

# SUPPORTING THE COMMUNITY: WATER FLUORIDATION IN ALBUQUERQUE

Howard Pollick, BDS, MPH  
Health Sciences Clinical Professor  
School of Dentistry  
University of California San Francisco

4/9/2014

Albuquerque Bernalillo County Water Utility  
Authority. TOWN HALL MEETING

# Overview

2

- What is tooth decay (dental caries)
- What is enamel fluorosis?
- Why fluoridate the water?
- Safety of fluoridation
- Cost-effectiveness of fluoridation
- WHO supports fluoridation?
- Why change to 0.7 parts per million?
- Comparing pro- and anti- fluoridation
- Summary

# Optimum Goal – Minimal decay; minimal fluorosis

3

80% of 6-39 year-olds have no signs of enamel fluorosis in front teeth – 1999-2004

No severe enamel fluorosis in fluoridated communities

**Urgent Dental Needs:**  
**Fluoridated: 4%**  
**Non-fluoridated: 25%**

California Oral Health Needs Assessment:  
High School Students: 10<sup>th</sup> grade:1993-94



Normal



Questionable



Very Mild



Mild



Untreated Decay



Decay – Abscess

# Why fluoridate the water?

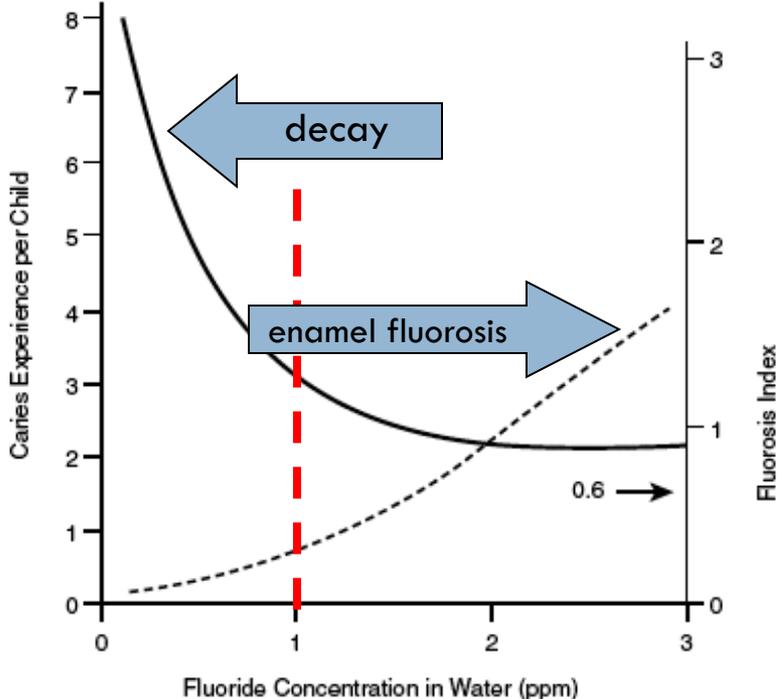
4

- To simulate the optimum natural environment
- Pre-1945 evidence
- Over 7000 children
- 12-14-year-olds
- Midwest US - 21 cities
- Comparing
  - ▣ tooth decay prevalence,
  - ▣ enamel fluorosis and
  - ▣ fluoride concentration of the water

# Fluoride in water: Caries and Fluorosis: Pre-1945 data

## The Scientific Basis for fluoridation

Historical Background



- Over 7000 children
- 12-14-year-olds
- Midwest US
- 21 cities
- CFI >0.6 Public Health Significance

Number of cities studied	Number of children examined	Number of DMF teeth per 100 examinees							Fluoride content of water (ppm)
		0	100	200	300	400	500	600	
11	3867	[Bar chart showing DMF teeth per 100 examinees for 11 cities]							< 0.5
3	1140	[Bar chart showing DMF teeth per 100 examinees for 3 cities]							0.5 - 0.9
4	1403	[Bar chart showing DMF teeth per 100 examinees for 4 cities]							1.0 - 1.4
3	847	[Bar chart showing DMF teeth per 100 examinees for 3 cities]							> 1.4

Dean, H.T. in *Dental caries and Fluorine*, Washington, American Association Advancement Science, pp. 5-31, 1946

# Why fluoridate the water?

*It started in 1945*

6

- Four community trials of fluoridation
- Compared fluoridated vs non-fluoridated
- From 1945 to 1960 - (12-14 year-olds)
- Showed 49% - 70% reduction in tooth decay

# Why fluoridate the water?

*Subsequent studies in an era of fluoridated toothpaste use*

7

- Tooth decay in fluoridated vs non-fluoridated areas
- 1987-88 (USA)
  - ▣ Comparing prevalence of decay in regions of USA
  - ▣ 75% fluoridated - no difference – diffusion effect
  - ▣ 20% fluoridated – 60% difference
  - ▣ Increasing benefit by age – 1.5 teeth for 17-year-olds
- 1993-94 (California)
  - ▣ Reduced disparities in decay between poor and non-poor
  - ▣ Significant benefit for children from poor families

# Safety of Water Fluoridation

## U.S. and International Scientific Reviews

8

Scientific Reviews

**ALL these reviews have found water fluoridation to be safe**

- ▣ **Public Health England. 2014**
- ▣ California Environmental Protection Agency's Office of Environmental Health Hazard Assessment 2011 – fluoride is not a carcinogen
- ▣ **Health Canada. 2010**
- ▣ **National health and medical research council, Australia. 2007**
- ▣ **National Research Council, U.S.A. 2006)**
- ▣ World Health Organization (2006)
- ▣ Agency for Toxic Substances and Disease Registry, U.S. PHS (2003)
- ▣ International Programme on Chemical Safety, W.H.O. (2002)
- ▣ Forum on Fluoridation. Ireland (2002)
- ▣ **Medical Research Council, U.K. (2002)**
- ▣ **University of York, U.K. (2000)**
- ▣ Institute of Medicine, U.S.A. (1999)
- ▣ Locker: Health Canada (1999)

# Recent fluoridation reviews

- **England – 2014 monitoring report**
  - 5-year olds in fluoridated areas are 28% less likely to have had tooth decay than those in non-fluoridated areas.
  - When deprivation and ethnicity (important factors for dental health) are taken into account
  - 45% fewer hospital admissions of 1-4 year-old children for dental caries in fluoridated areas. (mostly for extraction of decayed teeth under a general anesthetic)
  - There was NO evidence of a difference in the rate of hip fractures, Down's syndrome, osteosarcoma or all cancers, between fluoridated and non-fluoridated areas.

# Thyroid and fluoride

## *absence of an association*

10

- The available medical and scientific evidence suggests an **absence of an association** between water fluoridation and thyroid disorders.
- Many major reviews of the relevant scientific literature around the world support this conclusion.
  - ▣ Systematic review in 2000 by the NHS Centre for Reviews and Dissemination at the University of York, England
  - ▣ 2002 review by an international group of experts for the International Programme on Chemical Safety (IPCS)
- [http://www.bfsweb.org/facts/sof\\_effects/statementofflo.htm](http://www.bfsweb.org/facts/sof_effects/statementofflo.htm)

# No endocrine effects of fluoridation

*including thyroid effects*

11

- **None reached the level considered to be signs of adverse effects at the 4mg/L level**
- Fluoride in Drinking Water: A Scientific Review of EPA's Standards, National Research Council committee
- March 22, 2006, News Conference
- Chairman John Doull, M.D., Ph.D., Professor Emeritus of Pharmacology and Toxicology, University of Kansas Medical Center, Kansas City
- [http://www.nap.edu/webcast/webcast\\_detail.php?webcast\\_id=325](http://www.nap.edu/webcast/webcast_detail.php?webcast_id=325)
- <http://video.nationalacademies.org/ramgen/news/isbn/030910128X.rm>

# Basic principle of toxicology

*It's the dose that distinguishes a remedy from a poison*

12

- When studying the relationship between any substance and a disease or condition, it is most important to consider the dose – the amount that an individual is exposed to over a certain amount of time.
- Drinking water itself can be toxic if too much is consumed over a short period of time; it has been fatal
- Yet we don't consider water to be a poison or to be toxic
- The same is true of fluoride
- A certain amount consumed over a period of time could be toxic (too much) or it could be beneficial (an optimum amount).

# Recent article on neurotoxicity and fluoride

## *absence of an association with fluoridation*

13

- I appreciate the concern seeing the source of the recent article (*Lancet Neurology*) and 'new' listing of fluoride as a neurotoxin.
- The authors are Philippe Grandjean of the Harvard School of Public Health and Philip Landrigan from New York's Icahn School of Medicine
- However, the single reference on fluoride used in the Lancet article is from Grandjean's review of a collection of studies from China, Mongolia and Iran where there were very high levels of fluoride in the drinking water and other potential risk factors were not considered, including the concentration of arsenic. Published in *Environmental Health Perspectives* in 2012
- There have also been several criticisms of the methods employed with the studies used in that review.
- **The lead author of the 2012 review has stated that the findings do not apply to the conditions we have in the US.**

# Recent article on neurotoxicity and fluoride *absence of an association with fluoridation*

14

- As reported in The Atlantic by James Hamblin March 18, 2014
- **“Fluoride is very much a two-edged sword,” Landrigan said. “There’s no question that, at low doses, it’s beneficial.”**
- “Are the exposure levels in China comparable to what we have in our drinking water and toothpaste?”, he was asked.
- “No, they’re probably higher,” Landrigan said. “In some places in China, there are naturally high levels of fluoride in the groundwater.”

# Safety of Water Fluoridation

15

Environmental safety

## Fluoridation is safe for the environment

- Environmental concerns have been investigated in literature reviews
- Tacoma Pierce County Health Department, Washington State (2002)
- <http://www.tpchd.org/files/library/476fdfaa7219ff8f.pdf>
- City of Port Angeles, Washington State (2003)
- No negative impact of water fluoridation on the environment has been established

Pollick HF. Water fluoridation and the environment: current perspective in the United States. Int J Occup Environ Health. 2004 Jul-Sep;10(3):343-50

<http://www.cdc.gov/fluoridation/pdf/pollick.pdf>

# Safety of Water Fluoridation

16

## **CDC Statement on the 2006 National Research Council (NRC) Report on Fluoride in Drinking Water**

- ◆ The findings of the NRC report are consistent with CDC's assessment that water is safe and healthy at the levels used for water fluoridation (0.7 - 1.2 mg/L). CDC reviews the latest scientific literature on an ongoing basis and maintains an active national community water fluoridation quality assurance program. CDC promotes research on the topic of fluoride and its effect on the public's health. CDC's recommendation remains the same; that community water fluoridation is safe and effective for preventing tooth decay.
- ◆ **Water fluoridation should be continued in communities currently fluoridating and extended to those without fluoridation.**

# Overview

17

- What is tooth decay (dental caries)
- What is enamel fluorosis?
- Why fluoridate the water?
- Safety of fluoridation
- **Cost-effectiveness of fluoridation**

# Economic Benefits to the Community

18

- Cost Savings of Community Water Fluoridation
- Every \$1 invested in this preventive measure yields approximately \$38 savings in dental treatment costs.
  - <http://www.cdc.gov/fluoridation/factsheets/cost.htm>

# Economic Benefits to the Community

19

- Fluoridation lowers the need for general anesthesia for dental treatment
- Studies in the US, UK and Australia have shown that there are lower hospital costs for dental treatment in fluoridated communities.

# Economic Benefits to the Community

20

- Without fluoridated water, Medicaid-eligible children in Louisiana were three times more likely to receive dental treatment in a hospital operating room
- Cost of dental treatment per eligible child was approximately twice as high in non-fluoridated areas.
- Centers for Disease Control and Prevention (CDC). Water fluoridation and costs of Medicaid treatment for dental decay--Louisiana, 1995-1996. [MMWR](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm4834a2.htm) 1999 Sep 3;48(34):753-7. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm4834a2.htm>

# Economic Benefits to the Community

21

- Fluoridation lowers dental treatment costs for Medicaid recipients.
- In New York State, the mean number of fillings, root canal treatments, and extractions per person
- 33.4% higher in less fluoridated counties.
  
- Kumar JV, Adekugbe O, Melnik TA. Geographic variation in Medicaid claims for dental procedures in New York State: role of fluoridation under contemporary conditions. Public Health Rep. 2010 Sep-Oct;125(5):647-54.
- <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2925000/>

# Projected cost savings - Albuquerque

22

- Albuquerque Bernalillo County Water Utility Authority
- Serves 560,454 people (as of 2012)
- Authority used to adjust the fluoride level to 0.9 ppm
- Current average is 0.4 ppm: **increased surface water use**
- \$400,000 proposed one time cost
- \$100,000 annually budget for fluoridating
- Less than 20 cents per person per year
- \$4,000,000 of savings in **annual** average dental treatment costs to Albuquerque residents.
- \$1 invested in fluoridation brings \$38 in savings for dental care

## Comparing Annual Costs (1999 \$) per person of different methods of fluoride use

23

Fluoride Mode	Annual cost / person	People benefitting
Water fluoridation (all costs)	\$0.72 (\$0.17 - \$7.62)	All ages, all groups
Fluoride toothpaste	\$6 - \$12	All ages, all groups
Fluoride mouthrinse school-based programs not including personnel/indirect costs	\$1.41	Schoolchildren (>6 years) (High caries risk)
Prescription Dietary Fluoride Supplements	\$37	Ages 6 month to 16 years (Poor compliance)
Professional topical fluoride application	\$66 (twice/year)	High caries risk

Centers for Disease Control and Prevention. Recommendations for using fluoride to prevent and control dental caries in the United States. MMWR Recomm Rep. 2001 Aug 17;50(RR-14):1-42.  
Available at [http://www.cdc.gov/fluoridation/fact\\_sheets/fl\\_caries.htm](http://www.cdc.gov/fluoridation/fact_sheets/fl_caries.htm)

# Overview

24

- What is tooth decay (dental caries)
- What is enamel fluorosis?
- Why fluoridate the water?
- Safety of fluoridation
- Cost-effectiveness of fluoridation
- **WHO supports fluoridation?**

# The Case for Community Water Fluoridation

25

- Fluoridation is supported by major health and science organizations
  - World Health Organization, American Medical Association, American Dental Association, American Public Health Association, US Public Health Service, US Surgeons General, American Water Works Association and 100 more.
  - CDC: One of the ten great public health achievements of the 20<sup>th</sup> century

# US statistics on fluoridation

26

- Centers for Disease Control & Prevention (CDC)
  - <http://www.cdc.gov/fluoridation/statistics/2012stats.htm>
- 2012 data
- 74.6% of U.S. population on public water systems receiving fluoridated water
- 210 million people in the U.S.
- 18,502 Water Systems providing fluoridated water
- 44 of largest 50 cities
  - [http://www.ada.org/sections/newsAndEvents/pdfs/Fluoridation\\_Status\\_of\\_50\\_Largest\\_U.S.\\_Cities.pdf](http://www.ada.org/sections/newsAndEvents/pdfs/Fluoridation_Status_of_50_Largest_U.S._Cities.pdf)
- *Healthy People 2020* Target – 79.6% for the U.S.A.

# Overview

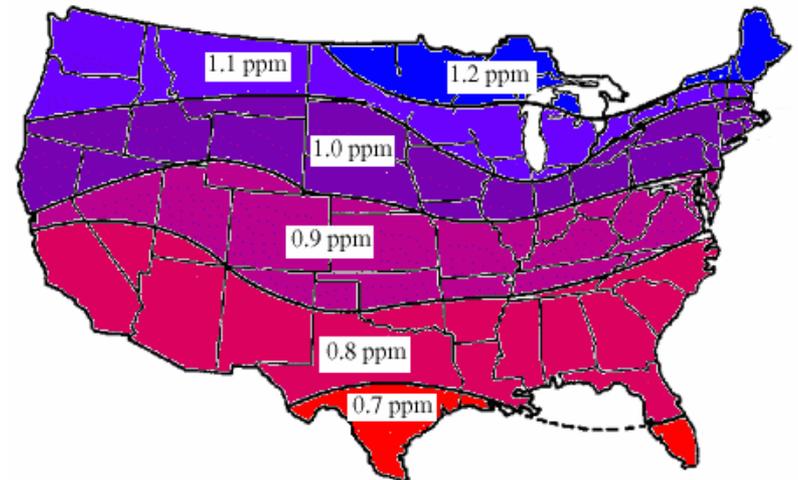
27

- What is tooth decay (dental caries)
- What is enamel fluorosis?
- Why fluoridate the water?
- Safety of fluoridation
- Cost-effectiveness of fluoridation
- WHO supports fluoridation?
- **Why change to 0.7 parts per million?**

# Recommended concentration of fluoride in drinking water

28

- US Public Health Service
- 1962 standard
- 0.7 – 1.2 ppm (mg/L)
  - ▣ According to annual average maximum temperature
- 2011 Proposed standard
- 0.7 ppm (mg/L)
  - ▣ Nationwide



# Reasons for proposal to standardize to 0.7 ppm

29

- 1. Strong supporting evidence on the safety and cost-effectiveness of optimally fluoridated community water for caries prevention;**
- 2. Public access to more fluoride sources than in the past, including fluoride toothpaste that young children swallow;**
- 3. Maintaining the caries-preventive benefits of community water fluoridation**
- 4. Reducing the potential development of enamel fluorosis, which has increased in prevalence due to greater access to more sources of fluoride; and**
- 5. Levels of total water intake among children aged 1 to 10 are similar across U.S. climate zones.**

# Overview

30

- What is tooth decay (dental caries)
- What is enamel fluorosis?
- Why fluoridate the water?
- Safety of fluoridation
- Cost-effectiveness of fluoridation
- WHO supports fluoridation?
- Why change to 0.7 parts per million?
- **Comparing pro- and anti- fluoridation**

# What is the difference between opponents and supporters of fluoridation?

31

## □ Anti-fluoridationists:

- Prevent the unnecessary exposure of living things to fluoride, in the belief that any amount of fluoride is toxic

## □ Fluoridationists:

- Reduce tooth decay through the judicious use of fluoride, with the knowledge that there is an optimum amount that is beneficial and safe

# Contrasting Opponents and Proponents

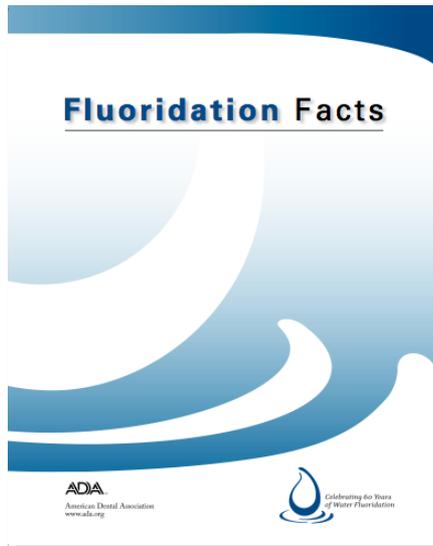
*No room for agreement or compromise*

32

- *Opponents:* “If they were to accurately draw up a list of the greatest public health achievements of the past century, fluoridation might appear alongside the Tuskegee incident or positions that once promoted smoking tobacco and the use of asbestos and lead in building materials.”
- *Proponents:* For 65 years, community water fluoridation has been a safe and healthy way to effectively prevent tooth decay. CDC has recognized water fluoridation as one of 10 great public health achievements of the 20th century.

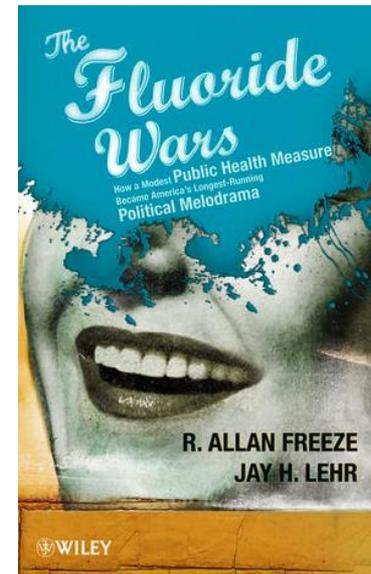
# Books on Fluoridation

33



This 2005 publication was developed by the ADA's Council on Access, Prevention and Interprofessional Relations.

<http://www.wiley.com/WileyCDA/WileyTitle/productCd-0470448334.html>



The Fluoride Wars: 2009  
By R. Allan Freeze, Jay H. Lehr

[http://www.ada.org/sections/professionalResources/pdfs/fluoridation\\_facts.pdf](http://www.ada.org/sections/professionalResources/pdfs/fluoridation_facts.pdf)

# Credible sources of information on fluoride and fluoridation

34

- CDC - <http://www.cdc.gov/oralhealth/>
  - ▣ Centers for Disease Control and Prevention has proclaimed community water fluoridation one of 10 great public health achievements of the 20th century
- ADA - <http://www.ada.org/fluoride.aspx>
  - ▣ America Dental Association: Fluoridation Facts
- American Academy of Pediatrics - <http://pediatrics.aappublications.org/content/122/6/1387.full>
- NSF –
  - ▣ Fact sheet on Fluoridation Products (February 2013)
  - ▣ [http://www.nsf.org/newsroom\\_pdf/NSF\\_Fact\\_Sheet\\_on\\_Fluoridation.pdf](http://www.nsf.org/newsroom_pdf/NSF_Fact_Sheet_on_Fluoridation.pdf)

# Recommendation for Albuquerque

35

## Reinstate Community Water Fluoridation: 10 Reasons to Fluoridate:

1. Single most effective public health measure to prevent tooth decay
2. Simply adjusts natural level of fluoride already in our water
3. Similar to fortifying other foods and beverages
4. Helps protect all ages against tooth decay
5. Safe and Effective
6. Lifetime cost per person less than single dental filling
7. Reduces public expenditures on dental treatment of tooth decay
8. Reduce pain from cavities, abscesses and toothaches
9. Recognized by more than 100 national organizations
10. 74.6% of public water systems in the U.S. are fluoridated

# Questions?

36

- Email: [howard.pollick@ucsf.edu](mailto:howard.pollick@ucsf.edu)



# Tooth Decay (Caries)

37

- Varies in severity; worse with time; affects any age
- Can cause pain/toothache; abscess may follow
- Tooth decay is a serious disease; can be fatal
- Tooth decay treatment is necessary and can require hospitalization
- Can impair classroom learning and behavior
- Often requires school or work absence for treatment
- The PEW Center on the States. [The Cost of Delay](#): State Dental Policies Fail One in Five Children. February 2010.
- [http://www.pewstates.org/uploadedFiles/PCS\\_Assets/2010/Cost\\_of\\_Delay\\_web.pdf](http://www.pewstates.org/uploadedFiles/PCS_Assets/2010/Cost_of_Delay_web.pdf)

# Enamel fluorosis

38

- Varies in severity; most people don't have it
- Does not get worse with time
- Do not cause pain/toothaches or abscesses
- Enamel fluorosis is a not serious condition; cannot be fatal
- Enamel fluorosis treatment is usually not needed and does not require hospitalization
- Only children aged 8 years and younger can develop dental fluorosis when permanent teeth are developing under the gums
- The teeth of children older than 8 years, adolescents, and adults cannot develop dental fluorosis

# Why water fluoridation?

39

- Overwhelming majority of studies
- Support fluoridation
- Safe
- Effective
- Very favorable cost/benefit ratio
- Simulates the optimal environment

# Recommendation for Phoenix



40

- Community Water Fluoridation: An Evidence Review. 2012.
- Doug Campos-Outcalt, MD, MPA
- Martin F. Celaya, MPH
- Annabelle Nunez, MA
- Cecilia Rosales, MD, MS
- UA Zuckerman College of Public Health and UA College of Medicine-Phoenix
- <http://www.azdhs.gov/phs/owch/oral-health/documents/community-water-flouridation-evidence-review.pdf>

# Community Water Fluoridation: An Evidence Review.

## 2012. Conclusions.



41

- The scientific evidence at this time provides high certainty that CWF benefits both children and adults with a reduction in tooth caries.
- There is moderate certainty that CWF causes tooth mottling in a small proportion of the population, which can have cosmetic consequences but no other known harm.
- There currently is no credible evidence of any other harms from CWF. (Community Water Fluoridation)
  
- UA Zuckerman College of Public Health and UA College of Medicine-Phoenix
- <http://www.azdhs.gov/phs/owch/oral-health/documents/community-water-flouridation-evidence-review.pdf>