Quantitative Sociological Analysis

Prefacing Statistics: Science and the Research Process

Part 1

January 21, 2025

Part 1

Learning objective: begin to understand why knowledge is not composed of facts, or truth, but rather different scientific versions of “reality”

Recognize how:

problems are framed, defined, by perspectives

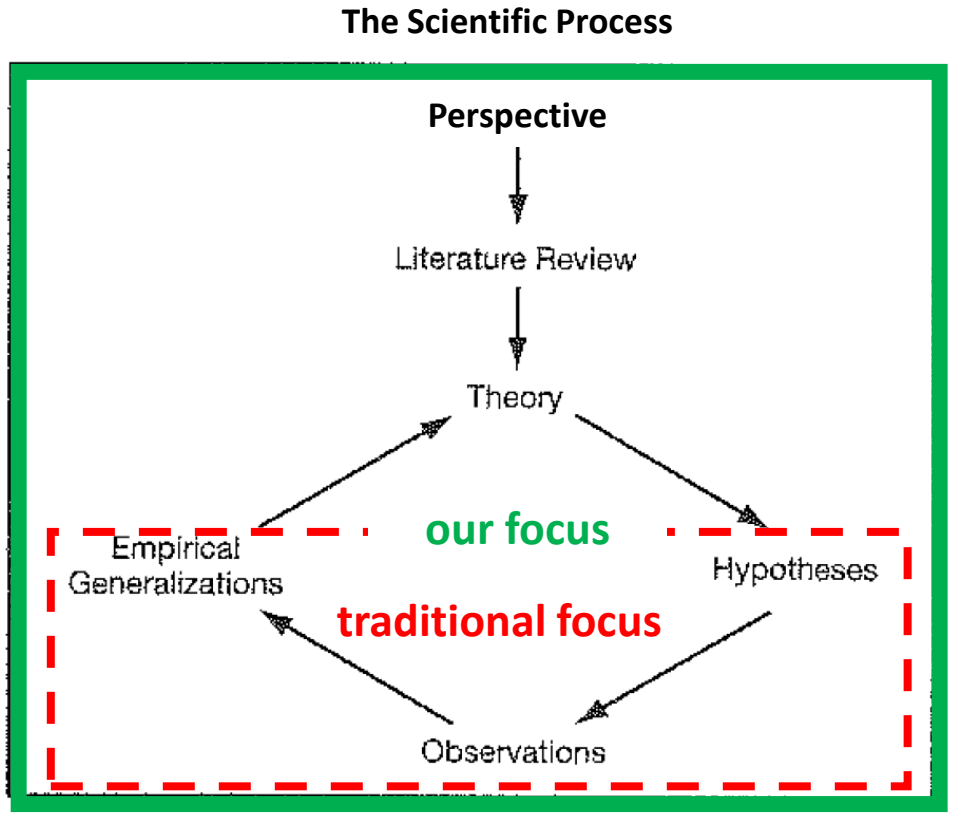
problems are specified and explained by theories

solutions are determined by perspectives and theories

Takeaway: decisions surrounding how science and practice are linked influence how society views problems, which shapes solutions and lived experiences

What does this have to do with stats?

- Perspective and theory form a foundation for how we will approach learning quantitative sociological analysis, statistical methods



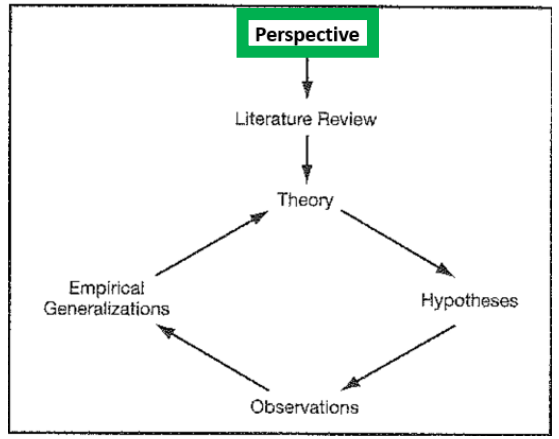
- often overlooked critical components in traditional statistical methods training
  - or, assumed to be already understood
- Why are perspective and theory so critical for understanding statistical methods?
  - consider the following examples…

How to approach following examples

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

Example: public health

- social epidemiological perspective used to frame a problem



News-Medical

Diabetes rates surge 18.6% in the U.S., highlighting racial and economic disparities

Researchers evaluate national trends and disparities in the prevalence of diabetes among adults in the United States.

Aug 25, 2024

In a recent study published in *Diabetes, Obesity, and Metabolism*, researchers evaluate national trends and disparities in the prevalence of diabetes among adults in the United States.

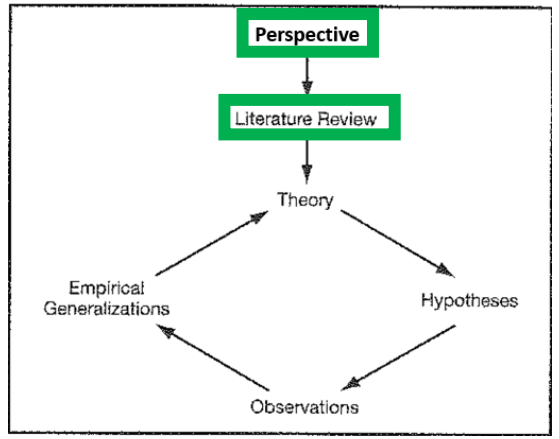
What appears to be the problem?

- Note: SocEpi's quantitative analyses used to inform public health policy and practice

Example: public health, continued

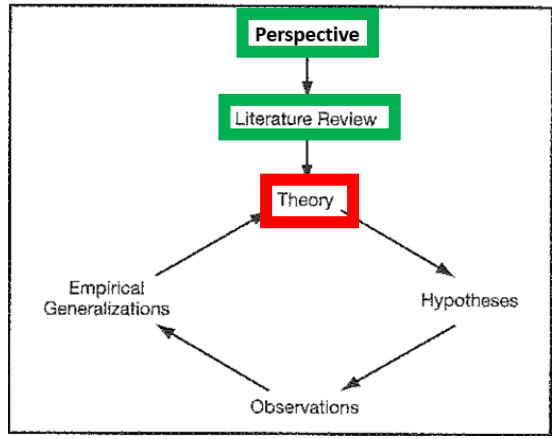
- public health literature suggests that…

Various factors, such as sedentary lifestyles, age, and obesity, associated with diabetes prevalence



Example: public health, continued

- What theory was used to inform this study?
  - no theory, just previously documented social patterns in diabetes prevalence

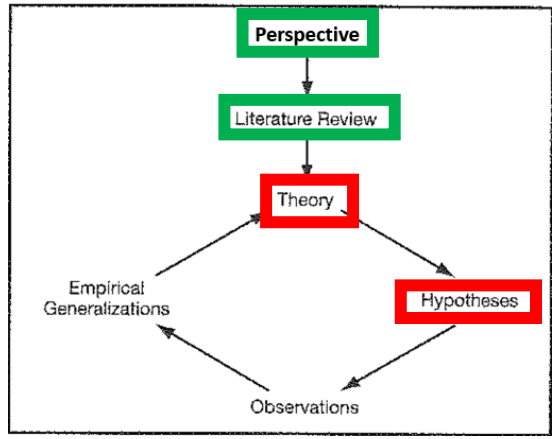


> Comprehending the trends, disparities, and risk factors associated with diabetes prevalence is crucial for developing effective prevention and management strategies.[2, 3] While previous studies have explored trends over past years, the association between risk factors and diabetes prevalence has not been comprehensively documented.

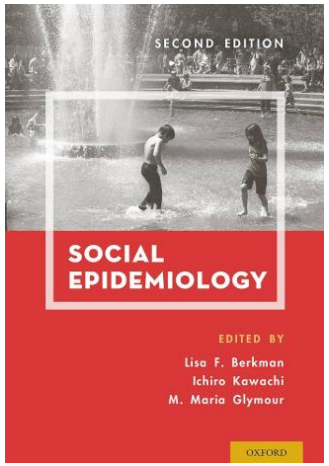
- public health's Social Determinants of Health (SDoH) framework simply suggests that there could be some utility in identifying social patterns of morbidity and mortality
  - this is not a scientific theory
    - more on that later—for now consider…

Example: public health, continued

- without theory, reasonable hypotheses cannot be derived
  - thus, SocEpi cannot yet fully follow scientific process



Without hypotheses that can be clearly supported or refuted, without having a clear understanding of the temporal sequencing or biological plausibility, and without articulated theories and specific concepts to guide empirical investigation, we will not be able to make progress.



not my words, but from public health and soc.epi. leaders

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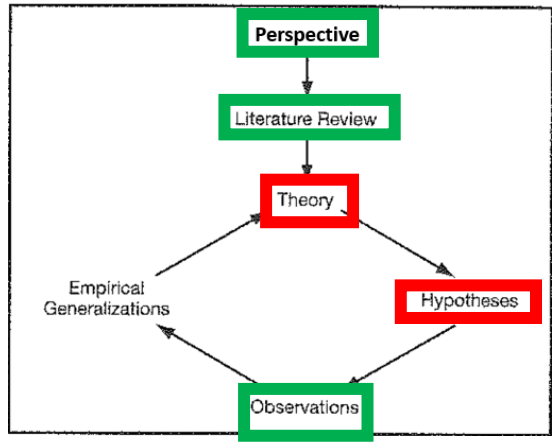
We will talk more about hypotheses in future classes.
So, if this seems unclear now, then don't worry.

Example: public health, continued

- observations based on relevance to medicine

  Data were obtained from the Behavioral Risk Factor Surveillance System (BRFSS), an ongoing health survey involving more than 400 000 adult interviews each year.[4] A sample of 5 312 827 observations from 2012 to 2022 were included in this observational study. This research followed the Strengthening the Reporting of Observational Studies in Epidemiology



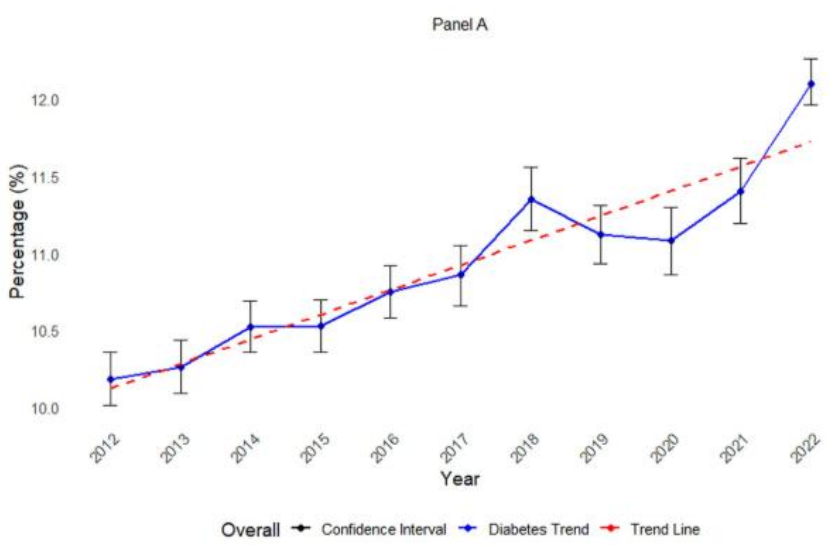
- public health/SocEpi works for medicine

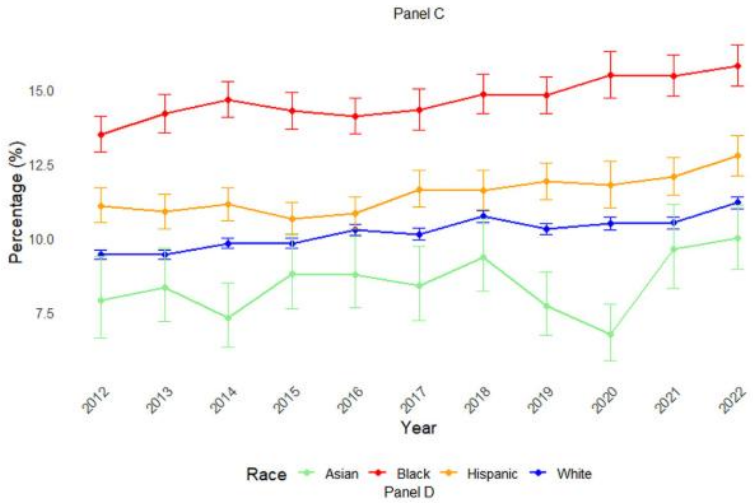
U.S. Surgeon Generals, 1990-present		
Years served	Name	Degree
1990–1993	Antonia Novello	M.D. (Doctor of Medicine)
1993–1995	Joycelyn Elders	M.D. (Doctor of Medicine)
1998–2002	David Satcher	M.D. (Doctor of Medicine)
2002–2006	Richard Carmona	M.D. (Doctor of Medicine)
2006–2007	Steven Galson	M.D. (Doctor of Medicine)
2009–2013	Regina Benjamin	M.D. (Doctor of Medicine)
2014–2017	Vivek Murthy	M.D. (Doctor of Medicine)
2017–2021	Jerome Adams	M.D. (Doctor of Medicine)
2021-2025	Vivek Murthy	M.D. (Doctor of Medicine)

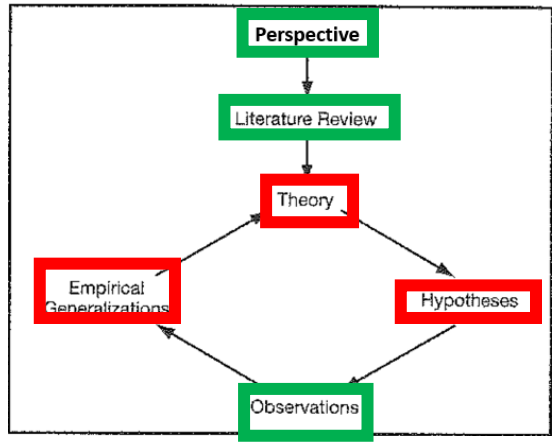
Why are motivating factors important to critique when you evaluate claims supported by a particular perspective?

Example: public health, continued

- problems framed by using statistical methods to organize observations in ways that match how a public health perspective claims they should be viewed







- without theory, solutions to problems cannot be generalized
  - Yet…

Example: public health, continued

- the present study claimed that

> *"Promoting healthy eating habits, increasing physical activity, and implementing community-based interventions to support weight management can play a significant role in reducing diabetes prevalence."*

What does this mean for members of racial/ethnic minority groups who, on average, have relatively much greater diabetes prevalence?

- In general, public health reinforces societal reliance on medical model

The NIH director on why Americans aren't getting healthier, despite medical advances

DECEMBER 7, 2021 · 5:05 AM ET

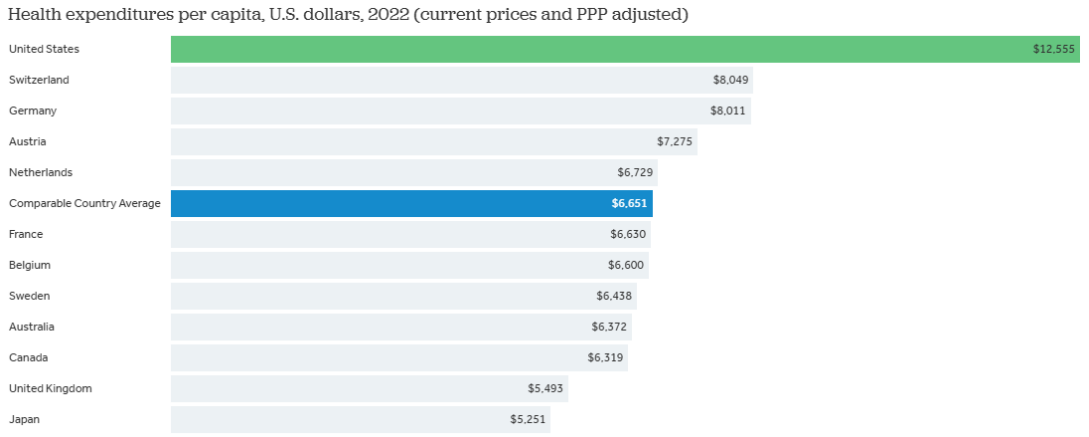
But we've lost ground in other areas, and a lot of them are a function of the fact that we don't have a very healthy lifestyle in our nation. Particularly with obesity and diabetes, those risk factors have been getting worse instead of better. We haven't, apparently, come up with strategies to turn that around.

Budget

Research for the People

The NIH invests most of its nearly $48 billion budget[1] in medical research for the American people.

Nearly 83 percent[2] of NIH's funding is awarded for extramural research, largely through almost 50,000 competitive grants to more than 300,000 researchers at more than 2,500 universities, medical schools, and other research institutions in every state.



Lies, damned lies, and statistics

- anchoring our learning of statistical methods in the scientific process will help us enhance our critical thinking skills
  - as stated in the UK Core, but maybe still a little unclear for now…

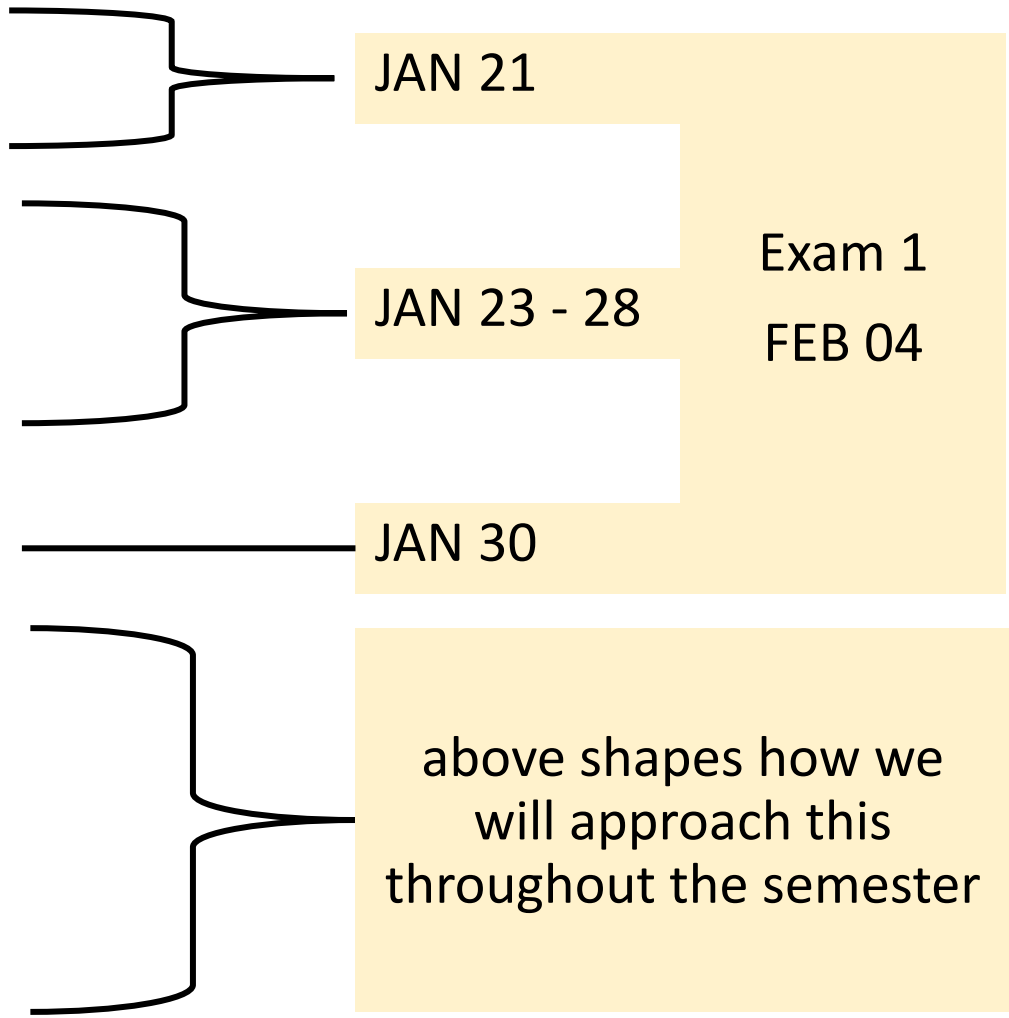
Learning Objective

- Evaluate claims that arise from statistical procedures through the act of informal human inference
  - assess challenges that confront numerical and graphical summaries used to support claims
  - discuss the importance of, and recognize fallacies that undermine, conditional reasoning
  - establish whether enough information is available to make claims about “truths,” and determine the importance of considering whether the information was based on correlation or causal inference

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



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

- typically distinguished in terms of two branches
  - further differentiated by discipline: unit of distinction established to help formalize archival of existing, and acquisition of new, *knowledge*
    - as well as help organize academia (i.e., university)

- natural sciences
  - e.g., biology, chemistry, physics
- social sciences
  - e.g., economics, psychology, sociology

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

- the accumulation of *theories* recognized to provide an understanding of natural or social phenomena, as determined by empirical evidence
  - information obtained via the *scientific process*

- Theory: set of interrelated *propositions* that explain a particular phenomena

- Propositions: statements describing the roles specific elements play in explaining a particular phenomenon

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

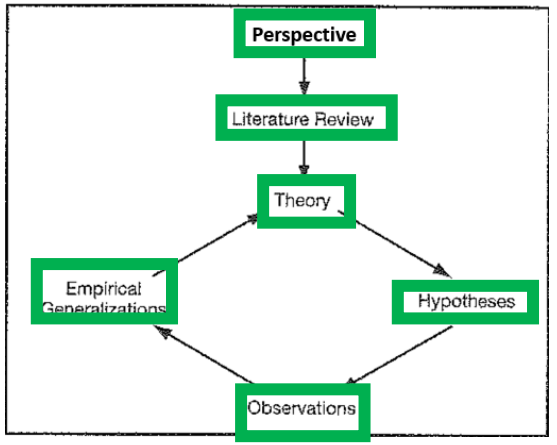
- ideally initiated by summarizing what is un/known about a particular phenomena
  - and assessing whether an explanation, theory, may be incorrect, falsifiable

- in turn, the scientific process begins with a <u>perspective,</u>
  - overarching lens thought to offer an accurate view into a defined portion of the empirical world
    - key unit by which knowledge is systemically organized and produced

- sets of well-established interrelated assumptions that have become expansive enough to shape a widely-shared version of reality
  - similar to the “laws” of physics, but more open to revision and even possible extinction
    - consider, in sociology, conflict theory or functionalism

- act as guidelines outlining how elements of a phenomena can or cannot operate
  - general rules that govern ways in which *theoretical propositions* can be constructed
    - consider the following example…

Example: medical sociology



- Fundamental Determinants of Health (FDoH) theory claims that certain social conditions are the root cause of population health

FDoH's Testable Theoretical Propositions

If social conditions are the root cause of population health, then they must…

- involve access to resources used to avoid ill-health and/or minimize its consequences
- influence many different health conditions not just one or a few
- affect health conditions through multiple pathways of risk
- and social disparities in health reproduced over time until the social condition itself is resolved

In sum: if we continue to primarily rely on solutions focused on certain diseases and behaviors then population health will remain unimproved or worsen

How does this differ from public health's SDoH framework, or why is SDoH not a theory?

In what ways are science and practice being linked, or not, regarding America's health?

How might decisions to link science and practice in this way shape lived experiences?

Exercise 1: perspective and theory

- see Exercise_1.pdf on Canvas in Week 2 module
- we will build on this exercise in future classes
  - to address other learning objectives