Adverse Birth Outcomes in the TriCounty Health Department Region

Environmental Epidemiology Program

Bureau of Epidemiology

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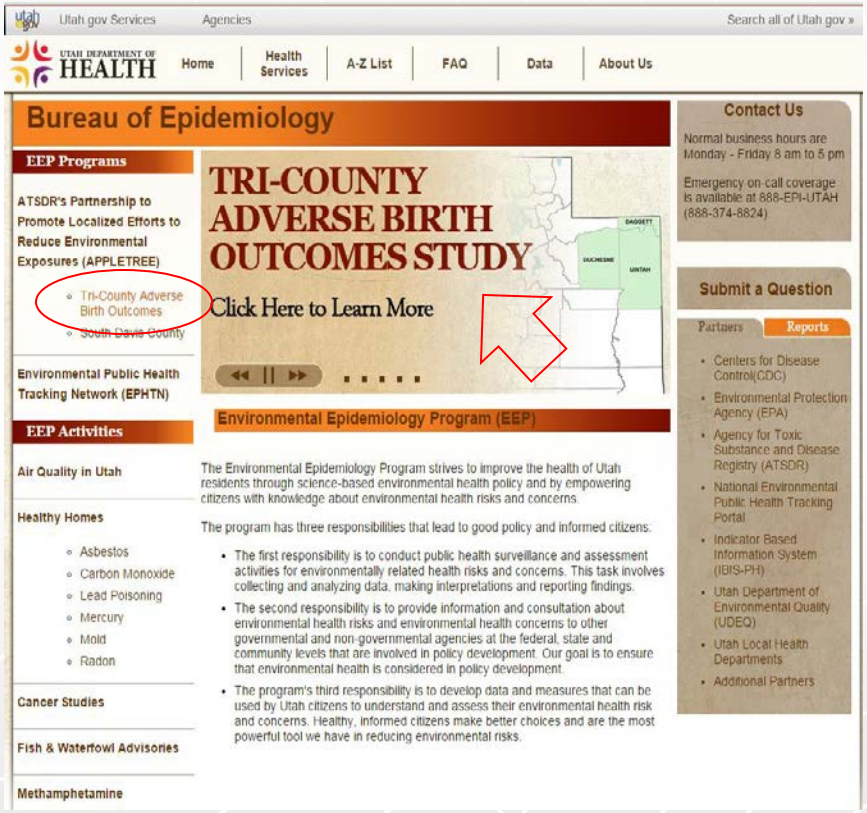
Where is the report?

http://health.utah.gov/enviroepi/appletree/TriCountyABO



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Documents

- Tri-County Adverse Birth Outcomes Study
- Presentation on the Study Design (March 2014)
- Presentation on the Findings (March 2015)

Adverse Birth Outcome Information

- Low-Birth-Weight
- Small-for-Gestational-Age
- Premature Birth
- Stillbirth (Fetal Death)
- Infant Death

Additional Links

- TriCounty Health Department
- Utah Department of Health
  - Environmental Epidemiolgy Program
  - Maternal and Infant Health Program
  - Baby Your Baby
  - Pregnancy Risk Line
- Utah Department of Environmental Quality

Contact Us

- Environmental Epidemiology Program

Environmental Epidemiology

Tri-County Adverse Birth Outcomes Statistical Review

Daggett, Duschesne, and Uintah Counties

Public Meetings

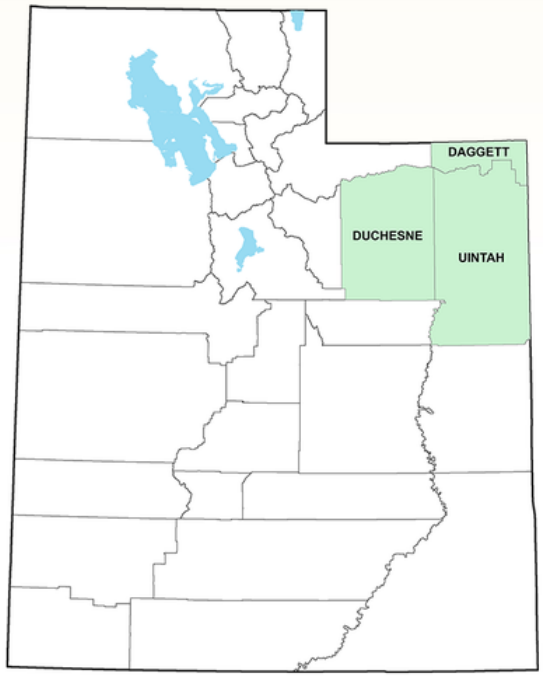
Documents

Background

Findings

Recommendations

Frequently Asked Questions



Utah counties, with the study area in green.

A Little History

- June 12, 2013: EEP becomes aware of a concern that there are more stillbirths and infant deaths occurring in Vernal Utah.
- March 20, 2014: TCHD contacts EEP with approval to conduct an investigation
- May 7, 2014: EEP presents study plan to TCHD
- May 14, 2014: TCHD requests EEP delay investigation until 2013 data is available.
- October 14-15 2014: EEP received 2013 data
- December 2014: Final analysis
- March 17, 2015: Final Report

October
November
December
January
March
Data Acquisition
Data Quality Checks
& Standardization
• Recode data
• Merge annual tables
• Georeference
Characterize Data &
Generate Definitions
• Risk strata
• Adverse birth outcomes
• Study and control areas
• Temporal aggregate units
Reporting Writing
• Context
• Methods
• Interpretation
• Action plan
REPORT
• Review
• Certification
• Publication
Reference
Data
Risk Characterization
Risk Quantification
• Rates
• Risk Ratios
• Temporal Trends
Literature
Review

Some Terms

- RISK:
  - Disease Risk: the probability of acquiring a disease (usually defined as a rate or risk ratio)
  - Environmental Risk: a function of (1) exposure and (2) hazard (usually defined as a hazards quotient)
  - Toxicological Risk: a function of (1) a dose and (2) an effect on the body (usually defined in terms of a reference dose or dose-response correlation)

- INCIDENCE: the number of new cases occurring in a time period (a year)

  Just a fancy word for "count"

- INCIDENCE RATE (or RATE): the number of new cases per time period occurring per a unit (i.e., 1,000) of the population

One Last Term

- RISK RATIO (or INCIDENCE RATIO): A ratio created by comparing the study area incidence to a comparison area incidence.

$$RR = \frac{Observed}{Expected}$$

  - The comparison population incidence (the "expected") has been re-proportioned to the same scale as the study population.
  - The "expected" risk is assumed to be the normal random occurrence of disease.

  - Interpretation
    - RR = 1: The risk in the study population and the comparison population are the same
    - RR > 1: The study population has more risk than expected
    - RR < 1: The study population has less risk than expected

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Example

$$RR = \frac{TriCounty\ Rate = 5.9}{Utah\ Rate = 4.8} = 1.29$$

- Question: When is a result indistinguishable from 1.0?

  1.002? 1.02? 1.2? 2?

- Solution: Apply a "95% confidence interval" on the "point estimate"

- Interpretation:
  - If the 95% CI does not include 1.0 (between the lower and upper values of the interval) then SIGNIFICANT
  - 1.01 – 2.10 would mean significantly elevated
  - If the 95% CI includes 1.0 (between the lower and upper values of the interval) then NOT significant
  - 0.65 – 2.10 would mean NOT significant

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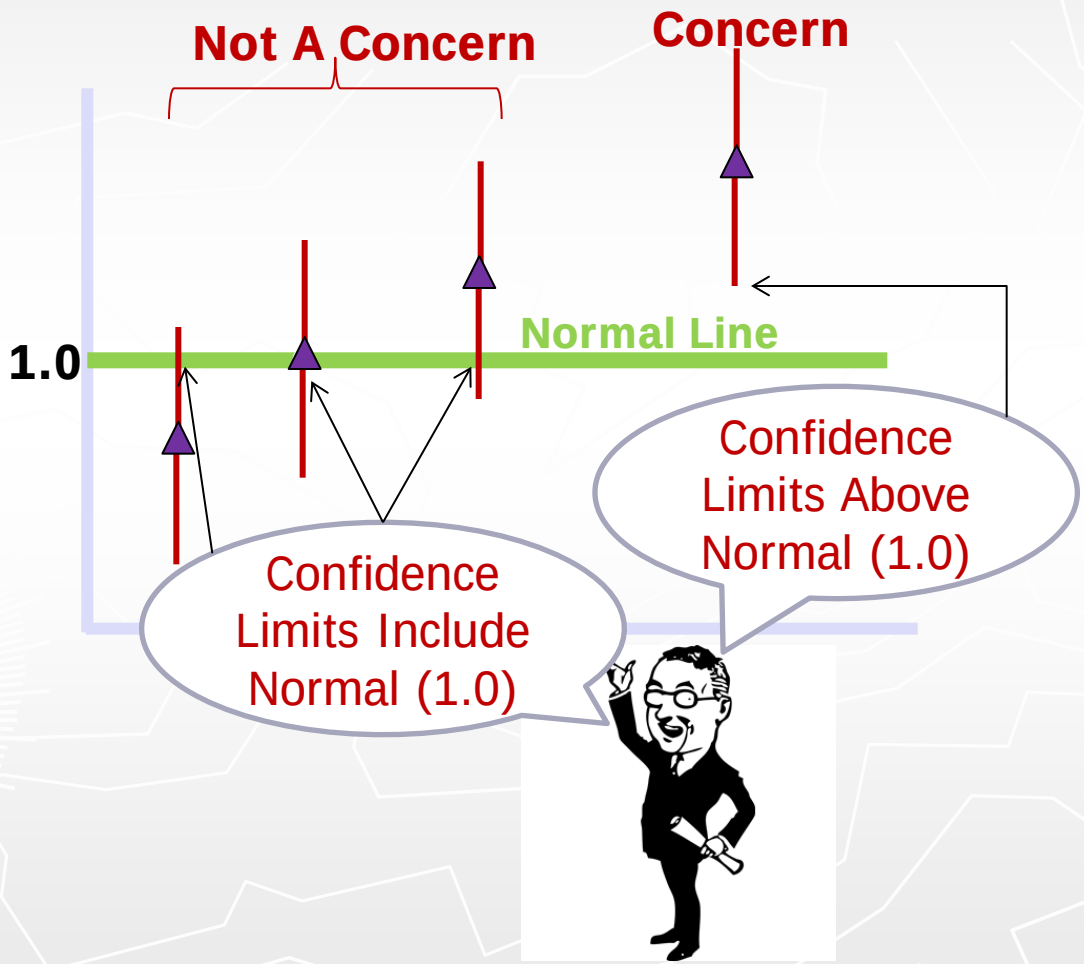
Interpretation



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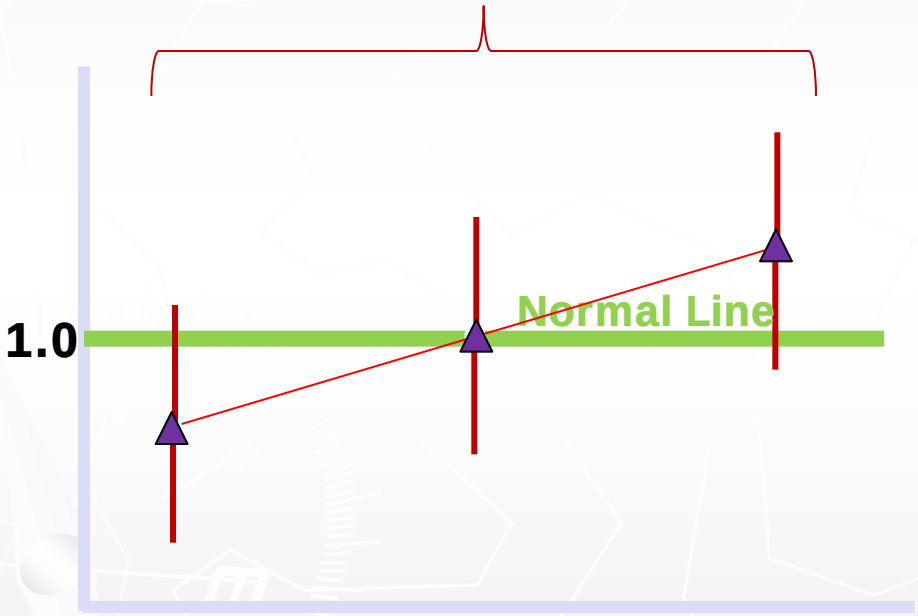
Also look at the trend through time



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Study Design Decision

- Aggregate geography-time to get approximately 2,000 births per analytical unit
  - TriCounty considered as one geographical unit allowed 2-3 year temporal ranges
  - Duchesne and Uintah counties could be evaluated individually if larger temporal ranges employed
  - Individual cities were too small to consider alone
- Why?

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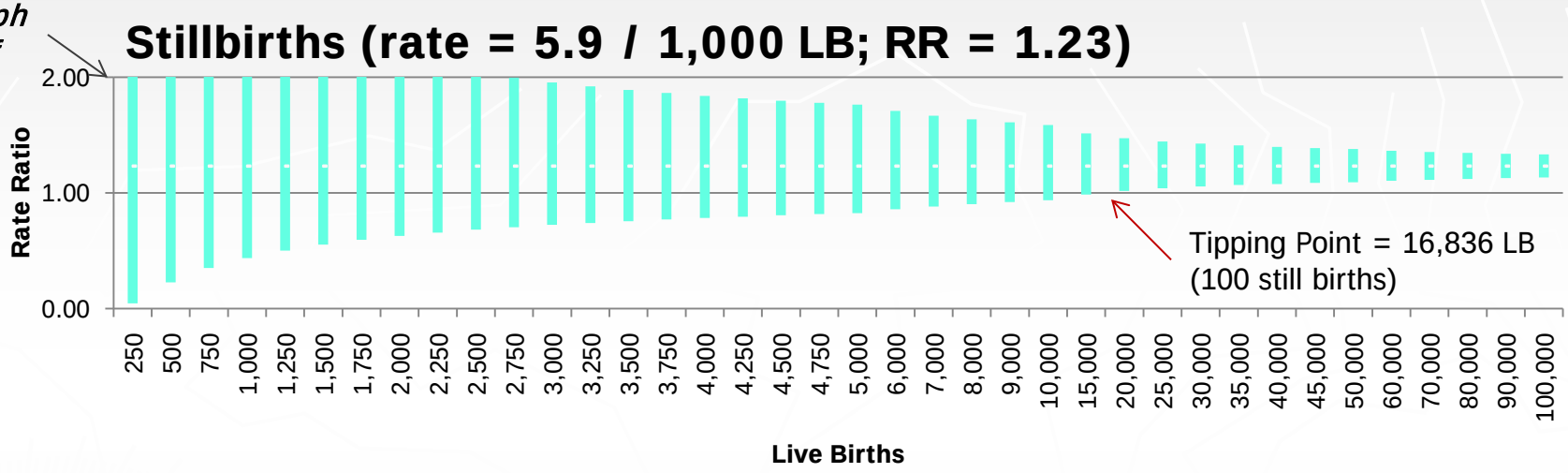
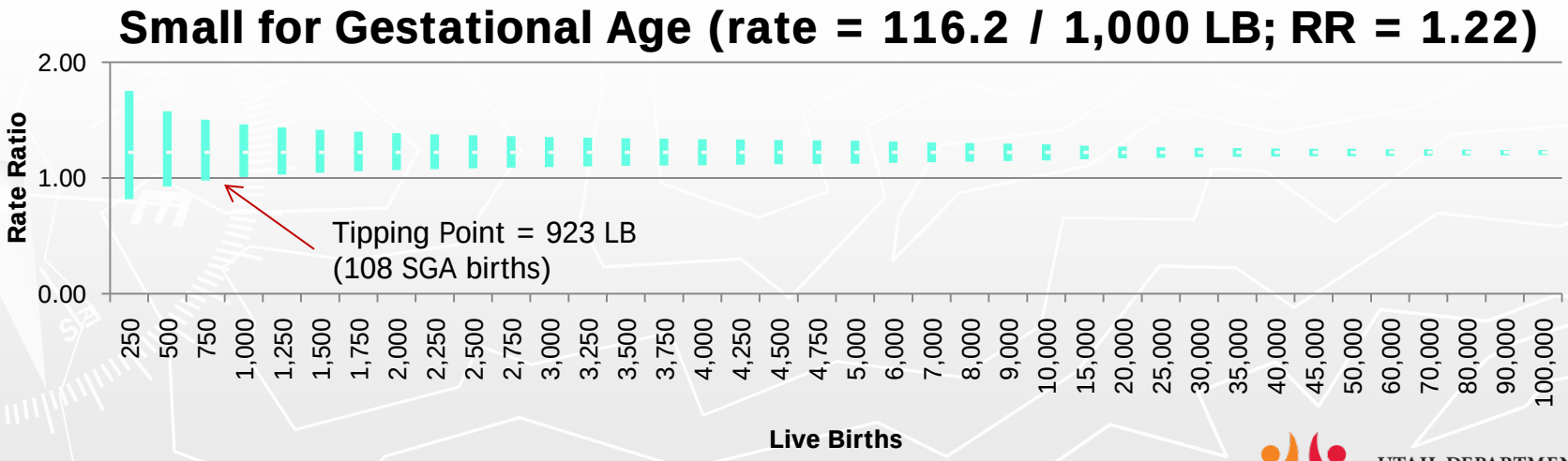
Effects of population size and case rate on the 95% confidence interval

Note: top of graph cut off





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Study Design Decision

- Use the rest of Utah (except TriCounty) as the comparison population

- Why not use the national rates?
  - The comparison population represents “normal”
  - What should TriCounty’s normal be?
    - Utah is healthier than the nation

  - National raw birth data are not readily available
    - Can’t control for behavioral risk factors
    - Can’t obtain rates in the same temporal scales, etc.

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Example
Stillbirth rate in 2012-2013

$$RR = \frac{TriCounty\ Rate = 5.9}{Utah\ Rate = 4.8} = 1.29$$

Not as good as Utah

$$RR = \frac{TriCounty\ Rate = 5.9}{National\ Rate = 6.3} = 0.94$$

Better than the nation

- Same relationship for every category of ABO
- Alternatives: Use another local health regions in Utah
  - Turned out to be equally challenging

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Controls

- Rate Ratio (RR) uses stratified state rate that has been proportioned to mimic the study area population ("standardized")

- The strata controlled for:
  - Mother's age
  - Mother's weight
  - Mother's race / ethnicity
  - Mother's access to health care
  - Mother's health status
  - Maternal use of tobacco, drugs, and alcohol

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Significant versus Meaningful

Not Significant

Significant
Not Meaningful

Significant
Meaningful

- When does a concern becomes a problem?
- Is it a big enough problem to become a priority?
- Can public health do something about it?

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Interpretation Rules for Meaningful Results

- Two or more sequential analytical periods with statistically elevated risk ratios
- One or more analytical periods with a power score greater than 80%
- Statistically significant last analytical period with an increasing trend

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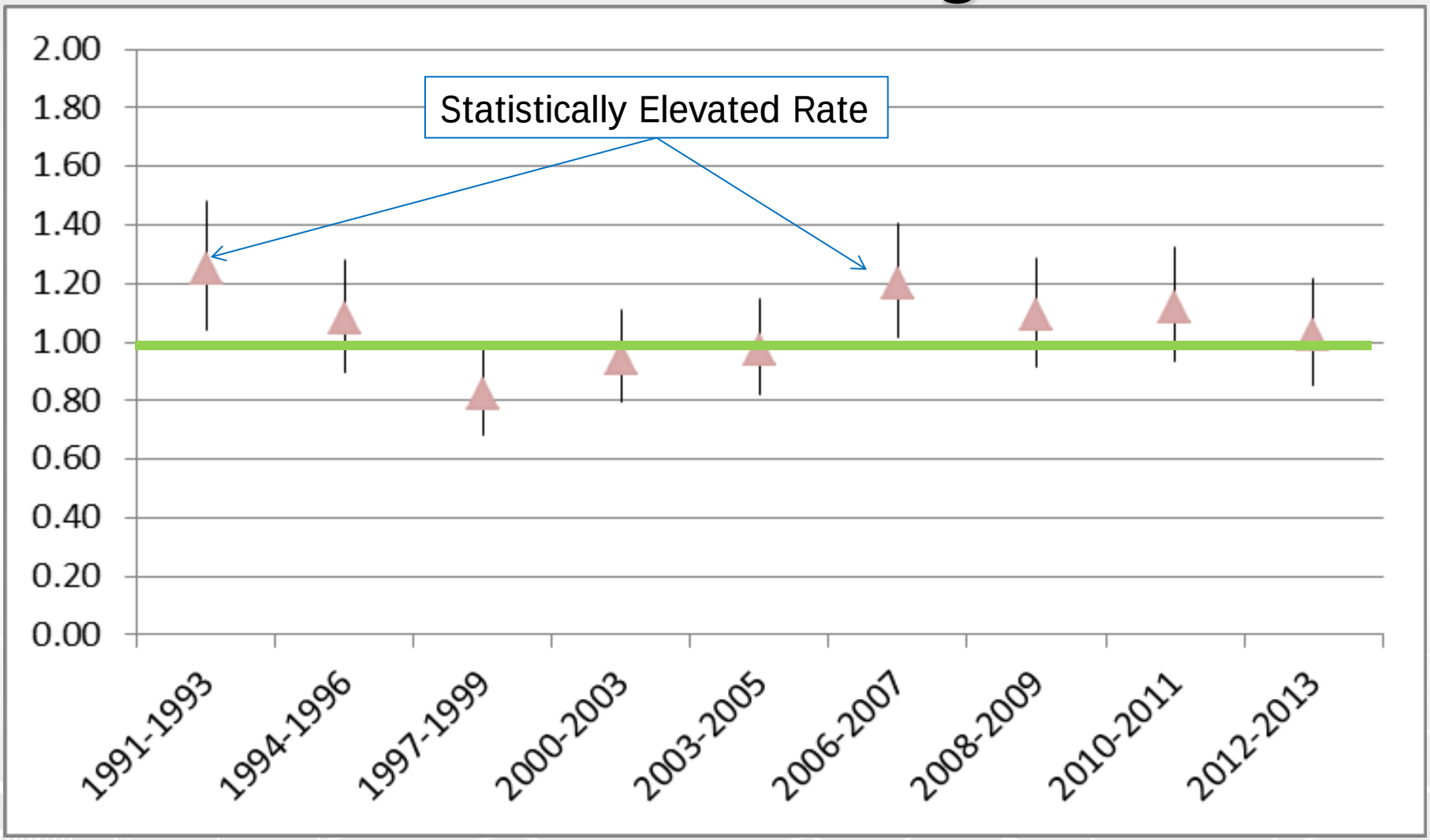
Low Birth Weight



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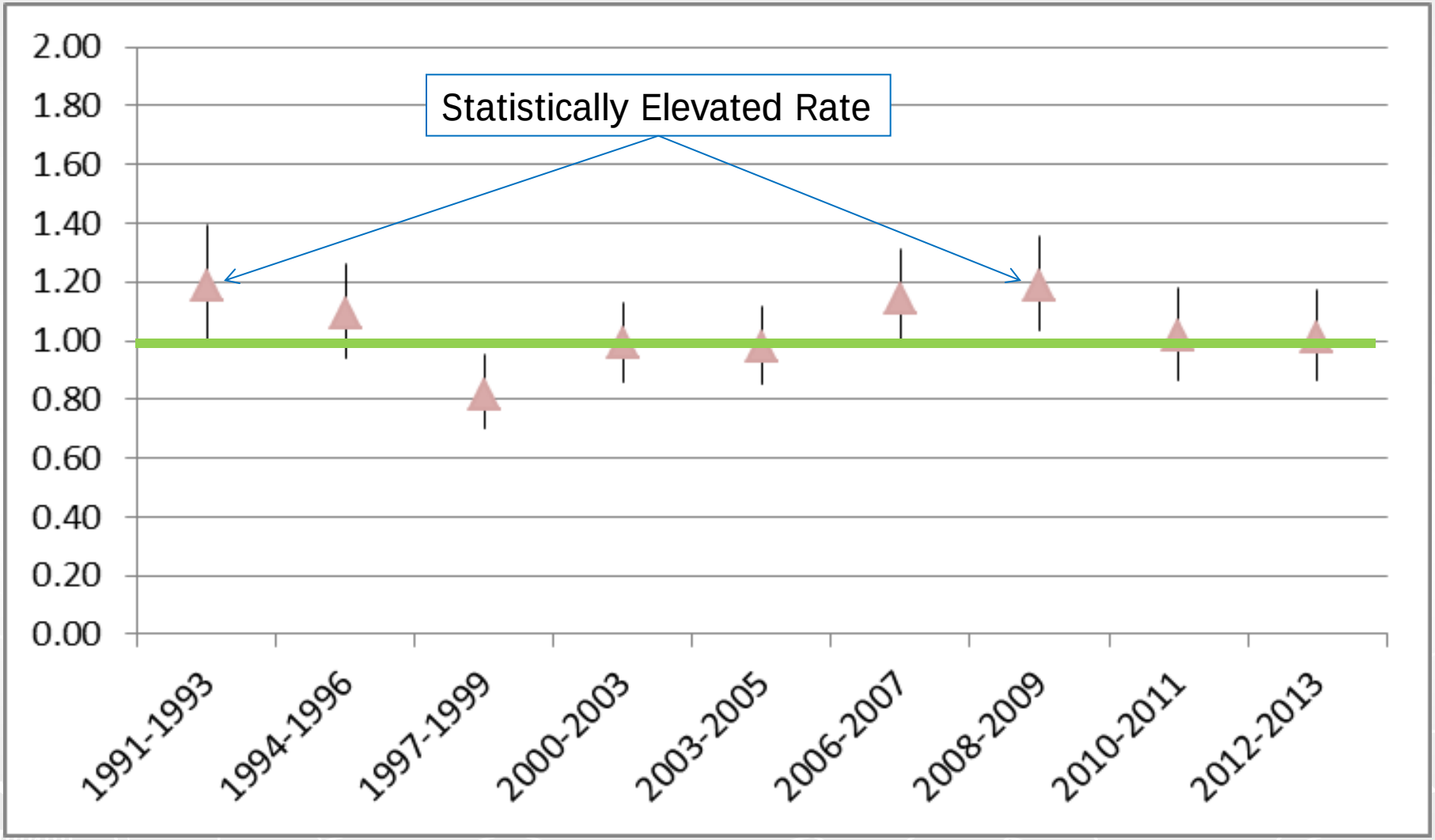
Premature Birth



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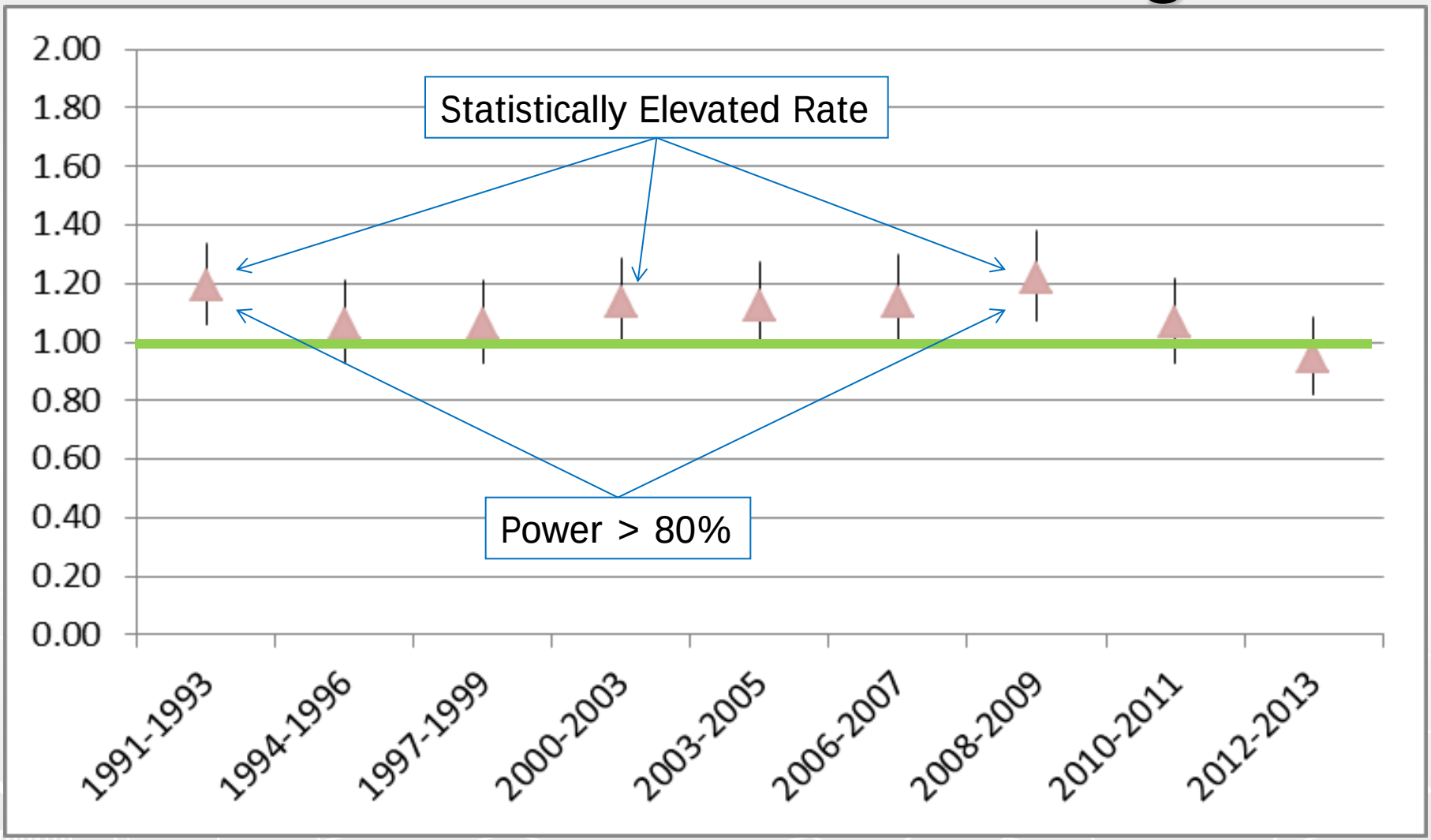
Small-for-Gestational-Age



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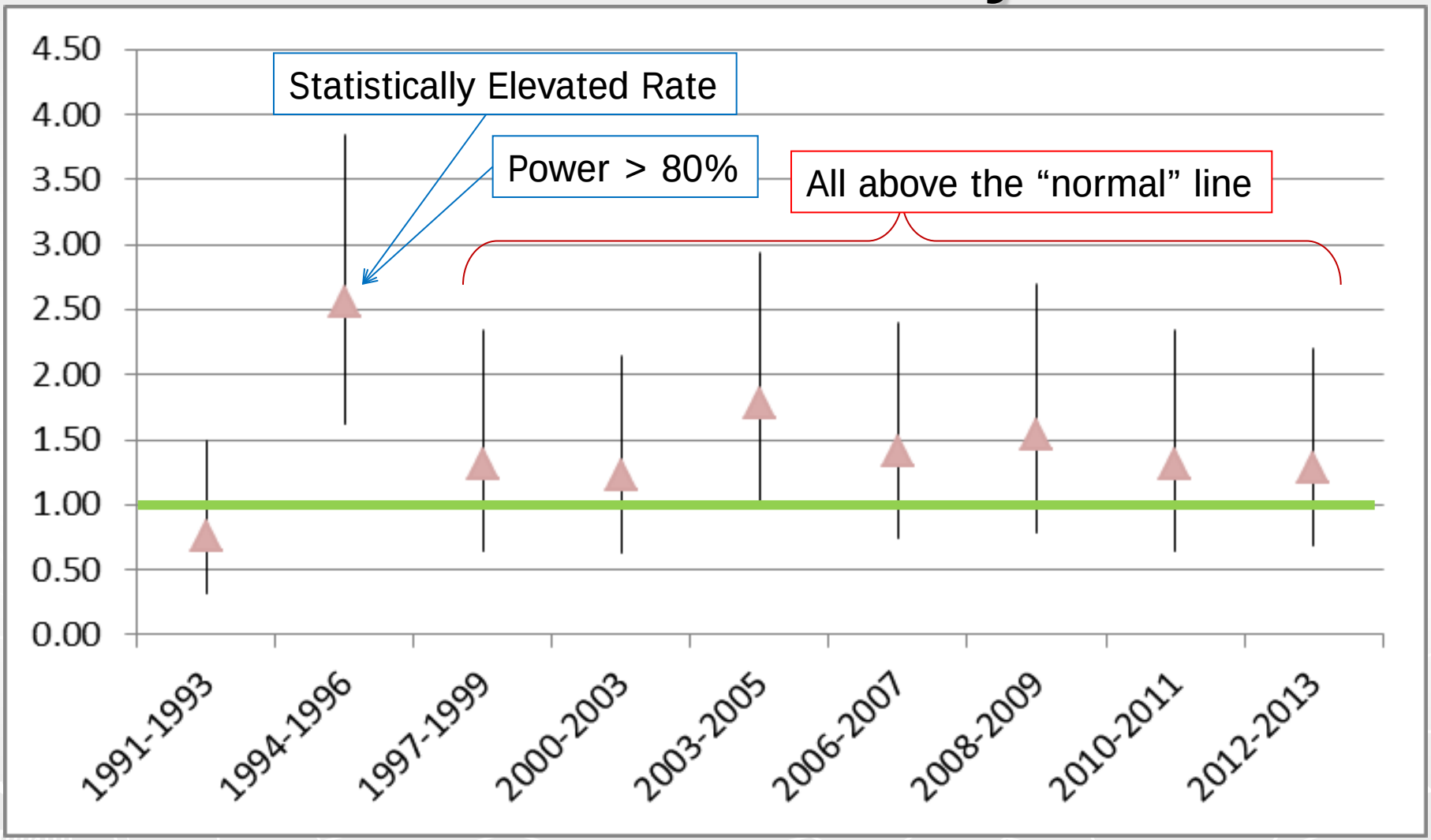
Infant Mortality



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Diagnostic Causes of Infant Mortality (n = 118)

- 58% due to a developmental or genetic defect at time of birth
- 22% due to a complication or injury that occurred at birth
- 11% resulted from an injury (physical & chemical) after birth
- 9% resulted from an infectious disease

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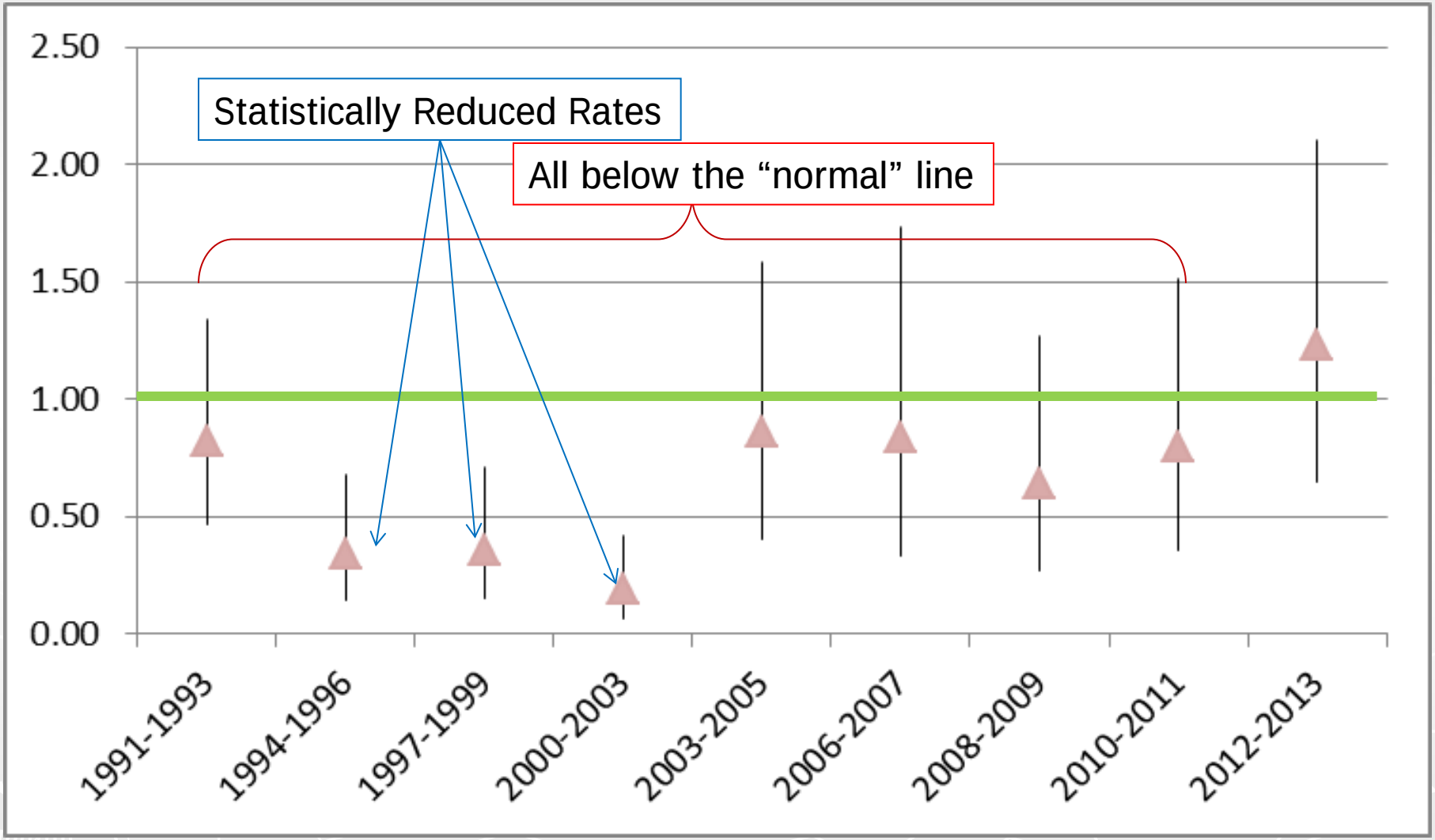
Stillbirths



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Diagnostic Causes of Stillbirth (n = 85)

- 74% due to a complication at the time of birth involving the cord or placenta
- 12% due to developmental anomalies
- 7% were attributed to a pre-existing maternal health condition (i.e., diabetes)
- 3% resulted from either Edward's or Patau's syndrome (types of trisomy)
- 2% due to Rh-factor sensitivity
- 2% not classifiable

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Birth Defects

- Separate report by Utah Birth Defects Network
  - All birth defects combined
  - Congenital heart defects
  - Orofacial clefts
  - Genitourinary defects
  - Gastrointestinal defects
  - Limb defects
  - Chromosomal birth defects
- No significant findings

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Conclusion

- **Statistical Findings**:
  - Past problem with SGA births
    - Not persistent to the present time
  - No concern for other kinds of ABO
- **Observational Findings**:
  - Infant deaths rates are consistently non-statistically higher than corresponding state rates
  - Stillbirths rates rose from consistently below the state rates to above the state rate for the 2012-2013 analytical period
  - This finding **confirms** the initial observation of more infant deaths and stillbirths than would be expected recently

County Level

- Analysis for Duchesne and Uintah Counties were consistent with the findings for the TriCounty study area

- Same conclusions

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Some Points

- Statistical reviews can not attribute risk to any causal factor
- The most important causal factors (discovered in the literature review) are:
  - Socio-economic factors, particularly access to health care
  - Maternal age, race, and ethnicity
  - Parity
  - Maternal health status during pregnancy
  - Maternal lifestyle before and during pregnancy
  - Inherited (genetic) risks

Study Limitations

- Power is limited by the population size
- Cannot discover Utah mothers who give birth outside of Utah
- The population risk can not be applied to the individual ("ecologic fallacy")

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The Hard Question:

Why didn't you do an environmental risk assessment investigation?

- Hard to justify until the problem is quantified
  - Very invasive to personal privacy
  - Would require 100% participation
  - After the fact = recall bias problem
- Not guaranteed to be able to find the risk

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One Rebuttal

- "UDOH recently acknowledge the statistical spike in perinatal deaths in Uintah basin, then mentioned everything but air pollution and environmental contaminants as possible explanations."

  Salt Lake Tribune, April 16, 2015

Risk Factors for Adverse Birth Outcomes (pages 19-21)

Category of Risk	Word Count	References
All Risks	994 (100%)	78 (100%)
Environmental	624 (63%)	64 (82%)
Air Pollution	273 (27%)	39 (50%)

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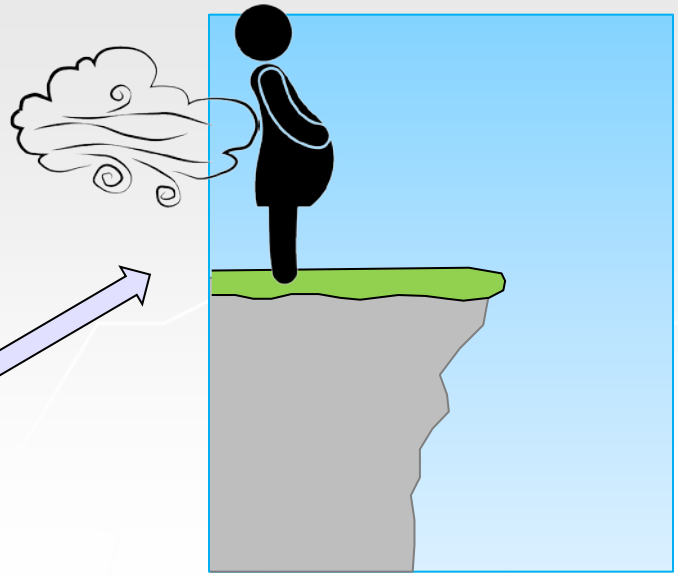
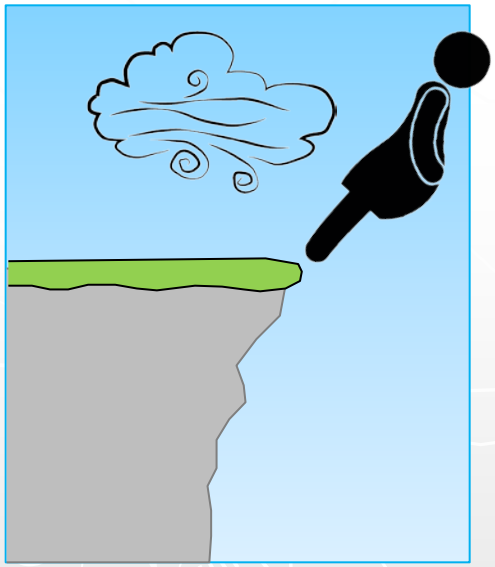
If mothers are predisposed for genetic or other reasons, poor air quality "could throw you over the edge."

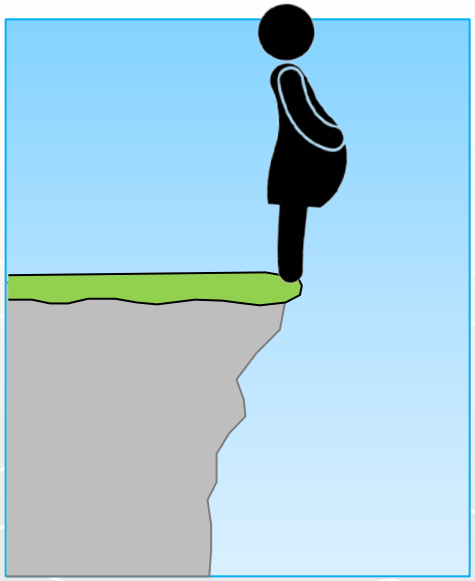
Robert M Silver, MD, University of Utah Professor of Obstetrics and Gynecology as reported in the Salt Lake Tribune



Move mom back from the edge.

Which is better?





Or remove the wind

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Some follow-up options

- We hope this report is empowering for further investigation
  - Request UDOH Maternal and Infant Health Program conduct a review of infant mortalities and local programs
  - Request that EEP conduct a follow-up statistical review in 2 years
  - Seek resources for a case/cohort investigation to establish causality
- Make available to mothers the list of services in Table 7

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Your Turn!

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