

FLUORIDE AND PUBLIC HEALTH

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No longer needed

Unsafe

Toxic

Doesn't work

Takes away choice

Forced medical treatment

TERMINOLOGY

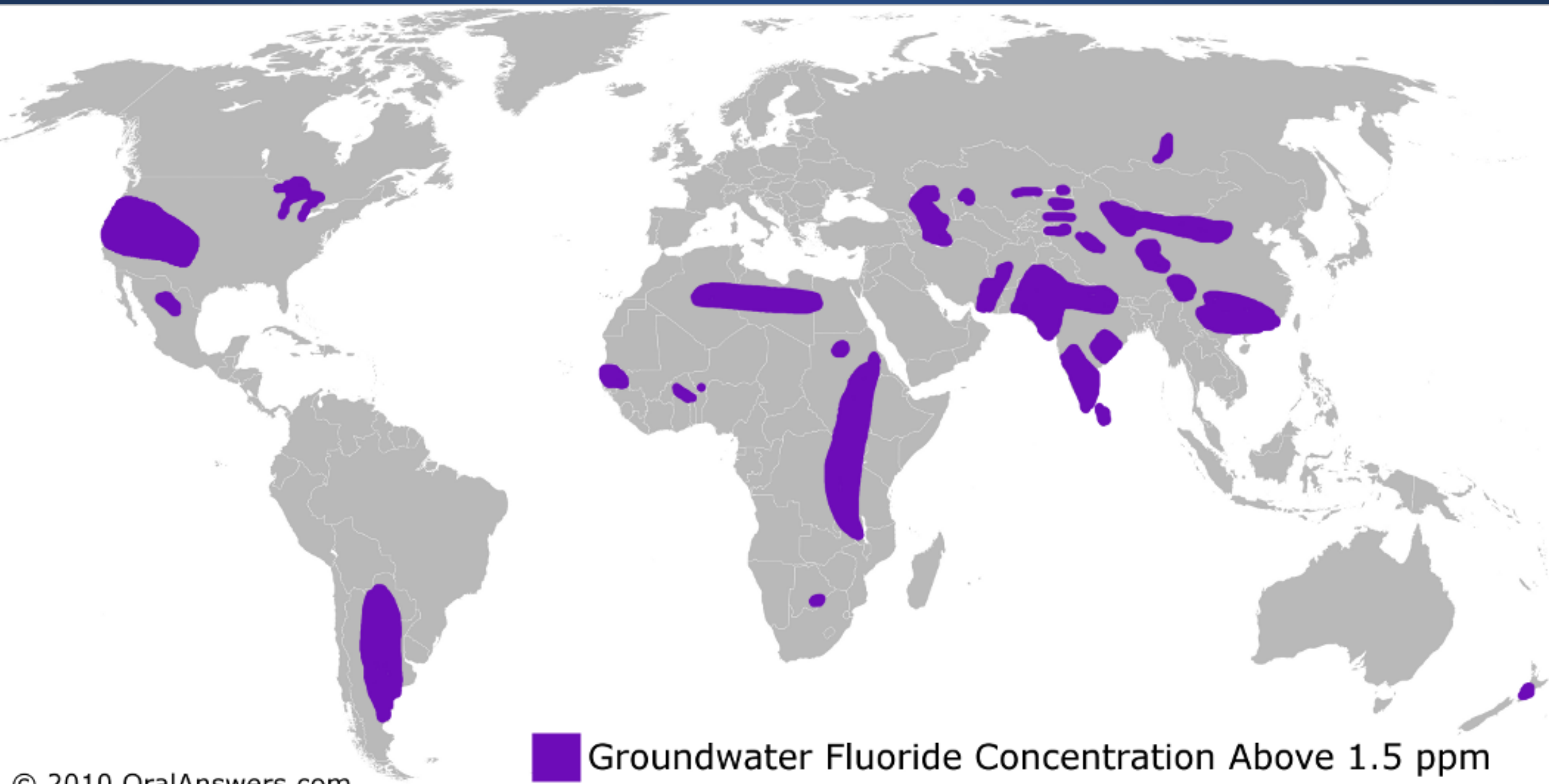
- Dental decay=Dental caries
- Cavities=carious lesions

WHAT IS FLUORIDE?

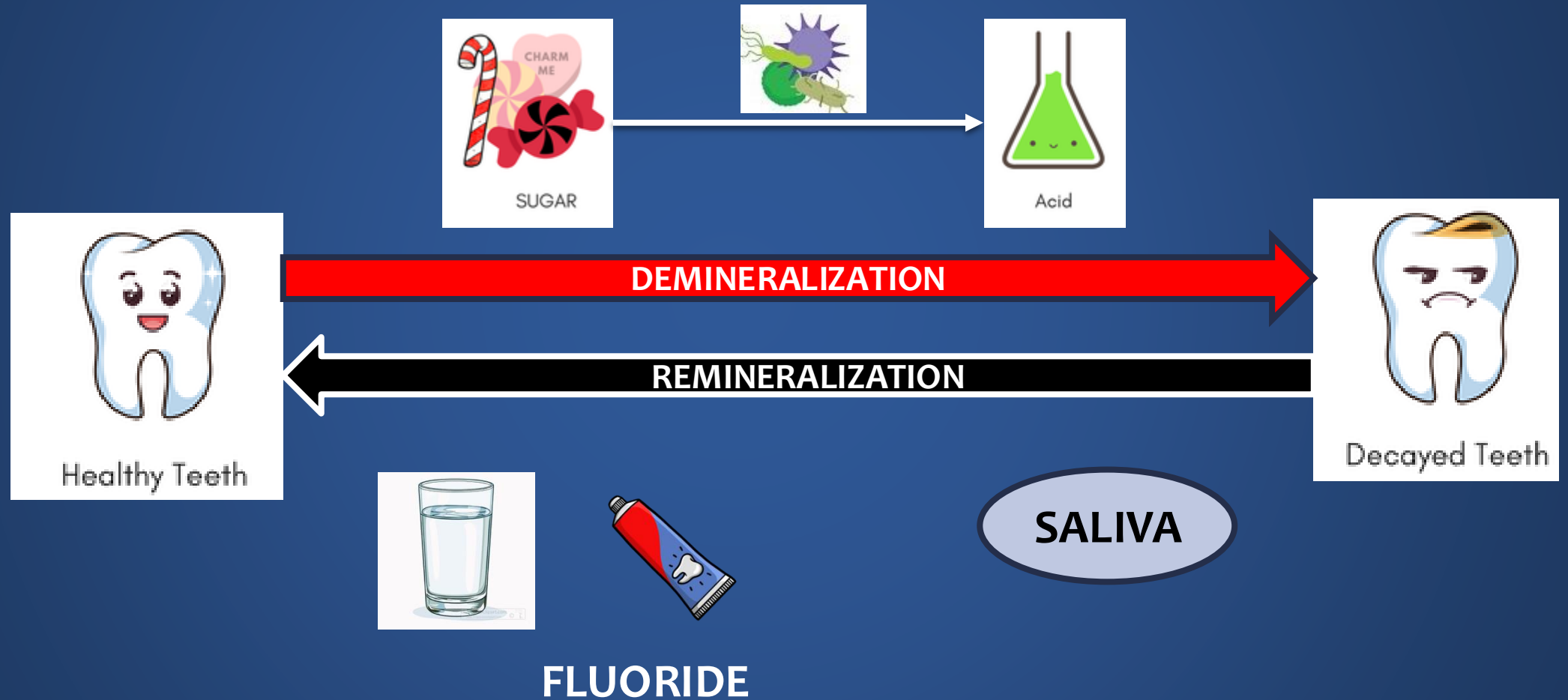
- Fluoride is a ubiquitous mineral present in all soil and bodies of water on Earth
 - Concentration varies
 - Natural presence in water led to discovery of cavity-preventing properties
 - Worldwide, 57 million people consume water with naturally occurring fluoride and more than 377 million drink water with added fluoride.
- It is a normal dietary constituent. Naturally rich sources:
 - Black tea
 - Seafood
 - Grapes
- Fluoride content in other food and beverages vary depending on concentration in soil or water source use in manufacture

WHAT IS COMMUNITY WATER FLUORIDATION (CWF)?

- With CWF, the fluoride level in water is adjusted to consistently deliver maximal preventive benefit while minimizing side effects.
 - US: 0.7 ppm (mg/L)
- Worldwide, more than 377 million people drink water with added fluoride.
- 57 million people consume water with naturally occurring fluoride.



HOW DOES FLUORIDE PREVENT CAVITIES?



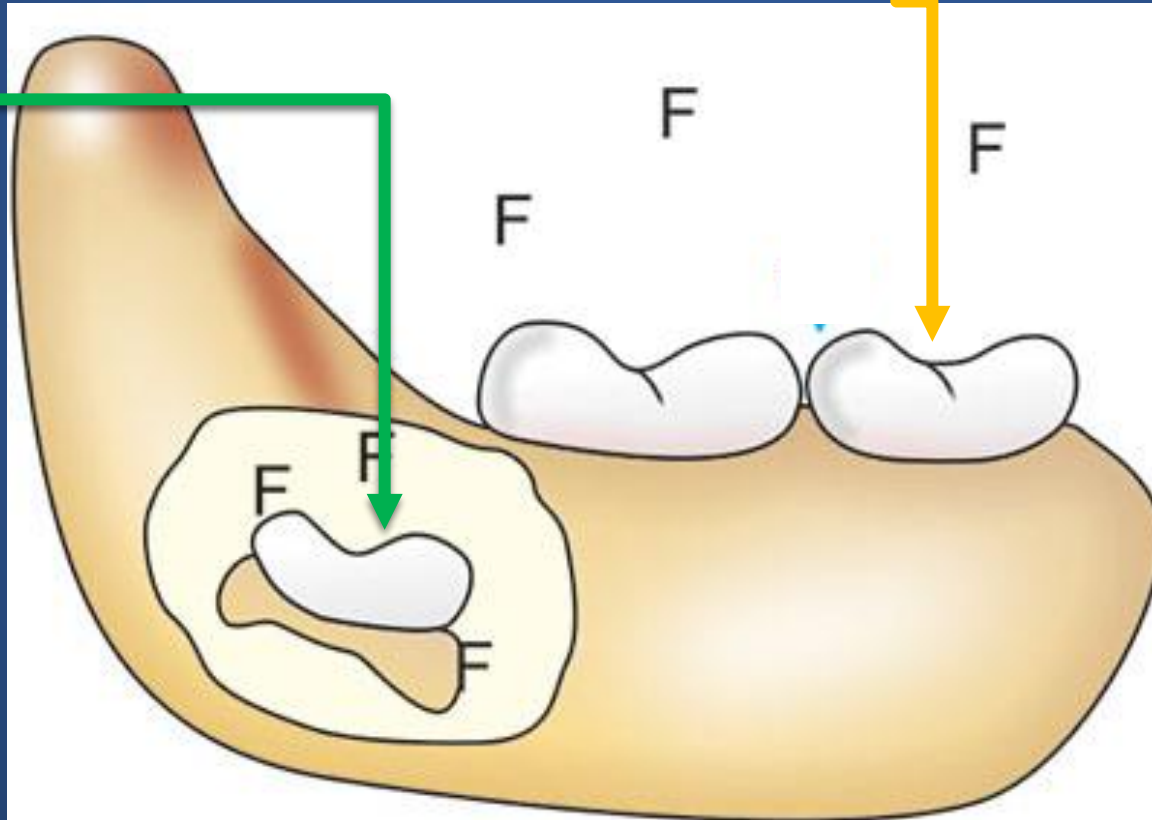
HOW DOES FLUORIDE WORK?

- Fluoride aids in incorporation of calcium and phosphate into enamel and is itself incorporated into enamel during remineralization.
- Fluoride-containing enamel, fluorapatite, is harder and less acid-soluble than the original enamel it replaces.



PRE-ERUPTIVE AND POST-ERUPTIVE FLUORIDE EFFECTS

Both pre-eruptive (ie, systemic) and post-eruptive effects in children 8 years and under



Post-eruptive (ie, topical) effects in older children and adults

HOW DID COMMUNITY WATER
FLUORIDATION COME ABOUT?

1938-DENTAL DECAY WAS UNIVERSAL

- Among 15-year-olds, 98% had caries and 50% had lost at least one tooth from decay.
 - Most recent data: 48% of 12- to 15-year-olds in US have at least one cavity and about 5% had lost a tooth to decay, but more than half had never had a cavity.
- More than half of older adults had lost all of their teeth and required dentures
- Leading reason for rejection of draftees in WWII was too few “serviceable teeth”—18% rejected
 - Needed 6 opposable teeth in each jaw
 - On average, men 20 to 35 years of age had lost an average of 4.2 teeth.

IN 1938...

- Dental caries is generally recognized as a physical impairment which exceeds in prevalence all others known to occur in children in the United States.
- Although the use of the toothbrush, dietary regulation, prophylactic odontotomy (placing a filling to obviate future decay) and the need for the application of chemotherapy (silver nitrate) have been suggested and advocated...
- No other effective method for the control and prevention of dental caries has been accepted other than the replacement of the carious tooth structure by chemically stable filling materials.

-Klein and Palmer, *Public Health Reports*, 1938

THE DISCOVERY OF FLUORIDE

- In some areas of the US, dentists noticed more “mottled enamel” (dental fluorosis) and subsequently that **mottled teeth were more resistant to decay.**
- Led to identification of fluoride naturally present in water as the factor responsible both for less dental decay and more dental fluorosis, depending on the concentration of fluoride in the water.

DENTAL FLUOROSIS AND WATER FLUORIDE CONCENTRATION

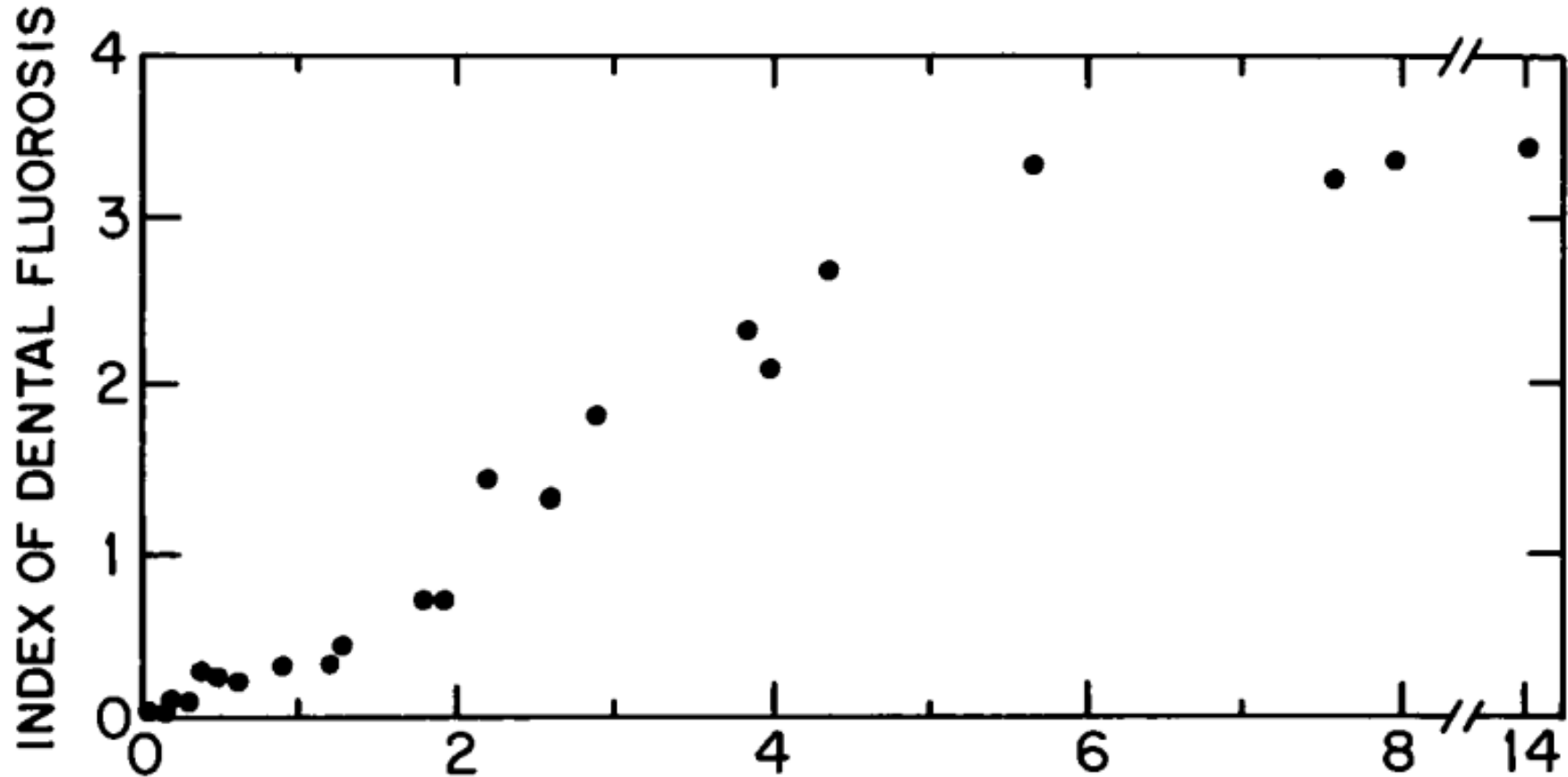


FIG. 1.—Index of dental fluorosis associated with the continued use of a communal water supply having fluoride content (in ppm) .

DENTAL CARIES EXPERIENCE VS. NATURALLY OCCURRING FLUORIDE CONCENTRATION IN PUBLIC WATER (DEAN, 1942)

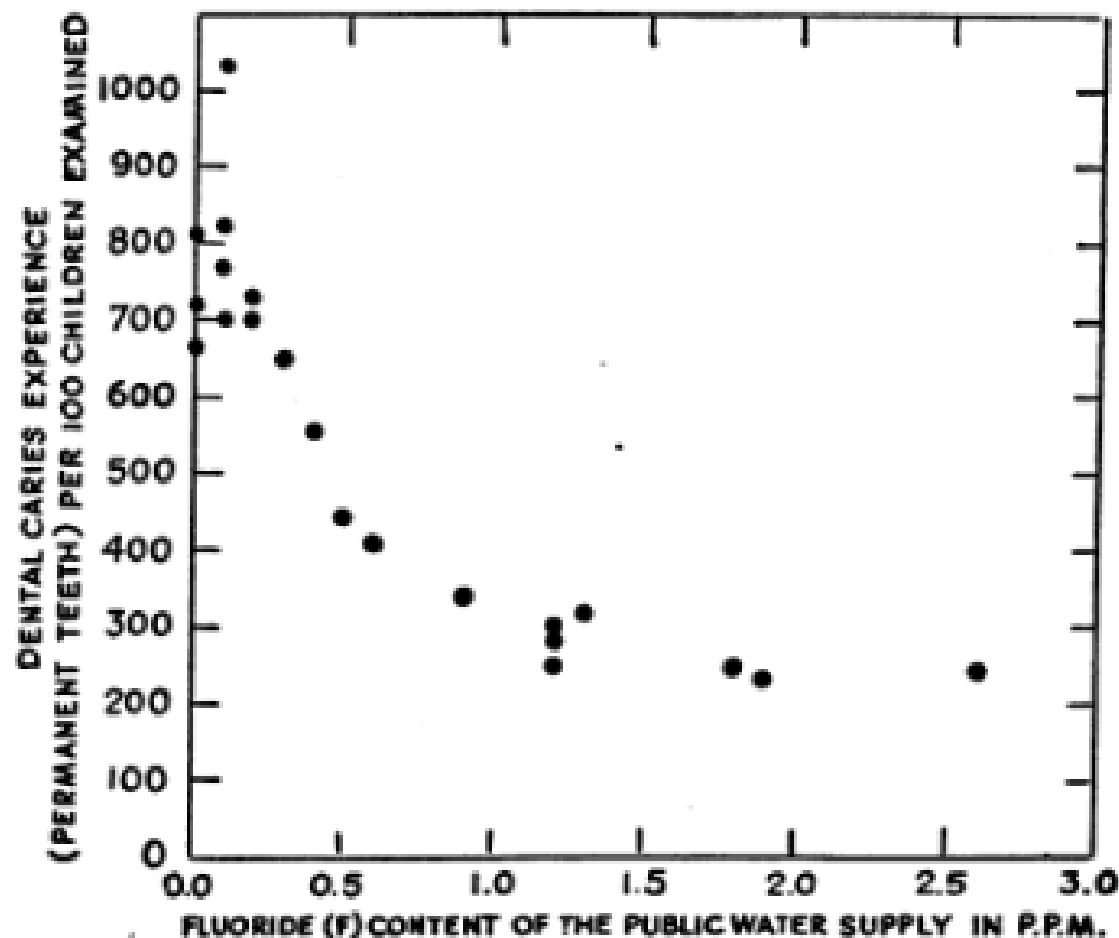
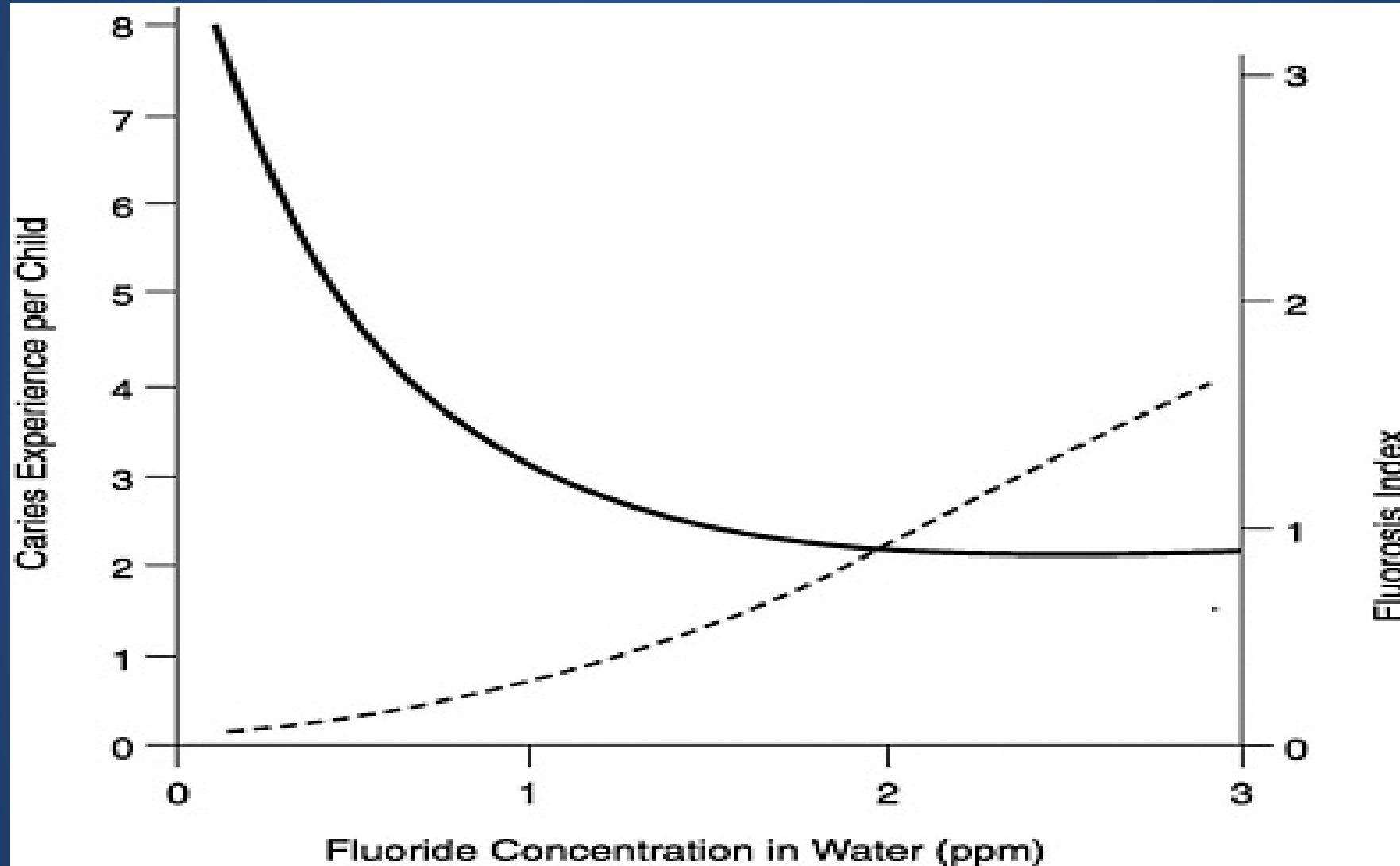


FIGURE 2

CAVITIES VS. FLUOROSIS



WHAT IS DENTAL FLUOROSIS?



- Dental fluorosis refers to localized changes to tooth enamel, presenting in its milder forms, such as seen now in US, as white lacy markings on the teeth.
- Teeth with fluorosis are *MORE* resistant to decay.
- Fluorosis occurs with fluoride exposure during tooth development.
 - Dose-dependent
 - When severe—enamel prone to staining—rare in US.



DR FRANK MCCLURE, ONE OF THE ORIGINAL FLUORIDE
RESEARCHERS:

“It seemed improbable that fluoride in drinking water could be both a benefit and deterrent to dental health, depending on its concentration.”

PAIRED CITY TRIALS

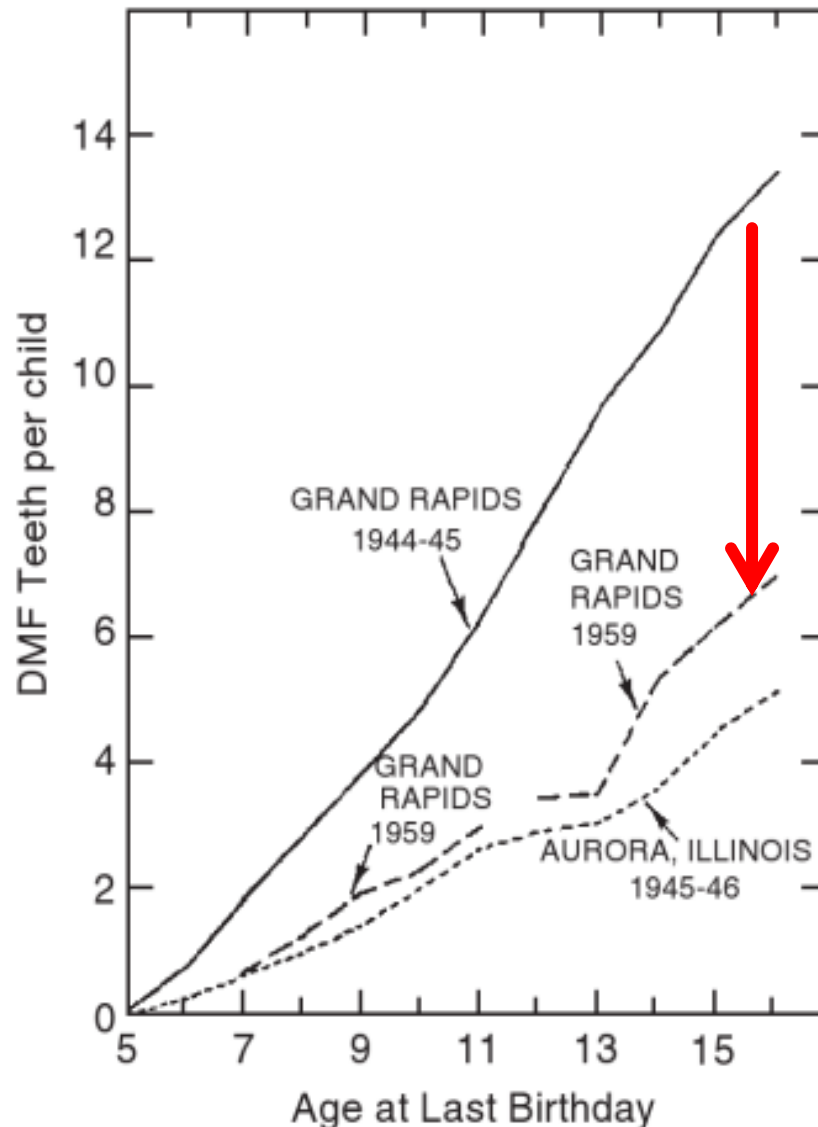
- Community-based trials initiated in 1945 compared cavities in cities with add fluoride to paired control cities
- 1945 Grand Rapids, Michigan-first city to fluoridate
- Muskegon, MI control city (0.2ppm) similar dental decay rates at baseline
 - After 6 years Muskegon, seeing the dramatic effect of CWF, decided to fluoridate too.



MORE ON THE HISTORY OF COMMUNITY WATER FLUORIDATION

- Other paired city trials (CWF vs control) in US
 - Newburgh-Kingston, NY (1945-1955)
 - Evanston- Oak Park,. IL (1946-1960)
- Similar studies in Canada, Netherlands, New Zealand, Great Britain
- Overall, 50-60% reduction in number of cavities in treatment cities over time with little change in control cities

COMMUNITY WATER FLUORIDATION: THE IMPACT



- 15-year-olds: average number teeth affected by caries decreased from **12.5** in 1944 to **6.2** in 1959 in Grand Rapids
- Aurora, IL naturally fluoridated at 1.2 ppm—15-year-olds averaged 4.3 in 1945

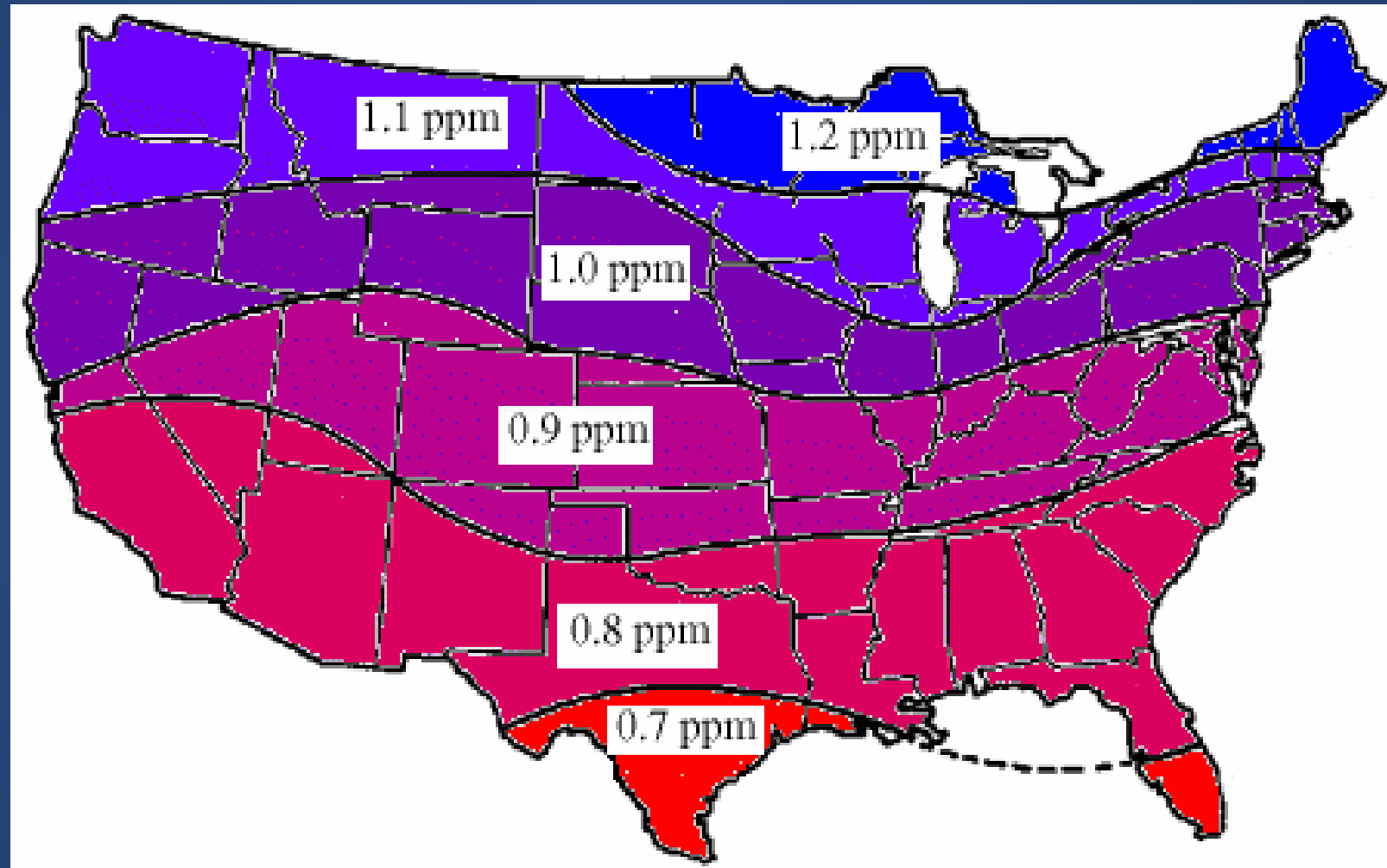
DR FA ARNOLD:

- “No such dramatic and persistent inhibition of caries in large population groups had ever been demonstrated by any other means than fluoridation of the domestic water supply.”

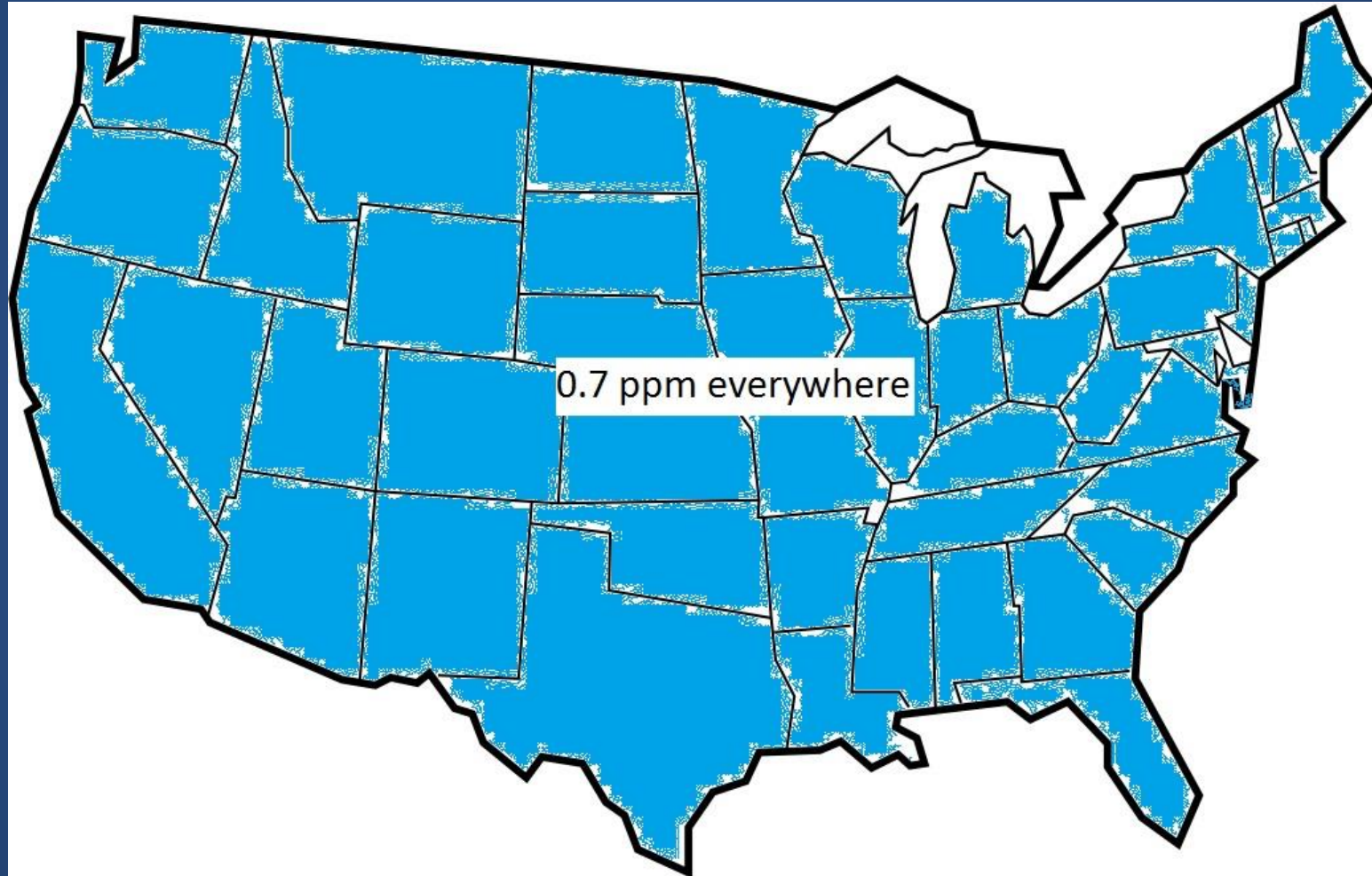
RAPID EXPANSION IN CWF

- Widespread adoption of CWF followed: About $\frac{3}{4}$ of Americans on public water systems receive fluoridated water.
- Most decisions about CWF are made on local or state level
- Variability across states
- Many other countries provide CWF to the majority of their population
 - Where not possible, salt fluoridation is available and advocated by WHO
- Now 0.7ppm in all of US

THEN...



NOW



WASHINGTON STATE: 56% OF RESIDENTS ON COMMUNITY WATER SYSTEMS RECEIVE CWF

From DOH. 5 pages. Fluoridated Public Water Systems by county



Operations and Maintenance

331-754 Optimally Fluoridated Public Water Systems

331-754 • Updated 8/28/2025

Is My Water Fluoridated?

Use this table to find out if your drinking water is fluoridated. First, find the county you live in, then the city, and look for your public water system (PWS) name. You can find most PWS names on your utility bill. If you don't receive a bill, you can check with a homeowner's association, landlord, leasing company, or the city and county you live in. Once the water system information is found, compare it to this table. If you are served by a listed system, then your water is optimally fluoridated.

The U.S. Public Health Service (PHS) recommendation for fluoride concentration in drinking water for the prevention of cavities is 0.7 mg/L, which is often referred to as "optimally fluoridated drinking water."

To be considered optimally fluoridated, a public water system must deliver fluoridated water to all the full-time residential population the system serves. A water system does this in two ways: by adjusting the level of fluoride in all the water it serves (fluoride source = "Fluoridated") or purchasing water from a system who fluoridates all of its water (fluoride source = "Intertied"). If a system listed below is designated as Intertie, purchases water AND has sources of its own, it also adjusts water in its own sources to be considered providing optimally fluoridated water.

We support fluoridation of drinking water as a sound, population-based public health measure. [See Washington State Health Office Tao Sheng Kwan-Gett, MD MPH statement on community water fluoridation.](#)

County	Public Water System City	System Number	Public Water System Name	Fluoride Source
CLARK	BATTLE GROUND	04700	BATTLE GROUND WATER DEPT, CITY OF	FLUORIDATED
CLARK	CAMAS	10800	CAMAS MUNICIPAL WATER SEWER SYSTEM	FLUORIDATED
CLARK	VANCOUVER	91200	VANCOUVER, CITY OF	FLUORIDATED
COWLITZ	CASTLE ROCK	11800	CASTLE ROCK MUNICIPAL WATER	FLUORIDATED
COWLITZ	KALAMA	37550	KALAMA, CITY OF	FLUORIDATED
COWLITZ	KELSO	38000	KELSO, CITY OF	FLUORIDATED
COWLITZ	LONGVIEW	48100	LONGVIEW WATER DEPARTMENT	FLUORIDATED
COWLITZ	KELSO	AD882	BEACON HILL EAST	INTERTIE
COWLITZ	KELSO	15650	BEACON HILL WATER & SEWER DISTRICT	INTERTIE
COWLITZ	WOODLAND	18150	DAVIS TERRACE WATER ASSN	INTERTIE
COWLITZ	KELSO	88905	TOUTLE COMMUNITY REGIONAL WATER	INTERTIE
FRANKLIN	PASCO	66400	PASCO WATER DEPARTMENT	FLUORIDATED

Clark
Cowlitz
Franklin
Gray's Harbor
Island
King
Kitsap
Kittitas
Lewis
Pacific
Pierce
Skagit
Snohomish
Spokane
Wahkiakum
Whitman
Yakima

WASHINGTON STATE

Naturally Occurring Fluoride - Average by County



Data formulated from 15,527 reported fluoride results for PWS from Jan 2000 – May 2015
Source of data: Sentry Database

Examples of WA cities with naturally occurring fluoride:

Moses Lake (Grant) –
~0.8 mg/L

Clarkston (Asotin) –
~0.8 mg/L

Selah (Yakima) – ~0.97 mg/L

Davenport (Lincoln) –
~1.0 mg/L

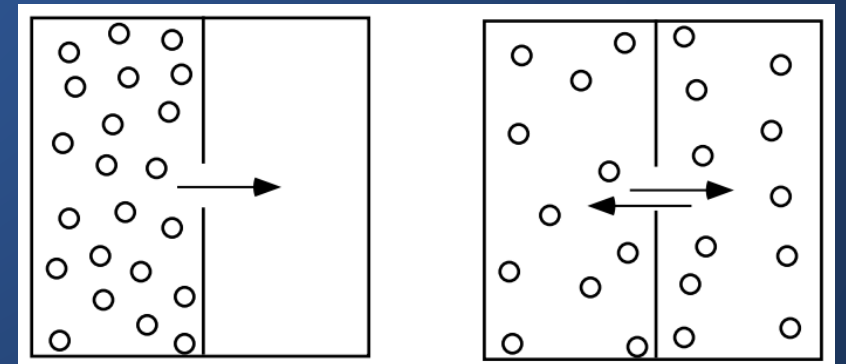
Warden (Grant) – ~0.96 mg/L

OK. BUT WITH OTHER SOURCES OF FLUORIDE NOW, DO WE STILL NEED CWF?

- Now, less of a difference in dental decay in fluoridated vs non fluoridated communities relative to the 1950's. Why?
- Commercial availability of fluoride toothpaste beginning in the late 1950s

COMMUNITY WATER FLUORIDATION— DIFFUSION EFFECT

- More and more cities with CWF
- Beverages and food manufactured with fluoridated water transported to and consumed in non-fluoridated areas
 - Study of 500 juices and juice-flavored drinks--43% had a fluoride concentration above 0.6 ppm.



OK. BUT WITH OTHER SOURCES OF FLUORIDE NOW, DO WE STILL NEED CWF?

- Still, optimally fluoridated water remains an effective preventive strategy for children and adults
 - reducing decay by about 25% over the lifespan and saving about \$20 in dental restoration costs for every dollar invested in CWF.
- CWF particularly benefits populations who have difficulty accessing dental care, reducing disparities.

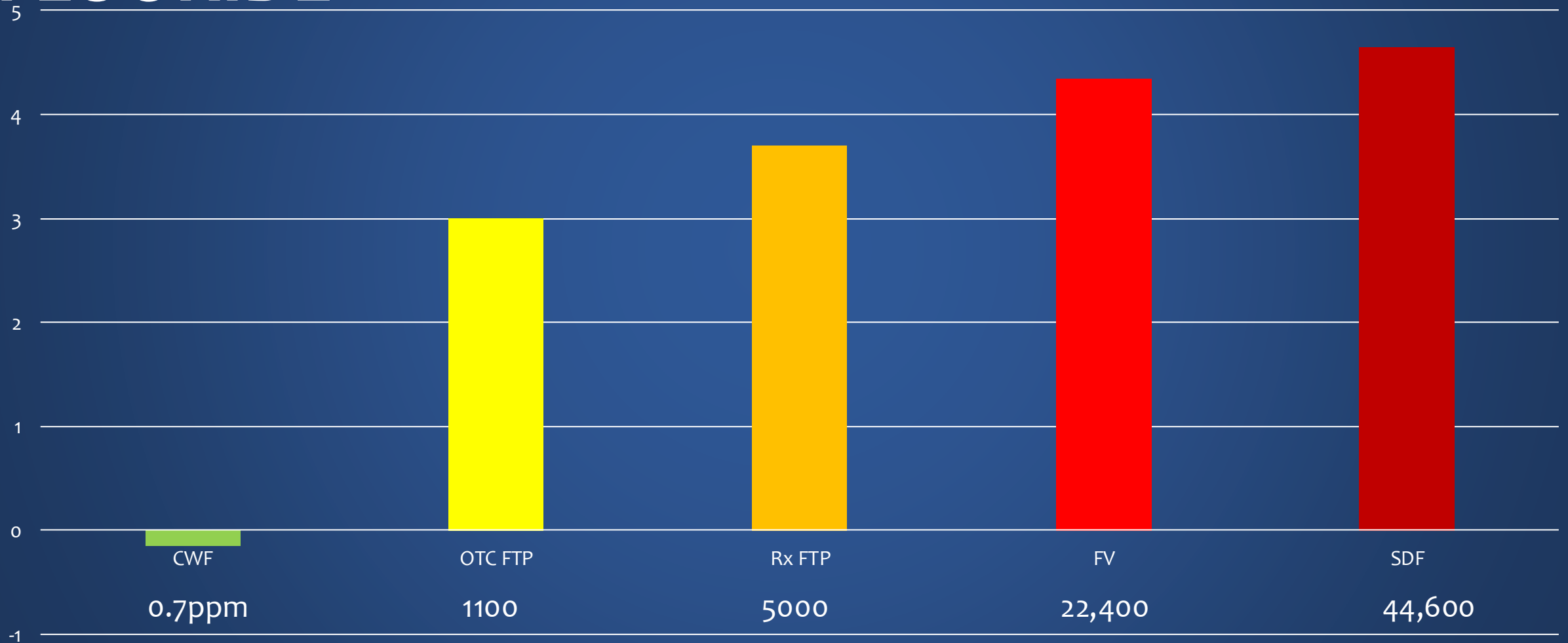
FOR SOME CHILDREN, CWF MAY BE THEIR ONLY CONSISTENT PROTECTION AGAINST CAVITIES

- Its impact can be profound.
- 2020 North Carolina study found that lifetime CWF exposure (through age 19) virtually eliminated oral health socioeconomic disparities.
- When CWF is discontinued, dental decay rates often rise, worsening inequities.

IS CWF MASS MEDICATION?

- No, CWF is primary prevention replicating a naturally occurring phenomenon
 - Chlorine
 - B vitamins
- Passive public health intervention available to all regardless of resources or access to dental care
- Fluoride, in high concentration formulations can TREAT dental decay

LOG F PPM FOR VARIOUS FORMULATIONS OF FLUORIDE



BUT IS CWF SAFE?

- Controversies around CWF are nothing new.
- Recent discourse on fluoride safety has focused on possible adverse effect on cognition.
- Many epidemiologic studies associating fluoride with IQ have been criticized for methodologic flaws.
- Studies conducted in regions of China, India, and Iran, where there are very high levels of naturally occurring fluoride causing endemic skeletal and dental fluorosis, **have limited, if any, relevance to CWF (but NTP did not make this clear)**.

DOESN'T “THE RESEARCH” SAY CWF DECREASES IQ IN CHILDREN?

- Bottom line: NO
- Different study types: individual-level and ecologic-level
- Two individual-level exposure studies noteworthy for their similarities: Canadian (Green et al, 2019) and Spanish (Ibarluzea et al, 2022)
 - Both comparing subjects living in communities with and without CWF and relying on convenience subsamples of mother-child pairs recruited for a larger environmental study.
 - Both assessed the association between prenatal fluoride exposure, measured by spot maternal urinary fluoride (s-MUF), and offspring neurocognitive test results.
- Completely opposite results

YES. OPPOSITE RESULTS!

- In Green (Canada), higher s-MUF associated with *lower* IQ in boys only.
- In Ibarluzea, higher s-MUF associated with *higher* McCarthy (widely used developmental test) scores at age 4 in boys only.
- Thus, Ibarluzea's study was *unable to replicate* Green's findings and in fact, found opposite results!
- But only Green's study, published in *JAMA Pediatrics*, got the attention and press.

WHY WOULD THERE BE OPPOSITE RESULTS?

- Variety of possible reasons
- Methodologic problems in both
- But most likely reason is that s-MUF is *neither accurate nor valid* to quantify individual fluoride exposure in a pregnant woman or her fetus.
 - Guichon et al, 2024
- Calls into questions conclusions from studies relying on s-MUF as an individual-level exposure measure, as well as NTP report and meta-analysis.

IS THERE ANY OTHER RESEARCH?

- Ecologic-level: residence in an area supplied by water with optimal fluoride vs lower fluoride.
- Population-based and longitudinal: More reliable for establishing causality.
- Three studies in past 10 years:
 - New Zealand (Broadbent et al, 2015)
 - Sweden (Aggeborn and Ohmann, 2021)
 - Australia (Do et al, 2023 and 2024)
- None found any effect on IQ or other behavioral or developmental outcome.
- Growing up in a fluoridated area did lead to fewer cavities.

SWEDISH STUDY (AGGEBORN AND OHMANN, JOURNAL OF POLITICAL ECONOMY)

- Mandatory military service for Swedish male citizens (80,000 subjects)
- Sweden does not have CWF, but the researchers relied on varying natural concentration of fluoride in water.
- Found “zero effect” of fluoride exposure on IQ.
- Better oral health *and* higher earning potential with fluoride exposure.
- *“This effect is foremost driven by individuals from a lower socioeconomic background.”*

POTENTIAL PROBLEMS WITH ECOLOGIC STUDIES

- Limited ability to characterize individual fluoride intake.
 - The NZ study considered individual fluoride supplements and fluoride toothpaste use but not tap water intake.
 - Drinking tap water was the norm in Sweden and NZ at the time of these studies, making it more likely that residence reflected fluoride exposure.
 - The more recent Australian study accounted for individual bottled water intake.
- Although these ecologic studies did not specifically assess prenatal fluoride exposure, pre- and post-natal fluoride exposures are expected to be highly correlated.

OTHER REPORTS

- Recently, several independent research groups in Canada, Europe, and Australia, as well as a US meta-analysis have examined research on fluoride exposure and adverse neurocognitive outcomes...
- All concluded that the collective evidence does not support an association at US levels of fluoride in CWF.

SUMMARY

- Despite the influence of political forces, CWF remains safe, cost-effective, and equitable strategy for prevention of dental decay for individuals of all ages.
- Epidemiologic evidence informs our understanding that fluoride is beneficial throughout the lifespan.

DR TERRY LUTHER (SURGEON GENERAL 1961-64), APPOINTED BY PRESIDENT KENNEDY

“The Four Horsemen of Public Health are the pasteurization of milk, the purification of water, immunization against disease and fluoridation.

None of these gains have been achieved easily.

None of the four measures has endured more severe obstruction than fluoridation.”

WHY SHOULD FLUORIDE MATTER TO PEDIATRIC PROVIDERS?

- Because fluoride is the most important modality available to prevent dental decay.
 - Community water fluoridation, toothpaste, supplements, professionally applied treatments
- Dental decay is the most common chronic childhood disease.
- Affects half of all children.
- Disproportionately impacts children experiencing poverty and/or who are racial or ethnic minorities.
- Untreated dental decay causes pain and suffering.
- Compelling reasons for pediatricians to address oral health.

AS A PEDIATRIC PROVIDER, HOW CAN I IMPROVE THE ORAL HEALTH OF MY PATIENTS?

- Educate and advocate around community water fluoridation. Tap water is safe to drink.
- Start fluoride toothpaste early. Use the right amount:
 - Rice-grain size in children under 3 years
 - Pea-size amount in children 3 and over
- “Healthy eating” for life-long health (ie, preventing obesity, heart disease, Type 2 diabetes) also promotes oral health.
 - Less sugar (less juice), less highly processed foods, less snacking
- Children at high-risk of cavities (family history, AI/AN, lower income) should be connected with dental care by 12 months of age.
- Learn to recognize early signs of dental decay for prompt treatment.
- Everyone deserves the opportunity for good oral health and access to high-quality dental care.

