A Tale of 2 Evidence-Based Reviews: Current Evidence on Community Water Fluoridation

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Disclaimer

The views and opinions expressed in this presentation are that of the presenter and do not necessarily reflect the official policy or position of the California Department of Public Health.

Are the results generalizable to the US population?

- Fluoridation initiation studies
  - 19 Observational Studies (1951 to 2015)
- Studies conducted in the USA
  - Ast 1951
  - Arnold 1956

Critique of the review of 'Water fluoridation for the prevention of dental caries' published by the Cochrane Collaboration in 2015

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IN BRIEF

- Discusses critically a recently published review of the effectiveness of water fluoridation.
- Highlights the lost opportunity to evaluate the vast majority of recent studies on water fluoridation to answer the research questions.
- Suggests modern and appropriate methods for systematic evaluation of the effectiveness of water fluoridation.

OPINION

British Dental Journal 2016; 220: 335-340

"Public health policy and decisions in public health should be grounded in the totality of the evidence with appropriate consideration of the quality of that evidence, its context, relevance, applicability and cost."

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Critique

- Requires assessment of multiple outcomes
- Rigid inclusion criteria that resulted in the exclusion of useful studies
- Reports published by governmental agencies were not included

- Requirements of two measurements and comparability of communities over time
- Four possible confounding factors be recorded and included in analyses of “low risk of bias”:
  - sugar consumption/dietary habits, SES, ethnicity, and use of other fluoride sources.

"To impose a narrow research model from clinical medicine (RCT) as the basis of evidence in public health will never be accepted among public health researchers and public health professionals – and not in this journal. With this editorial we raise a tombstone over the RCT fanatics with the inscription: Give peace to the fanatics – but let them stay in their grave and not disturb a sound and broad evidence-based development in public health."

- Finn Kamper-Jørgensen, Knowledge-base, evidence and evaluation in Public Health, Scand J Public Health 2000; 28: 241–243

Challenges

- Measuring the impact of CWF requires long term studies
- Finding comparable population groups
- A system to monitor F level in water should be in place
- Measurement of intake/exposure
- Data on covariates
- Lack of objective measures to assess outcomes
- Benefit and risk analysis

What is the right question to ask about a mature public health program?

Research and Evaluation

- Effectiveness
- Cost effectiveness
- Cost savings
- Optimum level
- Multiple outcomes
  - Tooth extractions
  - Size of the lesion and progression
  - Treatment in operating rooms

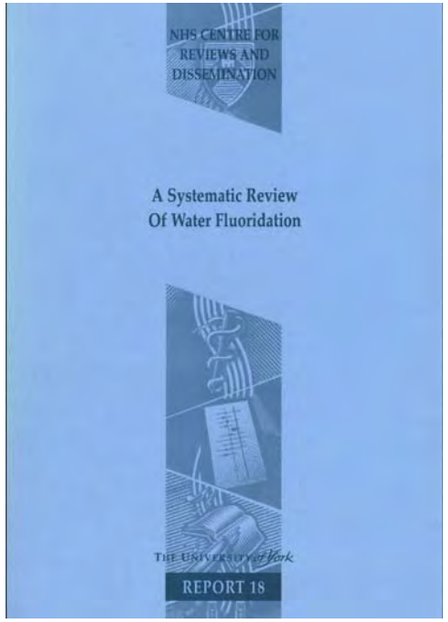
Quality Improvement

- Reach
- Maintaining optimum level
- Training
- Equipment

Economic Review:
Guide to Community Preventive Services

- Included Studies – USA (6) and Other Countries (4)
- Intervention benefit:
  - Studies that provided benefit and cost information reported a per capita annual benefit of CWF that ranged from **$5.49 to $93.19 (5 studies)**.
- Benefit-cost ratio:
  - Benefit-cost ratios ranged from **1.1:1 to 135:1** (6 studies).

Source: http://www.thecommunityguide.org/oral/fluoridation.html



Objective 2: If water fluoridation is shown to have beneficial effects, what is the effect over and above that offered by the use of alternative interventions and strategies?

To address this objective, studies conducted after 1974 were examined.

“In those studies completed after 1974, a beneficial effect of water fluoridation was still evident in spite of the assumed exposure to non-water fluoride in the populations studied. The meta-regression conducted for Objective 1 confirmed this finding.”

Are the results of Fluoride Toothpaste RCT studies generalizable?

- 30 studies in the US
  - 30 since 1955
  - 14 after 1975
  - 1 study in 2004
- Predominantly non-fluoridated areas
- Focused on high risk population
- Outcome measure – DMFS/DFS

Different Approaches

Geographic Variation in Medicaid Claims for Dental Procedures in New York State: Role of Fluoridation Under Contemporary Conditions

Jayanth V. Kumar, DDS, MPH[a,b]
Olubunmi Adekugbe, BDS, MPH[c]
Thomas A. Melnik, DrPH[a]

SYNOPSIS

Objective. We conducted an evaluation to determine if the number of claims reimbursed for caries-related procedures for children in the New York State Medicaid program varied by county fluoridation coverage.

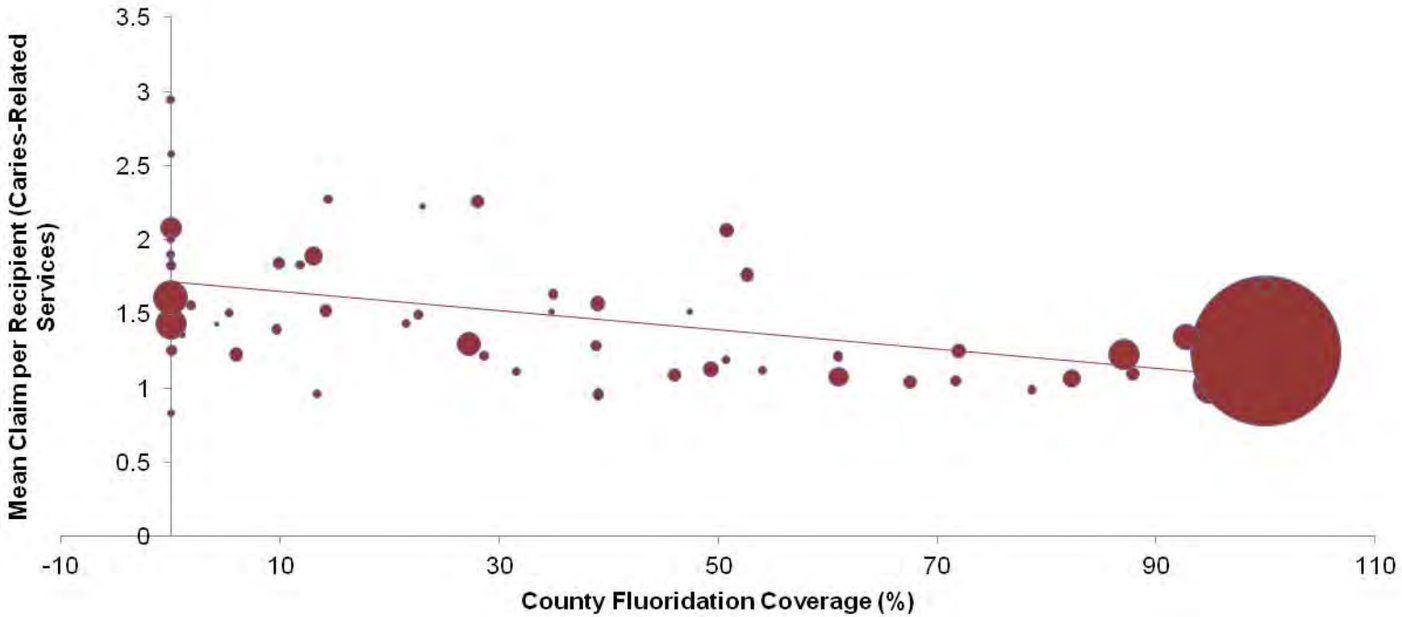
Methods. We calculated the mean number of claims per recipient for children in each county separately for the treatment of caries and all other procedures not related to caries using the 2006 Medicaid claims data.

Results. Compared with the predominantly fluoridated counties, the mean number of restorative, endodontic, and extraction procedures per recipient was 33.4% higher in less fluoridated counties. The mean number of claims per child for caries-related services was inversely correlated with the extent of fluoridation in a county (Spearman's correlation coefficient = −0.54, $p<0.0001$), but claims for non-caries related services were not.

Conclusions. These findings, when added to the already existing weight of evidence, have implications for promoting policies at the federal and state levels to strengthen the fluoridation program.

Geographic Variation in Medicaid Claims for Dental Procedures in NYS

Average child in a higher-fluoridation county incurred $23.65 less in Medicaid dental expenditures, compared with a child in a lower fluoridation county



Kumar JV, Adekugbe O, Melnik T. Public Health Reports 2010;125:647-54

Inverse association between fluoride in drinking water and dental caries in Danish children

Table 6. Association (OR and 95% confidence interval) between fluoride concentration in drinking water and caries in the permanent dentition (DMFS ≥ 2 and DMFS ≥ 6) in 15-year-old children born in 1989 (Cohort C89b; n = 43.848)

	DMFS ≥ 2		DMFS ≥ 6	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)[a]	Unadjusted OR (95% CI)	Adjusted OR (95% CI)[a]
Weighted mean fluoride exposure mg/l				
0–0.1249[b]	1	1	1	1
0.125–0.249	0.78 (0.74–0.83)	0.77 (0.73–0.81)	0.73 (0.68–0.78)	0.72 (0.67–0.77)
0.25–0.3749	0.67 (0.63–0.71)	0.66 (0.62–0.70)	0.51 (0.47–0.56)	0.52 (0.48–0.57)
0.375–0.99	0.57 (0.54–0.60)	0.57 (0.54–0.61)	0.44 (0.41–0.48)	0.45 (0.42–0.49)
≥1	0.50 (0.45–0.55)	0.54 (0.49–0.60)	0.33 (0.28–0.39)	0.36 (0.31–0.43)

[a]Adjusted for family income and gender.
[b]Reference group.

Kirkeskov L, Kristiansen E, Bøggild H, von Platen-Hallermund F, Sckerl H, Carlsen A, Larsen MJ, Poulsen S. The association between fluoride in drinking water and dental caries in Danish children. Linking data from health registers, environmental registers and administrative registers. Community Dent Oral Epidemiol 2010.

Effectiveness Studies: Challenges

	Baseline (within 1 or 3 years)	4 years later	40 years later
Fluoridate	Caries Fluorosis	Caries Fluorosis	Caries
	Other Variables	Other Variables	
Don't Fluoridate	Caries Fluorosis	Caries Fluorosis	Caries
	Other Variables	Other Variables	

Solution

	Birth -6 years	Baseline	4 years later	40 years later	
Prospective Cohort		1st Grade	5th Grade	At workplace	Retrospective Cohort
	Fluoridated	DMFS ~0	DMFS =?	Caries	
	Non-Fluoridated	DMFS ~0	DMFS =?	Caries	

RESEARCH REPORTS
Clinical

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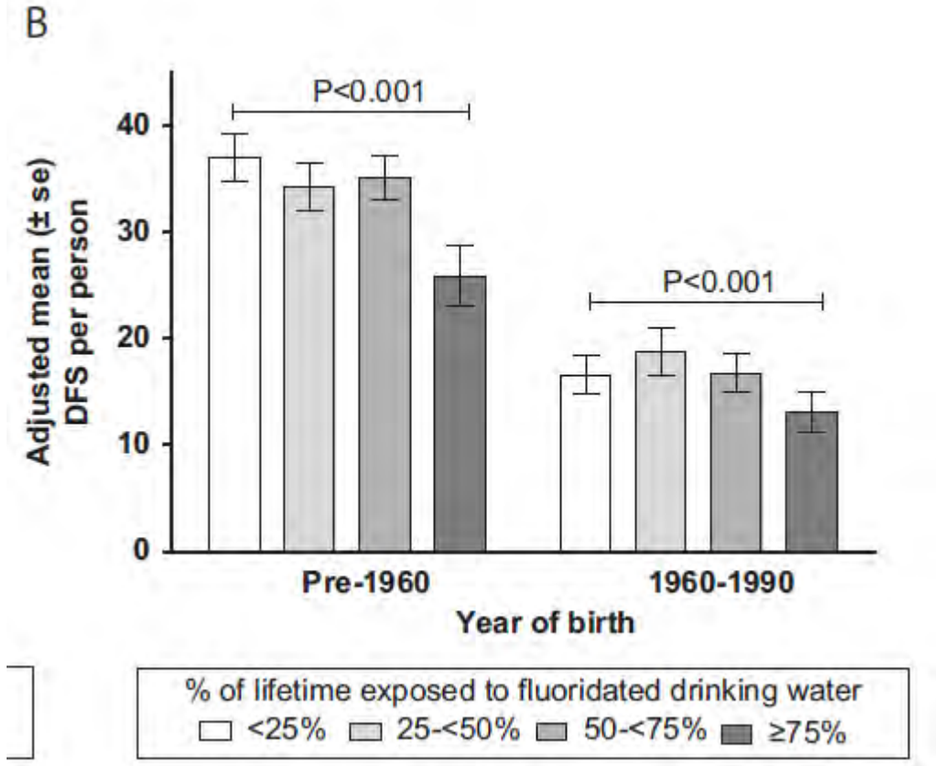
J Dent Res XX(X):1-7, 2013

Effects of Fluoridated Drinking Water on Dental Caries in Australian Adults

"Unfortunately, this epidemiologic principle was overlooked in 2 systematic reviews of water fluoridation that excluded cross-sectional studies (McDonagh *et al*., 2000; Yeung, 2008)."



Filling the gaps:
CDC monitors benefits and risks of CWF

NHANES (from 2013):

- Only one intervention
- This will be treated as another cross-sectional study
- Self reported data on exposure to other sources of fluoride
- No caries increment data
- No data on cost of interventions

The Cost and Effectiveness of School-based Preventive Dental Care

STEPHEN P. KLEIN, PHD, HARRY M. BOHANNAN, DMD, ROBERT M. BELL, PHD,
JUDITH A. DISNEY, DMD, CRAIG B. FOCH, MA, AND RICHARD C. GRAVES, DDS, DRPH

Abstract: The National Preventive Dentistry Demonstration Program assessed the cost and effectiveness of various types and combinations of school-based preventive dental care procedures. The program involved 20,052 first, second, and fifth graders from five fluoridated and five nonfluoridated communities. These children were examined at baseline and assigned to one of six treatment regimens. Four years later, 9,566 members of this group were examined again. Analyses of their dental examination data showed that dental health lessons, brushing and flossing, fluoride tablets and mouthrinsing, and professionally applied topical fluorides were not effective in reducing a substantial amount of dental decay, even when all of these procedures were used together. Occlusal sealants prevented one to two carious surfaces in four years. Children who were especially susceptible to decay did not benefit appreciably more from any of the preventive measures than did children in general. Annual direct per capita costs were $23 for sealant or fluoride prophy/gel applications and $3.29 for fluoride mouthrinsing. Communal water fluoridation was reaffirmed as the most cost-effective means of reducing tooth decay in children. (*Am J Public Health* 1985; 75:382–391.)

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APHA Technical Report

Review of the National Preventive Dentistry Demonstration Program

I. GENERAL BACKGROUND

Introduction

The National Preventive Dentistry Demonstration Program (NPDDP), carried out between 1976 and 1983, was the largest, most comprehensive school-based preventive dentistry program ever conducted anywhere. Its purpose was to determine the costs and effectiveness of several types and combinations of generally accepted school-based preventive dental procedures in order to provide the database for developing the most effective modern school-based preventive dental program.

nations of preventive procedures, and that the true costs of operating different types of preventive programs had not been adequately documented, served as the rationale for this demonstration program project. The problems with the ultimate design which was developed to accomplish this are discussed later in this report.

Underlying Assumptions

The NPDDP was based on four primary assumptions reflecting the conventional wisdom about caries prevention during the mid 1970s. *First,* it was assumed that the prevalence of dental caries in the United States was relatively

National Preventive Dentistry Demonstration Program

1& 2 Grades and 5th Grade Children in
Fluoridated and Non Fluoridated Communities

1.Rinse [Tablets] + Lessons + Brushing +Sealants +Prophy/Gel

2.Rinse (Tablets) + Lessons + Brushing + [Sealants in F or Prophy/Gel in NF]

3.Sealants + Prophy/Gel

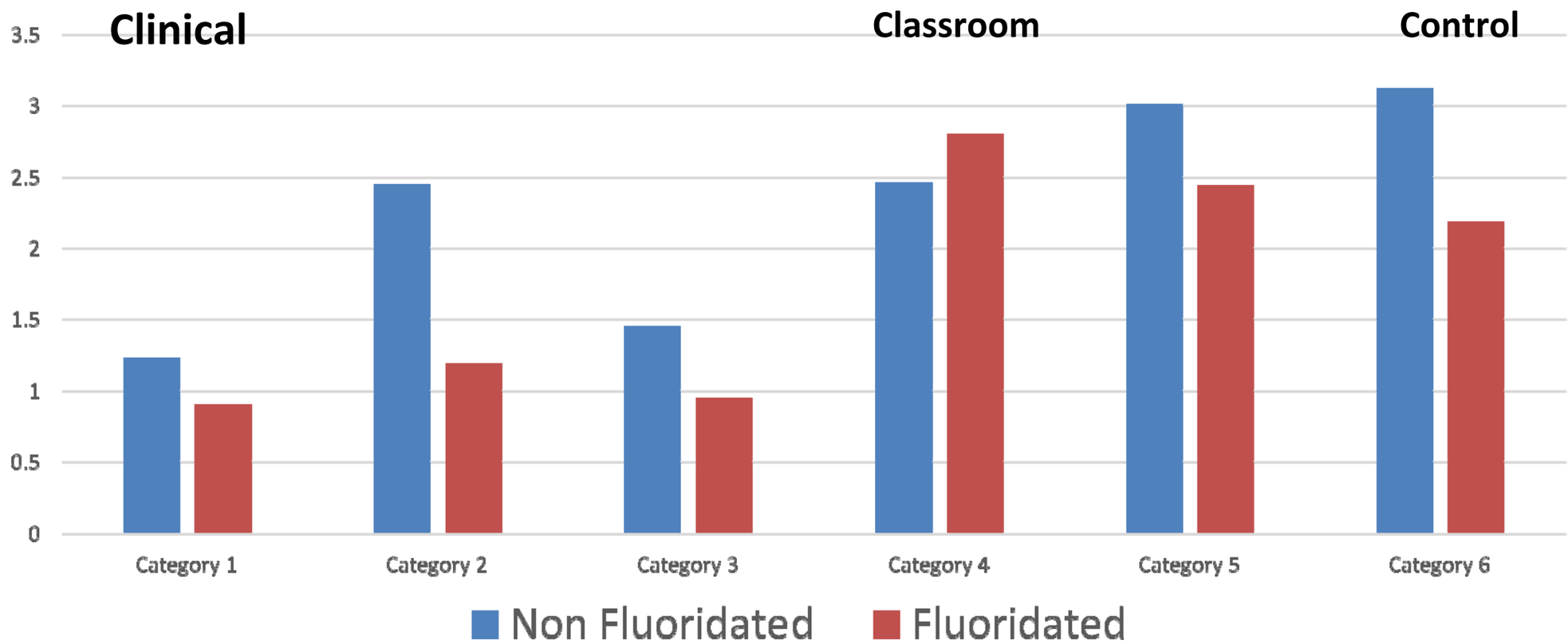
4.Rinse [Tablets] + Lessons + Brushing

5.Lessons + Brushing

6.Control

Mean 4 year caries increment (co-variate adjusted) among a cohort of 1 1 & 2nd grade children:

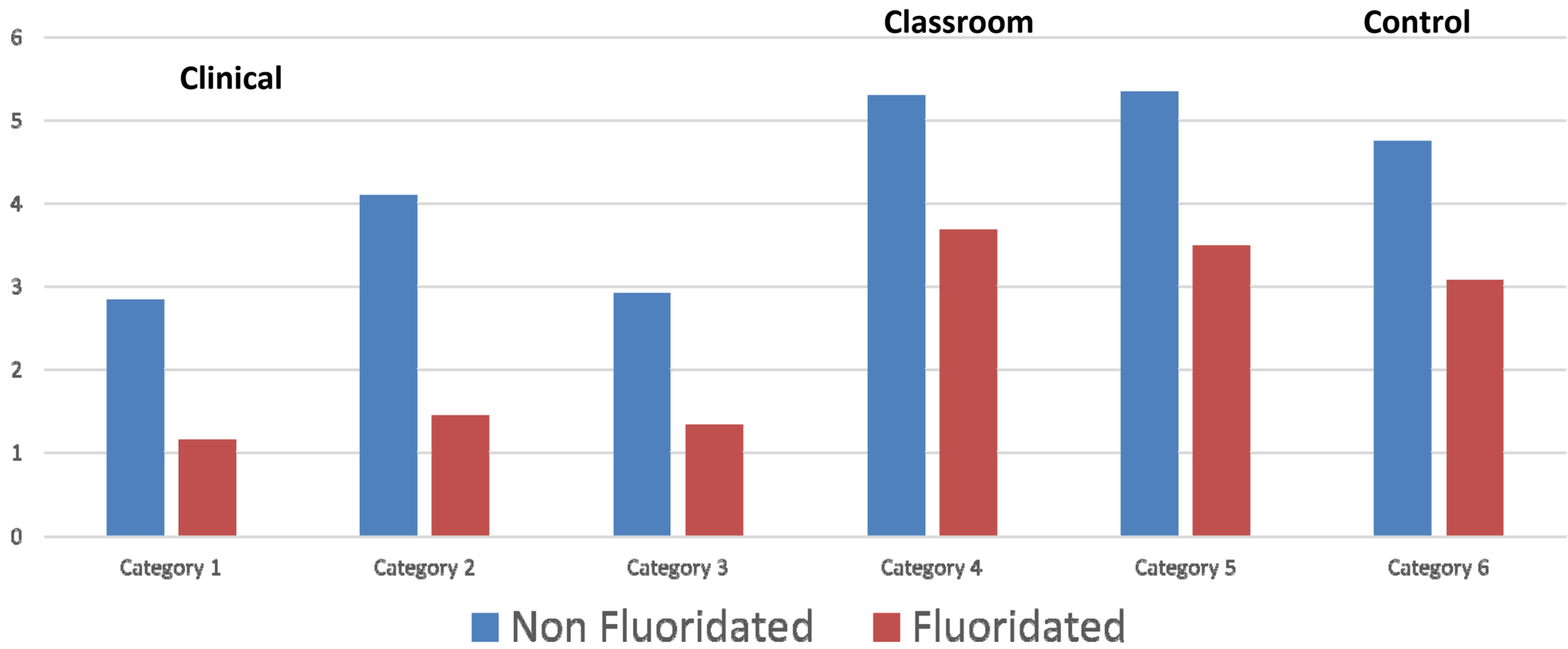
National Preventive Dentistry Demonstration Program



S P Klein, H M Bohannan, R M Bell, et al. Am J Public Health. 1985 April; 75(4): 382–391.

Mean 4 year caries increment (co-variate adjusted) among a cohort of 1 5th grade children:

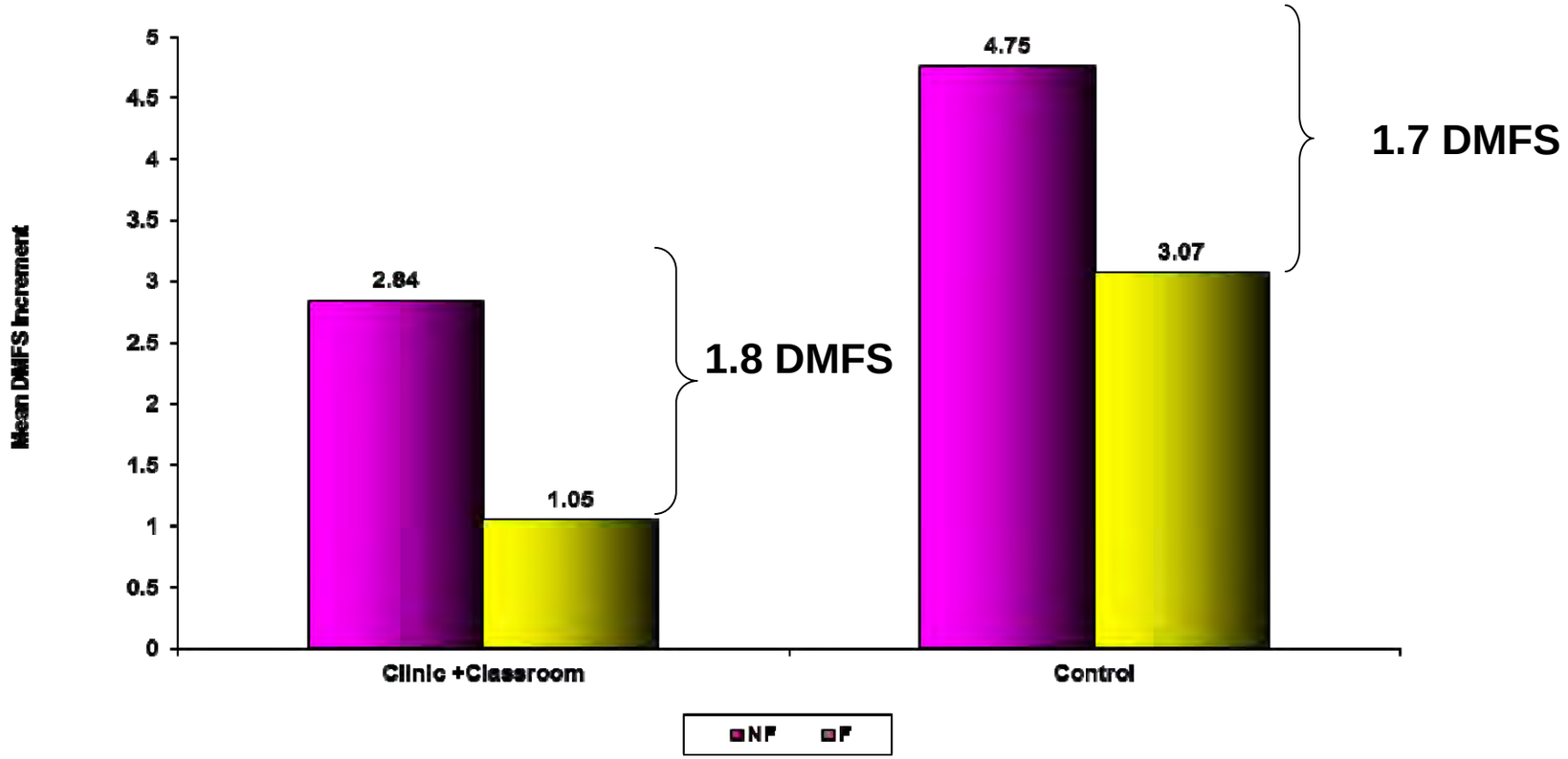
National Preventive Dentistry Demonstration Program



S P Klein, H M Bohannan, R M Bell, et al. Am J Public Health. 1985 April; 75(4): 382–391.

Fluoridation Effect by Clinic + Classroom Intervention

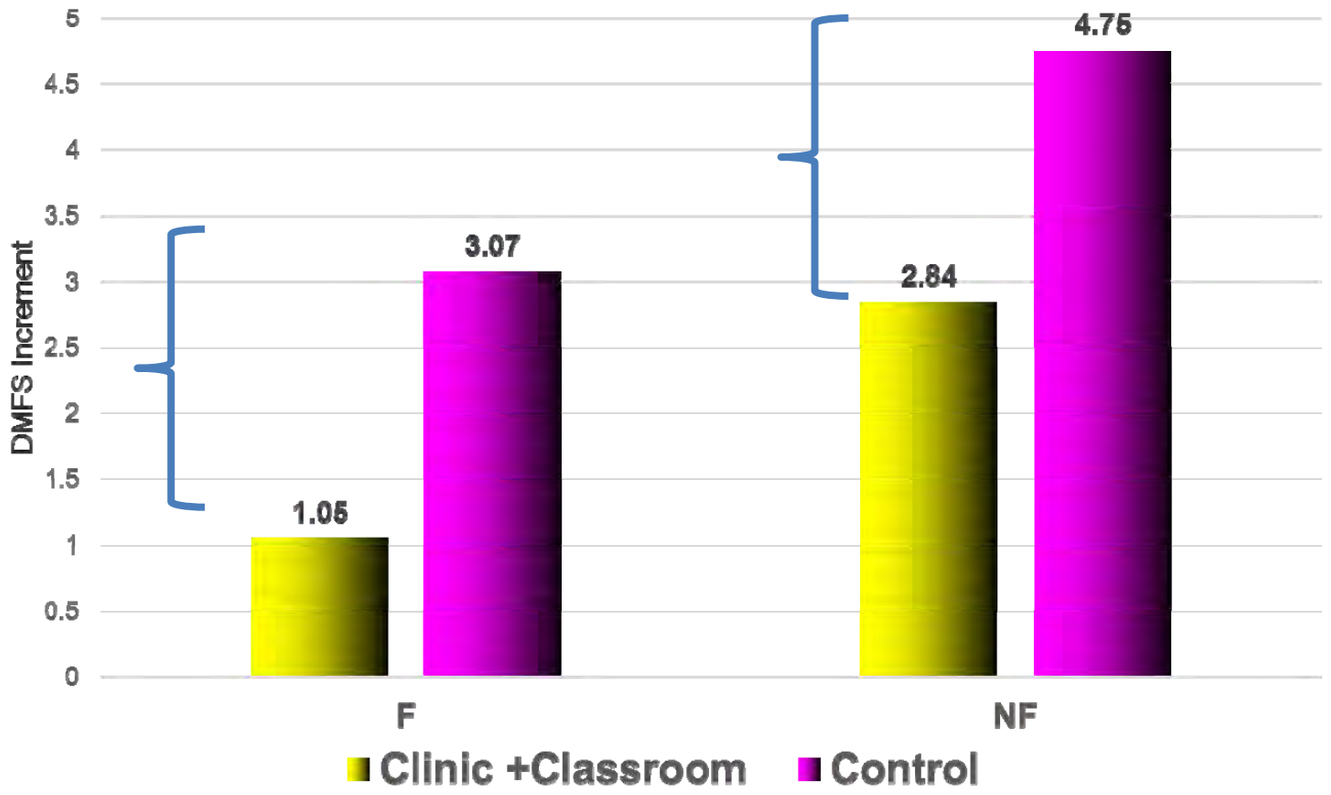
Mean 4 year caries increment among a cohort of 5th grade children -NPDDP



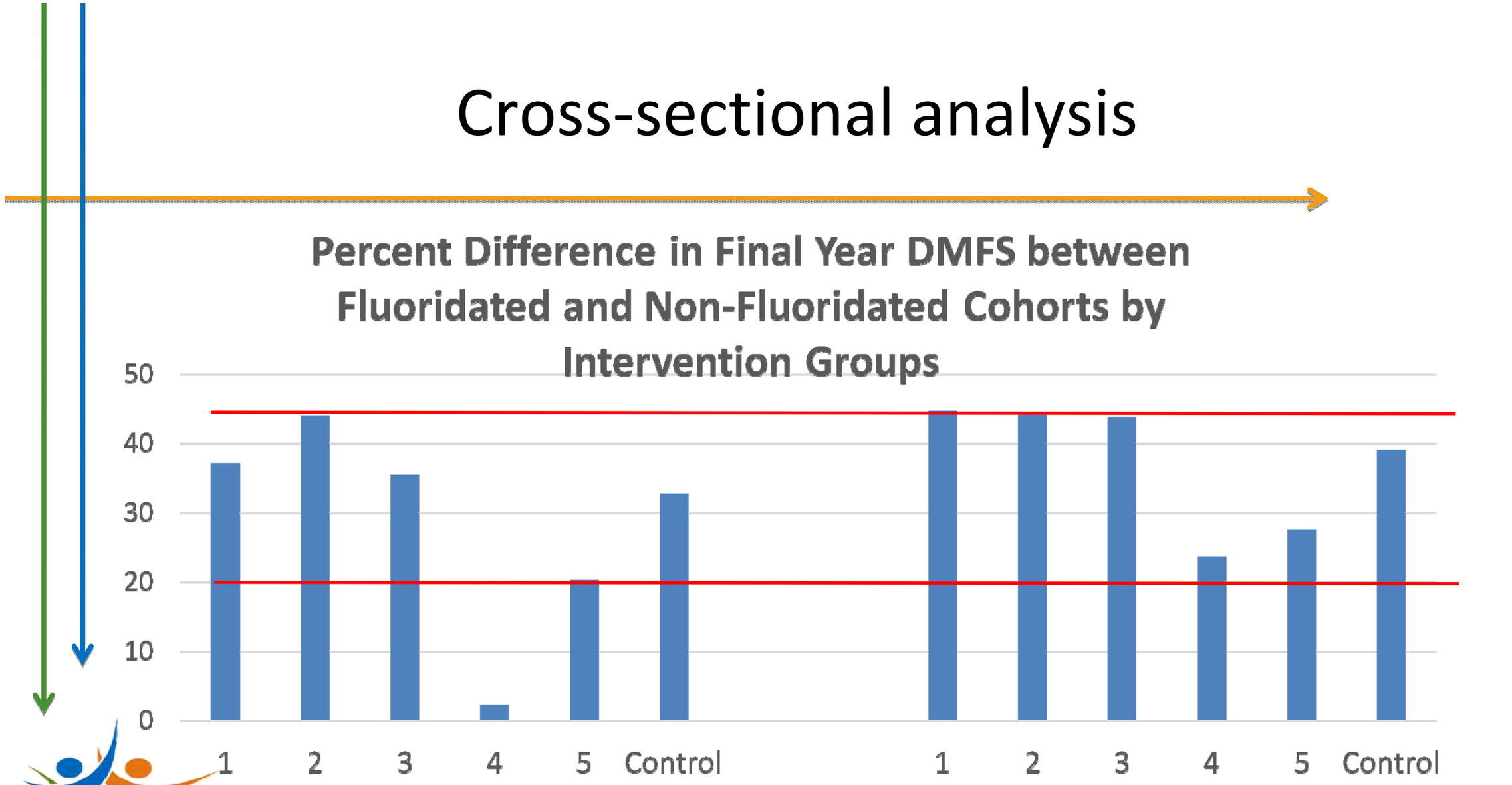
1. Rinse [Tablets] + Lessons + Brushing +Sealants +Prophy/Gel; 6. Control

Effect of Clinic + Classroom Intervention by Fluoridation Status

Mean 4 year caries increment among a cohort of 5th grade children -NPDDP



Cross-sectional analysis



“Some heterogeneities make the generalizability of any research more suspect.”

“If we want more evidence-based practice, we need more practice-based evidence.”

- L. Green

Conclusion

- Establish a Dental Public Health Research Collaborative
- Build evaluation capacity
- Develop infrastructure

Thanks