IIS as Population Representative: How Are We Doing on This Goal?

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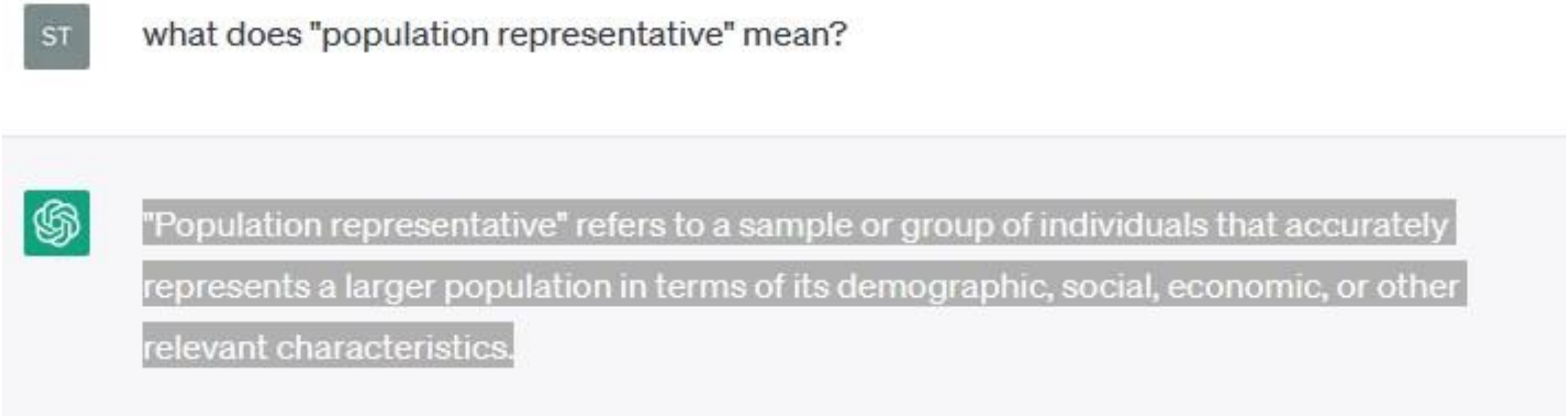
IIS as Population Representative

- IIS were implemented to meet the dual goals of provider support and immunization surveillance.
- A surveillance goal for IIS is to be population representative.
- Population representation is a carry-over concept from survey research
- For IIS, population representation and whole population capture can overlap

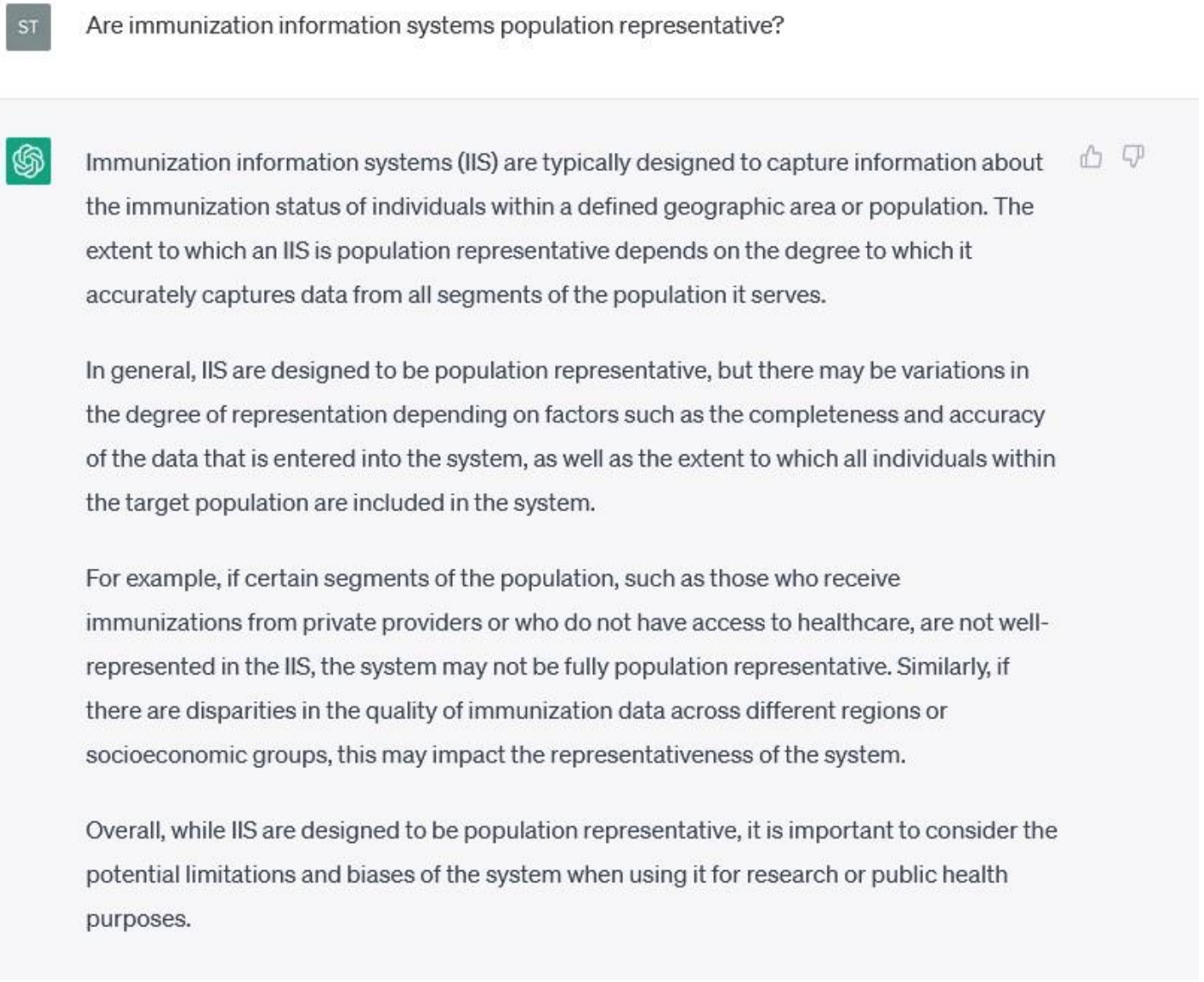
Population Representation

To start, I asked a new chat AI that's been in the news lately about this.



Are IIS Population Representative?

- I asked the AI this question 10 times.
- 2 clear “No’s”- IIS are for clinical support
- 1 clear “Yes” – IIS are designed to be population representative
- 2 fuzzy “Yes’s” – IIS are mostly pop representative w/caveats
- 3 “Maybe’s”- can be, but usually are not



Where IIS Are Now

- Over time the population size in IIS has dramatically increased.
- Population capture as the percentage of Census population is over 100% for many IIS and age groups.
- For example, by the 2020 IISSARS data, the average IIS has 124% of Census adolescent populations.

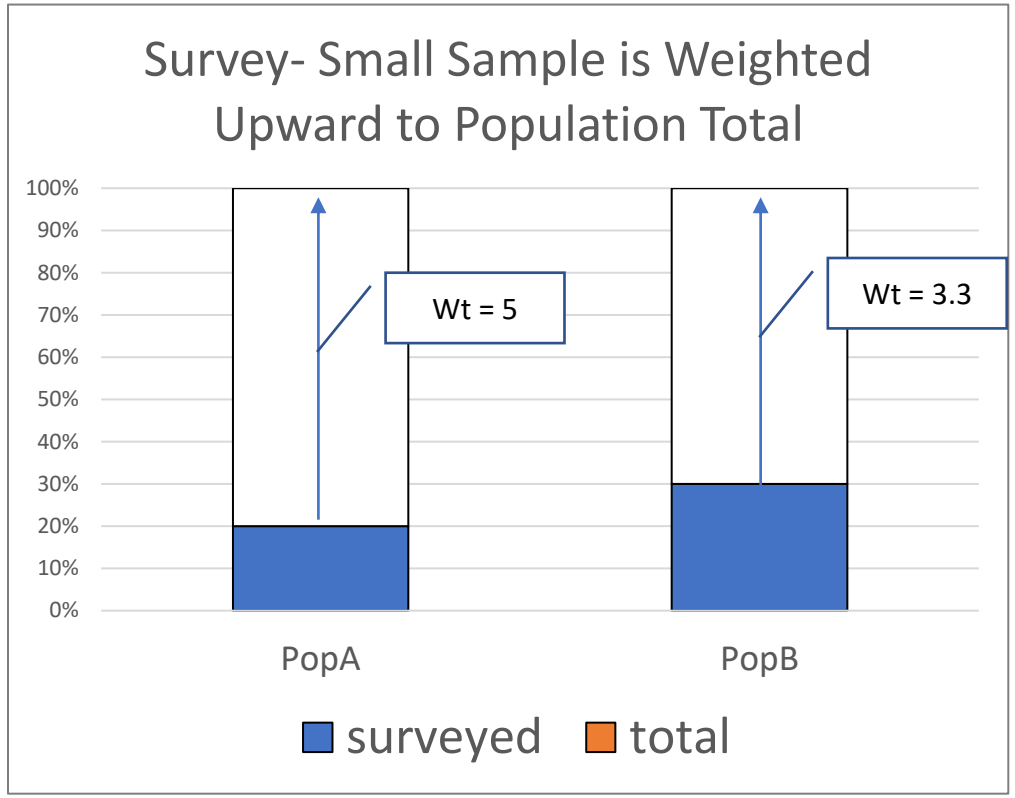
The ‘So What’ Slide

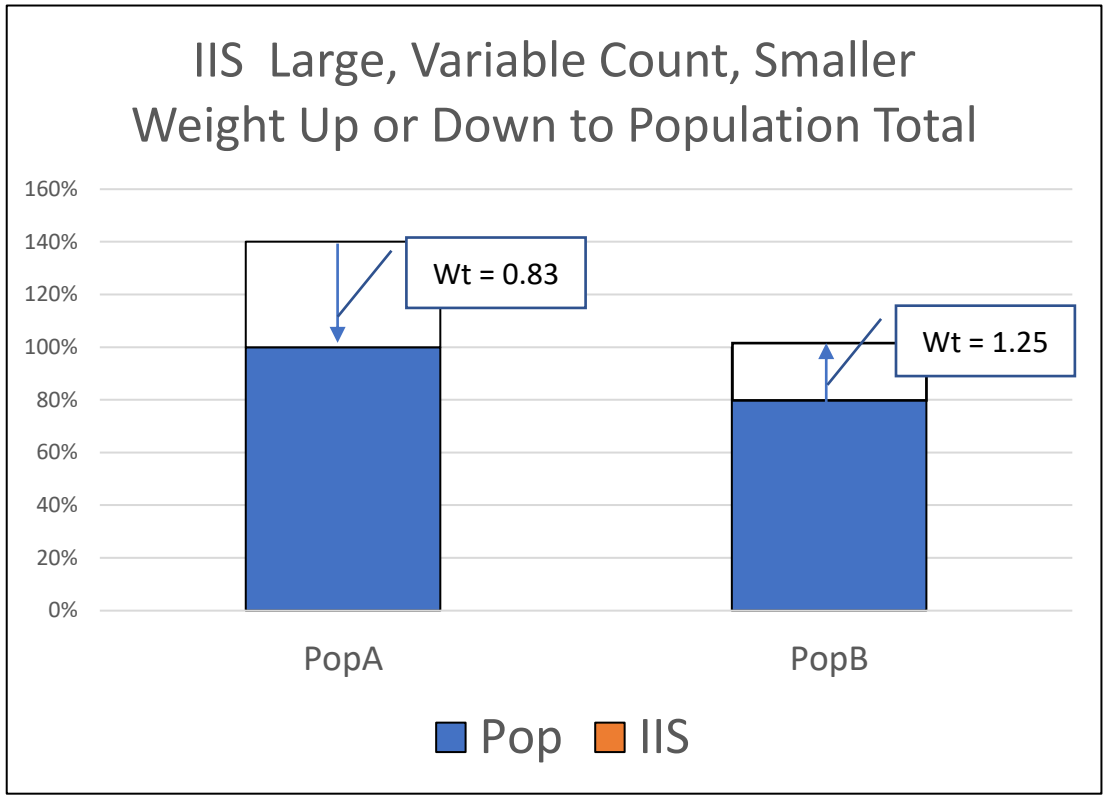
- So why should we care about being population representative?
- Outbreak risk can cluster in populations not well captured into IIS.
- IIS-based rates then may not be predictive of outbreak risks.
- Large measles outbreaks have historically occurred in uncaptured subpopulations:
  - U.S., 1989 (17,850 cases)
  - Brazil, 1997(42,000+ in Sao Paulo)

Changing The Paradigm for IIS

- IIS need to change the population representation paradigm developed for surveys.
- Surveys: small samples weighted/projected upwards to whole population.
- IIS: large data that needs to be both weighted up and down to match to population.

Survey vs IIS Comparison



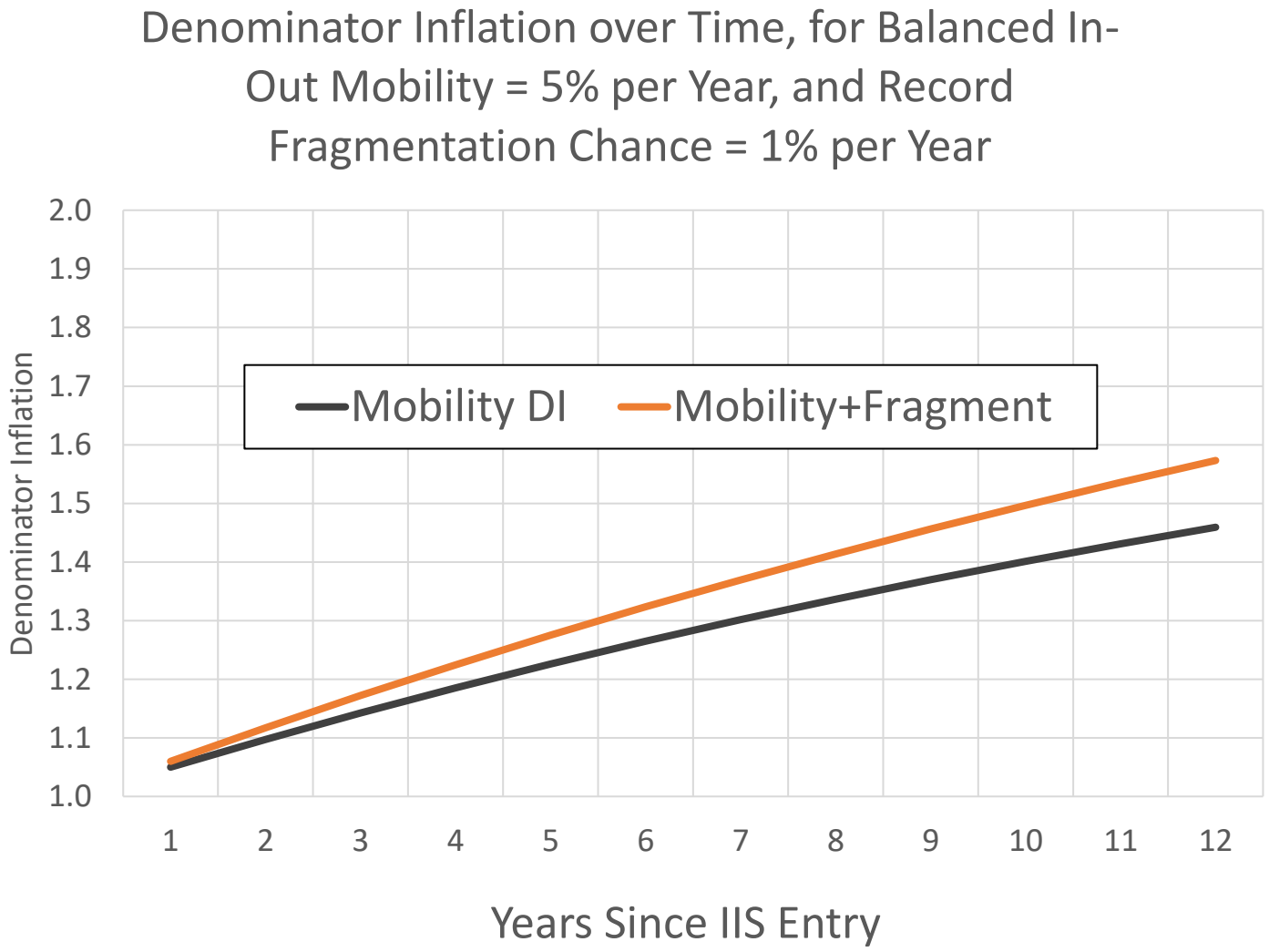


Starting Principles

- A claim that an IIS has all of the shots & population for their jurisdiction is an extraordinary claim
- Extraordinary claims require strong evidence to support.
- Size of IIS data alone is not strong evidence for representation or complete data.
- One time size of population capture is better evidence.
- Factors to consider in weighting:
  - Denominator Inflation (DI) &
  - Mobility (In, Out, and Local)
  - Lack of reporting vs lack of immunization

IIS DI Dynamics

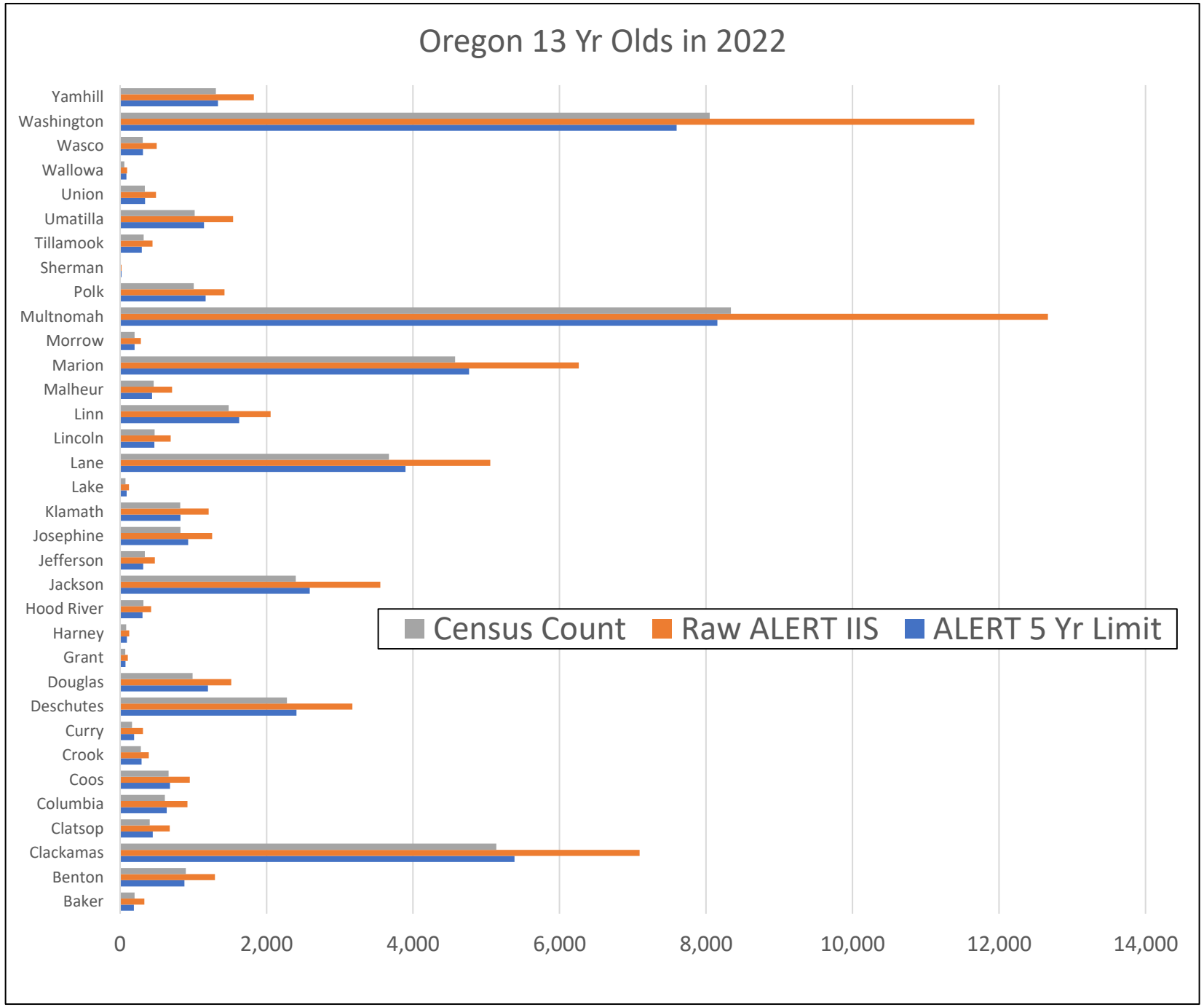
- Every IIS is affected by DI.
- Even small population dynamics add up over time.
- As an example for a stable population, IIS pops after 10 years are 150% of Census



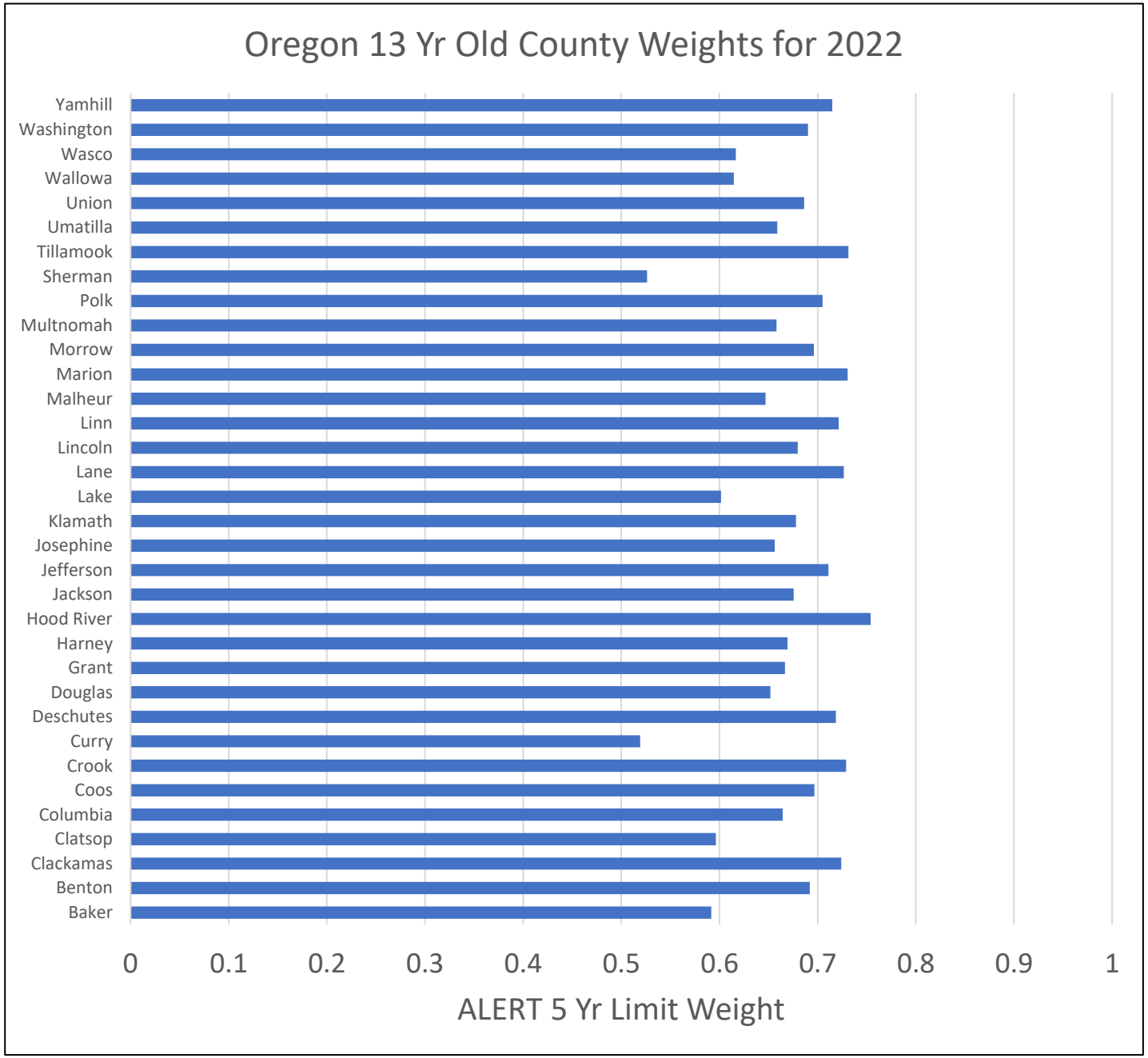
Example 1: Teen IIS Populations

- A popular IIS trend is to limit denominators to those with shots in the last 5 years.
- This adjusts over-Census denominators down to reasonable sizes for most IIS.
- On a county level, is this population-representative?

- Census counts are not perfect, but are still useful to compare to IIS data.
- 13 Yr-old counts by county in the ALERT IIS varied from 96% to 176% of Census counts.
- Applying a 5-year limit to ALERT population counts led to a close match to Census.



This table shows the county-level aggregate weights from the 5 year-limit on ALERT data



Caveats

- In Oregon, ~2% of kids never get shots.
- A larger group of kids, (~5%) start but drop out of shot seeking before age 9.
- So the five year limit may ignore ~7% of the population.
- A worry is if this ignored population is clustered by county.
- For accuracy, need to add a small weighting of all those under the 5 year cutoff back to county totals.
    - Such a second-stage weight could be validated for teens against school exemption rates for Tdap, or by other non-shot evidence of population presence.

Outside Population Validation Sources

- In the 13 year old example, a Census county population was used as an outside source of population data to validate an IIS weighting.
- Can also use outside rate sources in the same way.
- A caveat is that this can introduce sets of biases from the outside data.
- In an ideal world, would only use IIS data, but have weighting rules that are periodically validated against external sources.

Example 2: Adult Influenza

- In Oregon, not all flu shots are reported to the ALERT IIS.
- Example- Oregon adult age 18-64 flu rate of 30% in 2020, using a Census denominator.
- CDC estimate of 42% for 2020 in this age range.
- Implies that ALERT is getting 73% capture of flu shots?
  - Can use this 73% capture to leverage further sub-population rates.

Flu Example (cont)

- Extending the example with a 73% shot capture rate
- simple probability model is that, over 5 years, ALERT captures 83% of adult 18-64 populations that ever seeks flu shots: n = 1 -(1 - .3)^5
- CDC prob model- over 5 years, 91% of population will get at least 1 flu shot in five years: n = 1-(1-.42)^5
- This implies that among the adult 18-64 population that ALERT doesn't capture, estimated 14% rate of flu shots per year- 1/3rd of the 42% overall rate.

Refinement

- Examples so far are ad hoc methods of producing IIS weighting based on comparing aggregates (counts or rates)
- A refinement is to link individual level records across IIS to external data sources- either for rate estimate sources (small survey), or to large, comprehensive population data.
- Examples-
  - Linking NIS survey (child or panel adult) to IIS; the unlinked/unmatched records in each can drive capture statistics for subpops.
  - Linking IIS addresses to the National Address Database (or other state property registry)- generate local area rates of IIS address capture.
  - Use of DMV data (by name or address) to link to IIS adults.

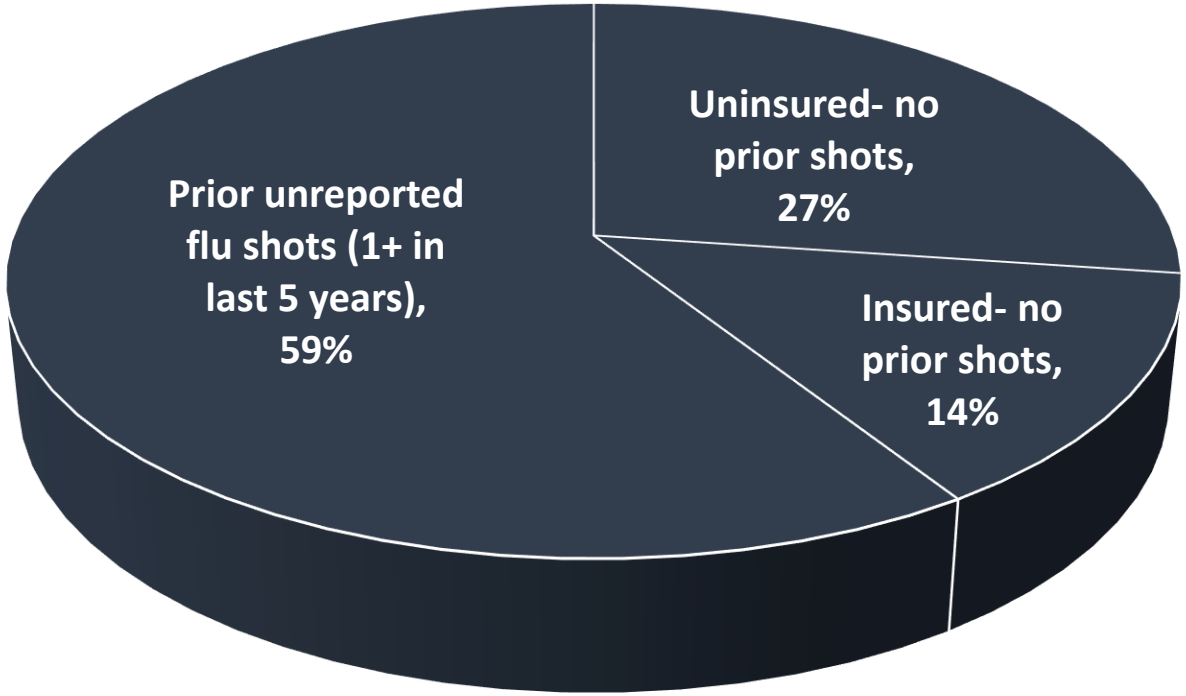
So What About COVID?

- COVID immunizations drove a surge of new clients into IIS.
- Mandatory reporting as a condition of provider vaccine-access and close lot/dose tracking was a factor.
- Heightened sense of risk around COVID was another factor that may have driven shot seeking among those who previously avoided shots.
- So which was the bigger factor? Or were they equal?

COVID IIS Effects

- In Oregon, virtually all adults with prior flu shots got COVID shots in 2021(95%+).
- Also in Oregon, ~3 times as many extra new adult clients age 18-64 in 2021 above previously levels.
- Estimate here combines insurance, flu capture dynamics, and COVID immunization demographics.
- Majority of surge (59%) among adults was from the increase in data capture that went with COVID immunization.

COVID Surge in New ALERT Adult 18-64 Clients- Estimated Prior Shot-Seeking



Summary

- The recommended process here is to develop IIS rules for weighting IIS population and capture data
- Such weights can be either greater than or less than one, depending on data capture and DI effects.
- Any inclusion approach can be taken as a form of ‘weighting’.
- Weighted results should be evaluated periodically against external population or rate data to assess if weighting rule is ‘reasonable’.