Epib 605

A few random thoughts

Jay Brophy MD PhD

McGill University — Departments of Medicine, Epidemiology & Biostatistics

2026-01-12

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Week 1

Fluoridation and Dental Caries - association vs causality

Community water fluoridation exposure and dental caries experience in newly enrolled members of the Canadian Armed Forces 2006–2017

** Abstract Conclusion**

"Residence in a municipality with water fluoridation was associated with reduced caries experience in a national sample of newly enrolled CAF members. The benefits of water fluoridation were uniform across neighbourhood income and military rank classes."

** Text Conclusion**

Municipal water fluoridation appears to have retained its effectiveness for reduction of dental caries in this contemporary national population.

Note difference between abstract and text = difference btw association and causality!

A few slides

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Cross-sectional design

DMFT and DMFS are cumulative, lifetime measures
Exposure is assigned at one point in time
Can't establish that exposure preceded the outcome
Regression coefficients estimate differences in mean prevalence, not incidence

Lack of temporality prevents any notion of causality

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Causal model

DAG: Fluoridation exposure → DMFS (caries)

Confounders (age/sex), effect modifier (SES)
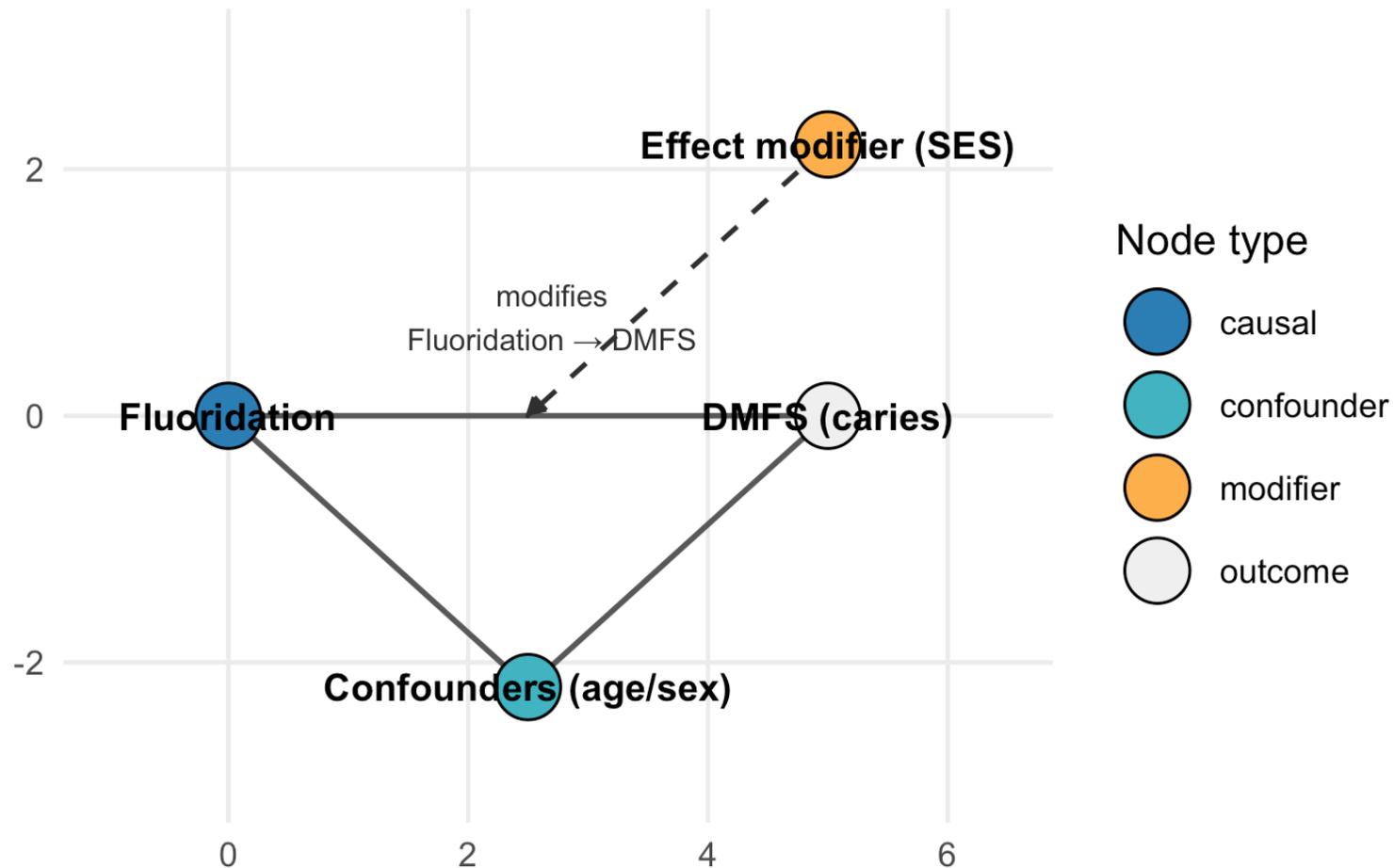
Analytical issues

1. Choice of statistical model
   Linear regression to model DMFT and DMFS as continuous outcomes
   Does this seem reasonable?
   What are the assumptions?

2. Problems with complete-case analysis
   Potential bias -> strong assumptions of data are missing completely at random (MCAR)
   Loss of power

3. Data (SES) accuracy
   Ecological bias - area level measure vs individual level
   Missing data (40% of sample)

4. Effect modification
   Need large sample (4-10X regular power)
   No formal tests of interaction performed

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LR assumptions

1. Linearity of relationship between predictors and outcome
   Possibly violated - e.g., age effect may be non-linear

2. Normally distributed errors?
   Unlikley - DMFT and DMFS are: non-negative integers, right-skewed, possibly zero-inflated in young adults.

3. Homoscedasticity (constant variance)
   Probably violated - variance likely increases with mean

4. Independence of observations
   Probably violated - clustered data (individuals within same municipality)

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Can you think of a more appropriate statistical model?

Hint: DMFT and DMFS are count data (0,1,2,3,...)
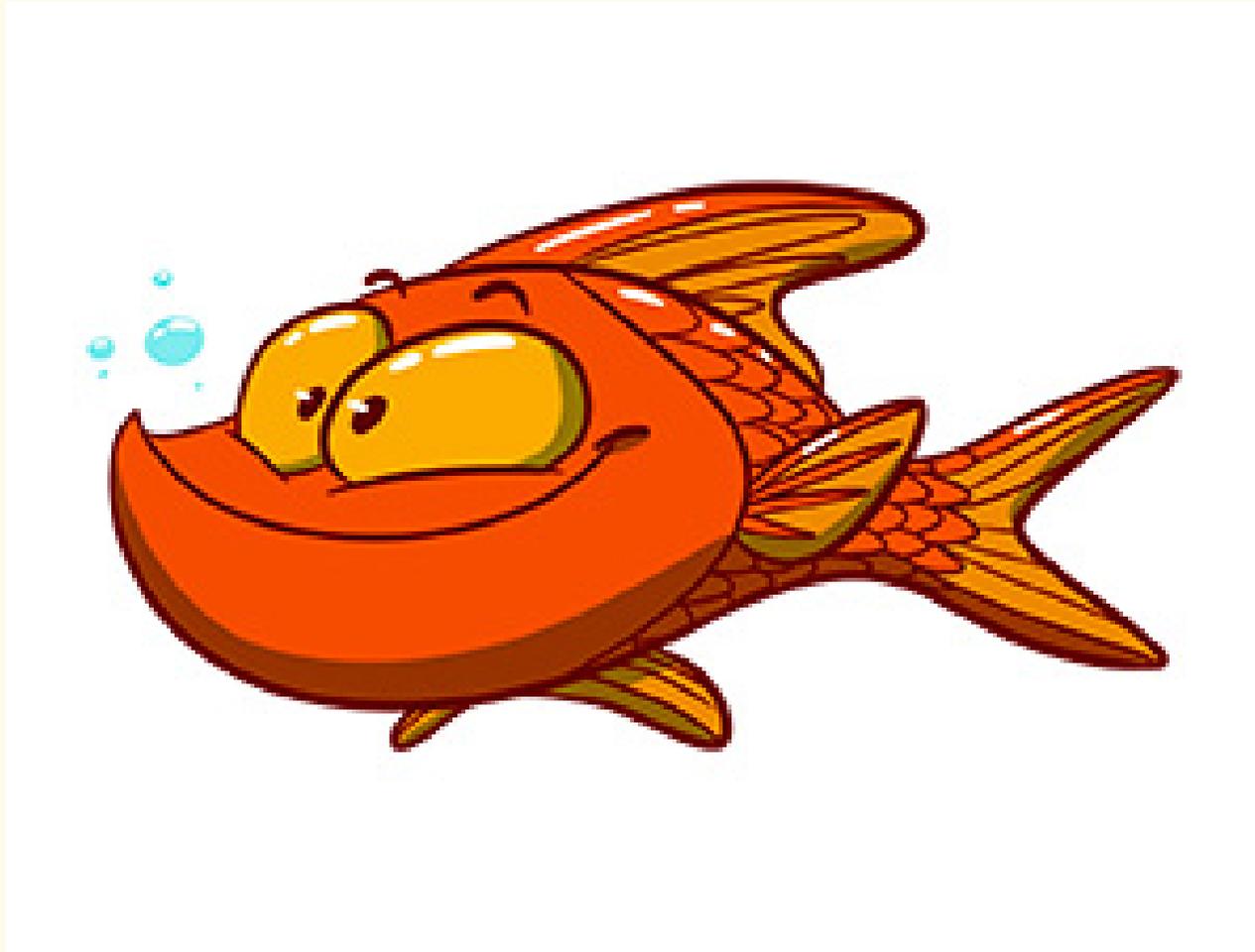
Counts -> regression model (Poisson, negative binomial, zero-inflated) with mixed effects to account for clustering

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Does Montreal fluoridate its water?

Nope

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What does public policy require for decision making?

Need good science

"policy makers require current knowledge of population oral health trends in order to ensure that programs are achieving intended goals"

But other considerations also matter:
- public acceptability
- political feasibility & sustainability
- cost effectiveness
- equity & ethics

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