

# Discussion 2

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Measurement & Magnitude

# Updated Office Hours Schedule

Professor Tello-Trillo: **Wednesday 1:30 - 3PM in Garrett Hall 101**

Elisabeth Doty: **Friday 8 - 10AM in in Pav X Basement Room 1**

Nicholas Fiore: **Mondays, 1:30-3:30PM in Pav X Basement room 2**

# Measurement

- Measurement Scales:
  - Nominal: the measurement is categorical and order is irrelevant (e.g. hair color)
  - Ordinal: categories are ordered, but the intervals between them are unequal or unknown (e.g. places in a race)
  - Interval: intervals are equal, but there's no meaningful zero (e.g. calendar years)
  - Ratio: intervals are equal and have a meaningful zero (e.g. income)
- Good measurements should be:
  - **Reliable:** gives similar values under the same conditions (i.e. consistent)
  - **Valid:** actually measures what you're trying to measure
  - **Accurate:** minimal measurement error

# Magnitude

- In research, it's important to know the magnitude (size) of an effect...
  - But it's not always easy to establish if an effect is big or small.
  - Economic significance: is a given effect big enough to matter?
- We establish economic significance with reference points.
  - You can compare change to a measure of central tendency
    - Ex: change in traffic accidents compared to the mean number of traffic accidents
  - You can compare with natural change in a variable
    - Ex: the price of a cup of coffee usually varies by about 50 cents, but this month it increased by \$5
  - You can compare with the effects of other policies
    - Ex: a change in training requirements reduced violent encounters with police by 5%, but a mandatory body-worn camera policy reduced the same measurement by 12%

# Practice Question 1: Measurement

A state introduces a policy that waives community-college tuition for eligible students and wants to measure whether enrollment increases.

The state measures “enrollment” using the number of students who activate their online student portal account (because activation is automatically logged and recorded consistently). But many eligible students register for classes through in-person advising and don’t activate the portal for weeks (or never activate it at all).

How reliable, accurate, and valid is this measurement?

# Answer

This is arguably a somewhat valid measurement, assuming that only enrolled students can activate a portal.

It's also a reliable measurement; since the portal activation is automatically logged, you would get the same result if you took the measurement multiple times.

The measurement isn't very accurate – many students wait to activate their portal (or don't activate it at all), so the measurement does not capture that students. If this is a significant number students, your measurement could be very inaccurate.

## Practice Question 2: Measurement

A state implements an automatic-enrollment policy for a new retirement savings program aiming to increase residents' retirement saving. Eligible workers are enrolled by default through payroll deductions unless they opt out.

The state wants to evaluate the success of the program. What measures could they use?

# Answer

Recall, a good measurement is valid, reliable (precise and consistent) and accurate. For this question, we also want a measurement that can establish a reference point.

Examples of good measurements include inflation-adjusted average savings contributions. This is **valid** because it measures what we are trying to measure (savings). It is **reliable** because inflation-adjusted average savings in 2000 and 2010 are comparable to each other. We assume it is **accurate** if the data comes from a reputable source. And we can operationalize it with a **reference point** if we make a “Year 0” and track changes over time.

## Practice Question 3: Magnitude

Statsville, Virginia introduced a new crisis intervention training (CIT) program for police officers in 2024. Before the intervention, Statsville had an average of 520 use of force incidents per 100,000 residents per year. A study reports that a year later, in 2025, there were 1,180 fewer arrests. Statsville has 1.2 million residents. Normally, use of force rates fluctuate by about 20 incidents per 100,000 residents per year.

- Is the change resulting from this policy economically significant? Why or why not?

# Answer

In this scenario, the change in use of force rates resulting from the CIT program is economically significant.

- Converted to use-of-force rates per 100,000 residents, the policy resulted in a decrease of 98.3 incidents per 100,000 residents
- This is pretty sizeable compared to the original use of force rate and is also nearly four times the normal year-to-year fluctuation

## Practice Question 4: Magnitude

A state rolls out an online renewal system intended to reduce wait times at DMV offices. A study reports that the policy reduced average in-person DMV wait times by 4 minutes per visit, and the estimate is statistically significant. Previously, the average wait time was 38 minutes, with a standard deviation of 10 minutes.

- What is the change in wait times expressed as a percentage?
- Is the change economically significant? Why or why not?

# Answer

This one is a little more ambiguous. While the policy didn't produce a *huge* change, it still represents a noticeable shift in wait times.

- Expressed as a percentage, the 4 minute decrease in wait times represents a ~10.5% change.
- This change is less than half of a standard deviation, which is generally considered a moderate, noticeable shift.