Psychology 205: Research Methods in Psychology: more designs

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May, 2021

Outline

Threats to validity for all studies

1. Maturation
2. History
3. Seasonality
4. Testing
5. Instrumentation
6. Attrition
7. Statistical regresion

Alternatives to experiments

1. Real Experiments
   - Within subjects
   - Between subjects (random assignment)
2. Quasi Experiments
   - Field studies, lack of subject assignment
3. Correlational/Observational
4. Longitudinal designs
5. N=1 studies

Requirements for any study

1. At least two levels of one variable (otherwise it is not a variable) to asses the effect of that variable on another/
2. At least two repliations of a level (as a way of estimating amount of variance associated with error)
3. Result = effect/(error of effect) or Effect +/- error

Types of comparisons

Table 3.1 A typology of comparisons

Prominent size-of-effect factor	*Assignment to treatment*		
	Random	*Non-random (quasi-experiment)*	
		Explicit quantitative ordering	*No explicit quantitative ordering*
Recipient	Randomized recipient design	Regression-discontinuity design	Nonequivalent group design
Time	Randomized time design	Interrupted time-series design	Nonequivalent time design
Outcome variable	Randomized outcome variable design	Discontinuity across outcome variables design	Nonequivalent outcome variable design
Setting	Randomized setting design	Discontinuity across settings design	Nonequivalent setting design

(From Reichardt)

Types of non-experimental or quasi experimental designs

1. One group, pretest-postest
2. Interrupted Time series

One group, Pretest- posttest

O X O

1. 1974 introduction of speed limits to 55 mph
2. Compare 1973 to 1974 fatalities
3. 1987 Congress raised limit to 65
4. 1995 Congress repeals state limis

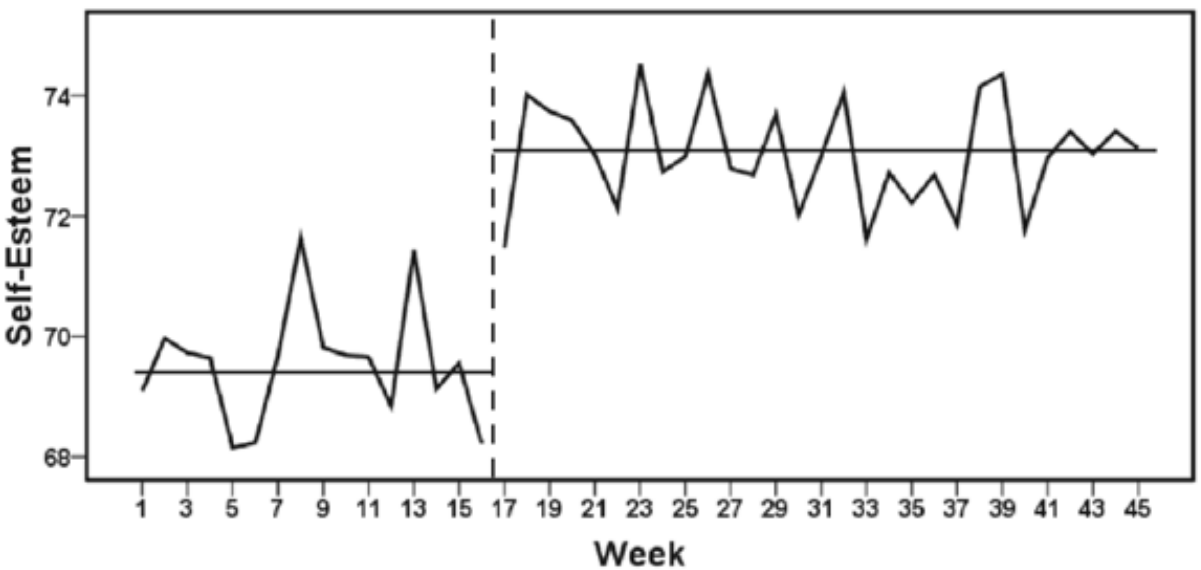
Multiple levels pretest-posttet

1. O1 X1 O2
2. O1 X2 O2
3. O1 X3 O2

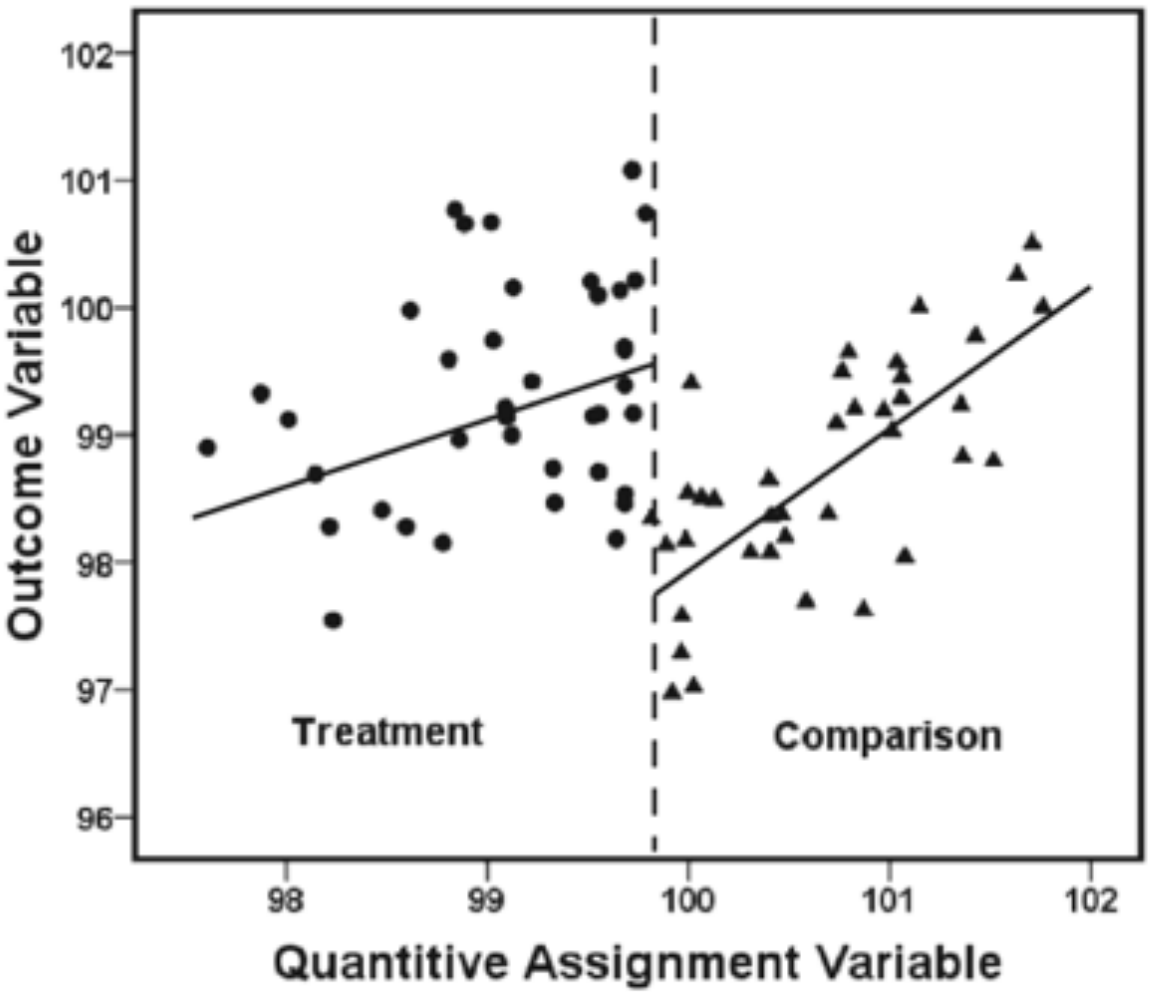
Interrupted time series

1. OOOOOOOXOOOOOO
   or
2. NR OOOOOOOOXOOOOOO
3. NR OOOOOOOO OOOOOO
4. Reversed time series
5. OOOOOOXOOOOOO -XOOOOO
   or
6. NR OOOOOXOOOOO OOOOOOO
7. NR OOOOO OOOOOXOOOOOOO
8. The effect of outward bound on self esteem

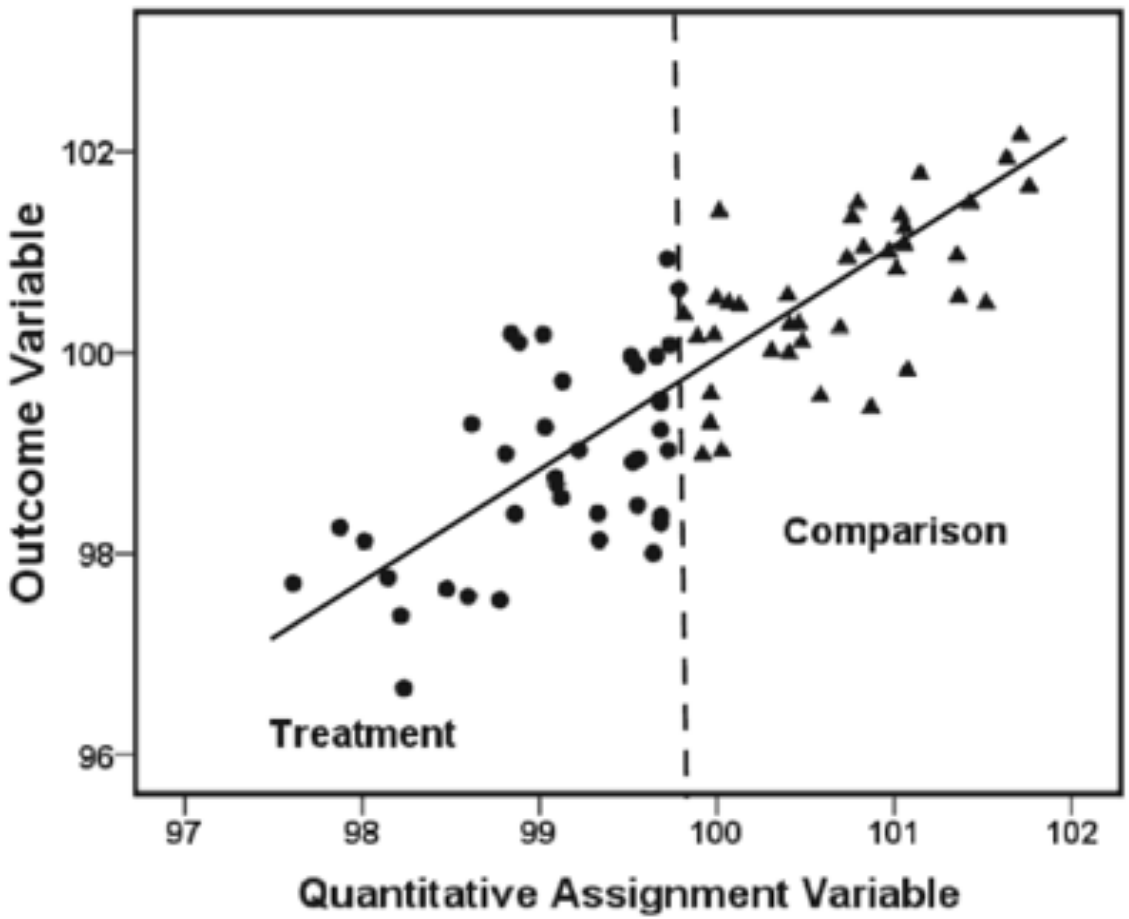
A one shot manipulation with a large effect



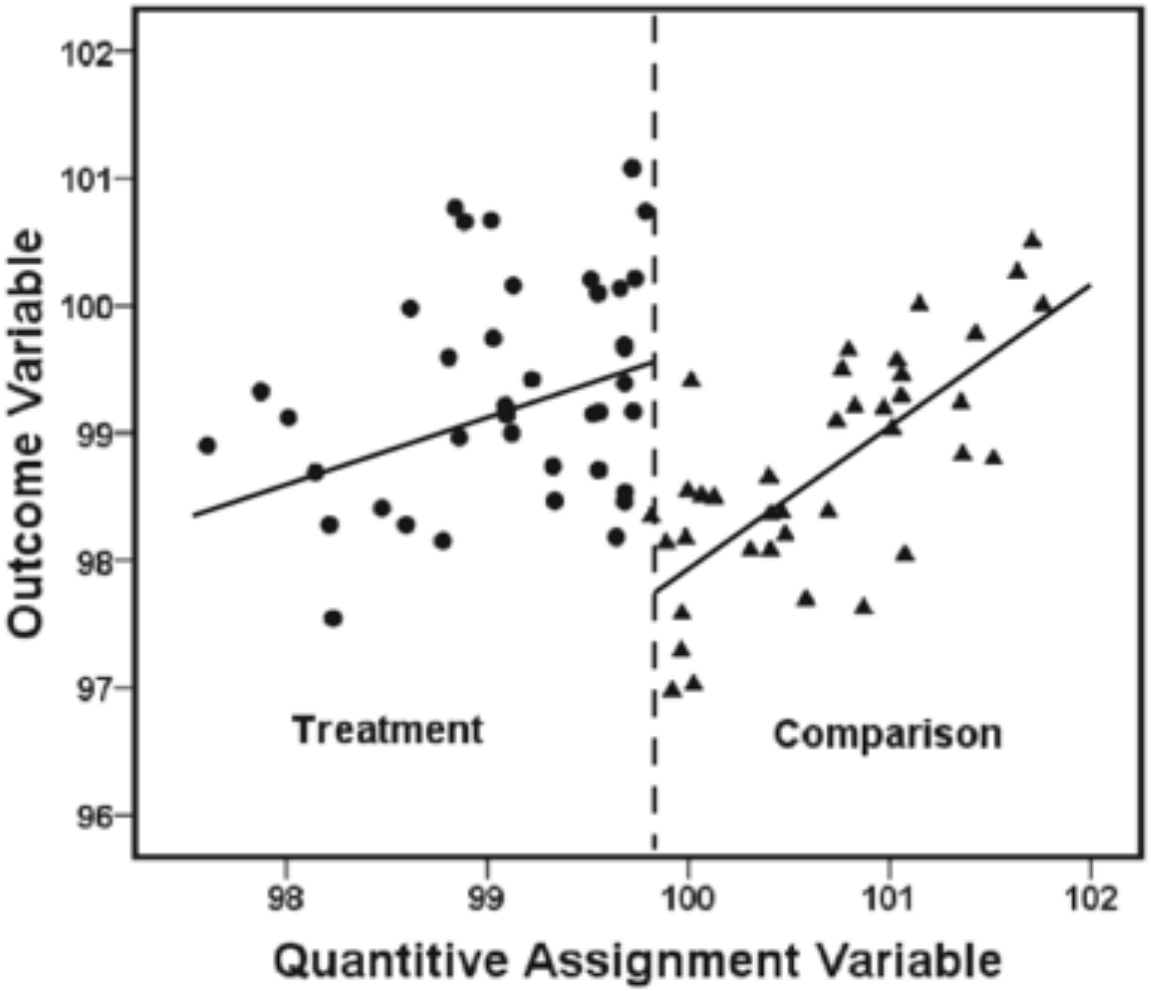
A one shot manipulation with a more subtle effect detected with a regression dicontinuity design



Treatment and control with no effect



Treatment has a large effect



Non-equivalent group designs

1. NR X O
2. NR O

   or

3. NR O X O
4. NR O O

One Group pretest post test

O1 X O2

Untreated Control Group

pretest posttest

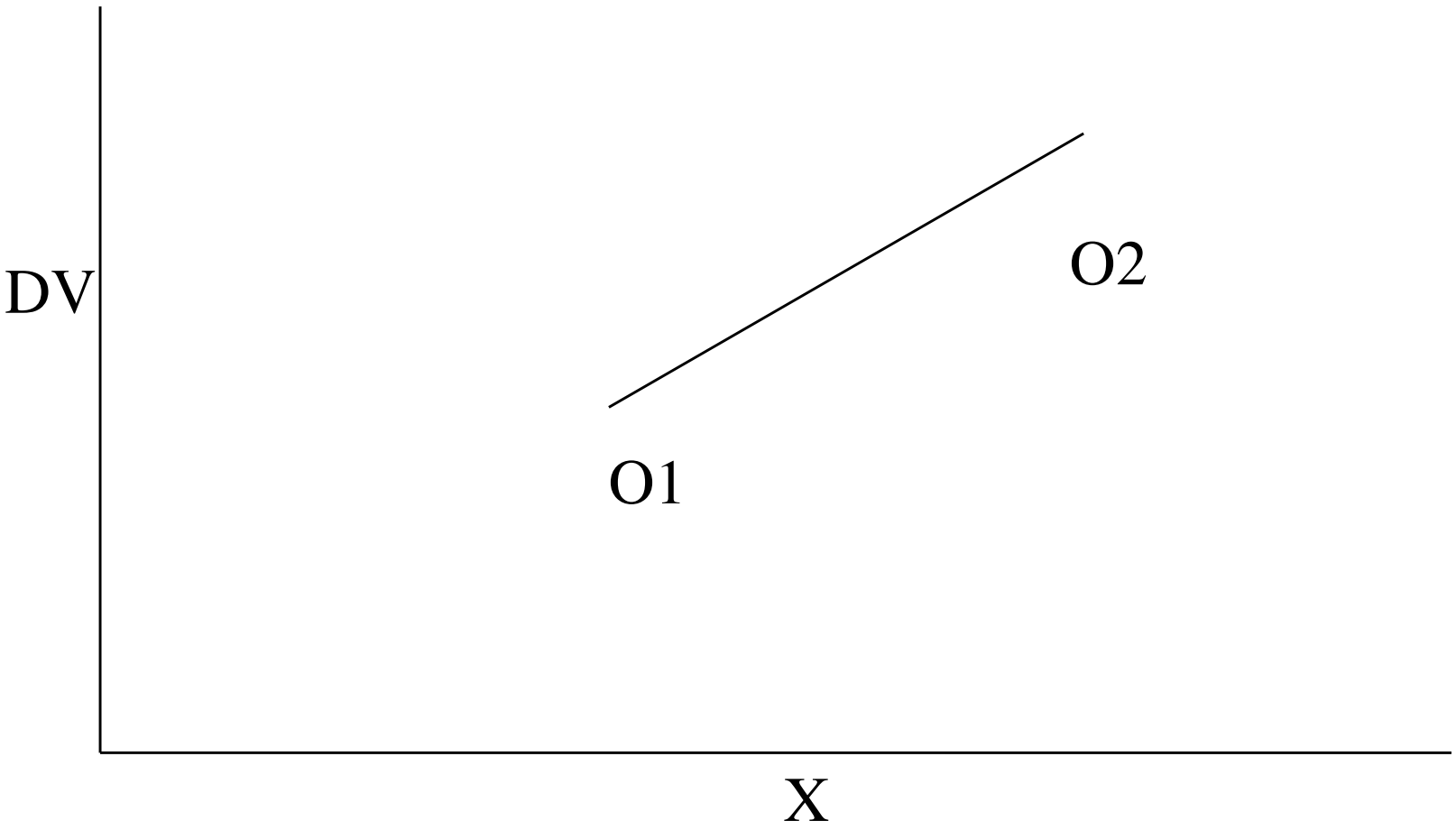
O1 X O2

O1 O2

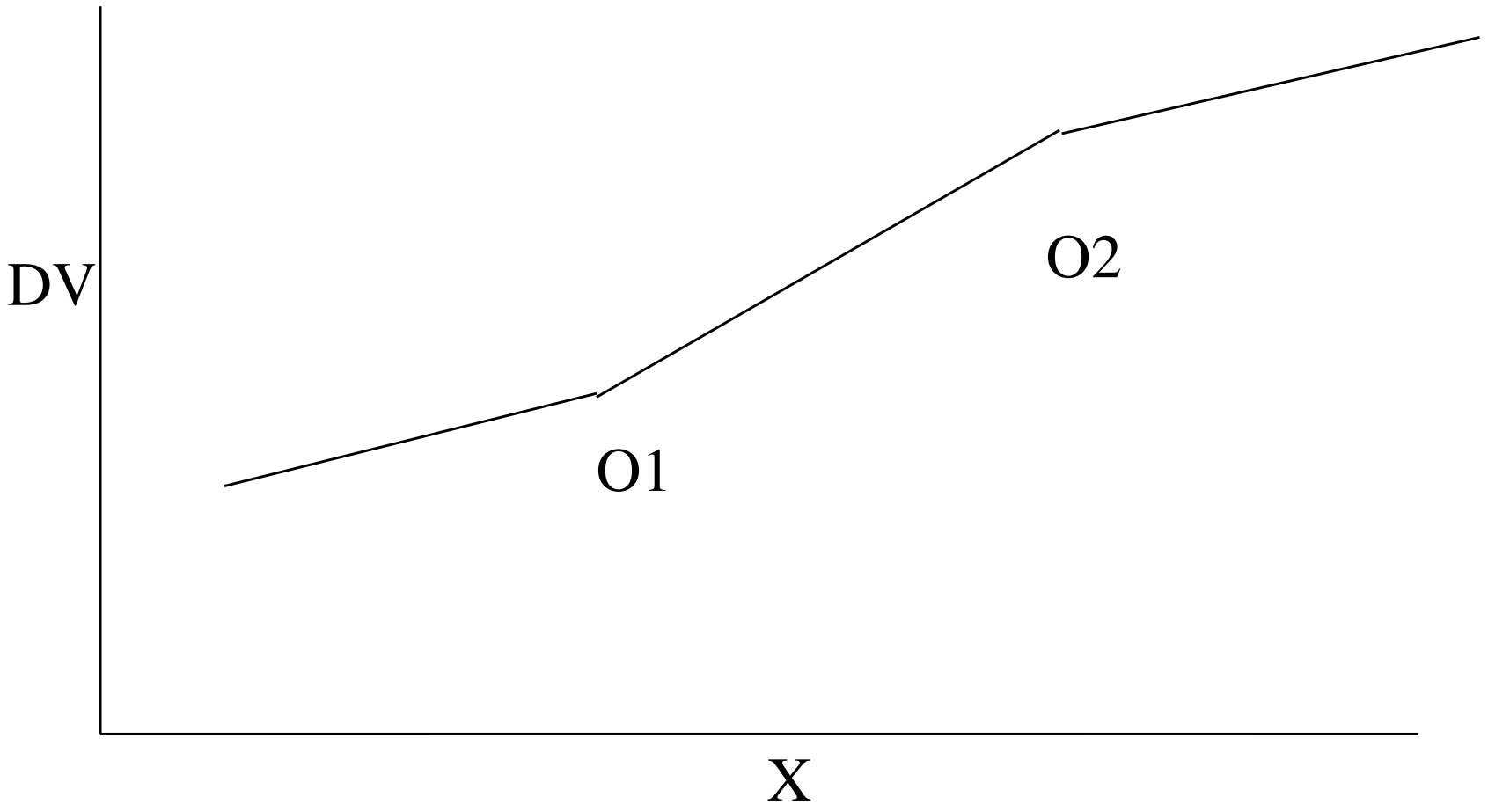
Multiple levels pretest-posttest

O1	X1	O2
O1	X2	O2
O1	X3	O2

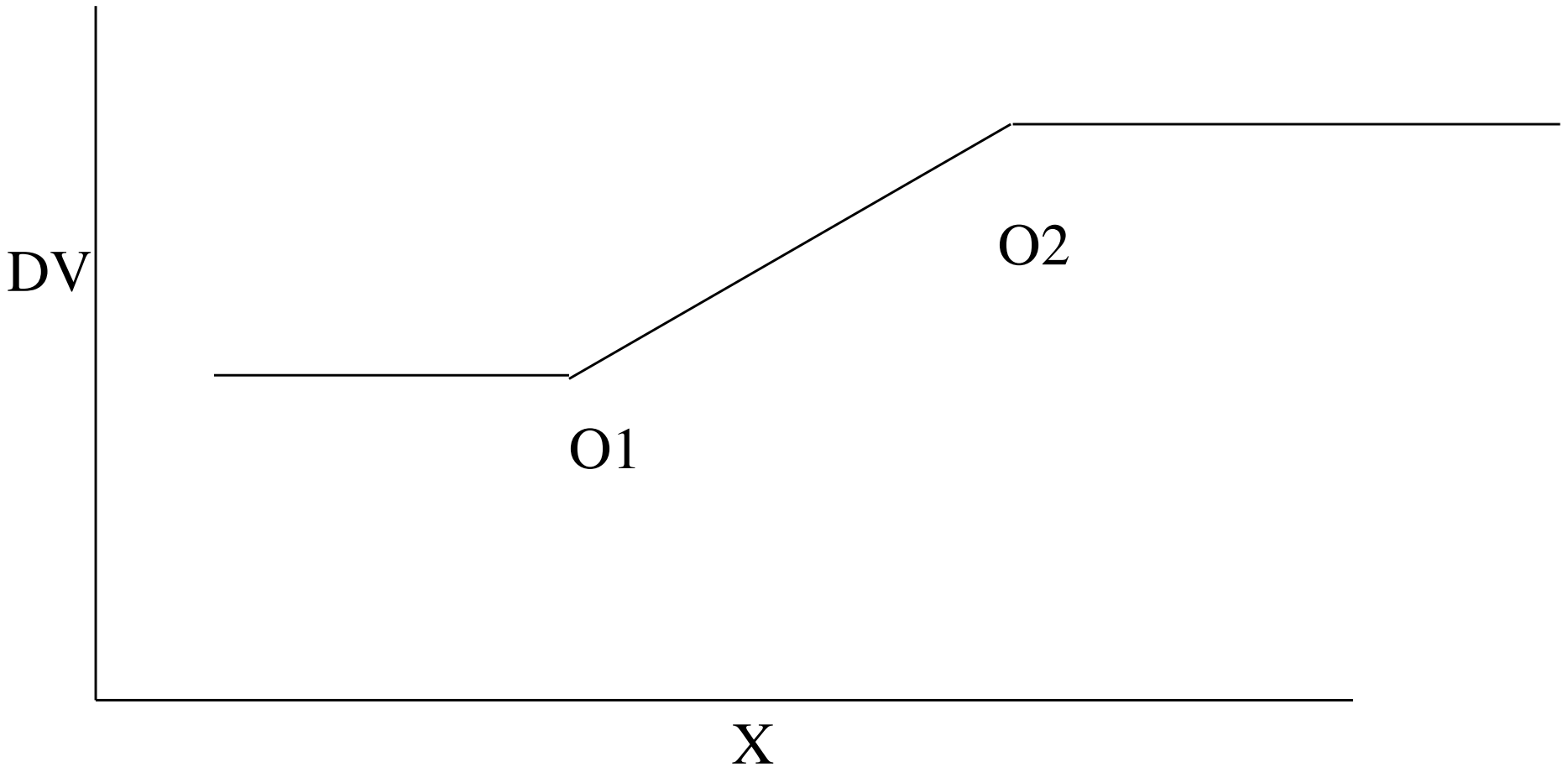
Time series variations



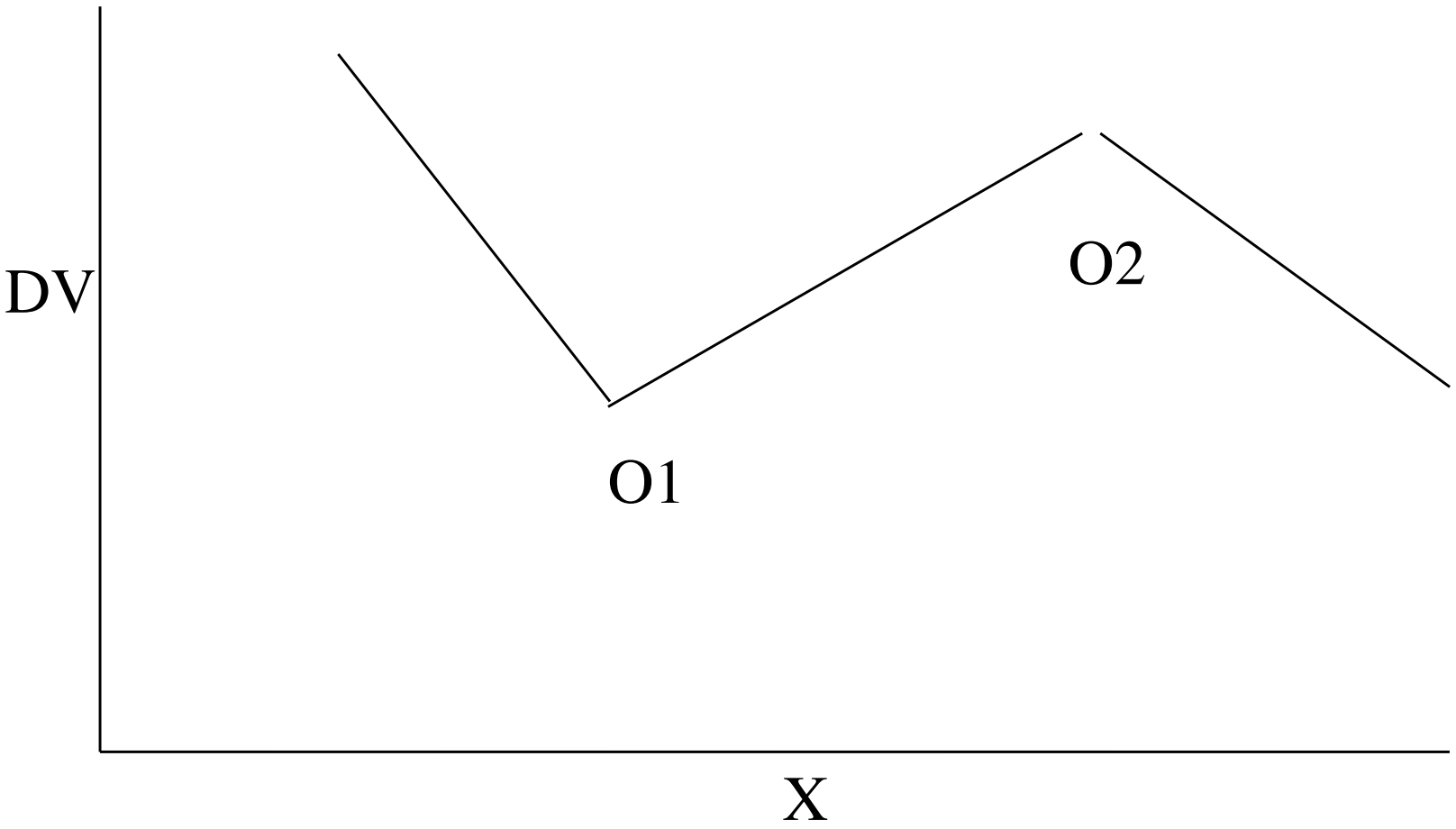
Time series variations



Time series variations



Time series variations



Types of Measures

- Direct
  - Self report
  - Peer rating
- Indirect
  - Reaction time

    implicit attitudes

    cognitive availability

Unobtrusive

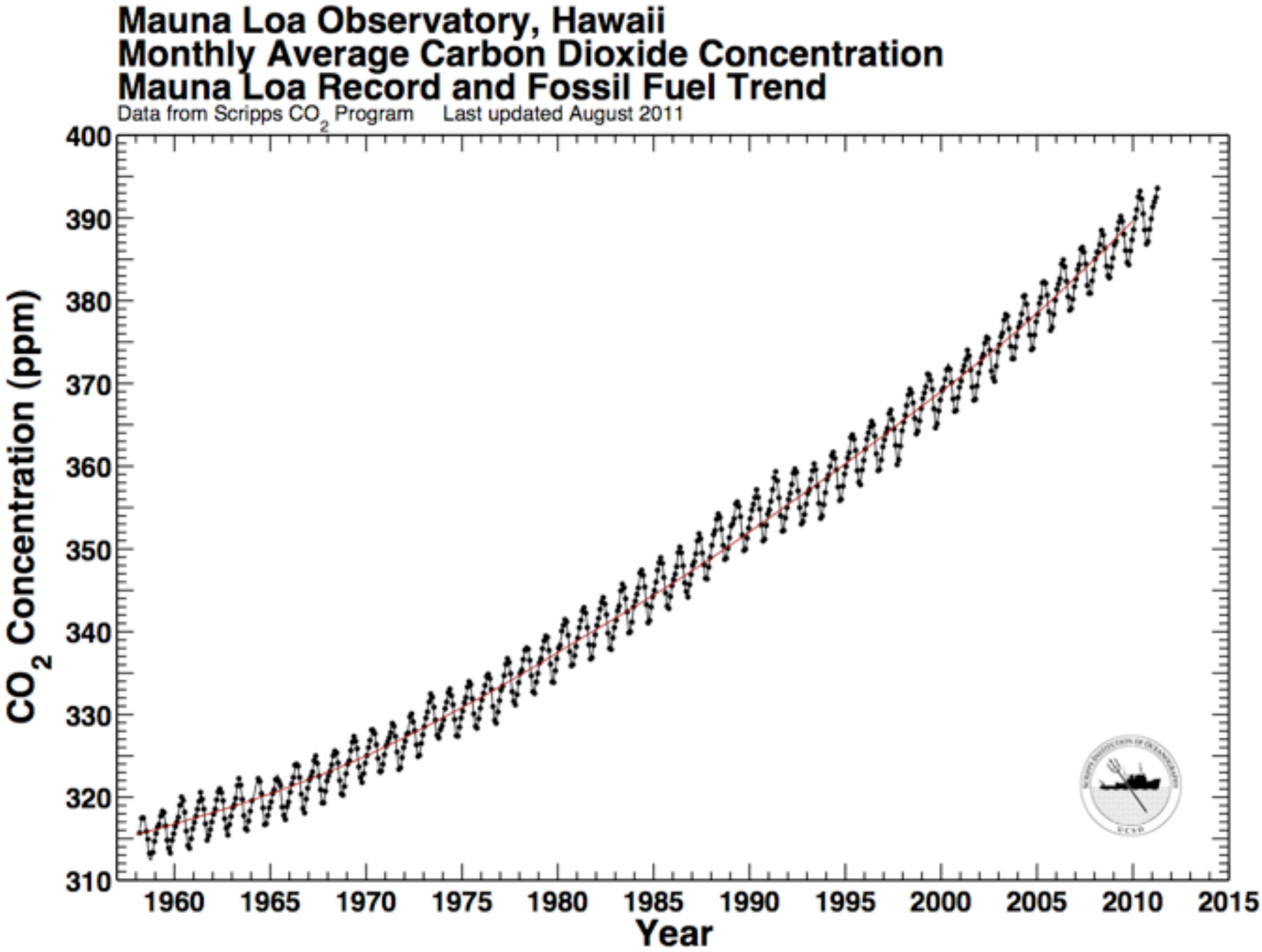
Archival

Observational

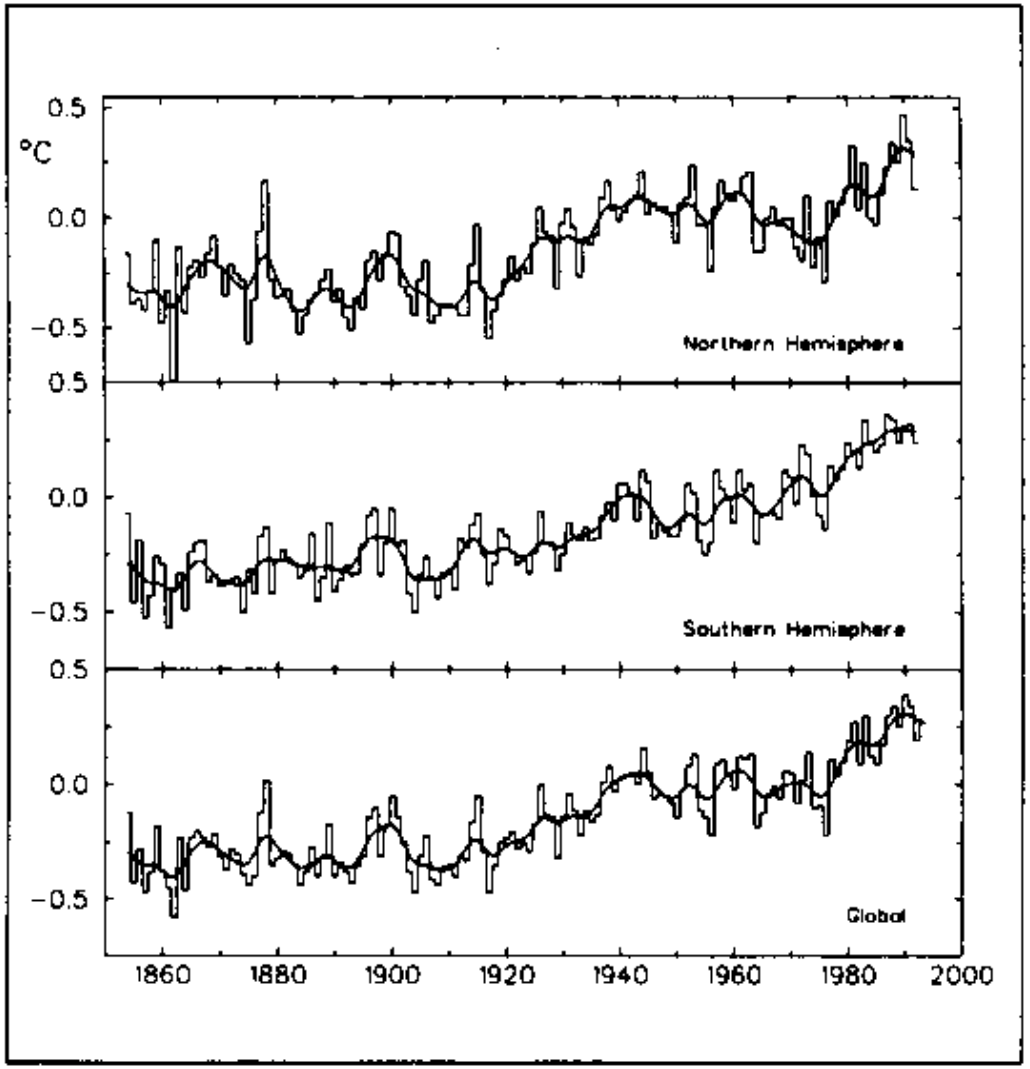
C02 and global warming - a field experiment

- Ninety-seven percent of the energy demand of the industrial world is met today by burning fossil fuels. Even if the industrialized world were to decide to shift to other energy sources as rapidly as possible, the annual consumption of fossil fuels would double before the shift was complete. Without such a shift, a peak annual rate ten or even twenty times today's rate may occur before fuel reserves, especially coal reserves, are exhausted. Thus a large additional increase in atmospheric CO2 is likely in the next few decades. … "Through his worldwide industrialized civilization, man is unwittingly **conducting a vast geophysical experiment**. Within a few generations he is burning the fossil fuels that slowly accumulated in the earth over the past 500 million years."

- The idea that CO2 from fossil fuel burning might accumulate in air and cause a warming of the lower atmosphere was speculated upon as early as the latter half of the nineteenth century (Arrhenius, 1903). At that time the use of fossil fuel was too slight to expect a rise in atmospheric CO2 to be detectable. The idea was again convincingly expressed by Callendar (1938, 1940) but still without solid evidence of a rise in CO2.
- (From Keeling, http://www.mlo.noaa.gov/HISTORY/PUBLISH/20th%20anniv/co2.htm)


Mauna Loa Observatory, Hawaii
Monthly Average Carbon Dioxide Concentration
Mauna Loa Record and Fossil Fuel Trend
Data from Scripps CO2 Program Last updated August 2011
CO2 Concentration (ppm)
400
390
380
370
360
350
340
330
320
310
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
Year

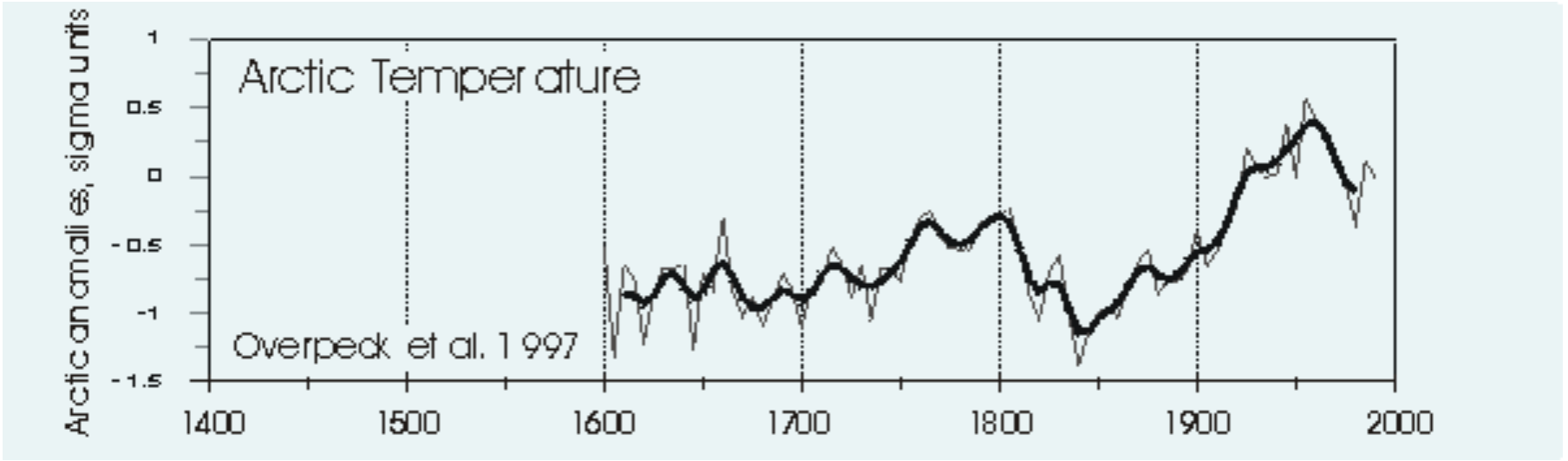
Temperature trends - time series



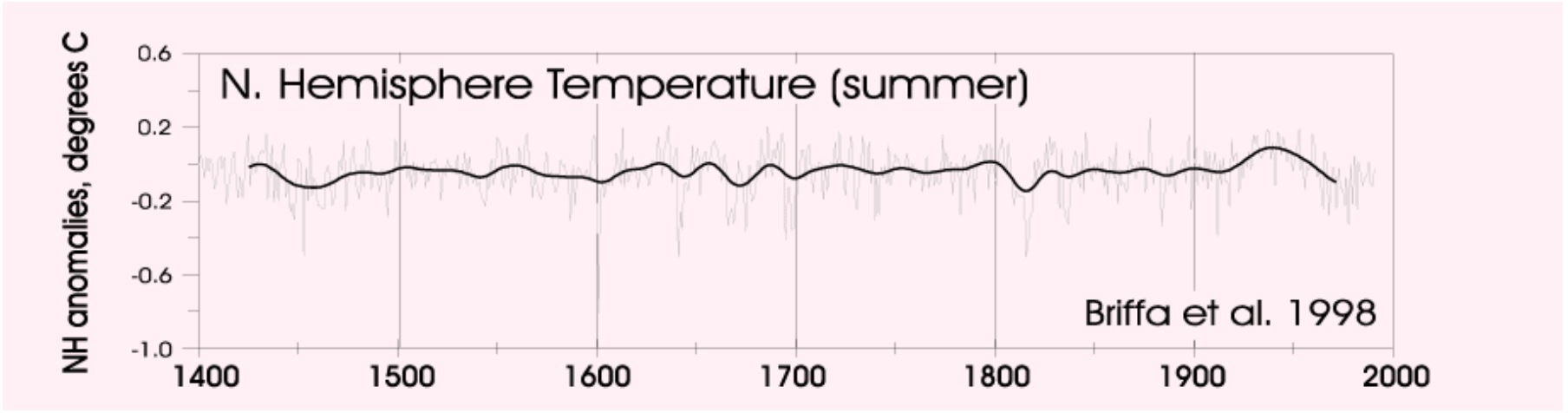
Hemispheric and mean global temperature trends, 1854 to the present

http://www.cru.uea.ac.uk/cru/annrep93/globtemp.htm

4 centuries of Arctic Temperatures

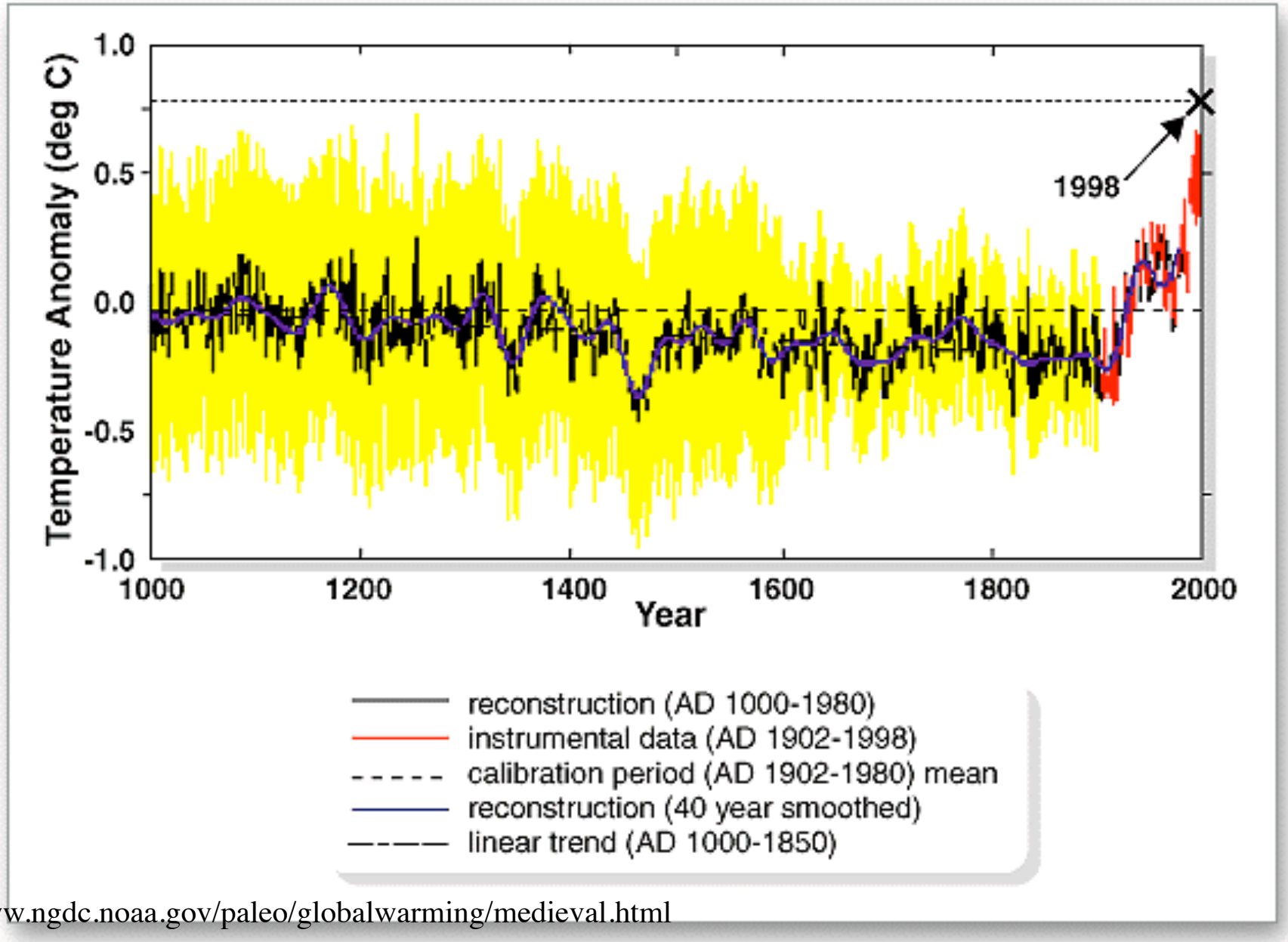


600 years of tree ring data



1000 years of temperature

(from ice cores + tree rings)



http://www.ngdc.noaa.gov/paleo/globalwarming/medieval.html

Longitudinal designs

- Multiple observations within subject over multiple occasions
  - Time interval can be minutes, hours, days, years
- Confounding effects
  - Cohorts
  - Age
  - Testing

Examples

- Terman study of exceptional children
- Berkeley growth study
- National Longitudinal Study of Youth
- Scottish study of ability
- Dunedin longitudinal study
- Women's Health Initiative

Terman study of exceptional youth

- ≈ 1200 very high performance (as judged by teacher ratings and IQ tests) Californian school children
- Personality measures at age ≈ 10
- Measures of achievement throughout life
- Reanalyses have shown many other effects
  - Effects of military disruption on career
  - Relationship of childhood personality to life span and health

Berkeley growth and guidance studies

- Berkeley Growth study
  - 61 healthy, full term infants born between Sept. 15, 1928 to May 15, 1929
- Guidance study
  - 248 subjects: every 3rd birth from Jan, 1928-June 1929
  - problems of pre-school children
- Oakland Growth Study
  - 212 adolescents from 5 elementary schools in Oakland

Followups to BGS/OGS

- Followup studies were conducted when the children were 30 (GS), 36-37 (BGS) in 1959-1960
- 1965-67
- 1981-1983 286 subjects from all studies were interviewed and given cognitive assessments about occupational careers, marriage, relations with parents, siblings and off spring.

Further followups

- parents of original sample were interviewed in 1969-1971 when they averae 70 years (N=142) and in 1981-1983 (N=94)
- Spouses of subjects
- Children of subjects

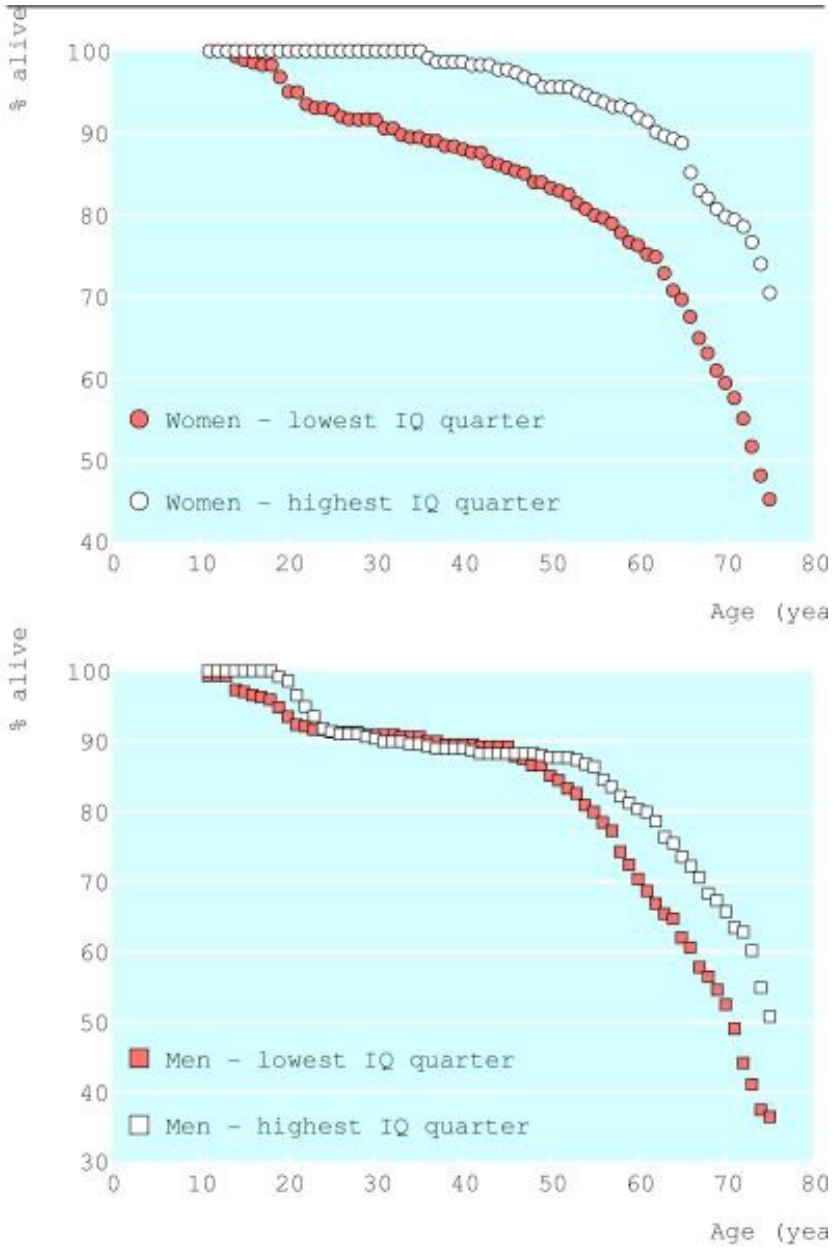
NLSY - U.S. Department of Labor-Bureau of Labor statistics

- **National Longitudinal Survey of Youth 1997 (NLSY97)**-- *Survey of young men and women born in the years 1980-84; respondents were ages 12-17 when first interviewed in 1997*.
- **National Longitudinal Survey of Youth 1979 (NLSY79)**-- *Survey of men and women born in the years 1957-64; respondents were ages 14-22 when first interviewed in 1979*.
- **NLSY79 Children and Young Adults**-- *Survey of the biological children of women in the NLSY79*.
- **National Longitudinal Surveys of Young Women and Mature Women (NLSW)**-- *The Young Women's survey includes women who were ages 14-24 when first interviewed in 1968. The Mature Women's survey includes women who were ages 30-44 when first interviewed in 1967. These surveys are now conducted simultaneously in odd-numbered years*.
- **National Longitudinal Surveys of Young Men and Older Men**-- *The Young Men's survey, which was discontinued in 1981, includes men who were ages 14-24 when first interviewed in 1966. The Older Men's survey, which was discontinued in 1990, includes men who were ages 45-59 when first interviewed in 1966*.

Scottish school children Ability over the life span

- Entire Scottish 11 year old population tested for ability in 1932
- Retested in late 1990s and early 2000s
  - Early correlates of intellectual growth and stability
  - long term measures of life satisfaction
- Replication sample— tested in 1947
- (See Emily Underwood, Science, 2014, 568-571).

Edinburgh longitudinal study of IQ -- hazard function



Lawrence J Whalley,Ian J Deary, Longitudinal cohort study of childhood IQ and survival up to age 76 BMJ. 2001 April 7; 322 (7290): 819

Dunedin Multidisciplinary Health and Development Study

- birth cohort, April 1, 1972-March 31, 1973 in Dunedin, NZ
- 1037 assessed at age 3
- whose members were questioned regularly throughout growth
  - at ages 5, 7, 9, 11, 13, 15,18, 21, 26 years
  - Physical abuse
  - Psychological abuse
  - delinquency
  - child rearing effect
  - Gene-environment interactions (resiliency)
  - Low MAO
- Following slides taken from Professor Richie Poulton (http://www.nzshs.org/dunedin/richie_poulton_08.pdf)

Five Steps

1. Identify a plausible combination of disorder, environmental risk factor and candidate gene to generate a hypothesis.

2. Test the interaction hypothesis between the gene, the environmental risk factor, and the disorder.

3. Replicate the findings with alternative measures of the disorder.

4. Check to see other genes are interacting with the gene being tested.

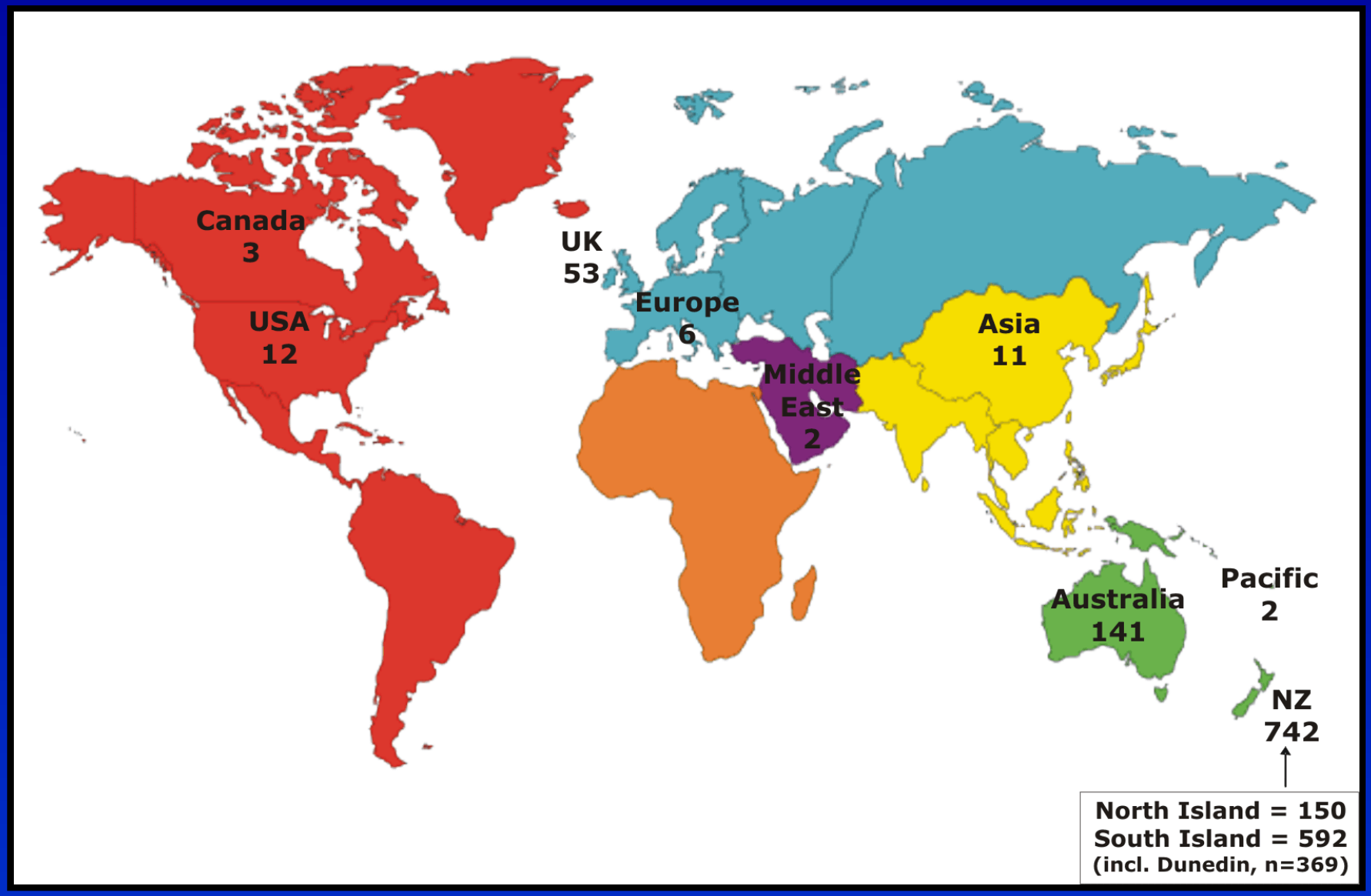
5. Test if the gene-environment interaction predicts other disorders.

Retention in the Dunedin Study

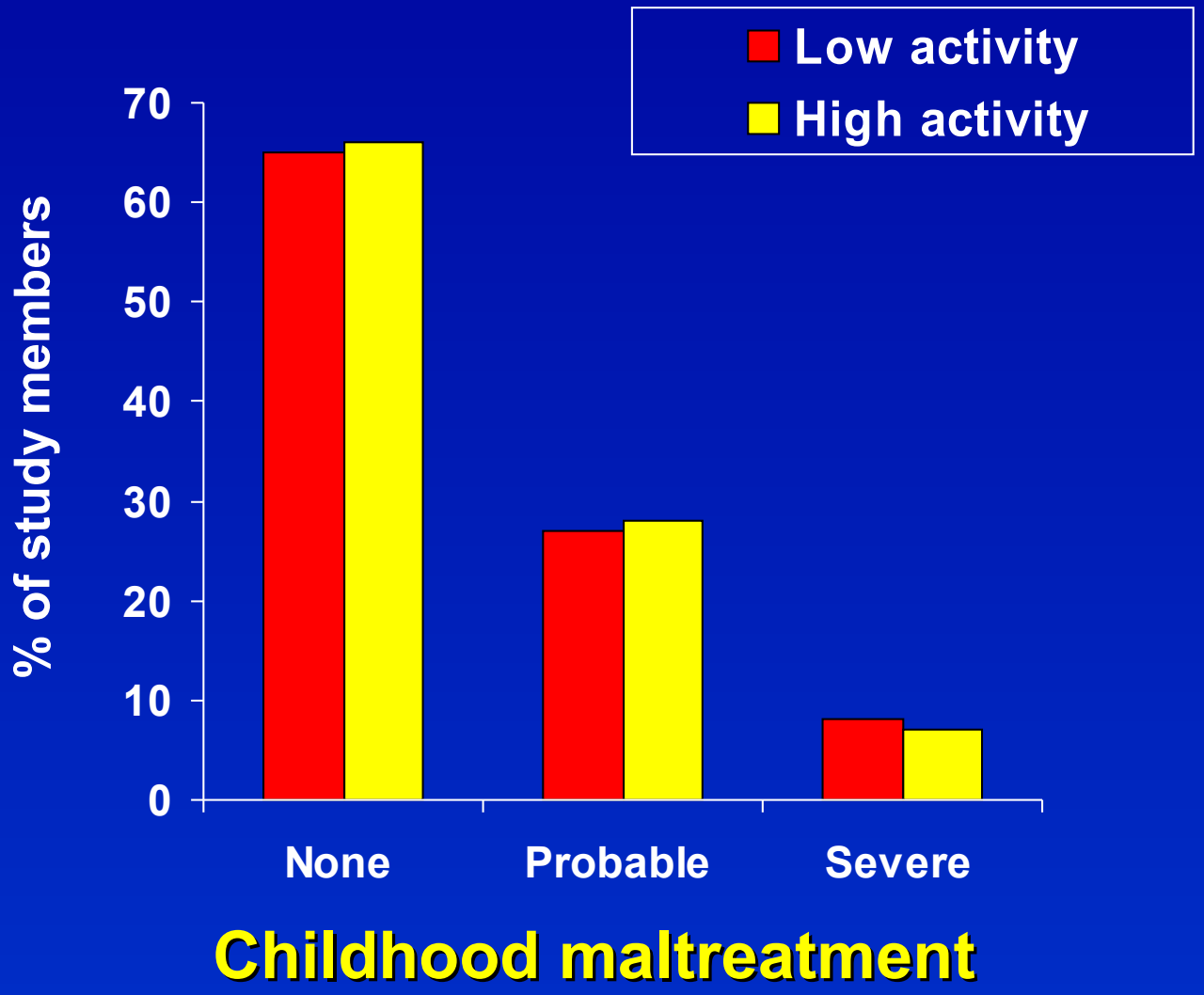
Age	Year	Number	Percent*
Birth	1972-73		
3	1975-76	1037	100%
5	1977-78	991	96%
7	1979-80	954	92%
9	1981-82	955	92%
11	1983-84	925	90%
13	1985-86	850	82%
15	1987-88	976	95%
18	1990-91	993	97%
21	1993-94	992	97%
26	1998-99	980	96%
32	2004-05	972	96%

* Percentage seen of those who were eligible (i.e. alive) at each age

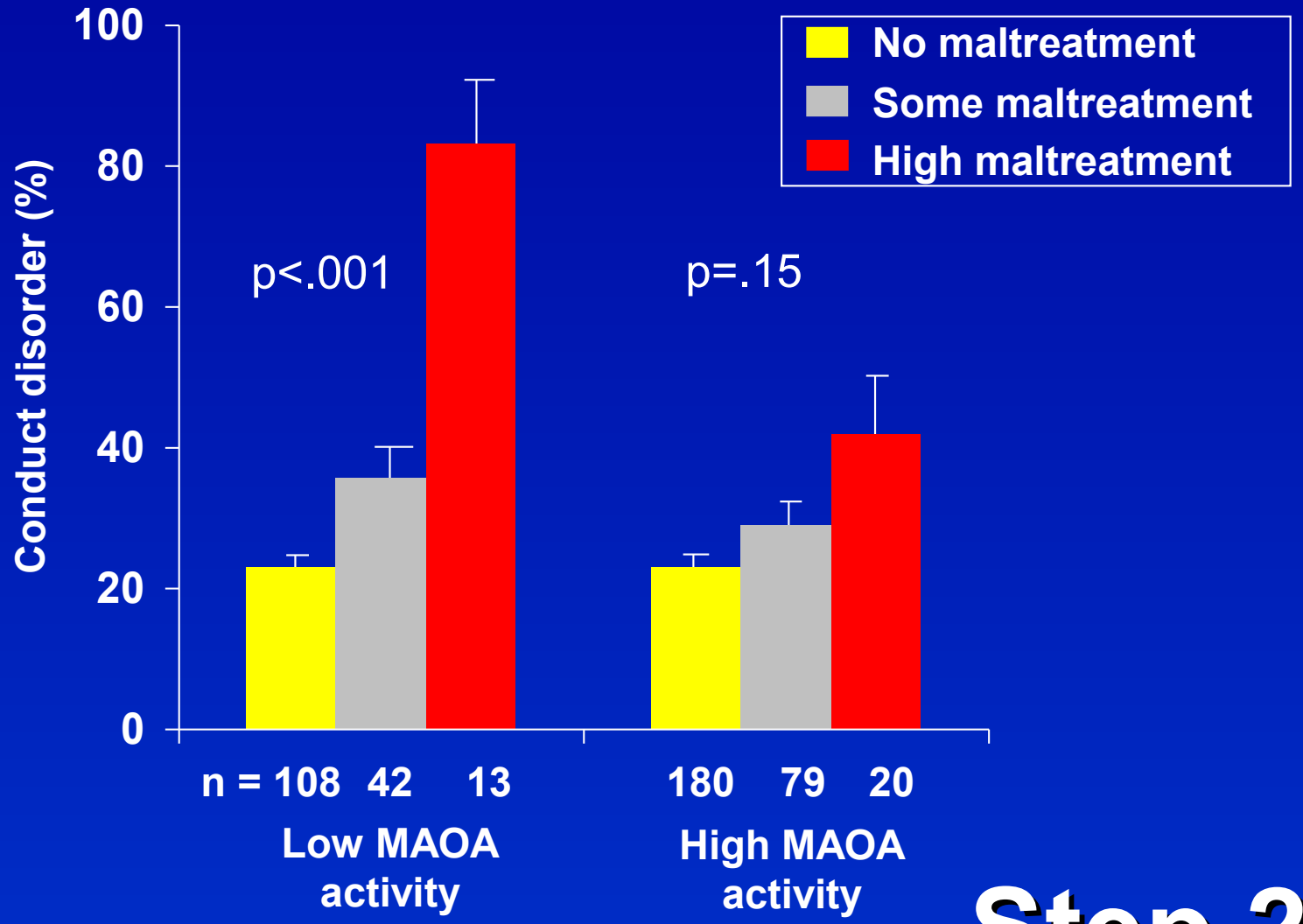
Location of Study Members at age 32



Exposure to childhood maltreatment as a function of MAOA activity



Conduct Disorder (ages 10-18) by MAOA gene activity and childhood maltreatment

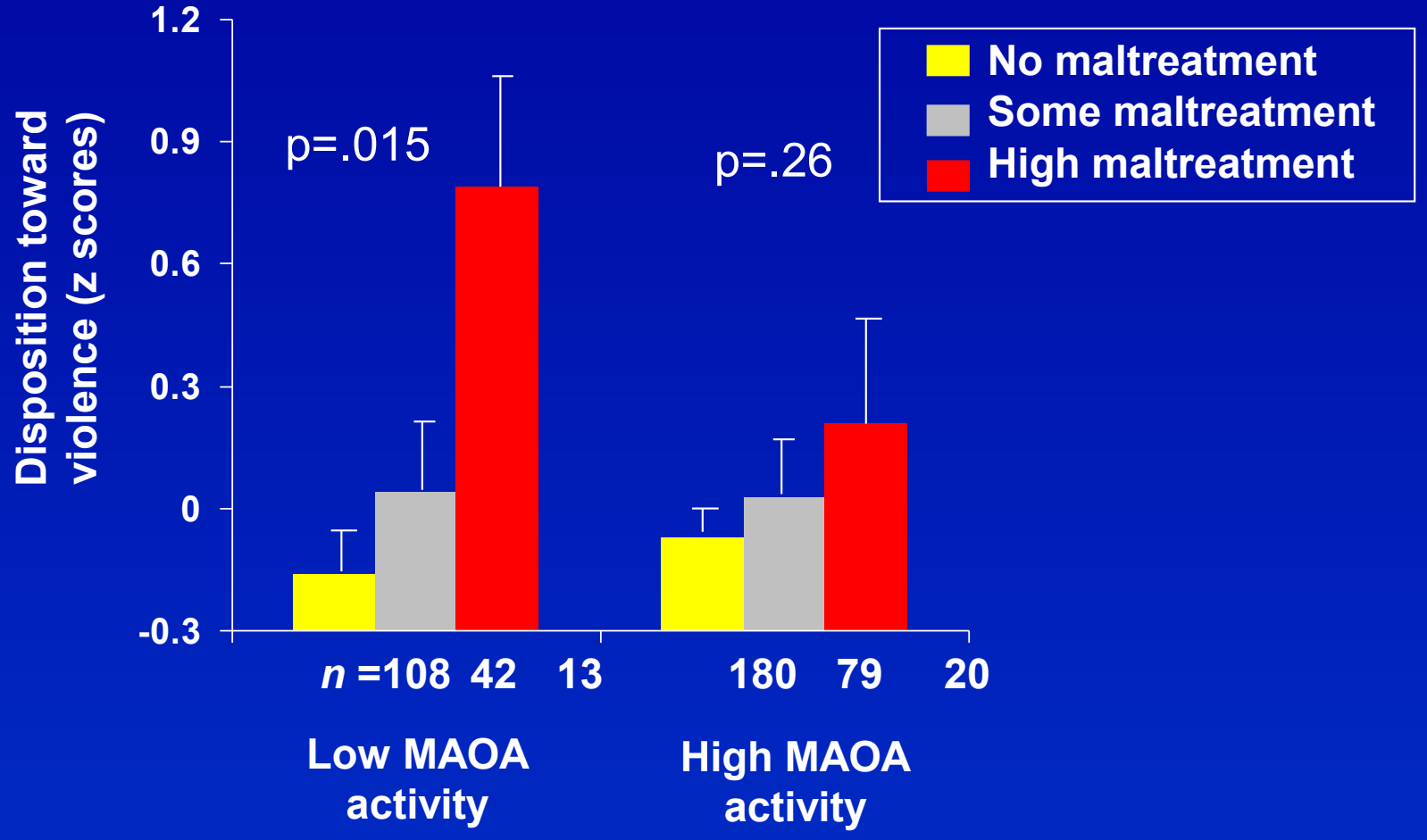


Step 2

Personality disposition toward violence (self-report at age 26 years)

- Sometimes I daydream about injuring or hurting someone
- My temper is quick and hot
- When I get angry, I fly off the handle before I know it
- When I get angry I am ready to hit someone
- I admit that I sometimes enjoy hurting someone physically
- I enjoy a good brawl
- Sometimes I hit people who have done something to deserve it

Aggressive personality (age 26) by MAOA gene activity and childhood maltreatment

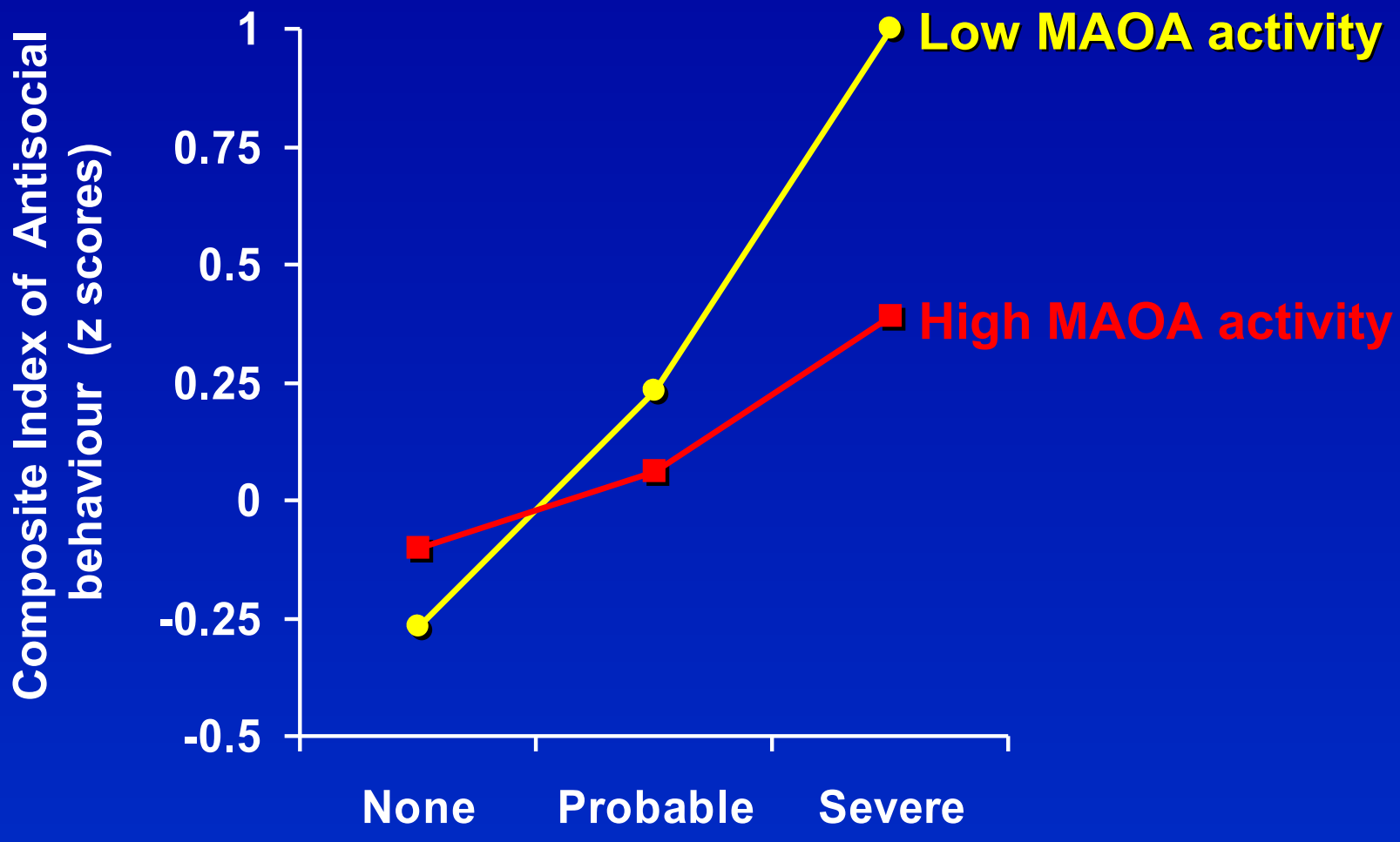


Conviction of a violent crime by age 26

- Court records searched for all Study members
- 25% of Study males received 987 criminal convictions
- 11% of Study males received 172 convictions for violent crimes

- Common assault
- Assault with intent to injure
- Manslaughter
- Rape
- Indecent assault on female
- Aggravated cruelty to animal

The Interaction between MAOA and Childhood Maltreatment



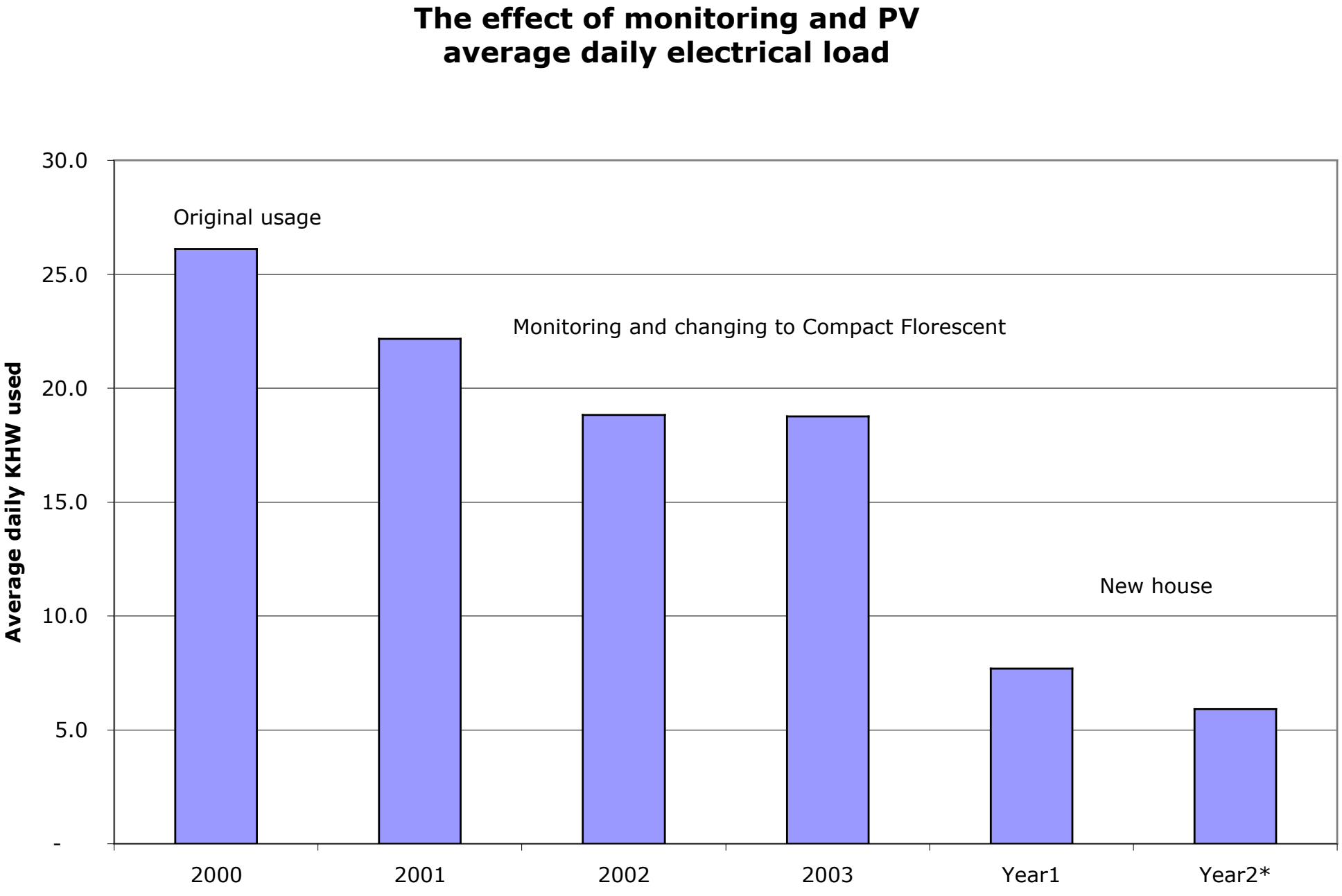
Womens' Health Initiative

- 15 year study
- 161,000 women aged 50-79 at start
- Randomized controlled clinical trials (68,000)
  - Hormone Replacement Therapy
  - Dietary Modification
  - Calcium/Vitamin D
- Observational study (93,000)

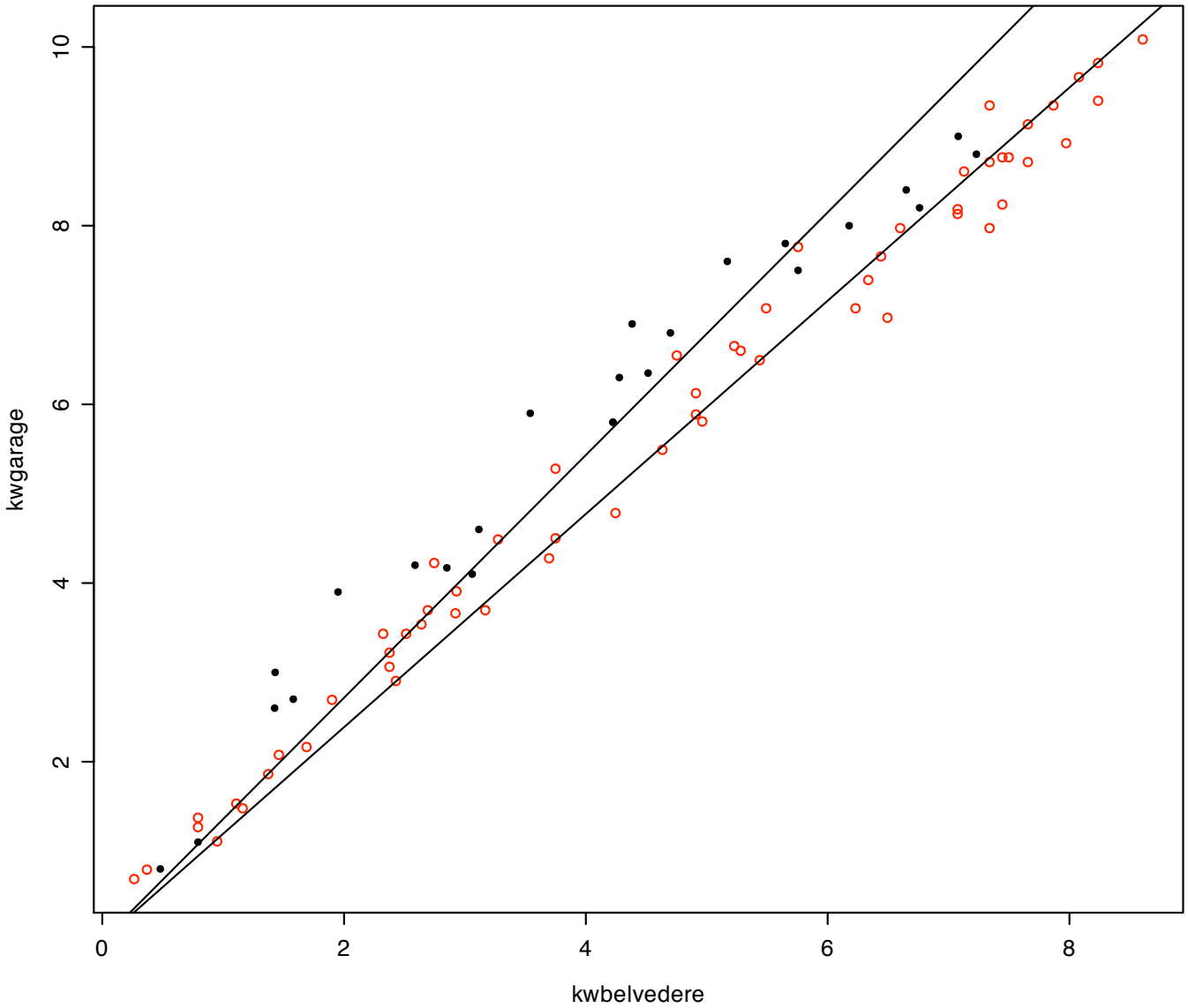
Research Methods as general skill set

- What is the influence of X upon Y?
- Does changing X influence Y?
- How large is the effect compared to what I would expect by chance variation?
- Is there some other variable Z that is mediating or moderating the effect?

Longitudinal Experimental



Does a new charge controller work better than the prior one?



Compare known benchmark to old and new system