CADTH

CADTH RAPID RESPONSE REPORT: REFERENCE LIST

Community Water Fluoridation Programs: Clinical Effectiveness and Safety

Service Line:	Rapid Response Service
Version:	1.0
Publication Date:	March 16, 2020
Report Length:	8 Pages

CADTH

Authors: Shannon Hill, Hannah Loshak

Cite As: Community water fluoridation programs: clinical effectiveness and safety. Ottawa: CADTH; 2020 Mar. (CADTH rapid response report: reference list).

About CADTH: CADTH is an independent, not-for-profit organization responsible for providing Canada's health care decision-makers with objective evidence to help make informed decisions about the optimal use of drugs, medical devices, diagnostics, and procedures in our health care system.

Funding: CADTH receives funding from Canada's federal, provincial, and territorial governments, with the exception of Quebec.

Questions or requests for information about this report can be directed to **requests@cadth.ca**

Research Questions

1. What is the effectiveness of community water fluoridation (fluoride level between 0.4 ppm and 1.5 ppm) compared with non-fluoridated drinking water (fluoride level < 0.4 ppm) in the prevention of dental caries in children and adults?
2. What are the effects of community water fluoridation cessation (fluoride level < 0.4 ppm) on dental caries in children and adults compared with continued community water fluoridation (fluoride level between 0.4 ppm and 1.5 ppm), the period before cessation of water fluoridation (fluoride level between 0.4 ppm and 1.5 ppm), or nonfluorinated communities (fluoride level < 0.4 ppm)?
3. What are the negative effects of community water fluoridation (at a given fluoride level) compared with non-fluoridated drinking water (fluoride level < 0.4 ppm) or fluoridation at different levels on human health outcomes?

Key Findings

Three systematic reviews with meta-analyses and 21 non-randomized studies were identified regarding the clinical effectiveness of community water fluoridation in the prevention of dental caries, the effects of community water fluoridation cessation on dental carries, and the negative effects of community water fluoridation on human health outcomes.

Methods

This report makes use of a literature search strategy developed for a previous CADTH report. For the current report, a limited literature search was conducted by an information specialist on key resources including Medline via OVID, CINAHL via Ebsco, Scopus, Pubmed, the Cochrane Library, the University of York Centre for Reviews and Dissemination (CRD) databases, the websites of Canadian and major international health technology agencies, as well as a focused Internet search. The search strategy was comprised of both controlled vocabulary, such as the National Library of Medicine's MeSH (Medical Subject Headings), and keywords. The main search concepts were water and fluoridation. Search filters were applied to limit retrieval to health technology assessments, systematic reviews, meta-analyses, or network meta-analyses, any types of clinical trials or observational studies. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2018 and March 10, 2020. Internet links were provided, where available.

Selection Criteria

One reviewer screened citations and selected studies based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria

Population	Human populations of any age
Intervention	Q1: Natural or artificial water fluoridation (fluoride level 0.4 ppm to 1.5 ppm) Q2: Cessation of water fluoridation (fluoride level < 0.4 ppm) Q3: Water fluoridation at any level
Comparator	Q1: Non-fluoridated water (fluoride level < 0.4 ppm) Q2: Continued water fluoridation (fluoride level 0.4 ppm to 1.5 ppm), before cessation of water fluoridation, or non-fluoridation community Q3: Non-fluoridated water (fluoride level < 0.4 ppm) or different fluoride levels in drinking water
Outcomes	Q1-2: Clinical effectiveness: Any measure of dental outcomes including but not limited to: • Mean DMFT • Mean DMFS • Mean DFS • Proportion of children with or without caries in primary teeth • Proportion of individuals with or without caries in permanent teeth • Hospital admissions for dental surgery under general anesthesia Q3: Negative effects Any measure of adverse health outcomes associated with water fluoridation, including but not limited to: • Dental fluorosis • Skeletal fluorosis • Bone development and bone fracture • Thyroid function • Cancer • Neurodevelopment • Mortality • Other negative effects
Study Designs	Health technology assessment, systematic review, randomized controlled trials, non-randomized studies

DFS = decay, and filled (permanent) tooth surfaces; DMFS = decay, missing/extracted, and filled (permanent) tooth surfaces; DMFT = decay, missing/extracted, and filled (permanent) teeth; ppm = part per million

Results

Rapid Response reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports and systematic reviews are presented first. These are followed by randomized controlled trials and non-randomized studies.

Three systematic reviews with meta-analyses[1-3], and 21 non-randomized studies[4-25] were identified regarding the clinical effectiveness of community water fluoridation in the prevention of dental caries, the effects of community water fluoridation cessation on dental carries, and the negative effects of community water fluoridation on human health outcomes. No relevant health technology assessments or randomized controlled trials were identified.

Additional references of potential interest are provided in the appendix.

Health Technology Assessments

No literature identified.

Systematic Reviews and Meta-analyses

1. Keramati H, Miri A, Baghaei M, et al. Fluoride in Iranian drinking water resources: a systematic review, meta-analysis and non-carcinogenic risk assessment. *Biol Trace Elem Res*. 2019;188(2):261-273.
PubMed: PM29943372

2. Lima IFP, Nobrega DF, Cericato GO, Ziegelmann PK, Paranhos LR. Prevalence of dental fluorosis in regions supplied with non-fluoridated water in the Brazilian territory: a systematic review and meta-analysis. *Cien Saude Colet*. 2019;24(8):2909-2922.
PubMed: PM31389538

3. Duan Q, Jiao J, Chen X, Wang X. Association between water fluoride and the level of children's intelligence: a dose-response meta-analysis. *Public Health*. 2018;154:87-97.
PubMed: PM29220711

Randomized Controlled Trials

No literature identified.

Non-Randomized Studies

4. Godebo TR, Jeuland M, Tekle-Haimanot R, et al. Bone quality in fluoride-exposed populations: a novel application of the ultrasonic method. *Bone Rep*. 2020;12:100235.
PubMed: PM31890757

5. Till C, Green R, Flora D, et al. Fluoride exposure from infant formula and child IQ in a Canadian birth cohort. *Environ Int*. 2020;134:105315.
PubMed: PM31743803

6. Wang M, Liu L, Li H, et al. Thyroid function, intelligence, and low-moderate fluoride exposure among Chinese school-age children. *Environ Int*. 2020;134:105229.
PubMed: PM31698198

7. Zheng D, Liu Y, Luo L, Shahid MZ, Hou D. Spatial variation and health risk assessment of fluoride in drinking water in the Chongqing urban areas, China. *Environ Geochem Health*. 2020 Feb 15. [epub ahead of print]
PubMed: PM32062738

8. Ahada CPS, Suthar S. Assessment of human health risk associated with high groundwater fluoride intake in southern districts of Punjab, India. *Exposure and Health*. 2019;11(4):267-275.

9. Goldfeld S, Francis KL, Hoq M, Do L, O'Connor E, Mensah F. The impact of policy modifiable factors on inequalities in rates of child dental caries in Australia. *Int J Environ Res Public Health*. 2019;16(11):03.
PubMed: PM31163687

10. Green R, Lanphear B, Hornung R, et al. Association between maternal fluoride exposure during pregnancy and IQ scores in offspring in Canada. *JAMA Pediatr*. 2019;173(10):940-948. [online ahead of print]
PubMed: PM31424532

11. Ha DH, Spencer AJ, Peres KG, Rugg-Gunn AJ, Scott JA, Do LG. Fluoridated water modifies the effect of breastfeeding on dental caries. *J Dent Res*. 2019;98(7):755-762. PubMed: PM30974070

12. Kroon J, Lalloo R, Tadakamadla SK, Johnson NW. Dental caries experience in children of a remote Australian Indigenous community following passive and active preventive interventions. *Community Dent Oral Epidemiol*. 2019;47(6):470-476. PubMed: PM31328295

13. Montanha-Andrade K, Maia W, Pimentel ACP, Arsati Y, Santos JND, Cury PR. Dental health status and its indicators in adult Brazilian Indians without exposition to drinking water fluoridation: a cross-sectional study. *Environ Sci Pollut Res Int*. 2019;26(33):34440-34447. PubMed: PM31637613

14. Riddell JK, Malin AJ, Flora D, McCague H, Till C. Association of water fluoride and urinary fluoride concentrations with attention deficit hyperactivity disorder in Canadian youth. *Environ Int*. 2019;133(Pt B):105190. PubMed: PM31654913

15. Shaik N, Shanbhog R, Nandlal B, Tippeswamy H. Fluoride and thyroid function in children resident of naturally fluoridated areas consuming different levels of fluoride in drinking water: an observational study. *Contemp Clin Dent*. 2019;10(1):24-30. PubMed: PM32015627

16. Zhou G, Yang L, Luo C, et al. Low-to-moderate fluoride exposure, relative mitochondrial DNA levels, and dental fluorosis in Chinese children. *Environ Int*. 2019;127:70-77. PubMed: PM30909095

17. Al-Akwa AA, Al-Maweri SA. Dental caries prevalence and its association with fluoride level in drinking water in Sana'a, Yemen. *Eur J Dent*. 2018;12(1):15-20. PubMed: PM29657520

18. Do LG, Ha DH, Roberts-Thomson KF, Jamieson L, Peres MA, Spencer AJ. Race- and income-related inequalities in oral health in Australian children by fluoridation status. *JDR Clin Trans Res*. 2018;3(2):170-179. PubMed: PM30931771

19. Ghaderpoori M, Najafpoor AA, Ghaderpoury A, Shams M. Data on fluoride concentration and health risk assessment of drinking water in Khorasan Razavi province, Iran. *Data Brief*. 2018;18:1596-1601. PubMed: PM29900331

20. Ibiyemi O, Zohoori FV, Valentine RA, Kometa S, Maguire A. Prevalence and extent of enamel defects in the permanent teeth of 8-year-old Nigerian children. *Community Dent Oral Epidemiol*. 2018;46(1):54-62. PubMed: PM28895192

21. Meyer J, Margaritis V, Mendelsohn A. Consequences of community water fluoridation cessation for Medicaid-eligible children and adolescents in Juneau, Alaska. *BMC Oral Health*. 2018;18(1):215. PubMed: PM30545358

22. Mohd Nor NA, Chadwick BL, Farnell DJJ, Chestnutt IG. The impact of a reduction in fluoride concentration in the Malaysian water supply on the prevalence of fluorosis and dental caries. *Community Dent Oral Epidemiol*. 2018;46(5):492-499. PubMed: PM30019792

23. Trufanova V, Sheshukova O, Davydenko V, Polishchuk T, Bauman S, Dobroskok V. Characteristics of epidemiology of dental caries in children from regions with high and optimum fluorine content in drinking water. *Wiad Lek*. 2018;71(2 pt 2):335-338. PubMed: PM29786582

24. Yu X, Chen J, Li Y, et al. Threshold effects of moderately excessive fluoride exposure on children's health: a potential association between dental fluorosis and loss of excellent intelligence. *Environ Int*. 2018;118:116-124. PubMed: PM29870912

CADTH

Appendix — Further Information

Previous CADTH Reports

25. Community water fluoridation programs: a health technology assessment. *(CADTH Health technology assessment).* Ottawa (ON): CADTH; 2019: https://www.cadth.ca/community-water-fluoridation-programs-health-technology-assessment. Accessed 2020 Mar 16.

26. Community water fluoridation exposure: a review of neurological and cognitive effects. *(CADTH Rapid response report: summary with critical appraisal).* Ottawa (ON): CADTH; 2019: https://www.cadth.ca/community-water-fluoridation-exposure-review-neurological-and-cognitive-effects-0. Accessed 2020 Mar 16.

Systematic Review

Comparator Not Specified

27. Akuno MH, Nocella G, Milia EP, Gutierrez L. Factors influencing the relationship between fluoride in drinking water and dental fluorosis: a ten-year systematic review and meta-analysis. *J Water Health*. 2019;17(6):845-862. PubMed: PM31850893

28. Demelash H, Beyene A, Abebe Z, Melese A. Fluoride concentration in ground water and prevalence of dental fluorosis in Ethiopian Rift Valley: systematic review and meta-analysis. *BMC Public Health*. 2019;19(1):1298. PubMed: PM31619212

Additional References

29. Singhal, S. Evidence review for adverse health effects of drinking optimally fluoridated water (2010-2017). Toronto (ON): Public Health Ontario; 2018: https://www.publichealthontario.ca/-/media/documents/evidence-review-health-affects-fluoridated-water.pdf?la=en. Accessed 2020 Mar 16.