# Developing Nitrate-Attributable Health Damage Estimates for Public Water Supplies in Minnesota
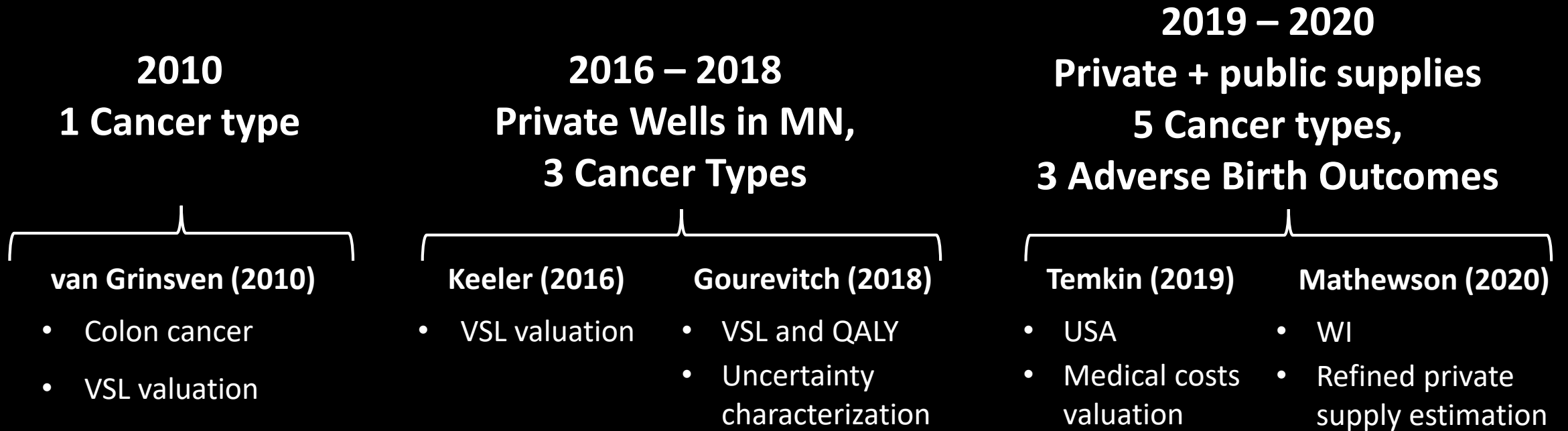
Bonnie Keeler, Terin Mayer, Ryan Noe
Humphrey School of Public Affairs, University of Minnesota

Questions: RRNoe@umn.edu

# Why quantify health costs from drinking water Nitrate?

- Existing standard (10 mg/L) was developed for preventing Blue Baby Syndrome, but other health impacts possible below that standard

- Avoided treatment costs not capturing the full scope of damages

- Quantifying health costs useful for prioritizing investments and identifying burdens on vulnerable populations
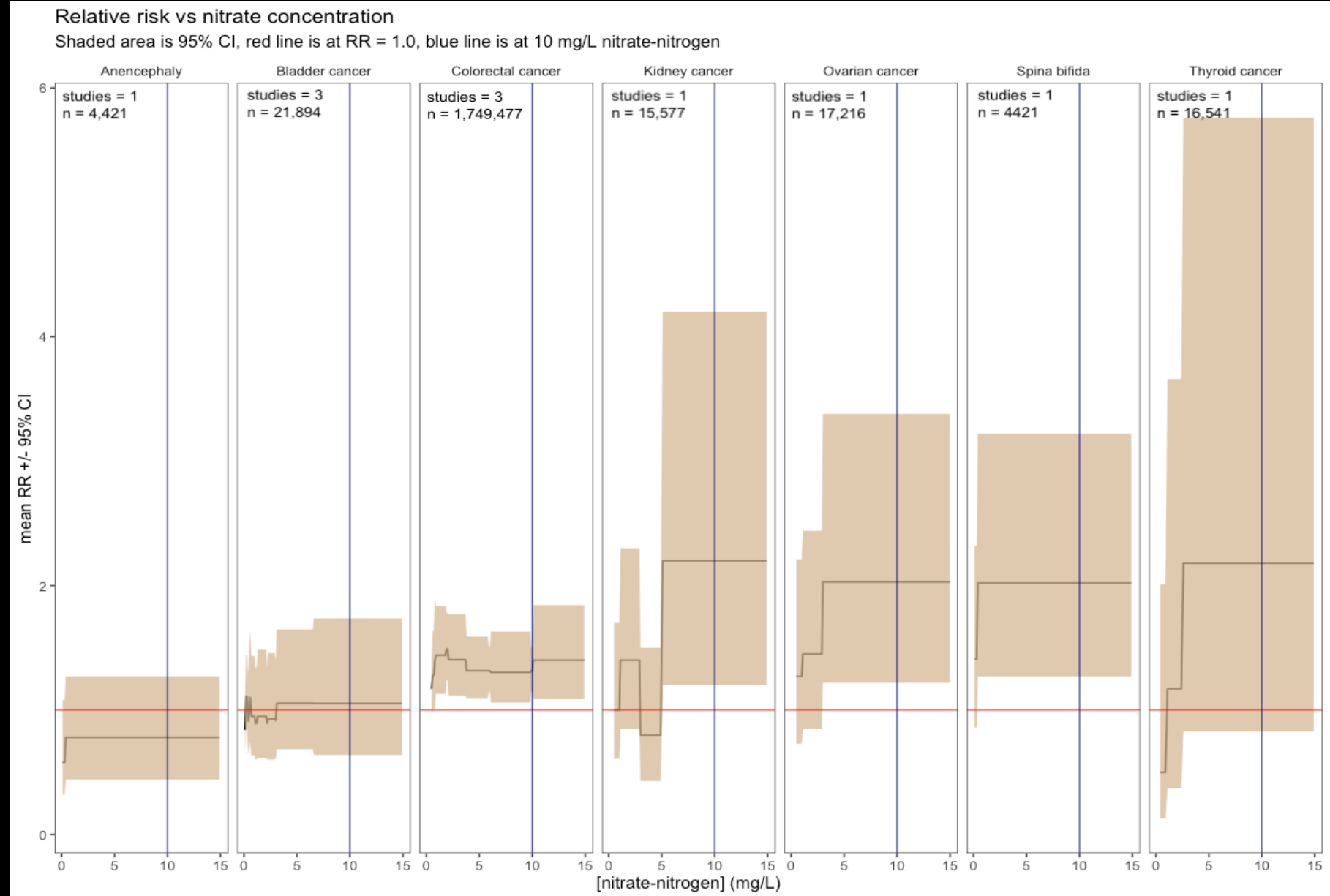
# Abridged timeline of past work

**2010**
**1 Cancer type**

**2016 – 2018**
**Private Wells in MN,**
**3 Cancer Types**

**2019 – 2020**
**Private + public supplies**
**5 Cancer types,**
**3 Adverse Birth Outcomes**

**van Grinsven (2010)**

- Colon cancer
- VSL valuation

**Keeler (2016)**

- VSL valuation

**Gourevitch (2018)**

- VSL and QALY
- Uncertainty characterization

**Temkin (2019)**

- USA
- Medical costs valuation

**Mathewson (2020)**

- WI
- Refined private supply estimation

Goal: Replicate work in MN, make generalizable tool incorporating all methods, and add further uncertainty characterization

# Example Public Water Supply (PWS) level health damage estimate workflow
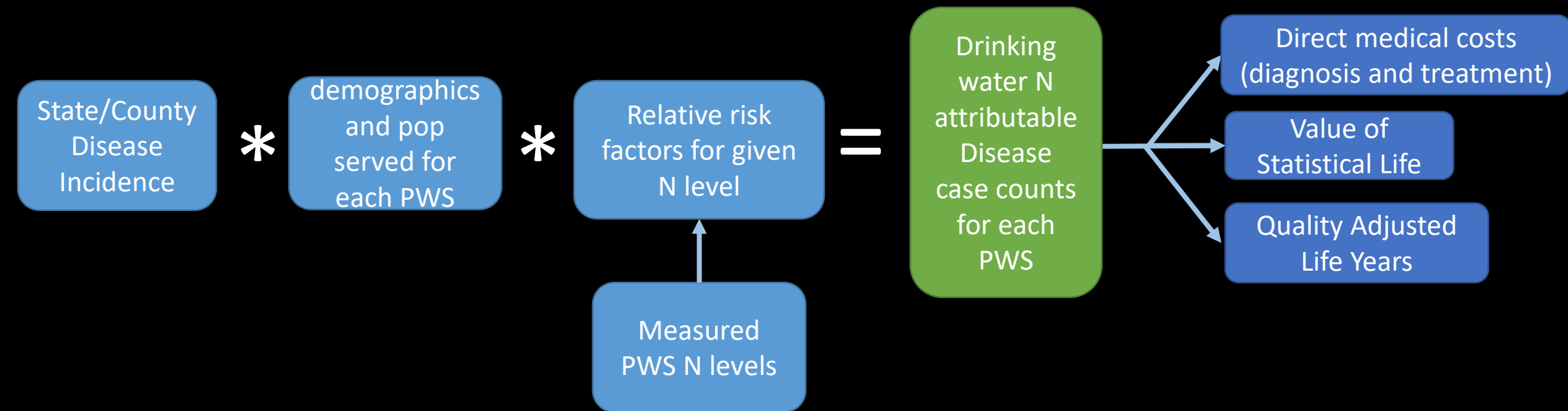
# Relative Risk Values

- Above red line is a positive relationship between N and disease

- Left of the blue line is below the Federal standard



Relative risk vs nitrate concentration
Shaded area is 95% CI, red line is at RR = 1.0, blue line is at 10 mg/L nitrate-nitrogen

| Anencephaly | Bladder cancer | Colorectal cancer | Kidney cancer | Ovarian cancer | Spina bifida | Thyroid cancer |
|---|---|---|---|---|---|---|
| studies = 1 | studies = 3 | studies = 3 | studies = 1 | studies = 1 | studies = 1 | studies = 1 |
| n = 4,421 | n = 21,894 | n = 1,749,477 | n = 15,577 | n = 17,216 | n = 4421 | n = 16,541 |

mean RR +/- 95% CI

[nitrate-nitrogen] (mg/L)

# Preliminary Results and Context

- 70 nitrate-attributable cases of cancer annually (out of 5963 total)
- 51 adverse birth outcomes annually

- VSL Valuation: $231 million
- Quality Adjusted Life Years Valuation: $37 million
- Medical Costs Valuation: $ 24 million

# Next steps:

- Areas of uncertainty to explore
  - Lifetime exposure assumptions
  - Precision weights for Relative Risk factors
  - Applying point estimates to continuous N concentrations
  - Valuation methodologies
- Policy applications

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