

Research Designs, Causation and Correlation

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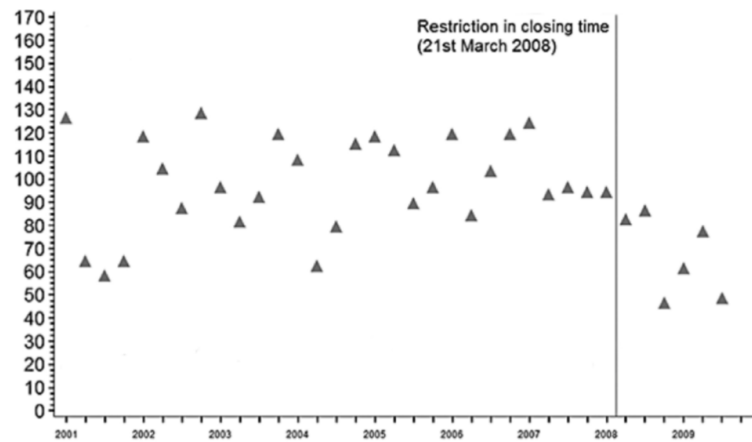
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Causation

1. Luck
2. Correlation
3. Other explanations

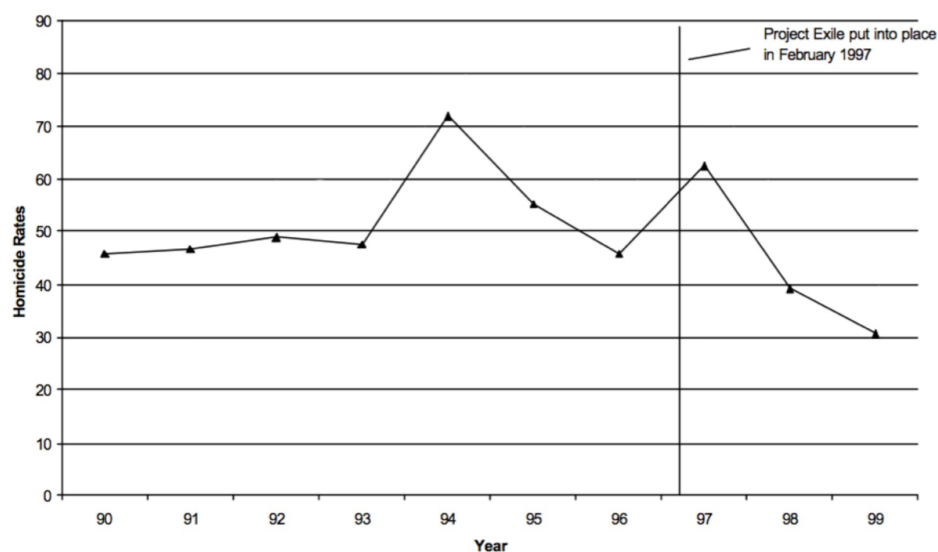
Correlation

and policy change worked. Here's the data.



Number of nighttime assaults recorded by police in each quarter in the central business district (CBD) of New South Wales, where closing time was restricted to 3 a.m. Adapted from Kypri, Jones, McElduff and Barker, 2010.²⁴

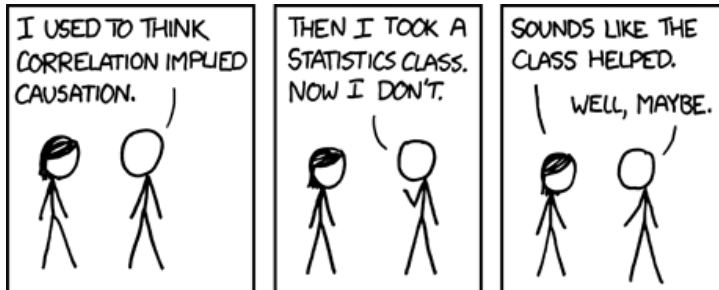
Correlation



Gun homicides per 100,000 residents in Richmond, Virginia, before and after Project Exile. Adapted from Raphael and Ludwig, 2003.³⁵

Correlation

Correlation does not = causation, but causation always is necessary for causation.



“Correlation doesn’t imply causation, but it does waggle its eyebrows suggestively and gesture furtively while mouthing ‘look over there’;”

Correlation

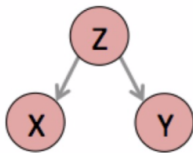
Problems with correlation



X causes Y



Y causes X



Z causes X and Y



random chance!

Research Designs

1. A particular way of gathering data to test hypotheses
2. Each have particular advantages and disadvantages
 1. *Cross-sectional*
 2. *Experiments*

Research Designs

Cross-sectional

1. take a single snapshot of some phenomenon at a time
 - *example: surveys*
2. Very good at establishing correlations
3. Can be good at controlling for other explanations
4. Terrible at assessing causation.

Research designs

Cross-sectional

Researchers find fewer depressive symptoms in dark-chocolate eaters > Out of 13,000 people they surveyed, about 7.6 per cent overall said they felt depressive symptoms, while only 1.5 per cent of chocolate-eaters in that group reported feeling those symptoms. Source: CTV News

Jackson et al, 2019

Research designs

Cross-sectional

TABLE 2 Associations of chocolate consumption with clinically relevant depressive symptoms among

	Unadjusted OR(95% CI)	Multivariable-adjusted ^b OR(95% CI)
Overall chocolate ^b		
None	Reference	Reference
Non-dark chocolate	0.80 (0.59 to 1.08)	0.95 (0.70 to 1.28)
Dark chocolate	0.19 (0.07 to 0.48)	0.30 (0.12 to 0.72)
Daily chocolate consumption ^b		
None	Reference	Reference
1st quartile (4.1–35.0 grams)	0.95 (0.53 to 1.71)	1.03 (0.57 to 1.87)
2nd quartile (37.0–95.1 grams)	0.45 (0.24 to 0.84)	0.56 (0.30 to 1.03)
3rd quartile (100–100 grams)	0.98 (0.61 to 1.57)	1.28 (0.80 to 2.03)
4th quartile (104–454 grams)	0.34 (0.16 to 0.73)	0.42 (0.19 to 0.93)
P for trend ^e	0.015	0.224

Abbreviation: NHANES, the National Health and Nutrition Examination Survey.

^aDepressive symptoms measured using Patient Health Questionnaire (PHQ-9): None or minimum to mild (0–9),

^bAdjusted for age, sex, BMI category (normal weight, overweight, obese), race (non-Hispanic white, non-Hispanic black, other), household annual income (<\$20000, \$20000–74999, \$75000, and higher), physical activity (inactive, any activity), sugar intake in quartiles, alcohol consumption (yes/no), and chronic conditions including cardiovascular disease,

^cAdditionally adjusted for daily sugar intake (grams/day).

^dAdditionally adjusted for dark chocolate consumption (yes/no).

^eP for trend was calculated by modeling the median value of chocolate consumption in each quartile as a continuous variable.

Research designs

Cross-sectional

2. What are the possible causal interpretations of these data?

- *eating chocolate might make you feel less depressed (x might cause y)*
- *being depressed might cause you to eat chocolate (y might cause x)*
- *Something else might cause depression and a propensity to eat chocolate (e.g. low levels of education, stressful job might cause both x and y)*
- *x and y relationship might actually be luck*
 - large sample size, low p-values of findings are supposed to guard against this, but remember the jelly bean comic and publication bias

Research Designs

Experiments

1. Technical name is Randomized Control Trial (RCT)
2. Seen as gold standard
3. Basic logic is to distinguish between causal models
 - *Randomly assign participants to a treatment group that gets the hypothesized cause or a control group that does not*
 - *in theory treatments are the only thing that distinguish random from control groups*

Research Designs

Experiments

Have their own problems. 1. hard to do for really interesting questions, expensive - How do you test the effects of poverty on future life happiness with an experiment 2. Can you really replicate the real world in a lab?

Research Designs

Experiments

There are some variations on experiments at a large scale

I. Quasi-experiments

- *take advantage of natural variation in the world*
- *the Richmond homicide example and the Hamilton pub closing time examples are great examples of these.*

Research Designs

Experiments

Quasi-experiments are variations on experiments at a large scale

- take advantage of natural variation in the world
- the Richmond homicide example and the Hamilton pub closing time examples are great examples of these.
- Williams (1986)¹
 - *researchers studied the impact of the introduction of television on three remote communities*
 - *one had no television, two others did.*
 - *Violence in playgrounds increased*

Falsification

- Falsification, not proof
- scientific explanations are always uncertain
- good because it encourages debate, criticism and avoids dogma and deference to authority

- I. Williams (ed), T. M. 1986. The Impact of Television: A Natural Experiment in Three Communities. Academic Press. ↩