

MECOR

Caveat Emptor



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Caveat Emptor



- Researchers report findings!
Coffee drinking causes
Myocardial Infarction!

+ Coffee

- Coffee

	+ MI	- MI
+ Coffee	68	44
- Coffee	32	56
	100	100

Caveat Emptor

- Objectives:
- Review reasons for getting the wrong answer
 - Chance
 - Bias
 - Confounding
- Bradford-Hill criteria for assessing causality

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- Example (cont.)
- Odds of coffee drinking
 - for: MI cases = 68:32 = 2.2125
 - for: Controls = 44:56 = 0.79
- Odds ratio = $2.125/0.79 = 2.70$
- Q: Is this a true causal association?

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- Evaluating Associations
- 1. Chance (Random Error)
- 2. Bias
 - Selection
 - Information
- 3. Confounding
- **4. Truth**

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- Random Chance?
- ✓ P Value or Confidence Interval
- To reduce errors from random chance:
 - Increase sample size
 - Improve measurement technique

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- Bias?

- Selection →

Subjects

- Information →

Measurement of
predictor and
outcome variables

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- Selection bias: Do subjects accurately represent target population?
- Information bias: Do measurements accurately represent phenomena of interest?

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- Question: Does coffee cause MI?

Truth in Universe

Population: All Adults

Actual Coffee intake

Actual MI

Selection bias

Information Bias

Truth in Study

Sample: Consenting adults

Reported Coffee intake

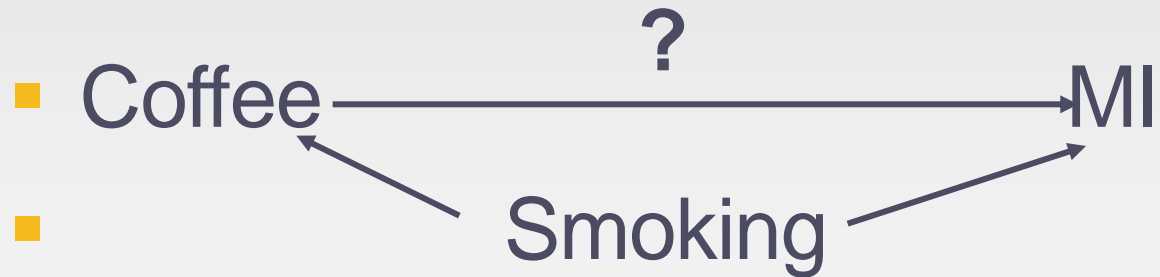
Reported MI

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- Possible sources of selection bias
- Controls are clinic patients who have reduced coffee intake due to illness (e.g., peptic ulcer disease patients)
- Low participation rates
- Possible sources of information bias
- MI patients overstate coffee use
- Esophageal spasm, caused by coffee, is misdiagnosed as MI

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- Confounding?



- A confounder must be associated with both the exposure (coffee) and the outcome (MI)

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- Confounding
- A confounder is associated both with the predictor (coffee) and the outcome (MI)
- ⇒ Was the association between coffee and MI simply due to coffee drinkers being more likely to smoke?

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- Confounding
- Can be addressed in
- Design – Specification, matching
- Analysis – Stratification, Regression Analysis

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- Confounding
- Specification
- (Limit study to non smokers)

- Matching
- (Pair cases and controls to match on smoking)

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- Confounding
- Specification
- Use when don't mind loss of generalizability

- Matching
- Use sparingly (e.g., age in lung cancer study)

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- Confounding
- Stratification: If you see an association between coffee and MI, but worry it may be due to confounding from smoking. . .
- Check to see if the coffee – MI association holds for all levels (or strata) of smoking

+ MI - MI

+ Coffee

68

44

OR=2.7

- Coffee

32

56

100

100

+ MI

- MI

64

32

OR
=1

16

8

+ MI

- MI

4

12

OR
=1

16

48

MEC(OR) Smokers

Non-Smokers

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- Confounding
- “A confounder is associated with both the predictor (coffee) and the outcome (MI).”
- Smoking in
 - coffee (+) 86%
 - coffee (-) 27%
 - MI (+) 80%
 - MI (-) 40%

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- Confounding
- Bottom Line:
- Coffee drinker group had more smokers (86%) than did the non-coffee drinkers (27%).
- The increased MI risk among coffee drinkers was entirely due to smoking.

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- Confounding:
- Analysis phase – use multivariable modeling
- Caveat Emptor!!
- It's too easy!
- Work with biostatistician to assure good fit.

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- Bottom Line for error reduction:
- 1. Large sample with high participation rate
- 2. Accurate, reliable measurements (continuous variables better than dichotomous)
- 3. Specify or match sparingly

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- Is the association causal?
- Bradford – Hill Criteria
 - Strength (R.R. > 2.5)
 - Consistency
 - Specificity
 - **Dose Response**
 - Biological Plausibility (Including temporality)