Emulation of Community Water Fluoridation Coverage across U.S. Counties

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Abstract

Objective: This study aims to determine the extent to which an emulation model of community water fluoridation (CWF) diffusion explains variance in fluoridation coverage across U.S. counties, as modeled using supply side factors (neighboring fluoridation coverage) and demand side factors (health literacy, education, and population density.)

Methods: We employ a multilevel geographically weighted autoregressive model (GWAM) to analyze county level fluoridation from the 2014 Water Fluoridation Reporting Systems (WFRS) data set. We predicted fluoridation coverage as a function of neighboring fluoridation coverage, a county’s health literacy, population density, and socio-demographic population characteristics from the U.S. Census. Our modeling strategy permits us to model emulation as a function of successful implementation of fluoride by neighboring counties and the conductivity of a county to learn and implement lessons from neighboring experiences as a function of their knowledge levels and suitability to implement CWF.

Results: Health literacy and neighboring fluoridation coverage were positively associated with fluoridation coverage within a county. Increasing the health literacy of a county from the first to third quartile increases fluoridation coverage by 25 percentage points, and increasing neighboring county fluoridation from the first to third quartiles increases fluoridation by approximately 30 percentage points.

Conclusion: There is evidence to support that counties emulate each other based upon the coverage of fluoridation within a county. Increasing the health literacy of a county from the first to third quartile increases health literacy and neighboring fluoridation coverage were positively associated with fluoridation and the conductivity of a county to learn and implement lessons from neighboring experiences as a function of their coverage of fluoridation practiced by their neighbors and their own health literacy. These results suggest that while fluoridation coverage expansion is prone to inertia, it appears possible to advance fluoridation through strategic efforts to share information of positive experiences from fluoridated counties to neighboring low fluoridated counties.

Main Objectives

- Describe extent of population coverage of community water fluoridation
- Determine the extent to which emulation explains diffusion of fluoridation across counties
- Identify regions to target with water fluoridation campaigns
- Aid in the development of strategies to increase adoption of fluoridation

Key Features of Fluoridation Access in the United States

- Initial fluoridation expansion occurred in the mid-20th Century
- Community Water Fluoridation not viable for the 13% of the population not connected to public water systems
- Decided at the local (i.e. town, municipality, county, public water system level)
  - More often than not decided by voters directly in ballot initiatives and referendums
  - One of the most easy issues to politicize at the local level
- Curiel et al (2018) find strong support that increased health literacy aggregated at the precinct level improves electoral support for fluoridation

Key Obstacles Facing U.S. Public Health Interventions:

- A focus on localities to provide education and health services
- For-profit media with incorrect framing of public dental health (Curiel et al 2018)
- Health literacy strongly influences scope and impact of interventions (Curiel et al 2019)

Conclusions

- Higher levels of education/health literacy positively associated with fluoridation
- Higher levels of neighboring fluoridation positively associated with fluoridation
- Evidence meets necessary conditions to support an emulation model of fluoridation diffusion
- Tentative best strategy for fluoridation expansion: Targeting of highly health literate areas or areas surrounded by fluoridated neighbors

References


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