Intermediate Statistics

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What we'll talk about today

1. Approaches to designing social research

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2. Experimental designs

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3. Observational studies

Outline of the session

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- What to do?

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- So how do scientists generally, and political scientists in particular, go about testing whether X causes Y? There are several strategies, or **research designs** that researchers can employ toward that end.
- The goal of all types of research designs are to help us evaluate how well a theory fares as it makes its way over the four causal hurdles—that is, to answer as conclusively as is possible the question about whether X causes Y.

Two approaches

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- We'll take them in turn.

Outline of the session

An example from the medical sciences

- Suppose that you were the CEO of a pharmaceutical company, and your scientific team tells you that they have just discovered a new drug that will help lower blood pressure. The pharmacists tell you that they have successfully tested the drug on rats and developed a dosage regimen that they expect will be effective on people. However, the drug has yet to be tested on people.

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- How would researchers in the physical sciences and medicine evaluate whether this new and promising drug works on humans? Note the focus on causality here. In more "causal" language, how can we find out whether or not taking the drug (X) will cause patients to have lower blood pressure (Y)?

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- It is very important, and not at all surprising, to realize that patients may have high or low blood pressure for a variety of reasons (Zs) that have nothing to do with our new drug—varying exercise habits, varying diets, and varying genetic predispositions can all cause blood pressure to be high or low. So how can we establish whether or not, among these other influences (Z), our new drug (X) also causes a patient's blood pressure (Y) to fall?

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- These two components—control and random assignment—form a necessary and sufficient definition of an experiment.

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- In our example of our blood-pressure drug, this requirement means that we cannot compare people who, by their own choice, already take the drug to those who do not (in this case the choice of whether or not to take the drug is a Z variable that may exert an influence on Y separate from X).

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- It means that we, the researchers, have to decide which of our experimental subjects will take the drug and which ones will not.

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- In the context of our drug-testing example, this means that we must toss coins, draw numbers out of a hat, use a random-number generator, or some other such mechanism to ensure that our subjects are divided into a **treatment group** (who will receive our drug) and a **control group** (who will not receive the drug, but will instead presumably receive a placebo).

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- Recall that we have emphasized that all science is about comparisons and also that every interesting phenomenon worth exploring—every interesting dependent variable—is caused by many factors, not just one.
- Random assignment to treatment groups ensures that the comparison we make between the treatment group and the control group is as pure as possible, and that some other cause of the dependent variable (Z) will not pollute that comparison. By first taking a group of subjects, and then randomly splitting them into two groups on the basis of a coin flip, what we have ensured is that the subjects will not be systematically different from one another.

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- And this is radically different from any non-experimental design (as we'll see).

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- Is there some **confounding variable** Z that is related to both X and Y, and makes the observed association between X and Y **spurious**?
- Because experiments deal with the fourth hurdle so effectively, they are said to have high degrees of internal validity—that is, the inferences we make about whether X causes Y or not are likely to be correct.

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4. The mistake of emphasis

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- Some maintain that, in the absence of experiments, we cannot demonstrate causality with any degree of confidence, but only correlation.

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- Hurdles 1 and 3 are rather similar between experiments and observational studies.
- Hurdles 2 and 4 are a bit different, though. How so?

Two types of data, two types of observational studies

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- Two types of observational studies, focussing on two different types of variation

Variation through space at one point in time

Nation	Government debt as a percentage of GNP	Unemployment rate
Finland	6.6	2.6
Denmark	5.7	1.6
USA	27.5	5.6
Spain	13.9	3.2
Sweden	15.9	2.7
Belgium	45.0	2.4
Japan	11.2	1.4
New Zealand	44.6	0.5
Ireland	63.8	5.9
Italy	42.5	4.7
Portugal	6.6	2.1
Norway	28.1	1.7

Variation through time in one spatial unit

Month	Presidential Approval	Inflation
2002.01	83.7	1.14
2002.02	82.0	1.14
2002.03	79.8	1.48
2002.04	76.2	1.64
2002.05	76.3	1.18
2002.06	73.4	1.07
2002.07	71.6	1.46
2002.08	66.5	1.80
2002.09	67.2	1.51
2002.10	65.3	2.03
2002.11	65.5	2.20
2002.12	62.8	2.38

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- We could compare the aggregated preferences of voters from a variety of districts (X) to the voting records of the representatives (Y).
- This particular X is not at all subject to experimental manipulation.

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- For example, how, if at all, do changes in media coverage about the economy (X) affect public concern about the economy (Y)? That is, when the media spend more time talking about the potential problem of inflation, does the public show more concern about inflation; and when the media spend less time on the subject of inflation, does public concern about inflation wane?

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- We need to focus hard on that fourth causal hurdle. Are there any other variables (Z) that are related to the varying volume of news coverage about inflation (X) and public concern about inflation (Y)?

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- How is this done? By the use of statistical controls.