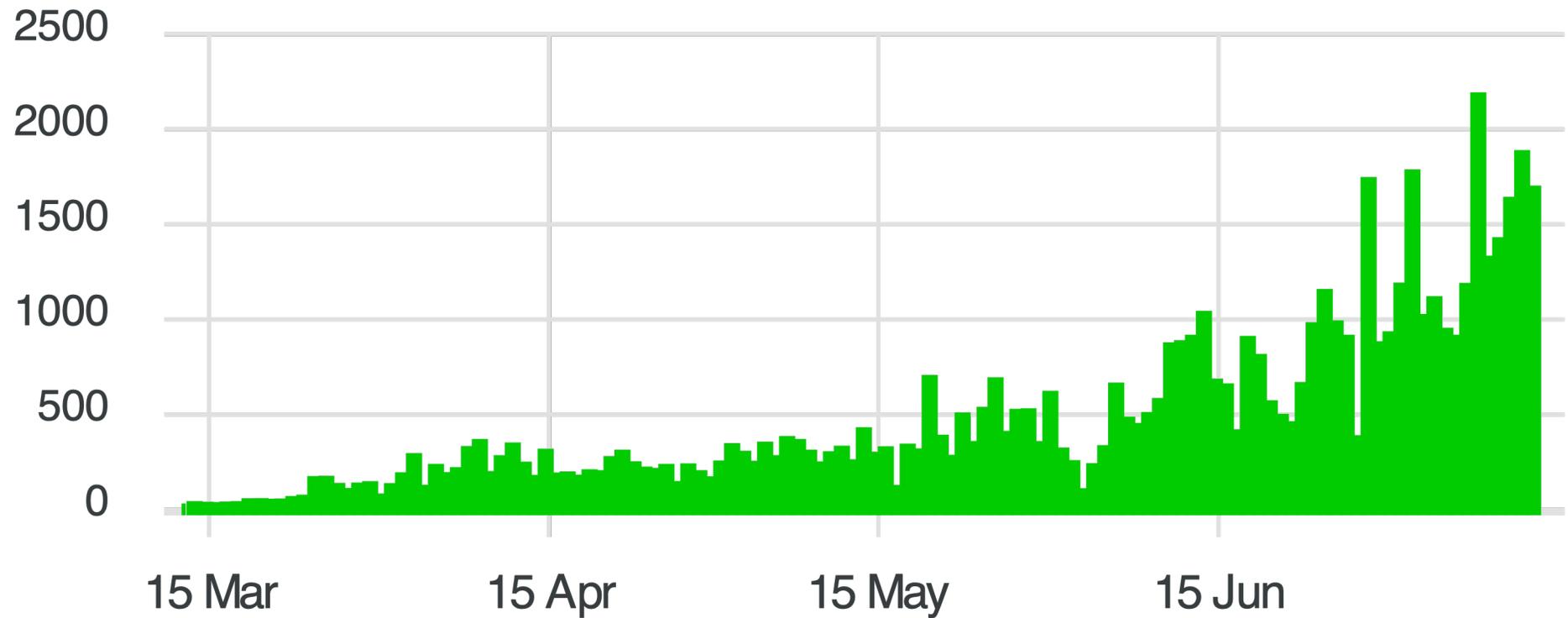
- How much?
 - Mean
 - Median
- How often?
 - Count
 - Proportion (cases/total population)
 - Rate (cases/time)

Time from HIV diagnosis to viral suppression



Batey et al, *JMIR Public Health Surveill*, 2020

Count of new COVID-19 cases in AL

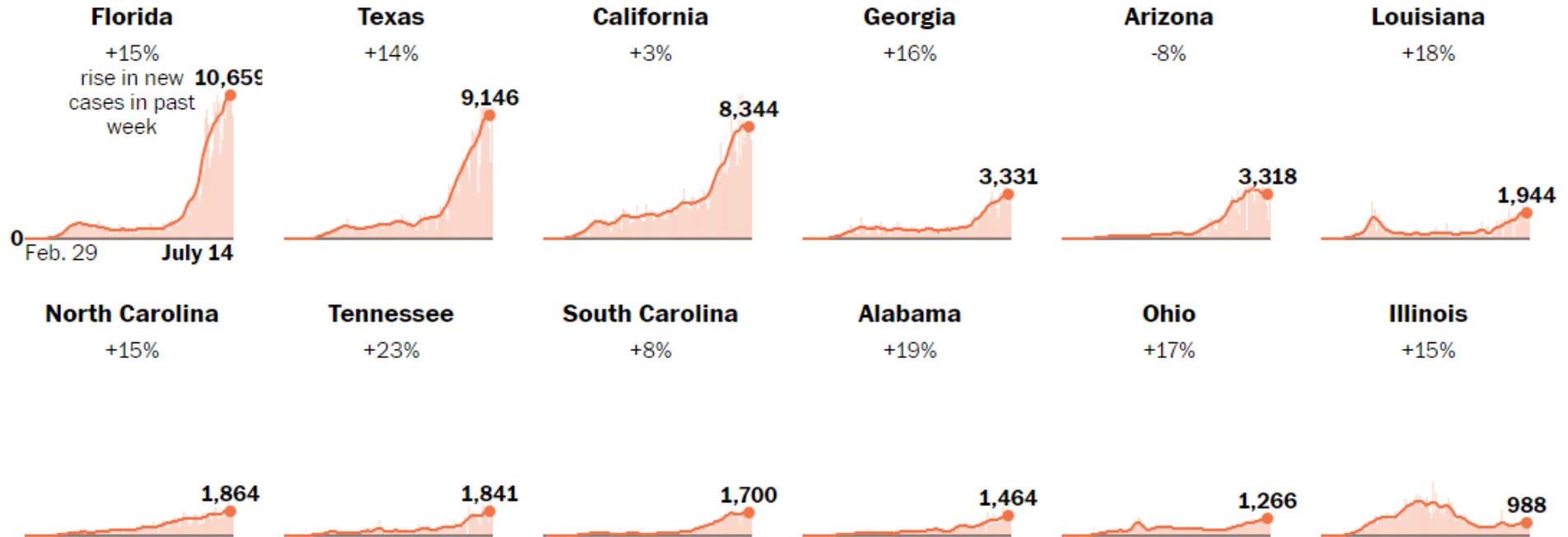


Is AL doing well or poorly? What additional information would you need to compare to other states?

Count of new COVID-19 cases

Places with highest daily reported cases

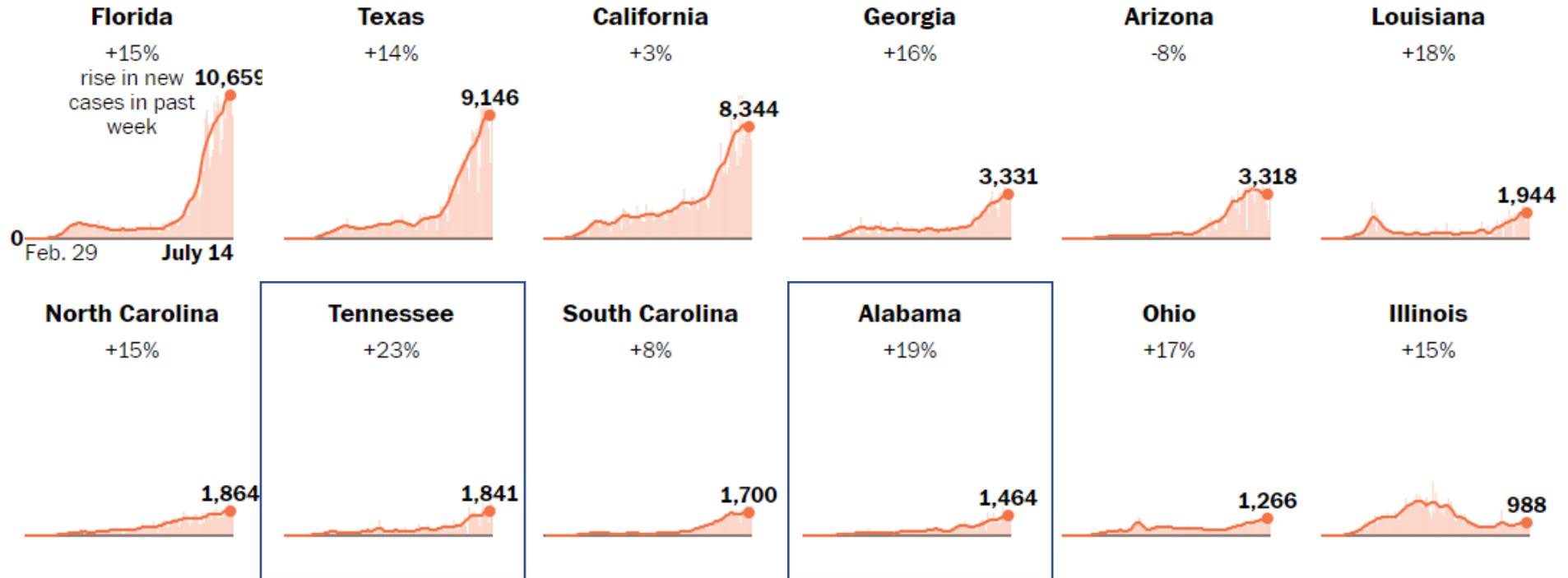
— Weekly trend of daily new reported cases



Count of new COVID-19 cases

Places with highest daily reported cases

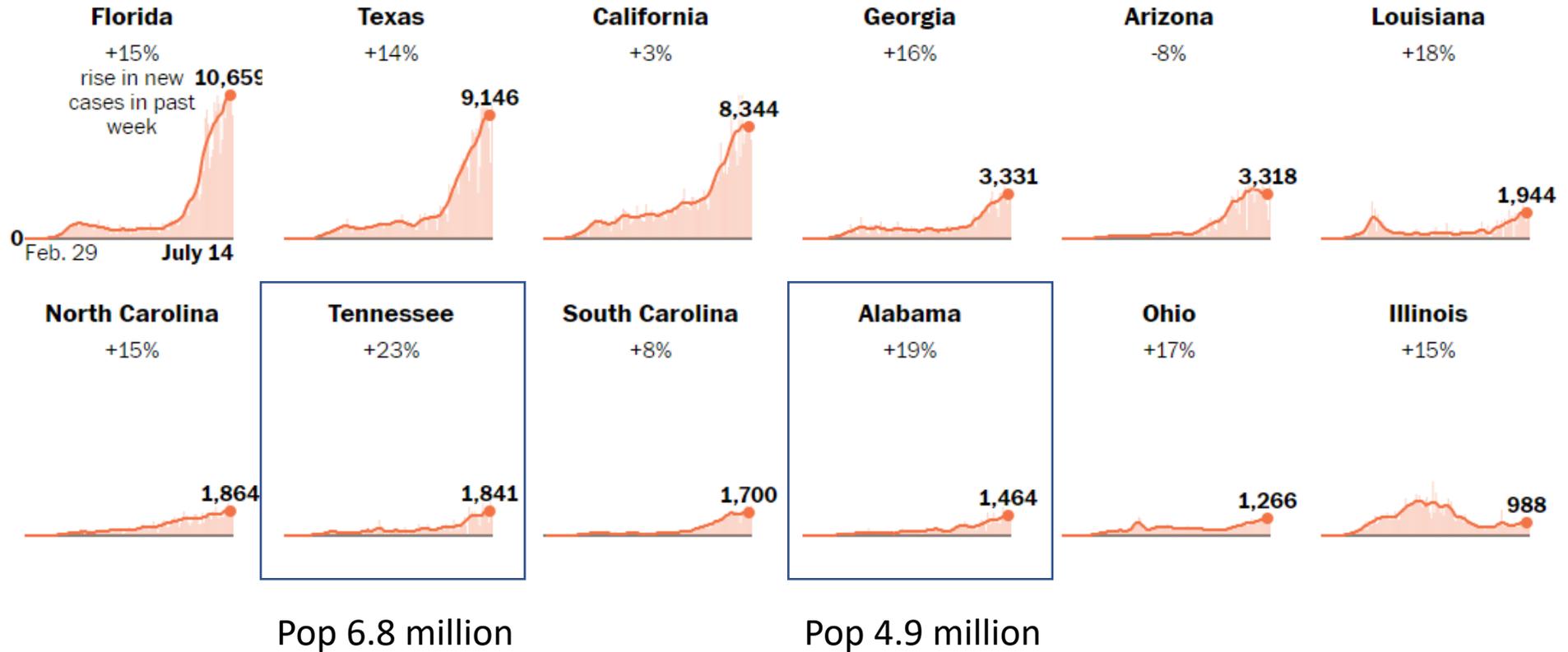
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Count of new COVID-19 cases

Places with highest daily reported cases

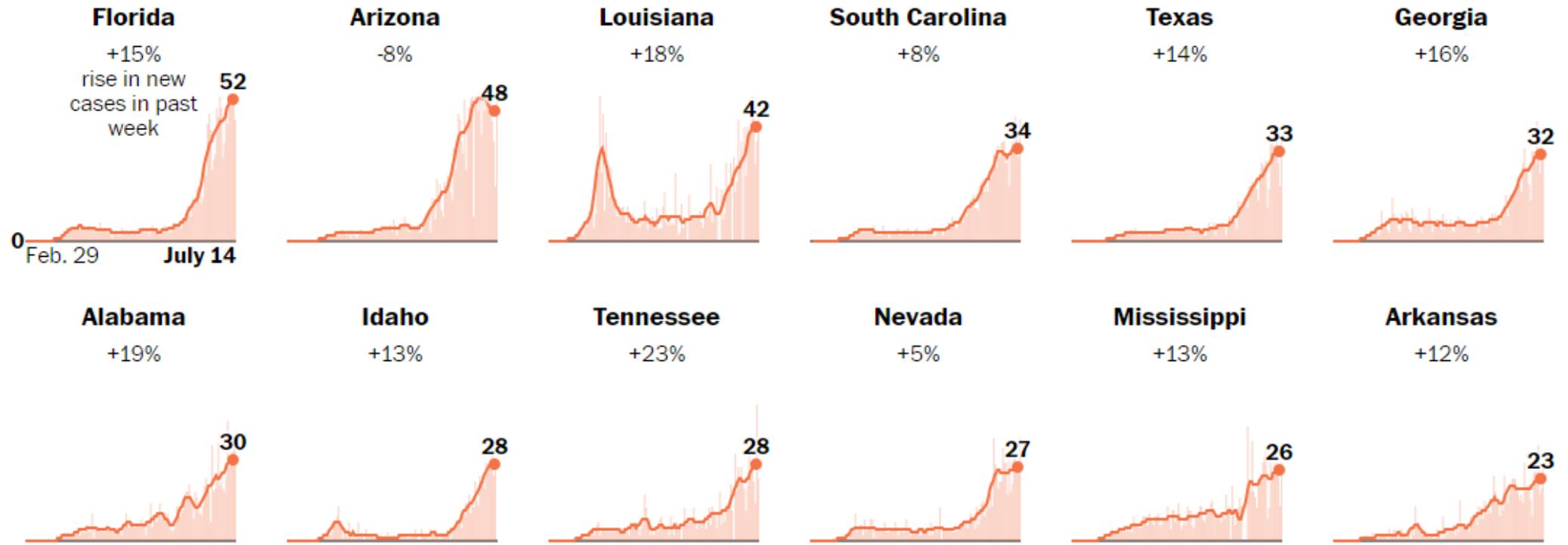
— Weekly trend of daily new reported cases



New COVID-19 cases per 100,000

Places with highest daily reported cases per capita

— Weekly trend of daily new reported cases per 100,000 residents



What is the problem with counts?

- In a population of 75, 50 people died.
- In a population of 100,000, 50 people died.

- Population size matters.

What is the problem with counts?

- In a population of 75, 50 people died over 1 year.
- In a population of 75, 50 people died over 70 years.

- Follow-up time matters.

Analytic epidemiology

How much?

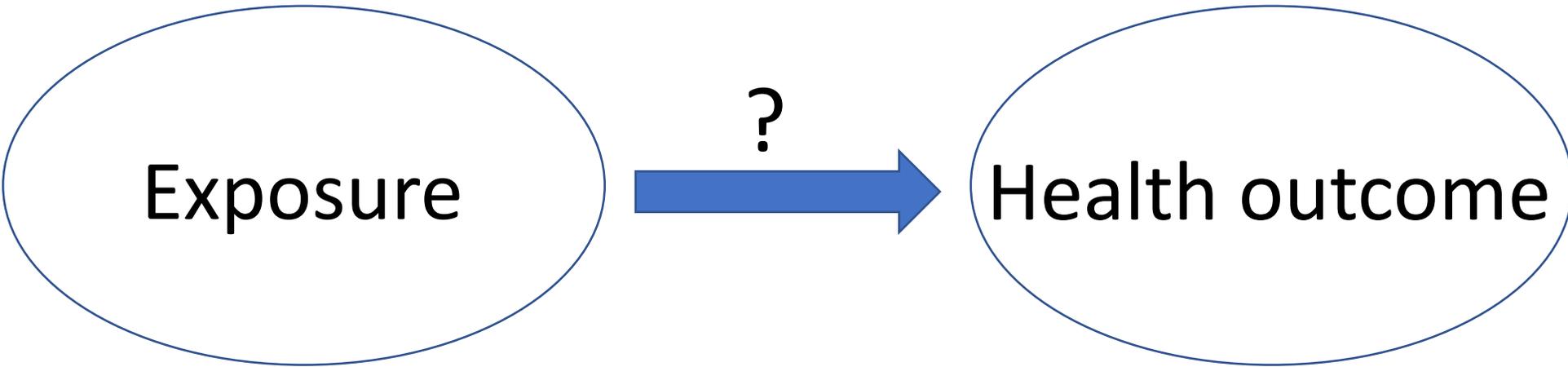
How often?

Why?



Health outcome

Analytic epidemiology



Exposure broadly defined

- Air pollution
- Ionizing radiation
- Contact with a person infected with SARS-CoV-2

Exposure broadly defined

- Air pollution
- Ionizing radiation
- Contact with a person infected with SARS-CoV-2
- Genetic traits
- Epigenetic markers
- Gender
- Race
- Insurance status

What exposures are you currently working on/hope to work on?

Measures of association

- Summary number that compares outcome by exposure status

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- What are the options for summary measures?

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Measures of association

- Summary number that compares outcome by exposure status
- What are the options for summary measures?
 - Difference
 - Outcome in exposed-outcome in unexposed
 - 0 means no association
 - Ratio
 - Outcome in exposed/outcome in unexposed
 - 1 means no association

Correlation \neq Causation

- The measure of association does not reflect the true causal relationship between exposure and outcome.

What might cause correlation to be different from the causal effect?

Correlation \neq Causation

- Biases

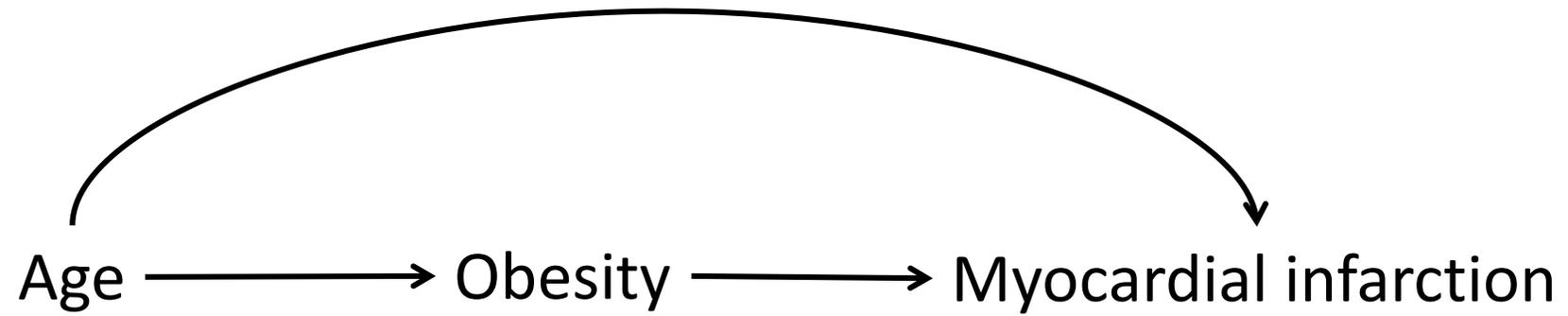
Correlation \neq Causation

- Biases
 - Confounding
 - Measurement error
 - Selection bias
 - Others

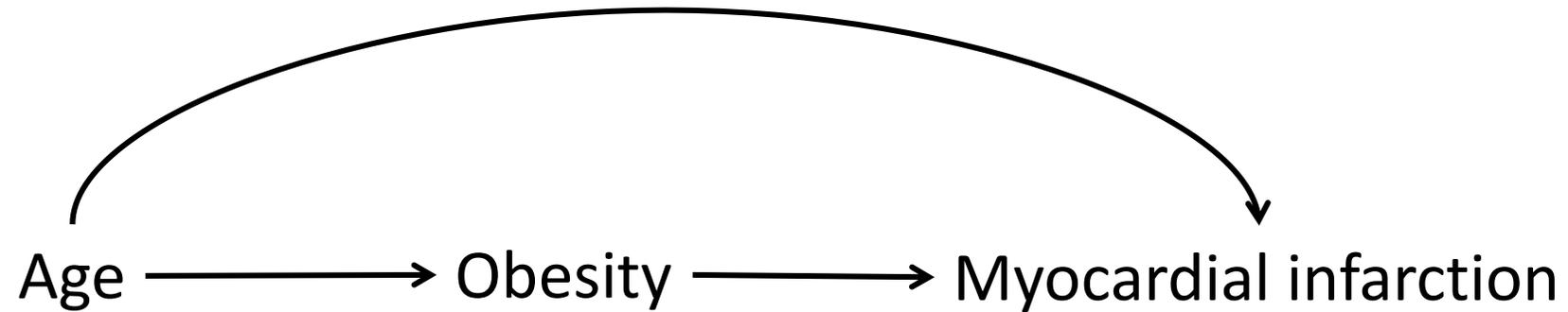
Confounding

- People who are exposed are different than those who are not.
- Risk is different in exposed and unexposed.

Confounding

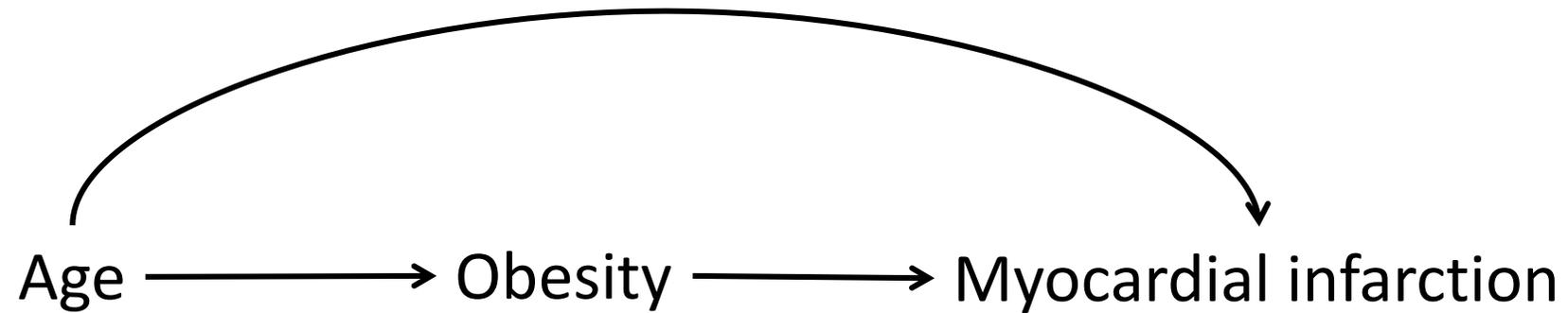


Confounding



Some portion of the association between obesity and myocardial infarction is due to age.

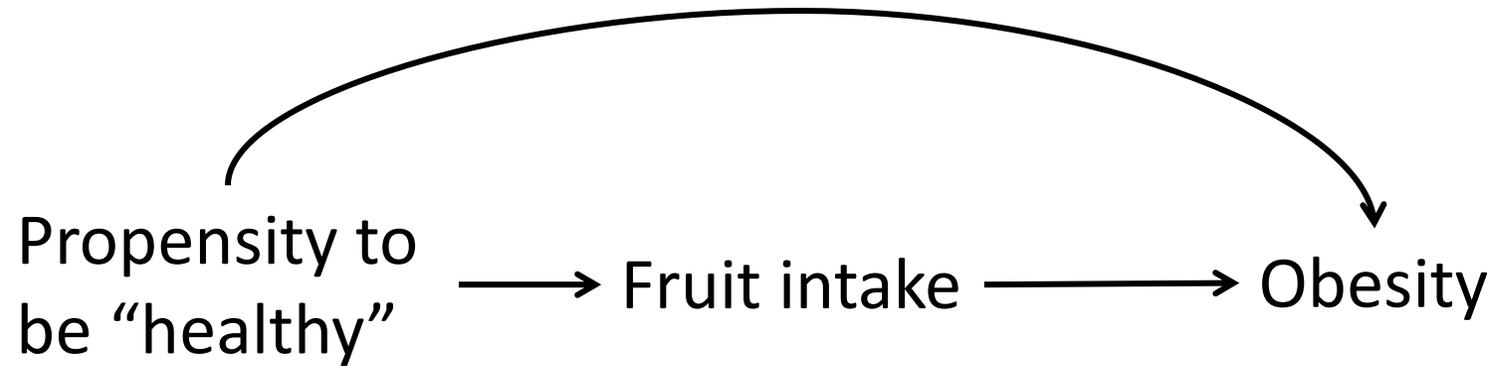
Confounding



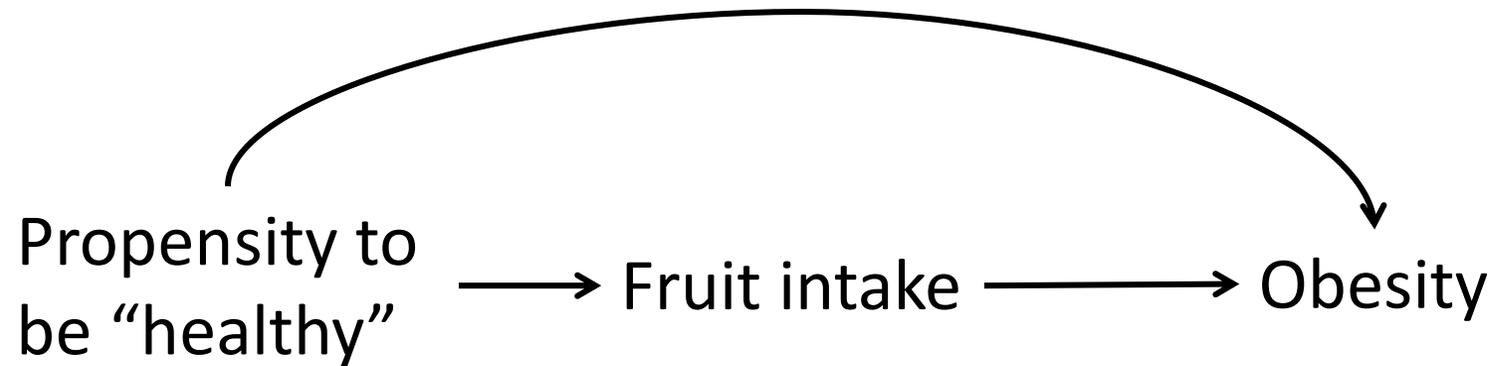
Some portion of the association between obesity and myocardial infarction is due to age.

Solution: “Control” for age

Confounding

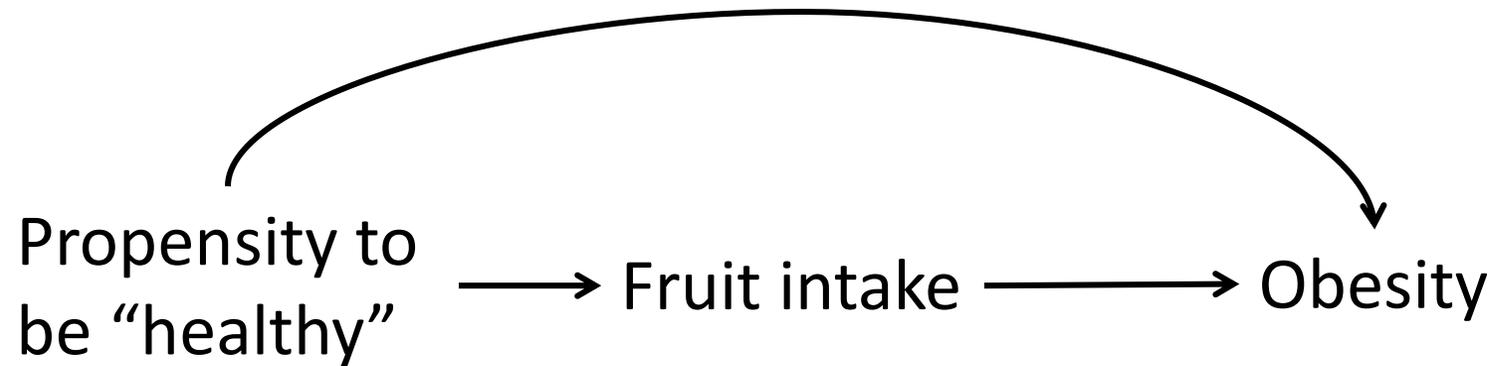


Confounding



Some part of the association between fruit intake and obesity is due to being "healthy".

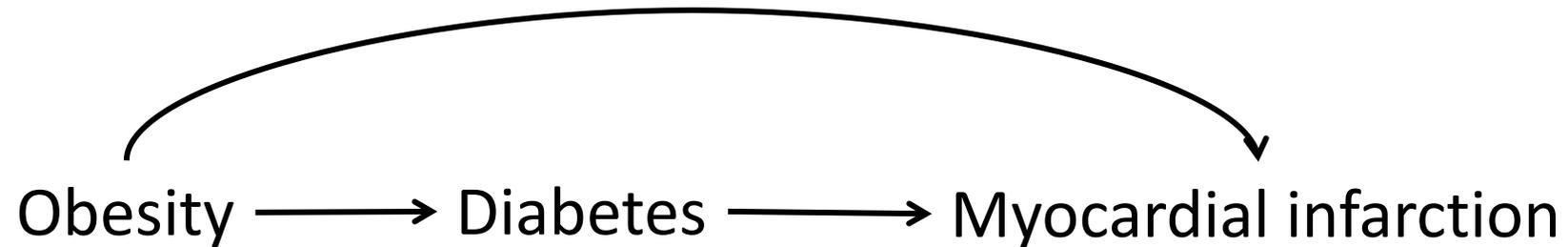
Confounding



Some part of the association between fruit intake and obesity is due to being “healthy”.

How do we measure “healthy”?

Not confounding



One of the ways that obesity causes myocardial infarction is through diabetes.

Diabetes is part of the causal pathway.

Selection bias

- Bias that occurs when the exposure is related to getting into the study
- Differential loss to follow-up is one example

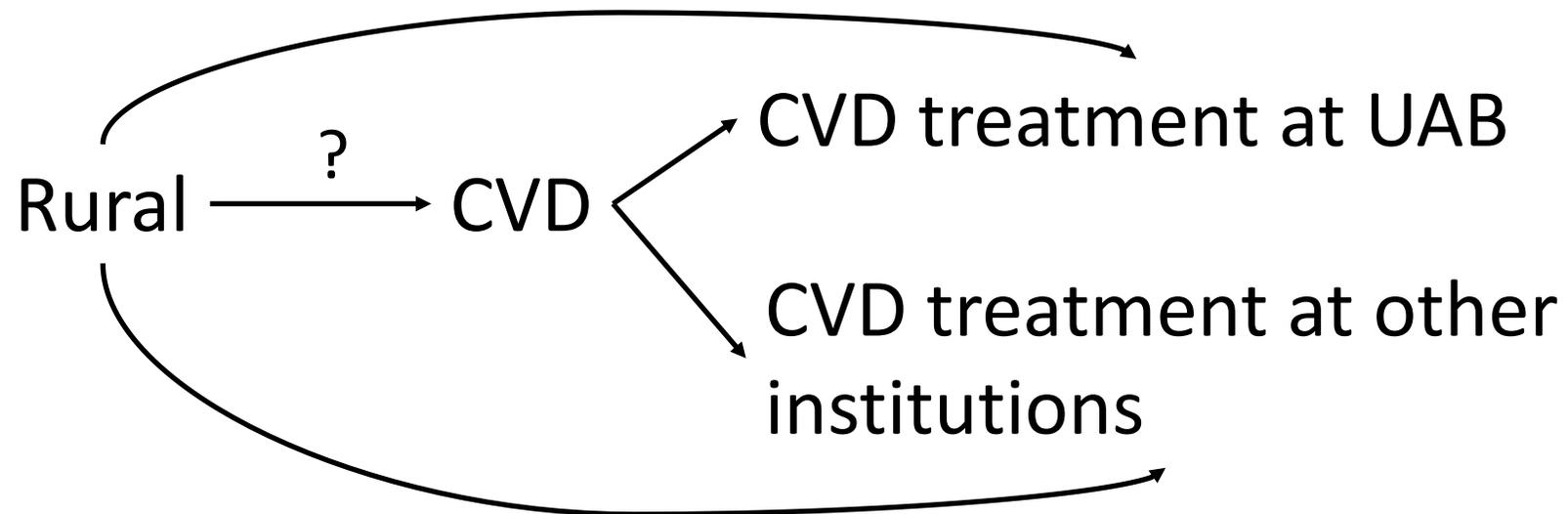
Selection bias

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- Is rural residence associated with cardiovascular disease among patients with cancer?

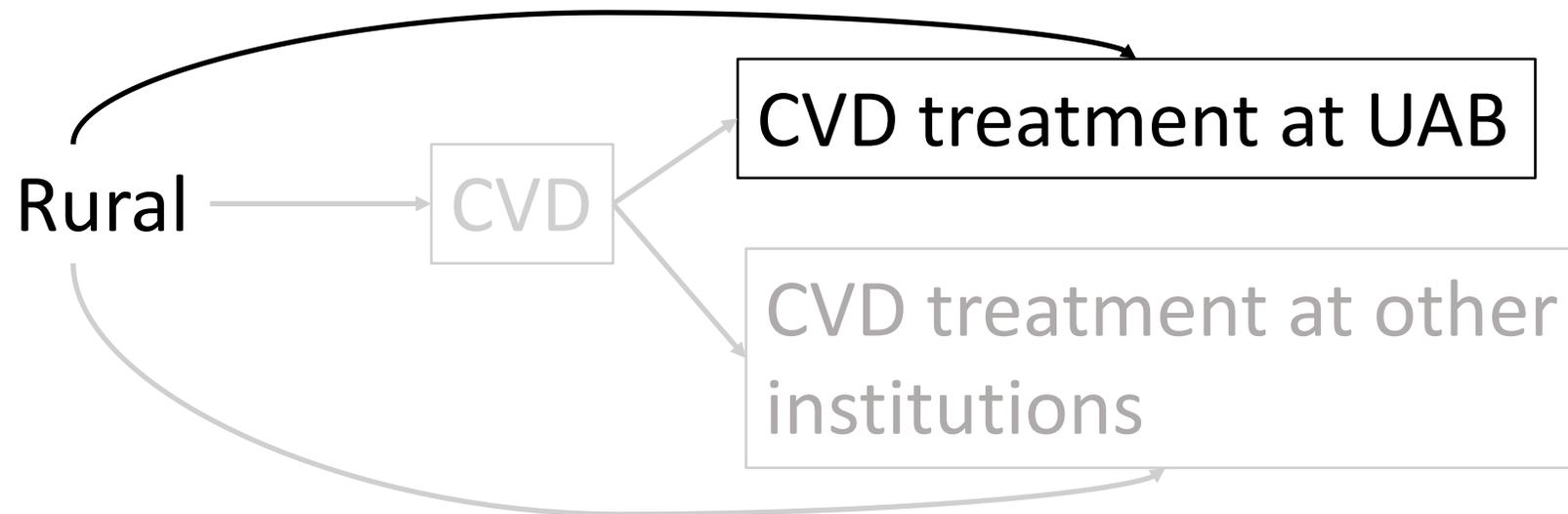
Selection bias

Study population: patients treated at UAB for initial cancer therapy



Selection bias

Study population: patients treated at UAB for initial cancer therapy



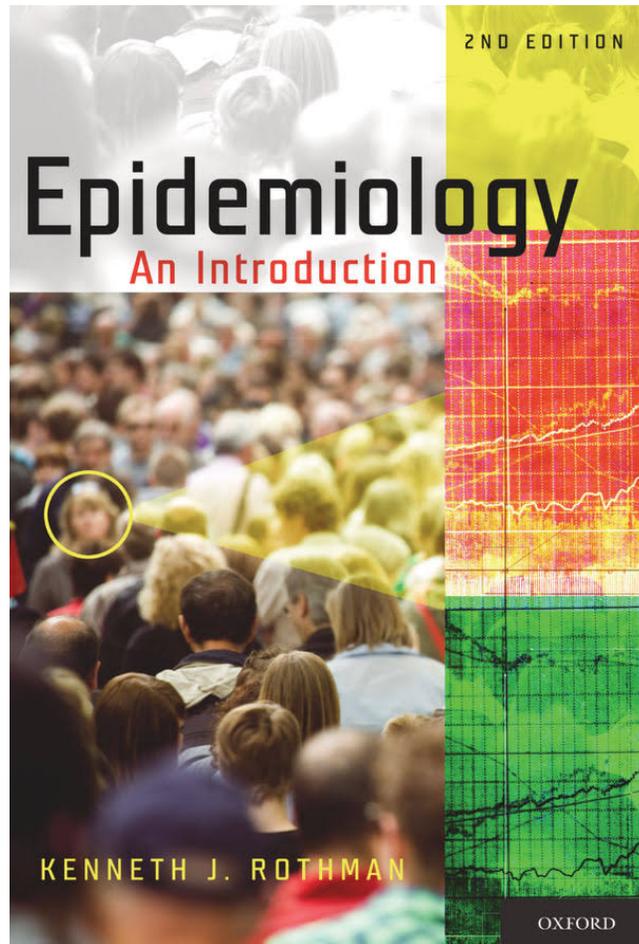
Using the UAB EMR, we only see CVD treated at UAB

What might be confounders of the exposure-outcome relationship you are interested in?

(The most important will be strongly associated with outcome and exposure.)

Additional epidemiology resources

Epidemiology textbooks



SELF-STUDY
Course SS1978

Principles of Epidemiology in Public Health Practice

Third Edition

An Introduction
to Applied Epidemiology and Biostatistics

October 2006
Updated May 2012



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention (CDC)
Office of Workforce and Career Development
Atlanta, GA 30333



Reporting on epidemiology

- STrengthening the Reporting of OBservational studies in Epidemiology (STROBE)
 - Checklist
 - Explanation
 - <http://www.strobe-statement.org/>

CCTS Biostatistics, Epidemiology and Research Design (BERD)

- Drop-in clinics
- Seminars/webinars
- One-on-one consultation

Epidemiology resources

- Most useful early in study planning!

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Questions?