Comparing States’ Immunization Coverages of Preschool Children

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Background and Summary

• States are often ranked by point estimates of their immunization coverage
• This does not account for sampling uncertainty in state ranks
• The sampling uncertainty in state ranks is large, and should not be ignored
The National Immunization Survey (NIS)

• The NIS provides estimates of immunization coverage in 19-35 month old children at a national and state level
• Estimates are not true coverage
  – National level estimates typically have standard errors of < 0.5%
  – State level estimates typically have much larger standard errors, ~2-3%
Ranking of States

- States are often ranked by NIS point estimate of coverage
- Media and state officials often take ranks very seriously
- Reports of ranks do not account for sampling uncertainty
Ranking of States, continued

- We calculated 90% confidence limits for states ranks of 4:3:1:3 (4+ doses of diphtheria and tetanus toxoids and pertussis vaccine, 3+ doses of polio vaccine, 1+ doses of measles containing vaccine, 3+ doses of haemophilus influenzae type b vaccine) coverage for 2001.
Methods

- We use the parametric bootstrap methods to construct confidence limits for ranks.
- We consider the District of Columbia as a state, so there are 51 states in our analysis.
90% Confidence Limits for States’ Ranks

- A hand-out gives the confidence limits for all states
- A few examples:
  - North Carolina; rank 2; 90% confidence limits for rank: 1-17
  - Virginia; rank 26; 90% confidence limits for rank: 9-44
  - Illinois; rank 33; 90% confidence limits for rank: 23-46
  - Hawaii; rank 48; 90% confidence limits for rank: 25-51
If We Can’t Rank, Can We Identify Quartiles?

• We can (perhaps) do a better job of identifying states by quartiles than we can of ranking states
• But …
... We Can’t Reliably Identify Quartiles

- Example one: 90% confidence limits for rank of Virginia: 9-44
  - Virginia could be in the first, second, third, or fourth quartile
- Example two: Connecticut, ranked 3, has 90% confidence limits of 1-19
  - Connecticut could be in the first or second quartile
Uncertainty is Not Uniform

• States with ranks near the top or bottom are less uncertain than states ‘in the middle’ (next slide)
• Width of confidence limits is ‘upper confidence limit minus lower confidence limit’
Width of Confidence Limits vs. Ranks

Y = 9.90026 + 1.32896X - 2.36E-02X^2
R-Sq = 63.2 %
How Might We Rank States?

• Practically speaking, we can’t – many states’ immunization coverages are so close that current methods of measuring coverage can’t distinguish them
  – Example: the point estimate of North Dakota and Wisconsin’s coverages differed by less than one tenth of one percent, with standard errors of about 2 percent
How Might We Rank States?, continued

- Fully functioning immunization registries *might* someday let us rank states
  - Might someday come close to a ‘census of immunizations’
  - That is years away
Conclusion

• We have very limited ability to rank the states with the highest and lowest immunization coverages
• We have much less ability to rank states ‘in the middle’
  – If a state’s rank is, say, 15 in one year and 35 in the next, it means absolutely nothing (although it will probably not be so perceived)
Conclusion, continued

• We need to educate the media and government officials concerning how little ranks mean