

Sponsored by the NM Department Of Health, Dental Support Center & Office of Oral Health

# FLUORIDE & TOOTH DECAY PREVENTION

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# New Mexico: Population at High Risk

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- High prevalence of untreated tooth decay in 3rd graders prior to sealant program
- 64% of all 3rd graders experience dental decay.
- 34% of all 3rd graders have untreated dental decay
- 43% of 3rd graders have received a dental sealant.
- 73% Children (K–12) on free/reduced-cost school lunch program
- New Mexico ranks 47th in poverty
- 77% Percentage of people on public water systems that receive fluoridated water
- State Population 1,984,356
- Population served by fluoridated water system 1,207,034
  - 61% of State Population
- 18% consuming fluoridated water
- 911 Number of dentists in the state - 2178 people per dentist (high)
- Sources: <http://nmhealth.org/PHD/OOH/data.shtml>
- <http://apps.nccd.cdc.gov/synopses/StateDataV.asp?StateID=NM&Year=2009>

# Bottled Water

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- Most have low fluoride
- Some are at 1 ppm
- Will they go to 0.7 ppm?



# Continued Reduction in 1999-2004 in Caries Experience for all over 6 years of age in U.S. Decayed, Missing and Filled Permanent Teeth

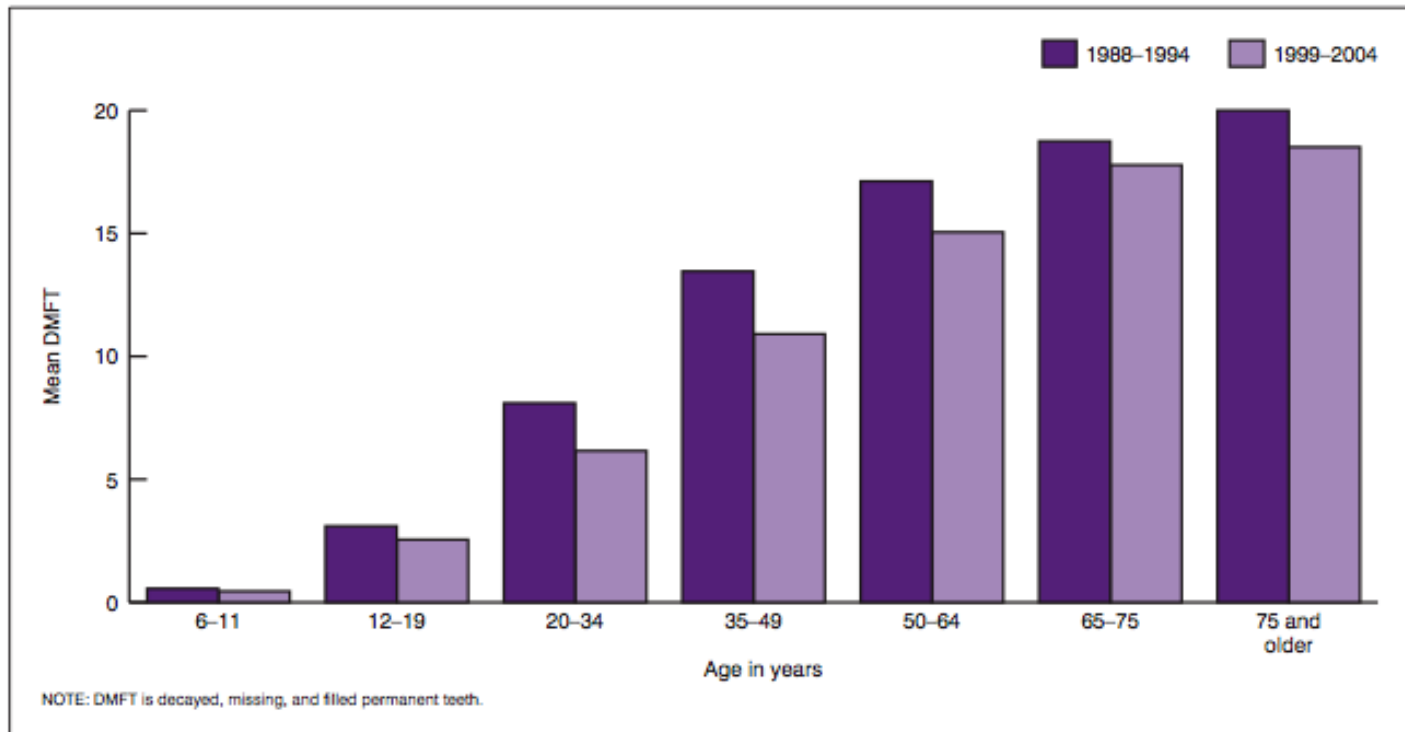


Figure 1. Mean DMFT scores for persons 6 years of age and older by selected age groups: United States, 1988-1994 and 1999-2004

Dye BA, Tan S, Smith V, Lewis BG, Barker LK, Thornton-Evans G, Eke PI, Beltrán-Aguilar ED, Horowitz AM, Li CH. Trends in oral health status: United States, 1988-1994 and 1999-2004. *Vital Health Stat 11*. 2007 Apr;(248):1-92  
[http://www.cdc.gov/nchs/data/series/sr\\_11/sr11\\_248.pdf](http://www.cdc.gov/nchs/data/series/sr_11/sr11_248.pdf)

# Caries prevalence for 2-11 year-olds increased: or has it? Primary decayed and filled tooth surfaces

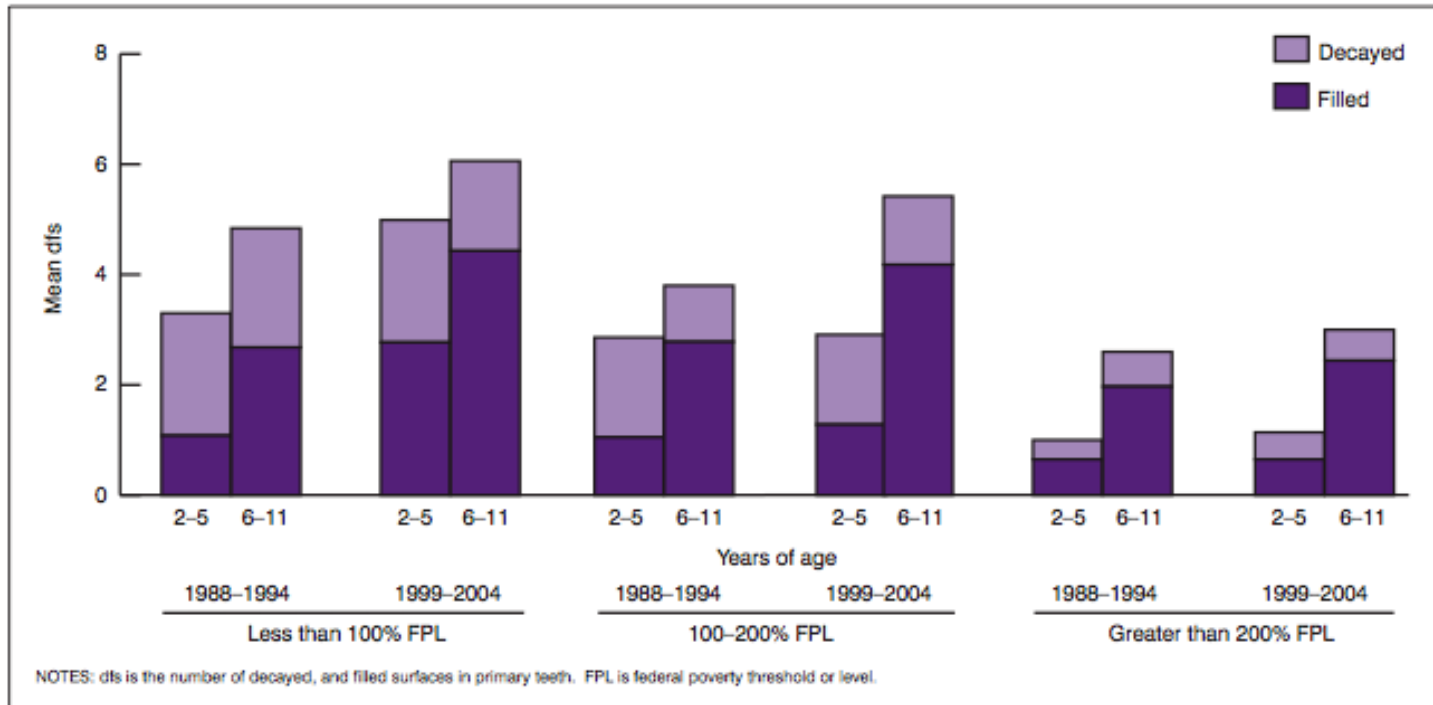


Figure 3. Decayed and filled primary dental surfaces (dfs) for youths 2–11 years of age by age groups and federal poverty level status: United States, 1988–1994 and 1999–2004

Dye BA, Tan S, Smith V, Lewis BG, Barker LK, Thornton-Evans G, Eke PI, Beltrán-Aguilar ED, Horowitz AM, Li CH. Trends in oral health status: United States, 1988-1994 and 1999-2004. *Vital Health Stat 11*. 2007 Apr;(248):1-92  
[http://www.cdc.gov/nchs/data/series/sr\\_11/sr11\\_248.pdf](http://www.cdc.gov/nchs/data/series/sr_11/sr11_248.pdf)

# Stainless Steel Crowns

- has there been an increase in use for primary teeth?

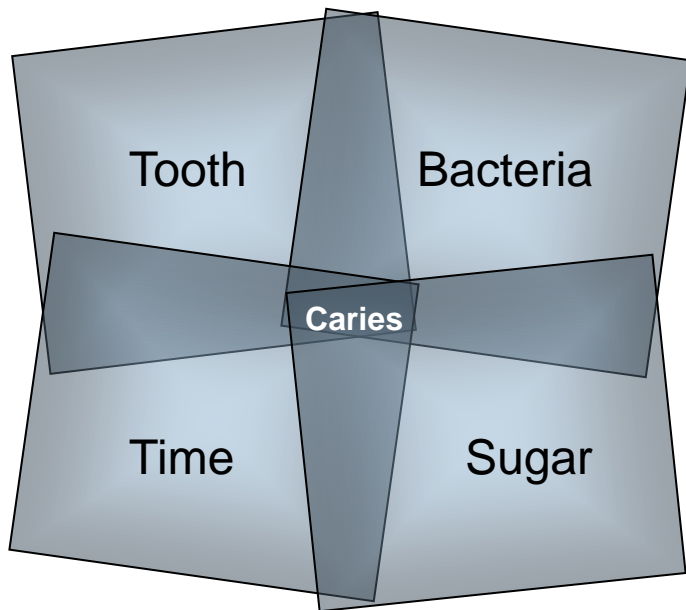
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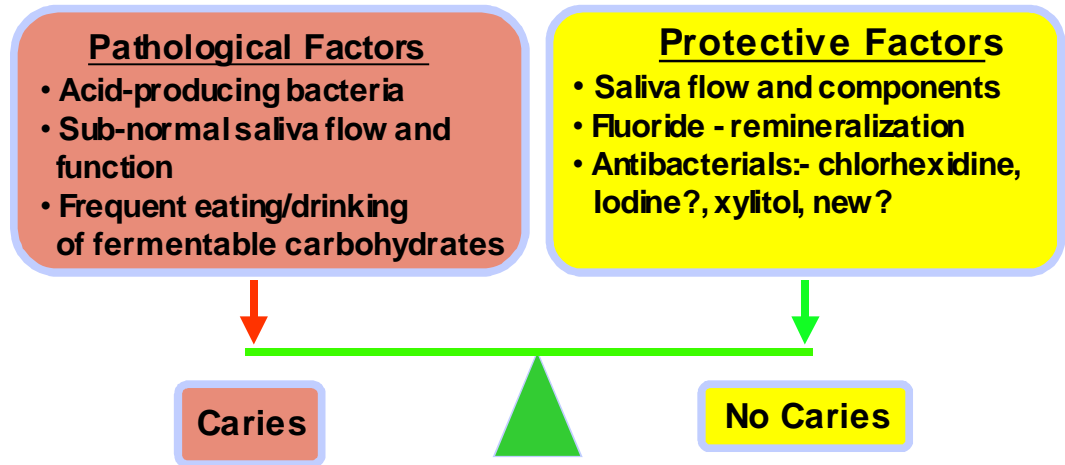
# Caries Development Models

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Bacteria	+	Sugar	→	Acid
(in specific locations)		(mono- / disaccharides)		- lactic acid, pyruvic acid
- pits & fissures - contact area between teeth		glucose, fructose, lactose, sucrose		- dissolves minerals in tooth
- gingival margin - margins of restorations		polysaccharides - reduced by ptyalin		(different acids than acids that cause erosion)

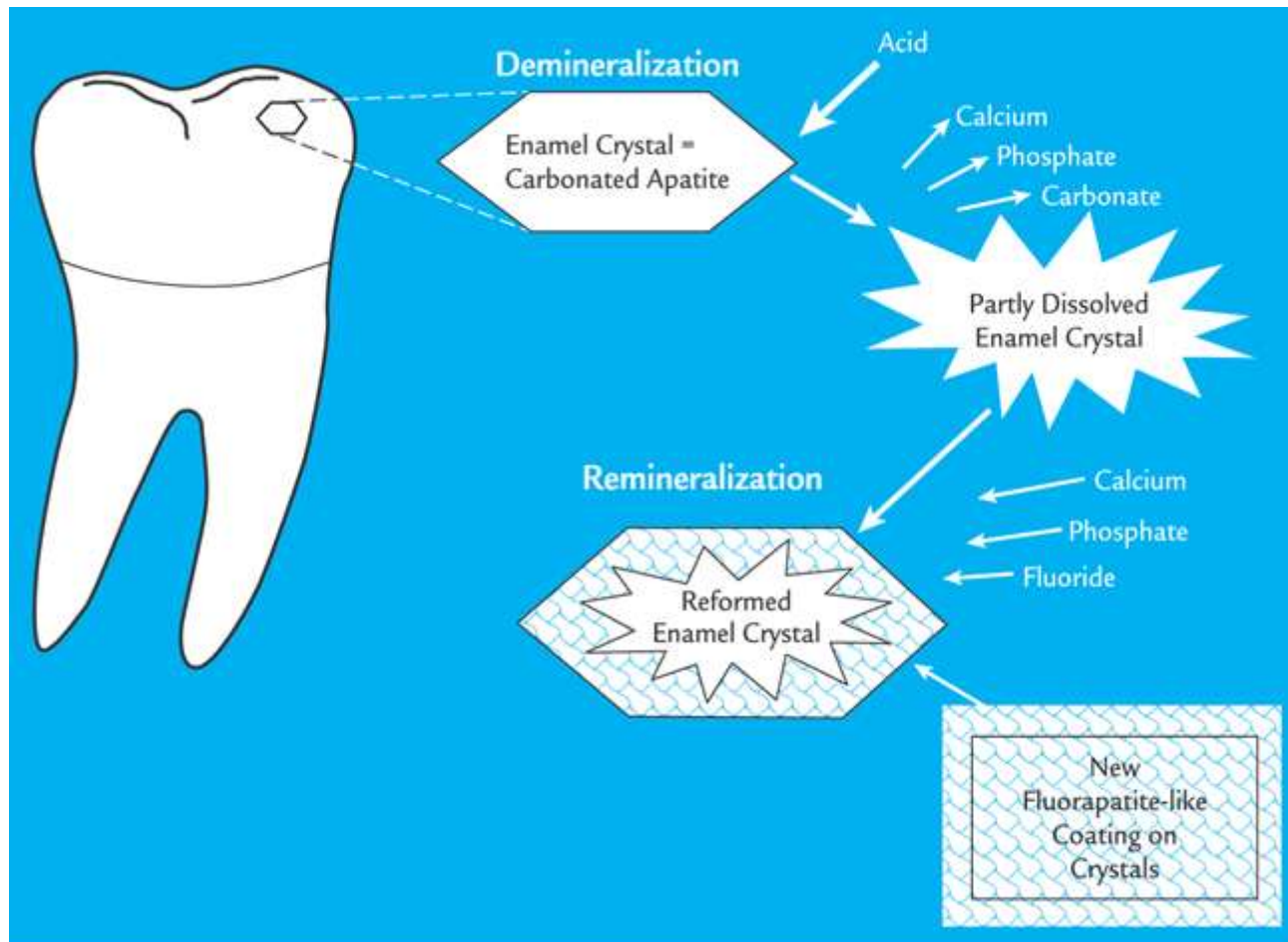


## The Caries Balance



# Biochemistry of Tooth Decay and Repair

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# How fluoride helps to prevent tooth decay

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1. inhibition of demineralization at the crystal surfaces inside the tooth
2. enhancement of remineralization at the crystal surfaces (the resulting remineralized layer is very resistant to acid attack)
3. inhibition of bacterial enzymes
4. formation of calcium fluoride with high fluoride concentrations (fluoride varnish)

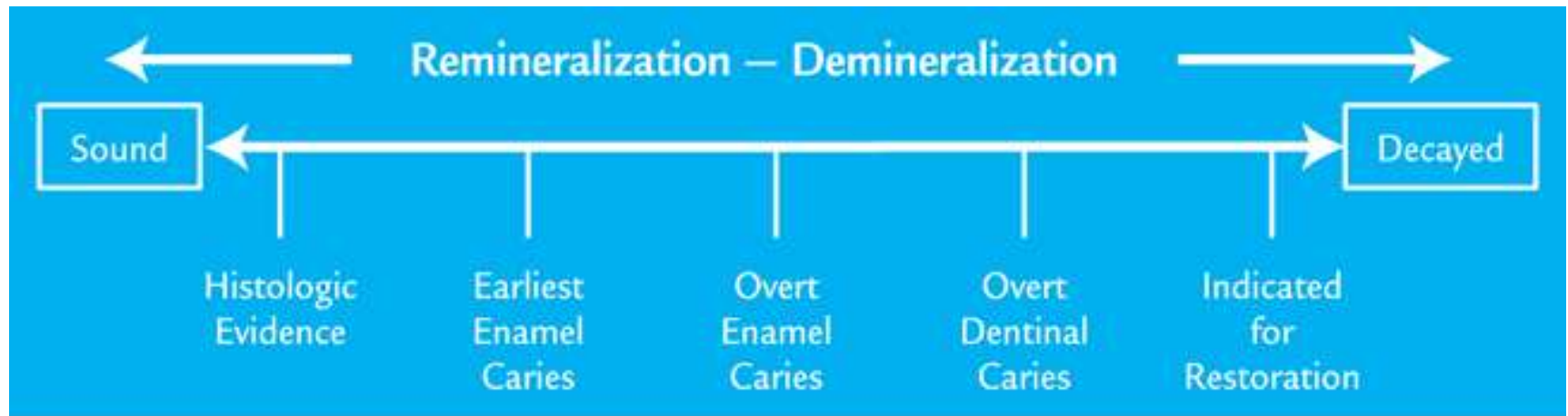
# Where does the fluoride come from and what's the concentration?

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- Fluoride in drinking water and in fluoride-containing products reduces tooth decay
- Low but slightly elevated levels of fluoride in saliva and plaque throughout the day provided from these sources help prevent and reverse caries
- High concentrations of fluoride from dental products are targeted for high caries risk (fluoride varnish)

# When is tooth decay a cavity?

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## Moderate and Severe Fluorosis and 'Moderate/Severe' Caries



Moderate



Severe



"Moderate/Severe Caries"



"Moderate/Severe Caries"

**Photographs from Forum on Water Fluoridation in Ireland, 2002**

# Dean's Classification of Fluorosis



Normal



Questionable



Very Mild



Mild

**Photographs from Forum on Water Fluoridation in Ireland, 2002**

# CDC: Fluoridation protects teeth in two ways

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- ◆ When delivered through the water supply to children **during the tooth forming years.**
- ◆ Through direct contact with teeth **throughout life.**



<http://www.cdc.gov/fluoridation/benefits.htm>

# Systemic and Topical Effects: or pre- and post-eruptive effects of fluoridation on caries prevention

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*Archs oral Biol.* Vol. 22, pp. 437 to 439. Pergamon Press 1977. Printed in Great Britain.

## EXPERIMENTS ON LOCAL AND SYSTEMIC ACTION OF FLUORIDE IN CARIES INHIBITION IN THE RAT

R. H. LARSON, J. R. MELLBERG\* and R. SENNING†

National Institute of Dental Research, National Institutes of Health,  
Bethesda, Md. 20014 and

\*Colgate Research Center Piscataway, N.J. 08854, U.S.A.

**Summary**—Fluoride administered to rats by gastric intubation was associated with an increase in fluoride uptake by the enamel and caries inhibition, but to a lesser extent than in animals consuming the same amount of fluoride in the drinking water. These differences were more pronounced in the first and second molars which erupted within 2 or 3 days of the start of the experiment than on the third molars which had at least two weeks of pre-eruptive exposure to systemic fluoride.

# Experiment to determine **topical and systemic** effects of fluoride on caries prevention

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Effect of fluoride administered by stomach tube or orally (5 ppm) on smooth surface & sulcal (fissure) caries in rat molars

Group	Number of animals	All Molars: Mean number of carious areas	
		Smooth	Sulcal
Control - No F	24	30.2	27.4
F - Stomach Tube	24	9.0 *	23.1
F - orally (water)	22	0.6 *	10.6 *



\*  $p < 0.01$

Larson RH, Mellberg JR, Senning R.

Experiments on local and systemic action of fluoride in caries inhibition in the rat.

Archives of Oral Biology. 1977;22(7):437-9

# Experiment to determine **pre- and post-eruptive** effects of fluoride on caries prevention

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Effect of fluoride administered by stomach tube or orally on smooth surface & sulcal (fissure) caries in rat:  
**3<sup>rd</sup> molars only (>2 weeks pre-eruptive effect)**

Group	Caries score <b>Smooth surfaces</b>	% Reduction	Caries score <b>Sulcal surfaces</b>	% Reduction
Control: no F	7.0		2.3	
F - stomach tube	0.5 *	93 %	1.6 *	30 %
F - orally (water)	0.0 *	100 %	0.8 *	65 %



\* p <0.01

Larson RH, Mellberg JR, Senning R.

Experiments on local and systemic action of fluoride in caries inhibition in the rat.  
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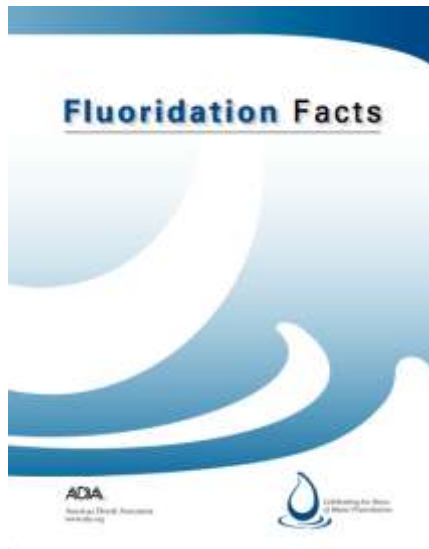
# Credible sources of information on fluoride and fluoridation

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- CDC - <http://www.cdc.gov/oralhealth/>
- ADA - <http://www.ada.org/fluoride.aspx>
- AAP - <http://www.aap.org/oralhealth/fluoride.cfm>
- New Mexico Dept. of Health, Oral Health  
<http://nmhealth.org/PHD/OOH/index.shtml>

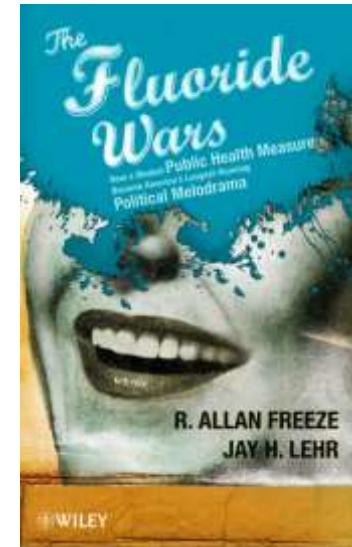
# Books on Fluoridation

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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>



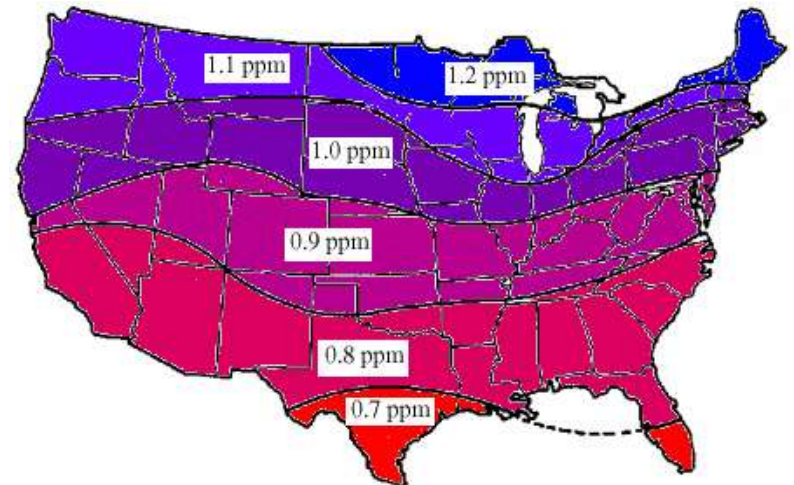
The Fluoride Wars: 2009  
By R. Allan Freeze, Jay H. Lehr

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

# Recommended concentration of fluoride in drinking water

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



# Maximum contaminant level of naturally occurring fluoride in drinking water

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- EPA
- 1986 standard
- 4 ppm (mg/L) – Primary
  - ▣ To prevent skeletal fluorosis
- 2 ppm (mg/L) – Secondary
  - ▣ To prevent severe dental fluorosis
- 2011 review

# Review Article

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- **What is the evidence that fluoride works to prevent dental caries?**
- **June 2004**
- Oral Health and Dental Management in the Black Sea Countries
- Journal of the Black Sea Countries Network of Dental Faculties
- <http://www.oralhealth.ro/volumes/2004/volume-2/V2-04-1.pdf>

# Fluoride Safety

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- Water Fluoridation and the Environment: Current Perspective in the United States.
- International Journal of Occupational & Environmental Health
- July-Sept 2004
- Scientific evidence supports fluoridated water as safe, effective and cost-effective
- <http://www.cdc.gov/fluoridation/pdf/pollick.pdf>

# Questions?

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



# Fluoride

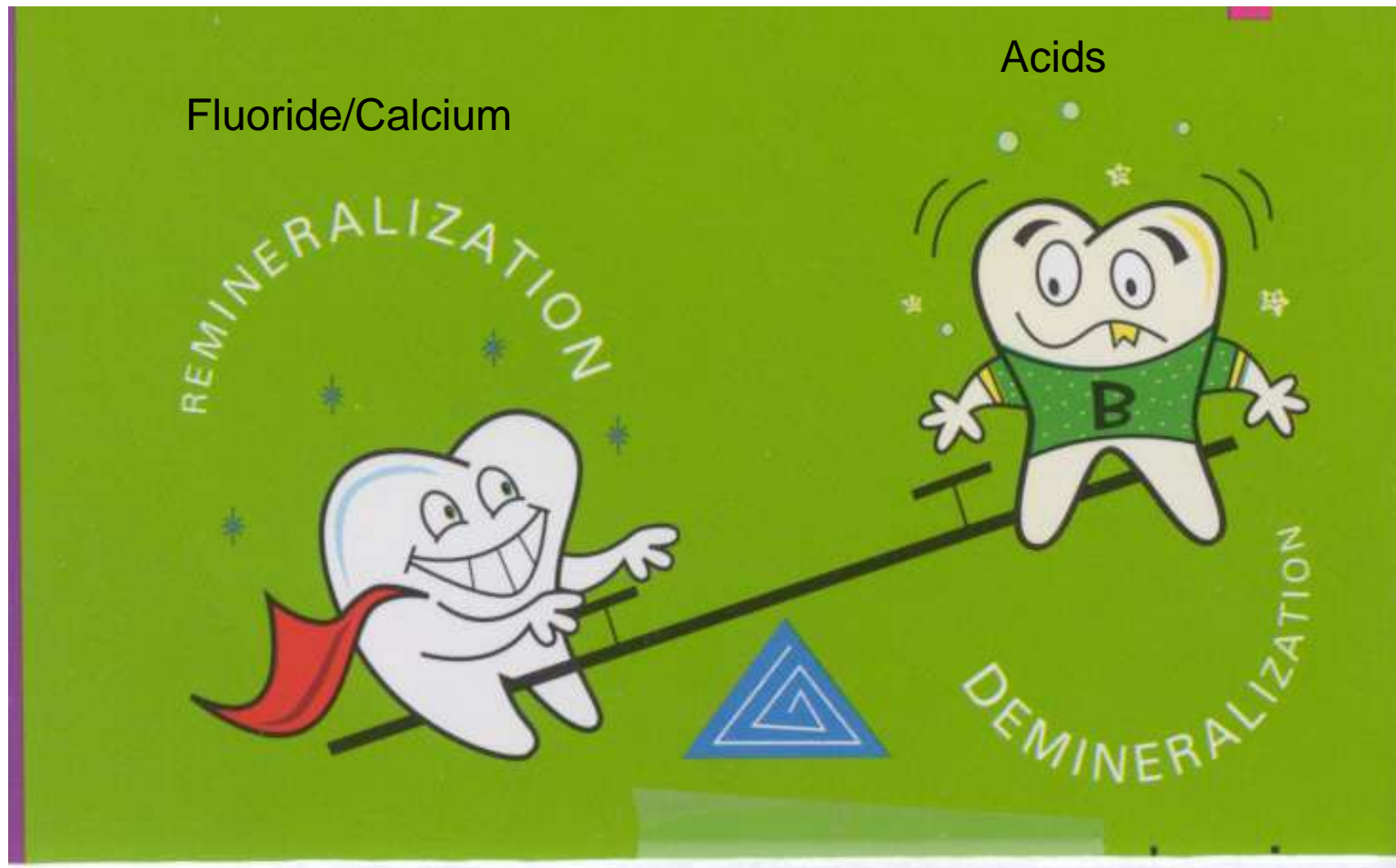
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- Naturally occurring- Earth's crust, oceans, streams
- Has non-therapeutic, therapeutic, & adverse effect levels
- Municipal water supplies can have fluoride added or removed to get optimal levels

# Fluoride- Topical Effects

- Topical effects last throughout life as long as teeth are present
  - ▣ Reduces enamel/tooth solubility
  - ▣ Inhibits enzyme/acid production by bacteria
  - ▣ Remineralizes enamel/ makes it stronger
- Frequent, low dose exposures best
  - ▣ Topical benefits can be derived from tap water, beverages made with tap water, toothpaste, rinses, gels

Continuous process that occurs 24/7...especially after you eat...and depending on what you eat...



# Ethnicity & Tap Water Consumption

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- After years of substantial growth in sales, U.S. bottled water market slowing down
  - ▣ Economy, environmental concerns
- Several studies show Hispanics/Latinos drink tap water less frequently than other ethnic groups
- CA, UT, AZ, W. VA

# Pregnant Women & Tap Water

*(Forssen et al, 2007)*

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- N= 2,297
- Higher intake among non-Hispanic white women compared to Hispanic & non-Hispanic black women
- The proportion of bottled water was particularly high among Hispanic women (54% of total intake), whereas black, non-Hispanic women drank more (60%) of their water as unfiltered tap water

# Water consumption beliefs and practices in a rural Latino community: implications for fluoridation

(<sup>30</sup>Scherzer et al, 2010)

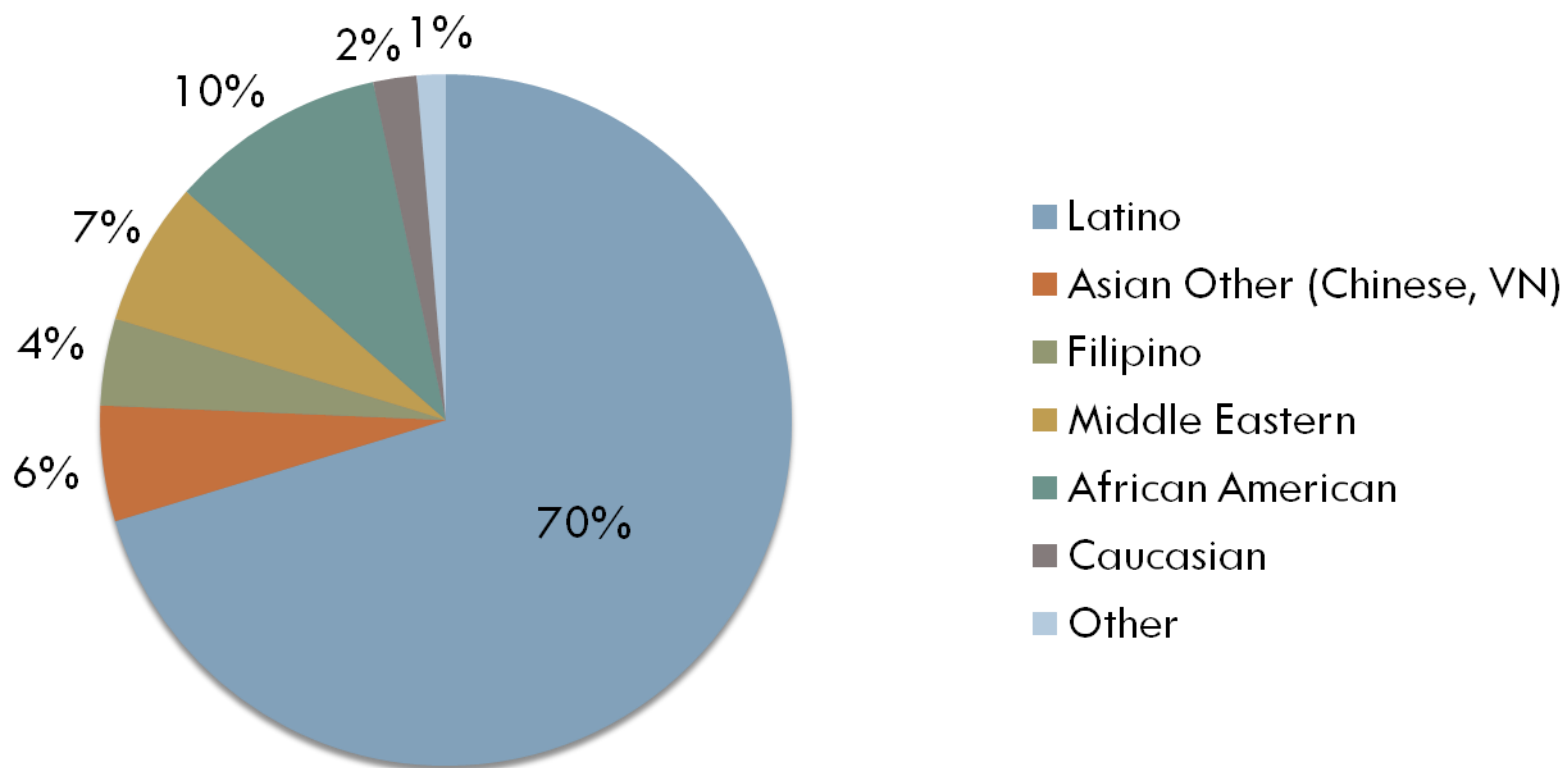
- Latino parents of young children- rural California
- Majority not born U.S., > 6 years in community
- Health Center and private practice dentists
- Vast majority avoided unfiltered tap water
- Felt unsafe based on taste, appearance, smell
- Long-time residents spoke of documented history of poor water quality, information transmitted to newer residents

# Family Health Center- SF

N=148

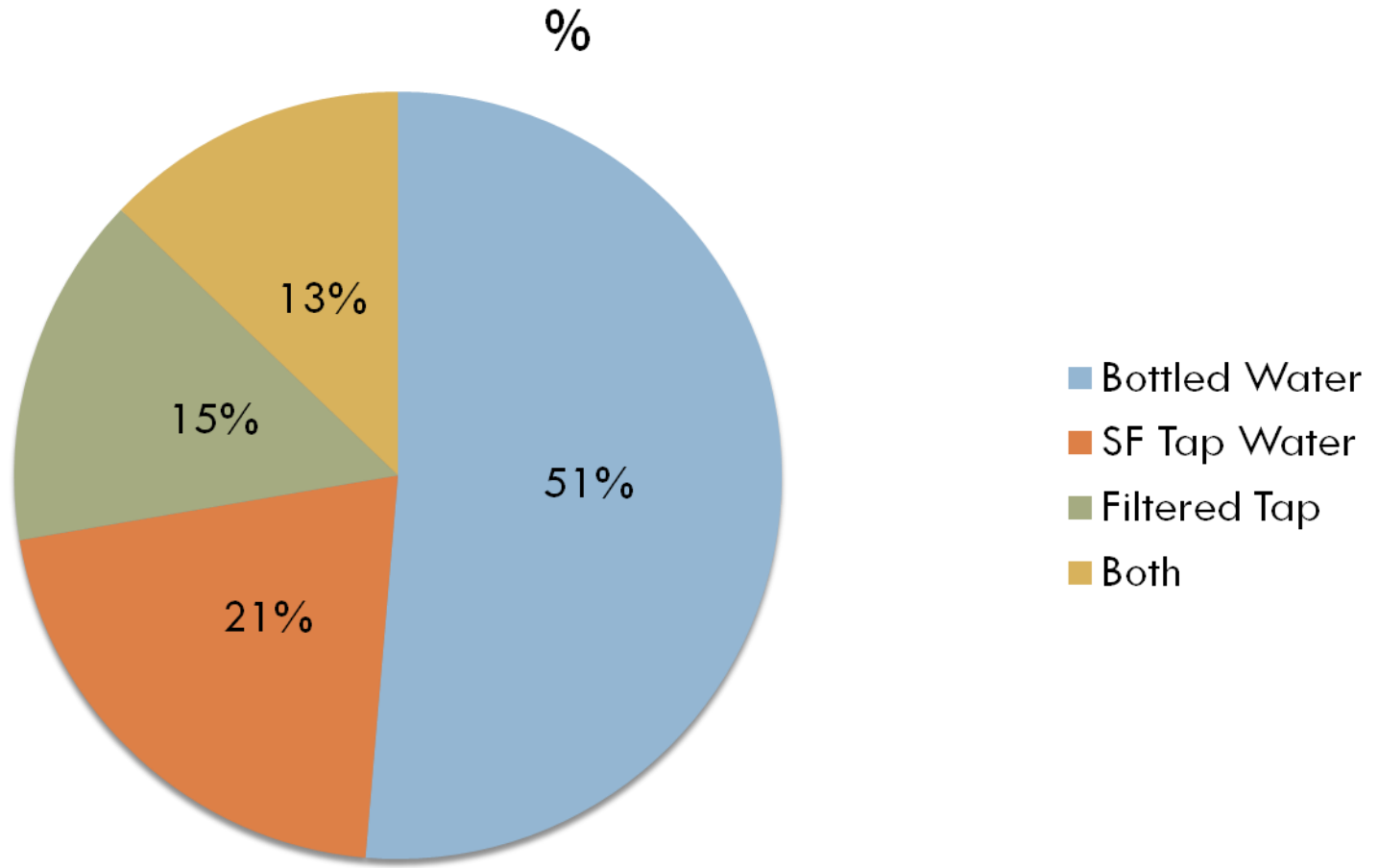
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## Ethnicity



# Water Consumption Ages 0-5

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# Low Tap Water Consumption

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- Continuation of habit in home country
- Visibly bad water
  - ▣ Poverty, poor infrastructure
  - ▣ Lead, corrosion, smell
- Perception of bad water
- Community norm

# Beliefs About Bottled Water Compared to Tap

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- Better taste
- Healthy, better...has minerals...
- Safer, purer, higher quality control
- Convenient
  
- Now...chemicals from plastics break down, cancer
- Now...not eco-friendly

# Know Your Local Water

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- Fluoridation levels
- Previous or current issues? More frequent in small water systems (rural, tribal etc.)
- 15-20% of US households obtain their water from private wells

# Strategies

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- Bottle water not regulated- tap is
- Some common labeled bottled water really super-filtered tap (Aquafina, Dasani)
- Consumers cannot see, smell or taste the most dangerous contaminants
- Cost of bottled water (500-1000x tap)
- Plastic bottles! Carbon footprint

# Options

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- ❑ Carafe/pitcher filter OK
- ❑ Faucet filter OK- Brita, Pur
- ❑ Dannon Fluoride Water



- ❑ Reverse osmosis filter will remove fluoride

# Don't Forget the Forest View

- Given current health care delivery system, water fluoridation is the #1 most effective way to prevent the most tooth decay in the most people
- CDC & Surgeon General list as one of the “Top 10” public health achievements of the 20<sup>th</sup> century
- 72.4% of US population on public water supply receive fluoridated water (CDC 2008)