

Status of state and national water fluoridation programs - Seventy years of progress in preventing tooth decay



Scott Presson, DDS, MPH
Senior Advisor, Division of Oral Health
National Center for Chronic Disease Prevention and
Health Promotion, CDC



U.S. Department of
Health and Human Services
Centers for Disease
Control and Prevention

Presenter Disclosures

- ❑ **The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:**

No relationships to disclose

- ❑ **The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.**

Community Water Fluoridation (CWF) Turns 70

- ❑ Used extensively throughout the U.S. and in many countries**
- ❑ Recognized by CDC as one of ten great public health achievements in the 20th century**
- ❑ Cornerstone of tooth decay prevention**

mg/L: milligrams per Liter

Fluoridation in Context

□ At the time when CWF was initiated:

- Extractions of first molars in young children were routine
- The typical school child developed 3-4 new cavities each year
- Full extractions and complete dentures were the norm for older adults
- Recruits into WWII rejected because of poor oral health – 6 opposing teeth -10% rejection rate – 40% needed immediate treatment for relief of pain
- Dowries of new brides sometimes included dentures

Early Community Trials

❑ **January 25, 1945**

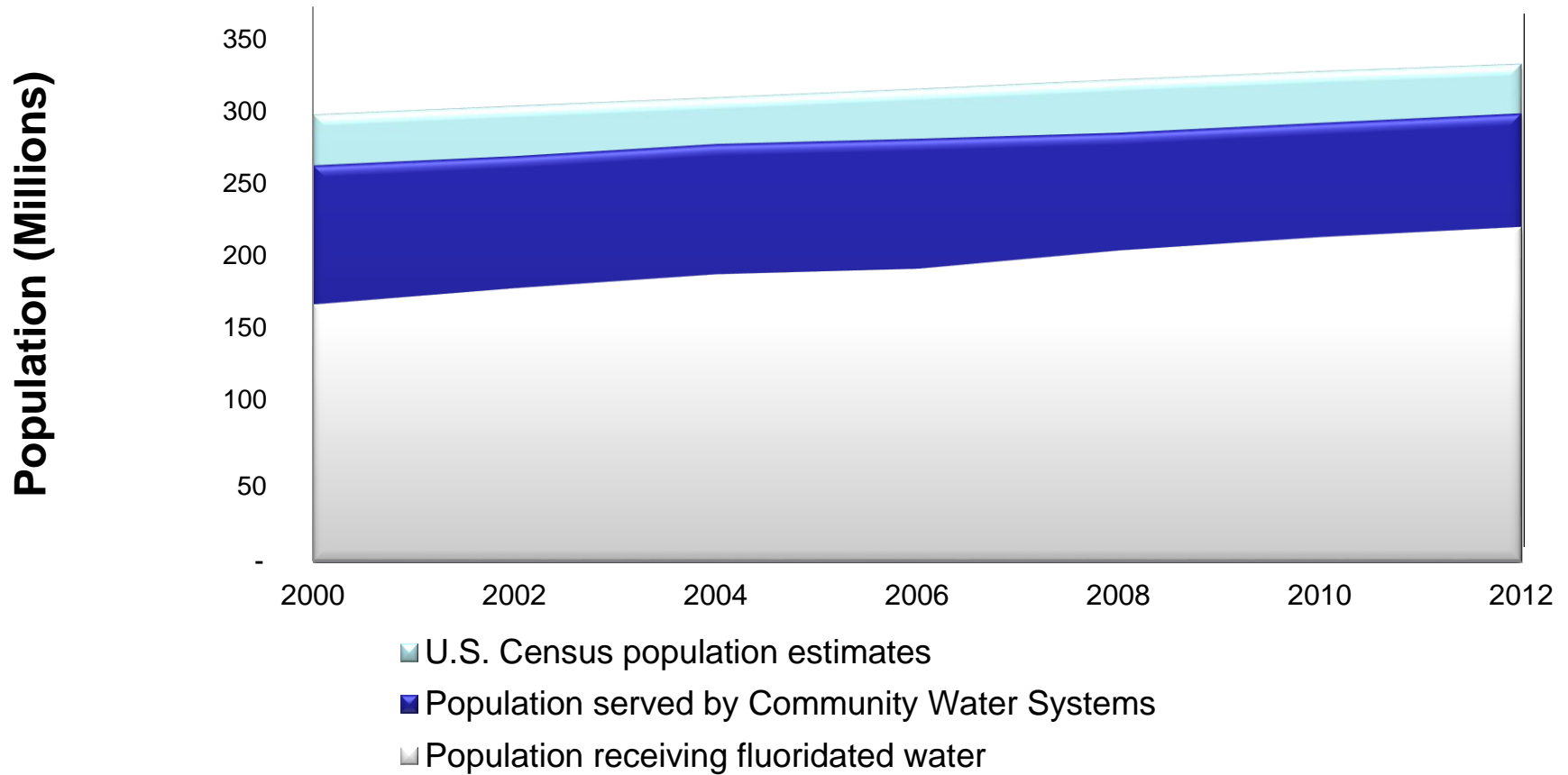
- **Grand Rapids and Muskegon, Michigan**

❑ **1945-1947 Other early trials**

- **Newburgh and Kingston, New York;**
- **Evanston and Oak Park, Illinois;**
- **Brantford and Sarnia, Ontario, Canada (Stratford)**

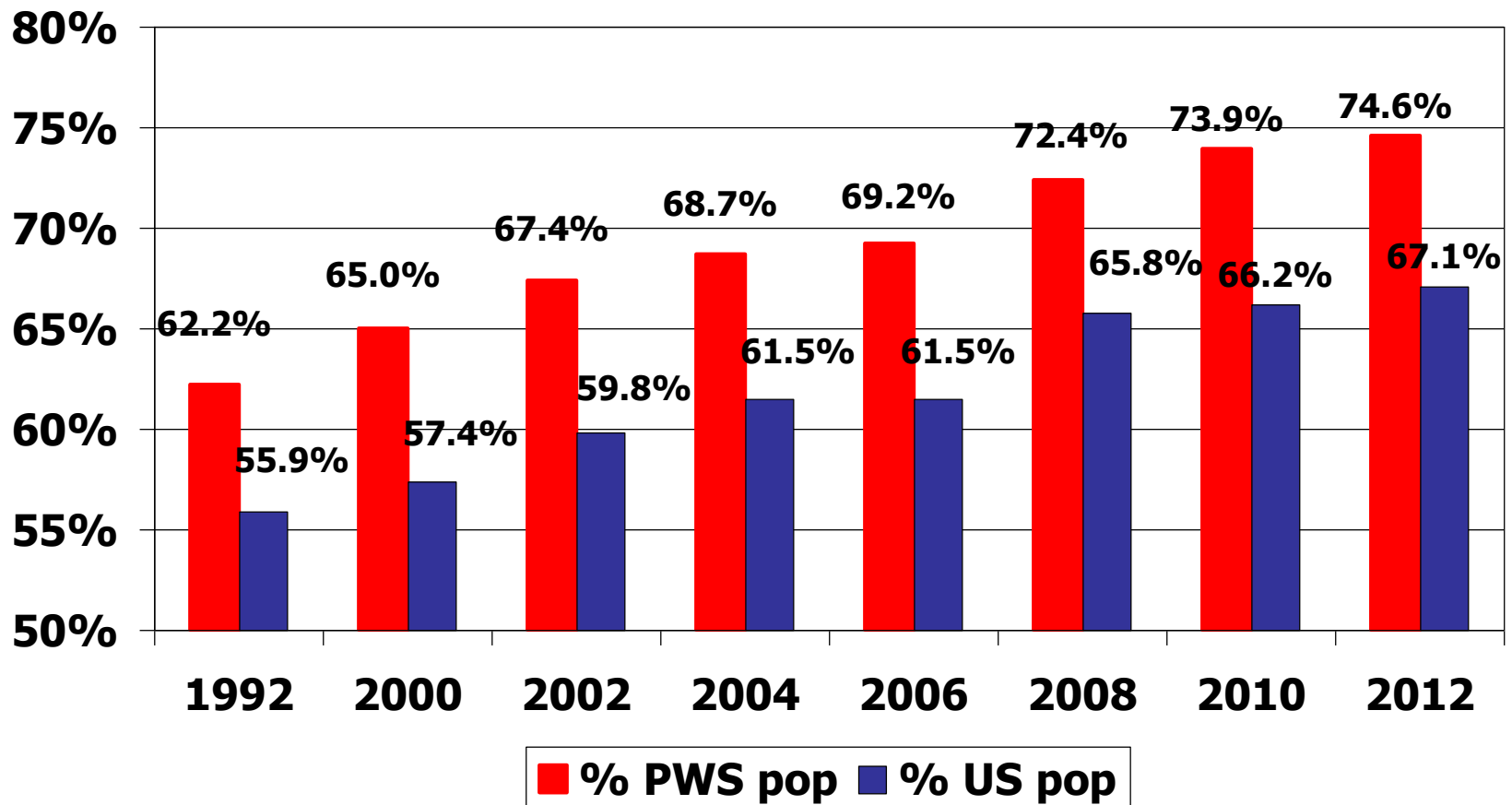
People Reached by Community Water Fluoridation

Trends in population receiving fluoridated water — U.S. 2000–2012



U.S. Fluoridation Status

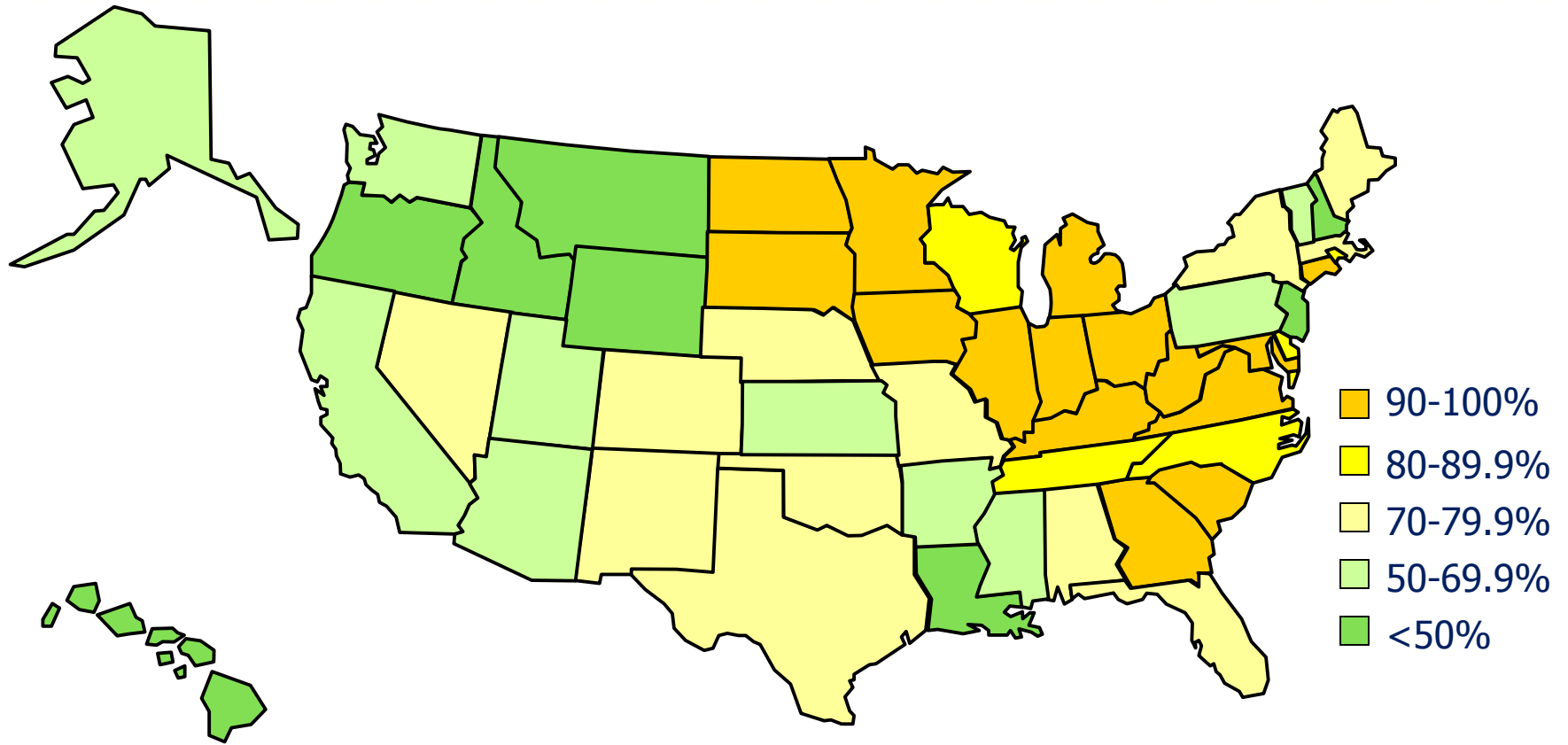
Percentage of people receiving optimally fluoridated water



PSW – Public Water System

CDC. Water Fluoridation Reporting System, 2012.

People Reached by Community Water Fluoridation, 2012

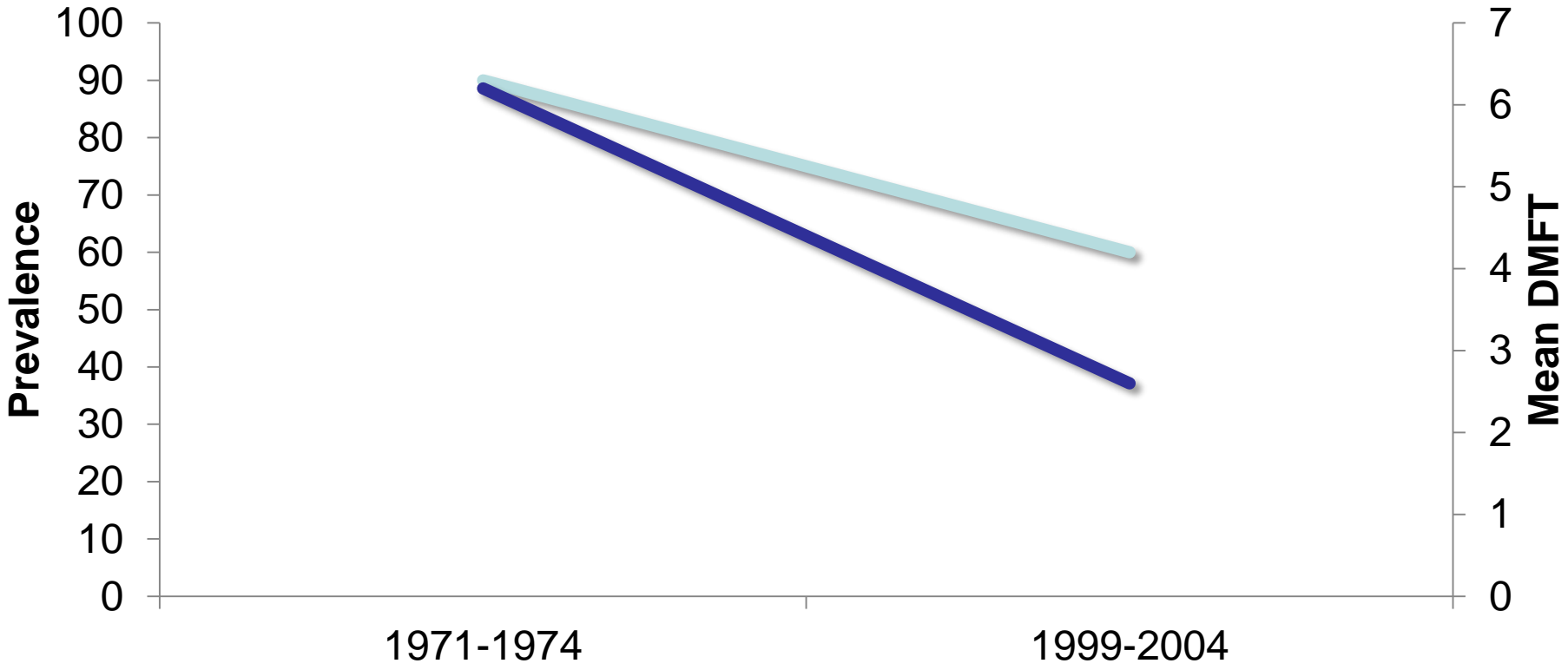


CDC. Water Fluoridation Reporting System, 2012.

Changes in Prevalence and Severity of Tooth Decay, 1971–1974 to 1999–2004

Dental Caries among U.S. Adolescents

— Prevalence of dental caries — Mean DMFT



CDC. MMWR.1999;48:933-40
DMFT: decayed, missing, or filled teeth

Policy Background

- ❑ **No federal requirement to fluoridate**
- ❑ **States and communities determine whether to fluoridate**
 - These decisions often are made by elected officials or by a public vote
- ❑ **CDC monitors benefits and risks of CWF**
 - NHANES:
 - Fluoride content of home water samples for children
 - Exposure to other sources of fluoride (toothpaste, fluoride drops and tablets)
 - Dentist-assessed measures of caries, fluorosis, and dental sealants

Community Water Fluoridation (CWF) Recommendations

- ❑ **Recommendations established by the USPHS (1962): 0.7–1.2 mg/L water**
- ❑ **HHS panel of federal scientists reviewed relevant evidence to update 1962 recommendations (2010)**
- ❑ **Proposed HHS recommendation (2011): 0.7 mg/L water**
- ❑ **Intent: Balance the health benefits of preventing tooth decay across the lifespan while reducing fluoride exposure in children**

mg/L: milligrams per Liter

Community Water Fluoridation (CWF) Recommendations process

- ❑ **Federal Panel on Community Water Fluoridation included representatives from CDC, NIH, FDA, Agency for Healthcare Research and Quality, the Office of the Assistant Secretary for Health, EPA, and the Department of Agriculture**
- ❑ **Public comments of the proposed change (~19,000) were reviewed, summarized, and considered by the Panel**
- ❑ **Independent peer review of draft recommendation**
- ❑ **Final recommendation and report developed and published**

Community Water Fluoridation (CWF) Recommendations

- ❑ **Uniform recommended level of fluoride of 0.7 mg/L announced April 27, 2015**
- ❑ **U.S. Public Health Service Recommendation for Fluoride Concentration in Drinking Water for the Prevention of Dental Caries** (Federal Register Notice May 1, 2015) and (Public Health Reports, July-August 2015)
- ❑ **Surgeon General's Perspective**, (Public Health Reports, July-August 2015)

Burden of Dental Caries

❑ **Dental caries (tooth decay) is a highly prevalent chronic condition.**

- One in four children from low-income families had untreated tooth decay (NHANES, 2009–2010).
- Untreated decay can cause pain, school absences, difficulty concentrating, and poor appearance.
- Nearly 60% of adolescents had decayed, missing, or filled teeth (NHANES, 1999–2004).

What are the benefits of CWF?

- ❑ **CWF reduces tooth decay by about 25% in persons of all ages.**
- ❑ **In large communities every \$1 spent on CWF saves \$43 in dental treatment costs annually.**

What are the risks of CWF?

- ❑ **Fluoride ingestion while teeth are developing can result in dental fluorosis, a visually detectable change in the tooth enamel.**
 - Range from barely visible lacy white markings (mild) to pitting of the teeth (severe)
 - No evidence that CWF results in severe dental fluorosis (CPSTF 2013)



(Very mild to mild fluorosis shown here.)

Main Reasons for Proposed Change In Recommendation for Fluoridation

- ❑ Evidence supports CWF effectiveness and cost-effectiveness
- ❑ Drinking water is now one of several sources of ingested fluoride
 - Fluoride toothpaste
 - Fluoride supplements
 - Commercial foods and beverages
- ❑ Increase in prevalence of dental fluorosis
- ❑ Caries prevention can be maintained while reducing risk of fluorosis
- ❑ Outdoor temperature is not an important predictor of children's water intake

Effectiveness

❑ **Community Preventive Services Task Force (2013):**

- Found strong evidence that community water fluoridation (CWF) was effective in reducing tooth decay
- Increase in percent of caries free (mean difference)
Median: 14.6%; range -5.0% to 64% (11 studies)
Median: 25.1%; range 19.8% to 31.6% (1 study)
- Decrease in number of DMFT (mean difference)
Median 2.25 teeth; range 0.5 to 4.4 (10 studies)

❑ **Task Force recommended CWF to prevent or control caries in communities**

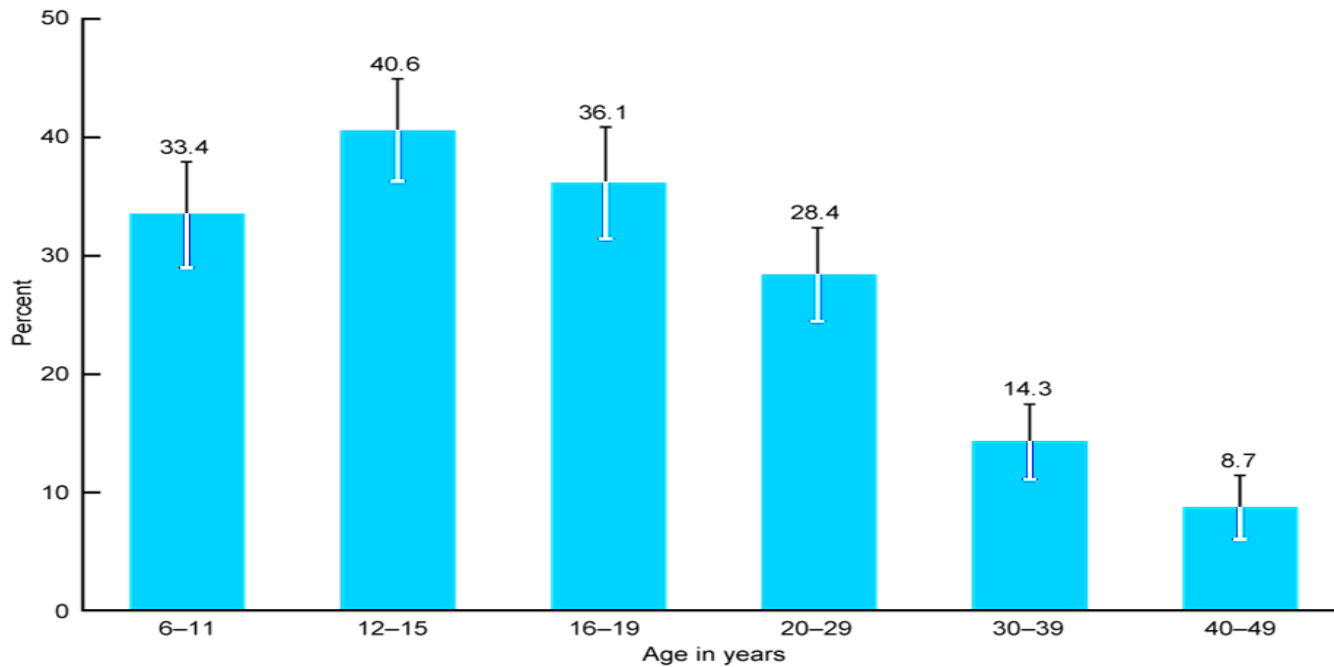
Effectiveness

- ❑ **Systematic review found that community water fluoridation was effective among adults (20–60 years) (9 studies) (N=7853)**
- ❑ **Meta-analysis of 5 cross-sectional studies published after 1979 and conducted among adults with lifetime residency in F and NF communities (N=2530)**
 - **Tooth decay reduced overall by 27% (95% CI 19–34%)**

Cost-Effectiveness

- ❑ **Two systematic reviews by the Community Preventive Services Task Force have found CWF to be cost-saving in all included studies.**
- ❑ **Medicaid costs for treatment of tooth decay were significantly lower among children in fluoridated vs. non-fluoridated communities in**
 - Louisiana parishes: preschoolers (1995–96); \$67 (2010 U.S. dollars)
 - New York counties: children and adolescents (2006); \$24

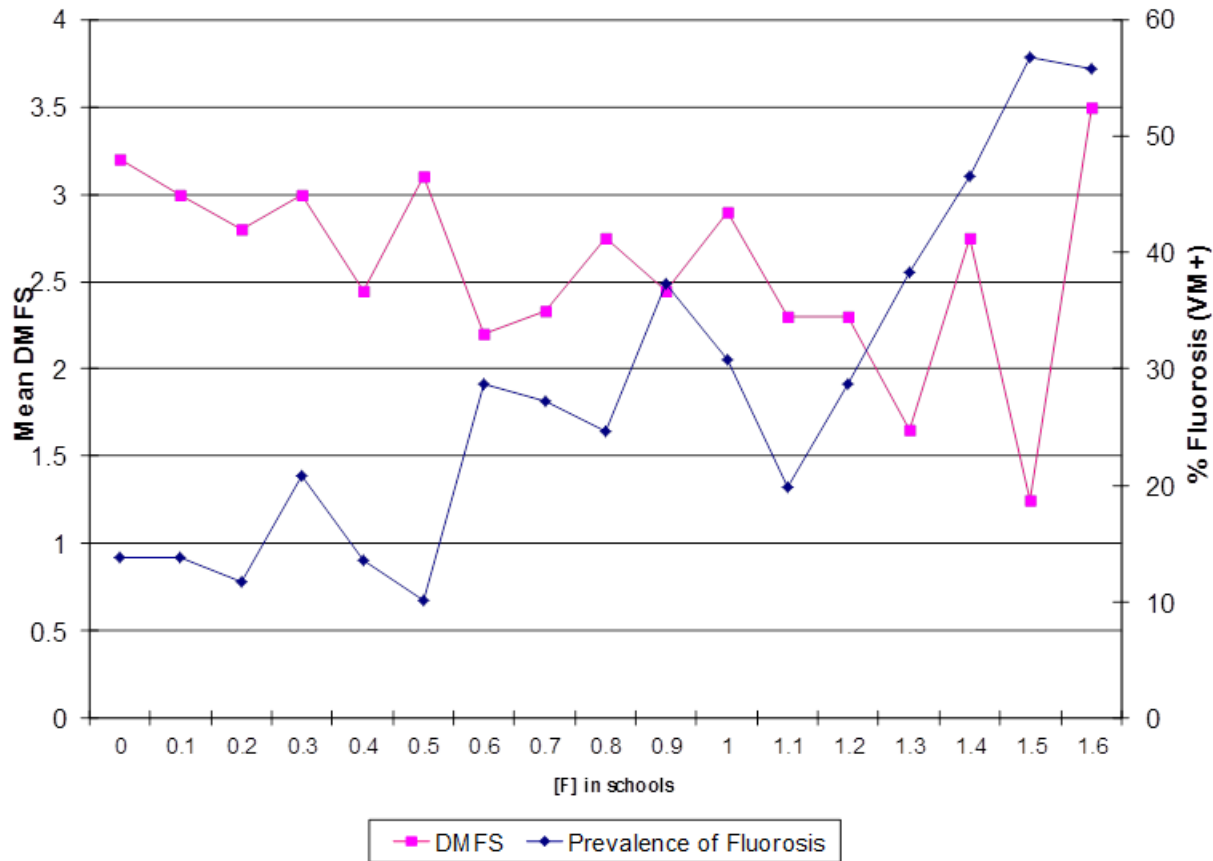
Prevalence in Enamel Fluorosis, Ages 6–49, 1999–2004



92% very
mild to mild



Dental Caries and Dental Fluorosis at Varying Water Fluoride Concentrations



Key finding:
decline in caries as
fluoride content
increased to 0.7 mg/L

Safety

- ❑ **U.S. Environmental Protection Agency (EPA), under the Safe Drinking Water Act**
 - Sets an enforceable standard for the highest concentration of fluoride that is allowed in community water supplies
 - Current MCL of 4.0 mg/L (1986)
 - Secondary MCL of 2.0 mg/L (non-enforceable) (1986)
 - Continues to review and analyze fluoride information to determine whether it is appropriate to revise the drinking water standard

Safety

□ Review by National Research Council (2006)

- Focused on naturally-occurring fluoride concentrations in drinking water of 2–4 mg/L
 - Notably higher than recommendations for CWF (~1 mg/L)
- Found substantial evidence only for increased risk of severe dental fluorosis
- Noted that prevalence of severe dental fluorosis was near zero with fluoride concentrations in drinking water of <2.0 mg/L
- Concluded that lifetime exposure to fluoride at drinking water concentrations of 4.0 mg/L is likely to increase bone fractures compared to exposures at 1.0 mg/L

Concerns: Measures of Intelligence

❑ NRC review (2006)

- Considered several Chinese studies reporting lowered IQ among children exposed to higher fluoride concentrations (2.5 – 4.1 mg/L) in drinking water
- Stated that “the significance of these Chinese studies is uncertain” because important procedural details were omitted; called for more research

❑ Meta-analysis (Choi, 2012)

- Found association; lower IQ scores among children residing primarily in rural China with high fluoride concentrations in drinking water
- Authors noted low quality of included studies; called for studies with measures of exposure at the individual level over time
- Findings cited to support “raised fluoride concentrations” in drinking water as a potential developmental neurotoxicant (Grandjean and Landrigan, 2014)

❑ Cohort study (Broadbent, 2014)

- Found no association between fluoride exposure during childhood and repeated IQ measures during childhood and at age 38 years.

Concerns: Attention Deficit and Hyperactivity Disorder (ADHD)

Ecologic study (Malin, 2015)

- Found that prevalence of ADHD was higher in states with higher percentages of persons receiving fluoridated water (CWF)
- Exposure to CWF was measured at the state level
- No control for other possible explanatory factors for ADHD
 - prenatal exposures to alcohol or tobacco, other environmental exposures (e.g., lead), premature delivery, and low birth weight

Concerns: Hypothyroidism

❑ **Ecologic study (Peckham, 2015)**

- Found a higher prevalence of hypothyroidism among primary care practices located in fluoridated vs. non-fluoridated areas in England
- No control for other explanatory factors at the individual level, such as iodine sufficiency

❑ **NRC review (2006)**

- Considered potential association between fluoride exposure (2 – 4 mg/L) and changes in thyroid function
- Noted limitations of available studies of the effects of fluoride exposure on endocrine functions
 - Many did not measure actual hormone concentrations; some did not report nutritional status or other potential confounders
- Called for better measurement of fluoride exposure, other potential explanatory factors, and outcomes at the individual level

Concerns: Ethics of CWF

❑ **Perceived unethical mass medication of the population**

- CWF is ethical because there is clear evidence of benefit; documented risk limited to dental fluorosis.
- State/local governments decide whether to implement
- Court reviews have consistently viewed CWF as a proper means to improve public health

Implementation of New Fluoridation Recommendation

- ❑ Many water systems and states have moved to adopt 0.7 mg/L
- ❑ Two states will need to adjust state statute
- ❑ Seven states will need to adjust state regulation
- ❑ Three states have 0.7 mg/L as lower limit of control range
- ❑ Revision of engineering and administrative practices in process

Fluoridation: Ongoing Public Health Initiatives

❑ Policy: Track policy changes on CWF

➤ www.fluidlaw.org: database maintained by academic partners

❑ Communications: Educate the public, health care providers, and decision makers

For 70 Years

For 70 years, people in the United States have benefitted from drinking water with fluoride leading to better overall dental health.


- Appealing, engaging
- Reinforces longevity and safety
- Informative



SMILE,
BECAUSE YOU CAN

For nearly 70 years, people in the United States have enjoyed the benefits of drinking water with fluoride, leading to better overall dental health. Adding fluoride to drinking water has been extensively studied and reviewed to ensure it is safe and effective.

Fluoride in water. Nearly 70 years and going strong.
At a faucet near you. CDC.gov/Fluoridation



www.cdc.gov/fluoridation/materials

Building Blocks

Water with fluoride builds a foundation for healthy teeth.

- Concise, simple
- Visual is easy to understand

**WATER WITH FLUORIDE
BUILDS A FOUNDATION
FOR HEALTHY TEETH**

Brush with fluoride toothpaste.

Visit the dentist regularly.

Drink water with fluoride.

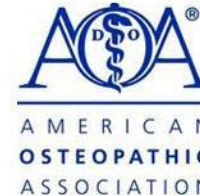
Water with fluoride provides the building blocks to good oral health by strengthening teeth throughout our lives.

Build a better foundation for healthy teeth and keep your teeth stronger, longer. Find out if your community has fluoride in the water at [CDC.gov/Fluoridation](https://www.cdc.gov/Fluoridation).

70th Anniversary of the National Water Fluoridation Act
CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

www.cdc.gov/fluoridation/materials

Expert Consensus: Professional Organizations Supporting CWF



Pew Children's Dental Campaign available at <http://www.pewstates.org/projects/childrens-dental-policy-328060>
CWF: community water fluoridation

Thank You



For more information please contact Centers for Disease Control and Prevention

1600 Clifton Road NE, Atlanta, GA 30333

Telephone: 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348

Visit: www.cdc.gov | Contact CDC at: 1-800-CDC-INFO or www.cdc.gov/info

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

The author has no conflicts to disclose.