Quantitative Sociological Analysis

Prefacing Statistics: Science and the Research Process

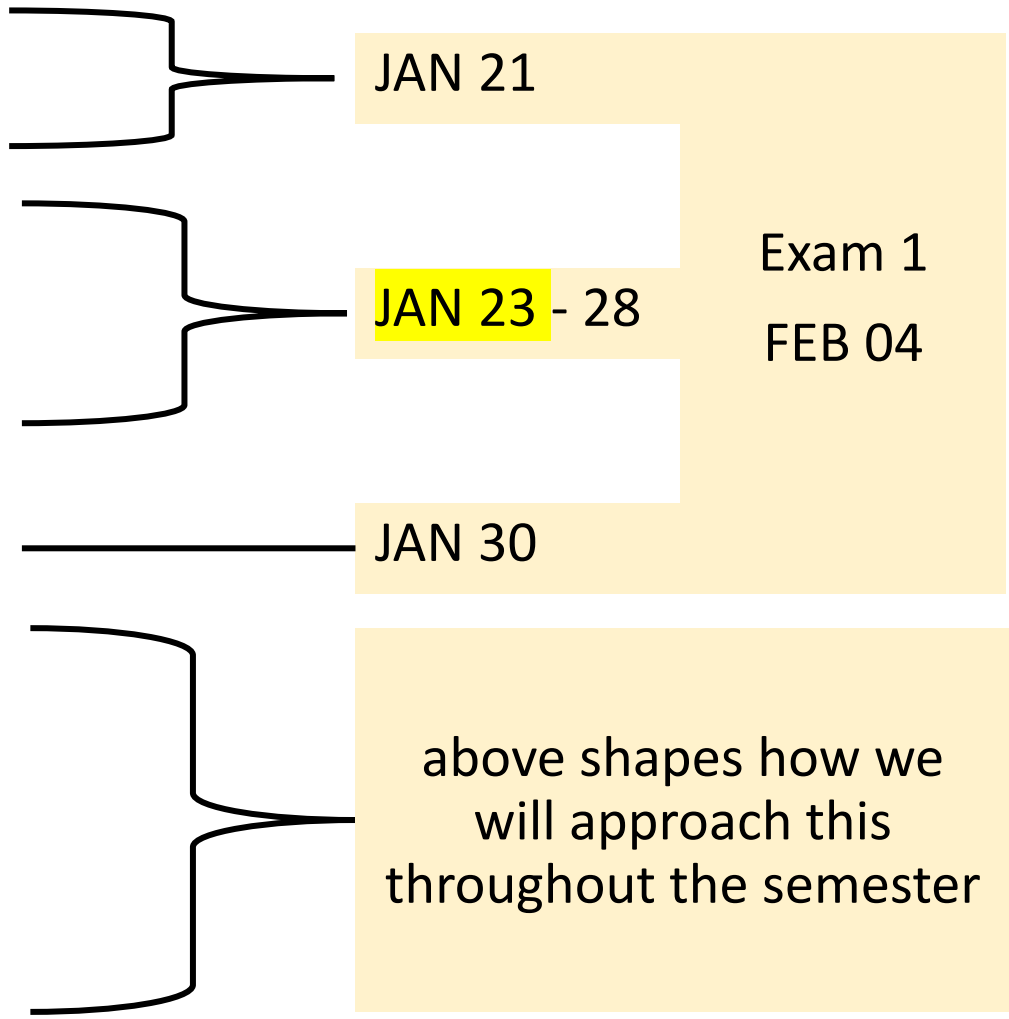
Part 2

January 23, 2025

Science: a **process** of organizing, and acquiring new, knowledge

Steps in the process

1. Start with a perspective
2. Select a theory
3. Derive a research proposition
4. Derive a research question
5. Derive a hypothesis
6. Find or collect data
7. Analyze data
8. Report results & Answer question
9. Interpret results in terms of theory
10. Draw implications for theory



Part 2

Learning objective: begin to understand why science assigns specific meaning to elements of study, and why this must also be conveyed in measurable terms

Recognize how:

conceptualization involves a meaning making process

operationalization involves a process of defining measurable terms

hypotheses rely on logic embedded in both meaning and measurement

Takeaway: words used to disseminate scientific claims often don't mean what we think they mean, largely because science demands unique precision

What does this have to do with stats?

- statistical methods are used to study phenomena that are
  - abstractly defined through specific word choices (conceptualization)
  - which must be made more concrete (operationalization), and eventually assigned numeric values, so they can be studied in a systematic way

- Why are conceptualization and operationalization so critical for understanding statistical methods?

- When words used to describe elements of study are similar or even the same, but meaning and/or measurement differs then we are not talking about the same thing
  - consider the following examples…

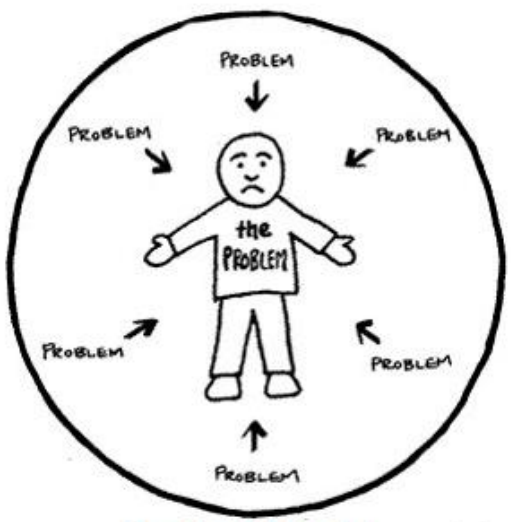
How to approach following examples

- substantively centered on health-related context
  - ideally relatable to general audience
    - ask if something is unclear
- not expected to memorize health-related context
- use examples as a vehicle to situate the importance of conceptualization and operationalization within the scientific process

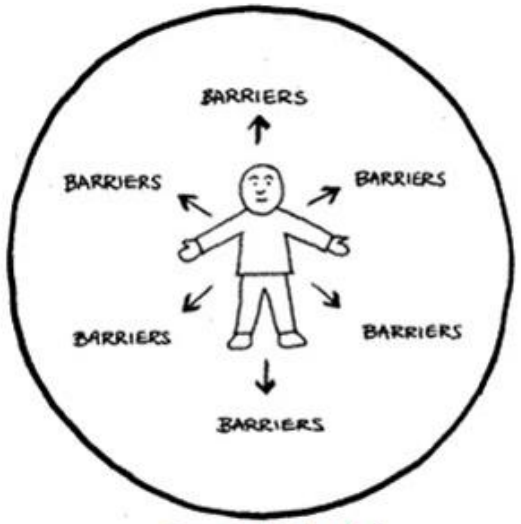
Example: medical vs social perspective

Topic: disability and quality of life

- [Step 1] start with a perspective
  - we will use a comparative example
- [Step 2] select a theory
  - we will skip most of these details
    - overly technical for our purposes



Medical Model



Social Model

- [Step 3] derive a <u>research proposition</u>
  - statement describing the roles of elements in explaining a particular phenomena
    - typically addresses a theoretical proposition

In our case..

How might medical and social perspectives differ in their understanding of disability and quality of life?

[Step 3] research proposition continued

- elements in theoretical proposition must first be <u>conceptualized</u>
  - process of defining and specifying the meaning of ideas being studied
    - unified language idealistically enhances scientific process
      - sometimes called “jargon”

	conceptualization			[step 3]
perspective	**disability**	**quality of life**	**accommodations**	**research proposition**
medical	a physical or mental condition that impairs one’s ability to perform a major life activity	absence of mental illness		Becoming disabled leads to the proliferation of mental illness.
social	a mismatch between the person and environment that presents a barrier to a major life activity	presence of well-being	adjustments intended to provide more equal opportunity for participation in life activities	Accommodations are important for well-being among people who develop a disability.

[Step 4] derive a research question

- refined restatement of the research proposition

perspective	[step 3] research proposition	[step 4] research question
medical	Becoming disabled leads to the proliferation of mental illness.	How does becoming disabled impact mental illness?
social	Accommodations are important for well-being among people who develop a disability.	How do accommodations impact the well-being of people who develop a disability?

[Step 5] derive a hypothesis

- falsifiable statement that *makes a prediction* based on the literature, grounded in selected perspective, and guided by selected theory
  - often formulated as an if-then statement
    - can only reject or fail to reject, NEVER accept or prove [more on this later]

[Step 5] derive a hypothesis continued

- concepts in the research question must first be operationalized
  - process of defining concepts into measurable terms

- when defined in measurable terms, a concept becomes a variable
  - representation of a characteristic that can take different values

- common concepts often have well-established measurable terms
  - can help scientists be more systematic (e.g., ADLs, depression, happiness)

	operationalization		
perspective	**disability**	**quality of life**	**accommodations**
medical	one or more activity of daily living (ADL) limitation	depression	
social	one or more activity of daily living (ADL) limitation	happiness	device, built, social

[Step 5] derive a hypothesis continued

- operationalization allows hypotheses to make predictive statements
  - testable proposition for how variables are expected to affect one another

perspective	[step 3] research proposition	[step 4] research question	[step 5] hypothesis
medical	Becoming disabled leads to the proliferation of mental illness.	How does becoming disabled impact mental illness?	People who become impaired in one or more ADLs will report higher levels of depressive symptoms.
social	Accommodations are important for well-being among people who develop a disability.	How do accommodations impact the well-being of people who develop a disability?	The importance of accommodations for happiness among individuals who develop a disability will differ by type, with social support being the most important, followed by the provision of an assistive device, and then improvements to the built environment.

- Ultimate objective of the scientific process: gather evidence to refine, replace, or expand existing theories with more accurate explanations
  - evidence from a single *hypothesis test*, study, is insufficient to change understanding

Wait, what is a hypothesis test?

- this involves an evaluation of empirical vs expected results
  - empirical results refer to output produced by a research study
  - expected results are what a research study's output was hypothesized to look like

- Thus, a hypothesis is…

- supported, failed to be rejected, if findings are consistent with expectations
  - some evidence to suggest that the selected theory should be refined or replaced

- rejected if findings do not match expectations
  - a lack of evidence to suggest that the selected theory should be refined or replaced

Wait, how do I know if results are in/consistent?

- assess the empirical results
  - which show how variables affected one another

- Wait, what do you mean by affect?

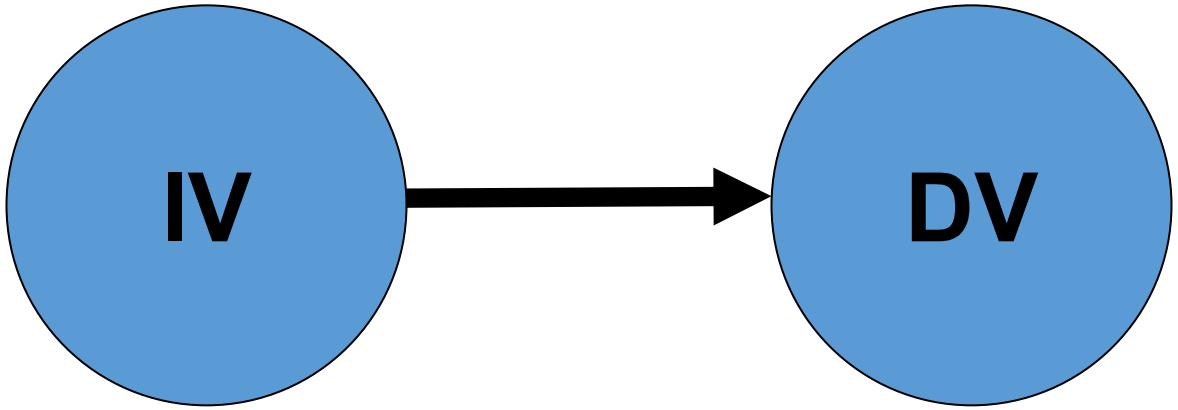
- a hypothesis is basically a refined theoretical proposition
  - proposed roles that variables play in explaining a phenomena

- a role is inherently agentic: ability to act as an agent of change
  - thus, understanding requires a cause-and-effect explanation

Were our hypotheses structured in any ways that reflect a cause-and-affect explanation?

What are the special titles for variables that respectively denote “cause” and “effect”

Independent and dependent variables



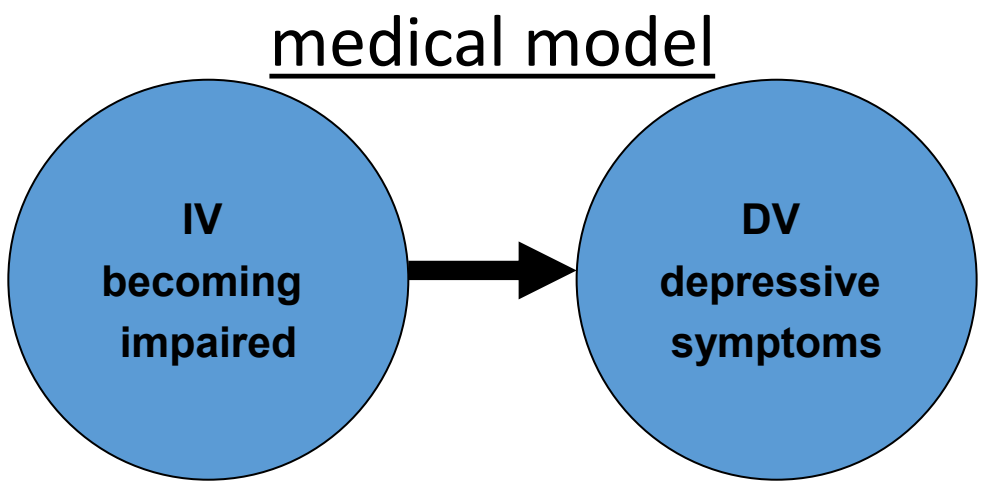
IV	DV
comes before DV	comes after IV
*not affected by DV	“depends” on IV
causes the DV	caused by the IV
arrow points away	arrow points toward

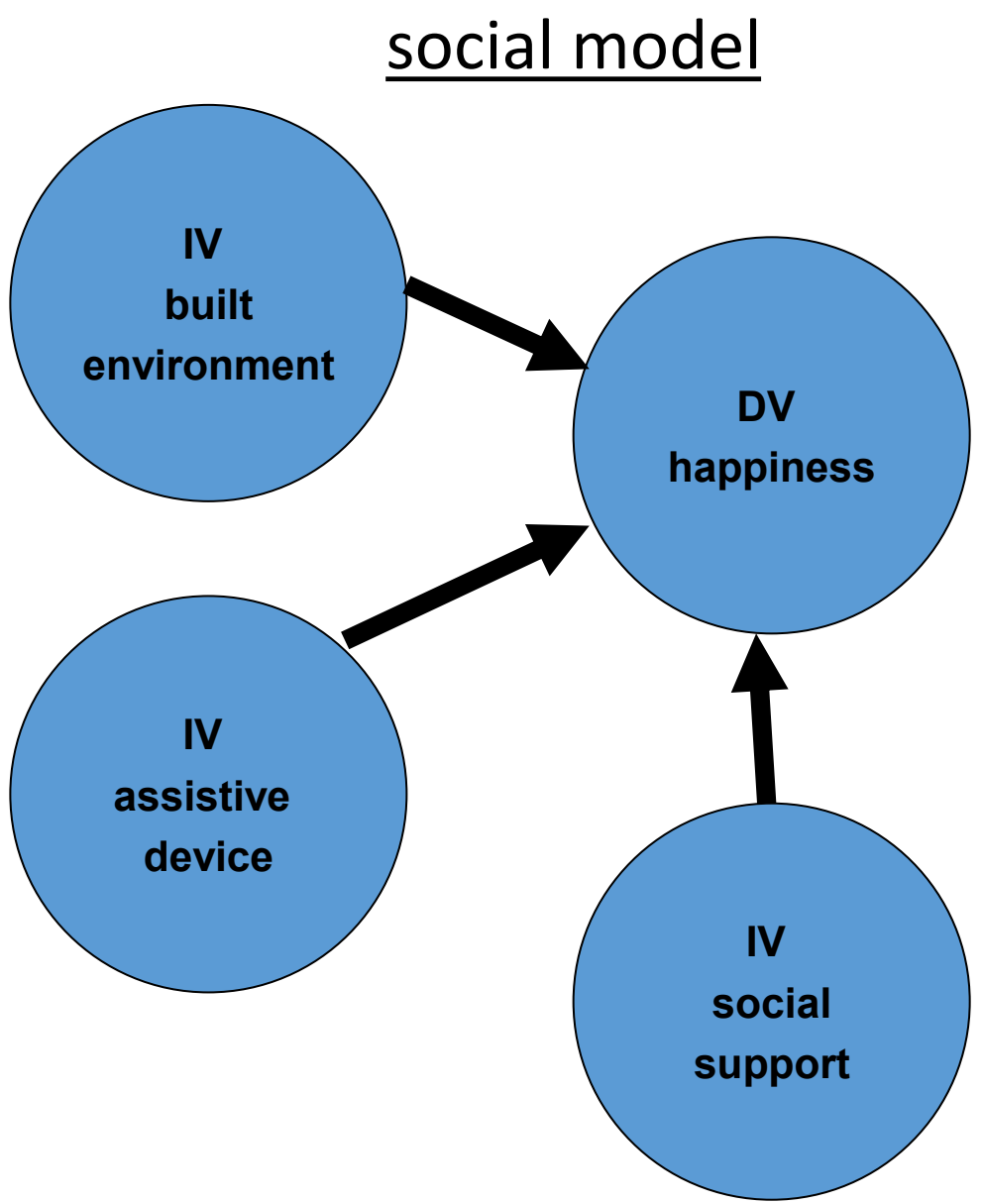
IVs and DVs: our examples

provides some logic to explain how variables affect one another in terms of

relationships between

cause (IV) and effect (DV)





Exercise 2: research question and hypothesis

- see Exercise_2.pdf on Canvas in Week 2 module
- we will build on this exercise in future classes
  - to address other learning objectives