Field studies and randomized designs

The example of epidemiology

Epidemiology

- "the branch of medicine that deals with the incidence, distribution, and possible control of diseases and other factors relating to health"
- Typical study is correlational: Higher levels of variable X are associated with more of disease Y
- Adapted from Gary Taubes: "Do we really know what makes us healthy". New York Times Magazine, September 16, 2007.
- http://www.nytimes.com/2007/09/16/magazine/16epidemiology-t.html?_r=2&ref=magazine&pagewanted=all&oref=slogin&oref=slogin

Hormone Replacement Therapy

- Nurses study (observational)
  - HRT is good
- Women's Health Initiative (random assignment)
  - HRT is slightly bad

Nurses Health Study

- Observational study of nurses
- Positive effect of estrogen on heart disease
- but also observed reduction in death by homicide, suicide, and accidents

The bias of healthy users

- "People who faithfully engage in activities that are good for them -- taking a drug as prescribed, ... or eating what they believe is a healthy diet -- are fundamentally different from those who don't.
- Nurses who took HRT were thinner, fewer risk factors for heart disease, more educated, wealthier, exercise more, more health conscious.

The bias of compliance

- People who comply with their doctors' orders are healthier than those who don't
- Effects are even true for placebo takers!

Doctors' prescribing effect

- People who are eager to take particular drugs are probably different than those who are not

Randomized field trials as an alternative

- Observational studies have all kinds of biases, what about doing random assignment?
- How to do it?
- The example of the Women's Health Initiative

Women's Health Initiative

- Older (pre and post menopausal) women
- Randomized field trial
  - HRT vs placebo
  - Reduced fat versus normal
  - Calcium supplements versus placebo

Participation bias

- Who participates in a random study?
- Who complies with instructions?
- Effect of assignment versus effect of actual treatment

Honors Workshops

- Evidence from calculus classes that study groups help performance
  - Treisman (1992) at UCB found that white and asian males used study groups, females and african-american students did not
  - interpreted differences in test performance as motivational effect

Study group effect on motivation

- Student by him/her self
  - I don't know how to do problem 6
  - I must be stupid
- Student in study group
  - I know how to do problem 5, you know how to do problem 6, lets teach each other
  - I am not stupid, the material is hard!

Biology Honors workshops at NU

- Students asked if interested in participating
  - volunteers more interested in biology
  - volunteers more anxious
- Among those willing to participate, random assignment to honors study groups or not
- Workshop students did better, more likely to complete the course than those who

- Born, W. K., Revelle, W., & Pinto, L. (2002) Improving Biology Performance with Workshop Groups. *Journal of Science Education and Technology*. 11, 347-365.

This 2-year quasi-experiment evaluated the effect of peer-led workshop groups on performance of minority and majority undergraduate biology students. The workshop intervention used was modeled after a program pioneered by Treisman (1992). Majority volunteers randomly assigned to workshops ($n = 61$) performed significantly better than those assigned to the control group ($n = 60$, $p < 0.05$) without spending more time studying. Workshop minority students ($n = 25$) showed a pattern of increasing exam performance in comparison to historic control minority students ($n = 21$), who showed a decreasing pattern ($p < 0.05$). Volunteers ($n = 121$) initially reported that biology was more interesting and more important to their futures than to nonvolunteers' ($n = 435$, $p < 0.05$). Volunteers also reported higher levels of anxiety related to class performance ($p < 0.05$). The relationship of anxiety to performance was moderated by volunteer status. Performance of volunteers was negatively associated with self-reported anxiety ($r = -0.41$, $p < 0.01$). Performance of nonvolunteers was unrelated to self-reported anxiety ($r = -0.02$). Results suggest elevated anxiety related to class performance may increase willingness to participate in activities such as workshop interventions. In addition, students who volunteer for interventions such as workshops may be at increased risk of performance decrements associated with anxiety. Even so, workshop programs appear to be an effective way to promote excellence among both majority and minority students who volunteer to participate, despite the increased risk of underperformance associated with higher levels of anxiety.