Application of Systems Dynamic Modeling for Prevention of Early Childhood Caries

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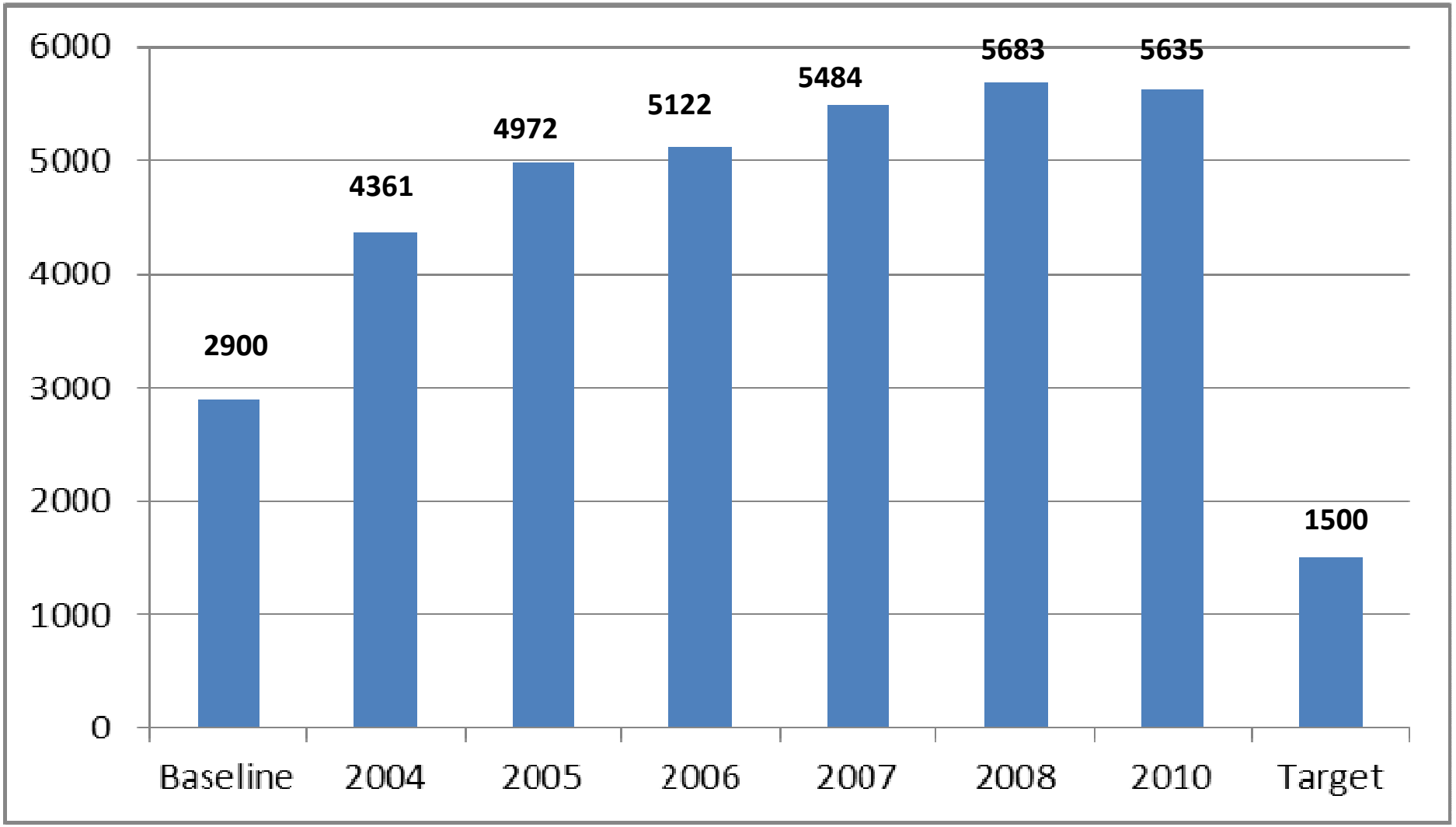
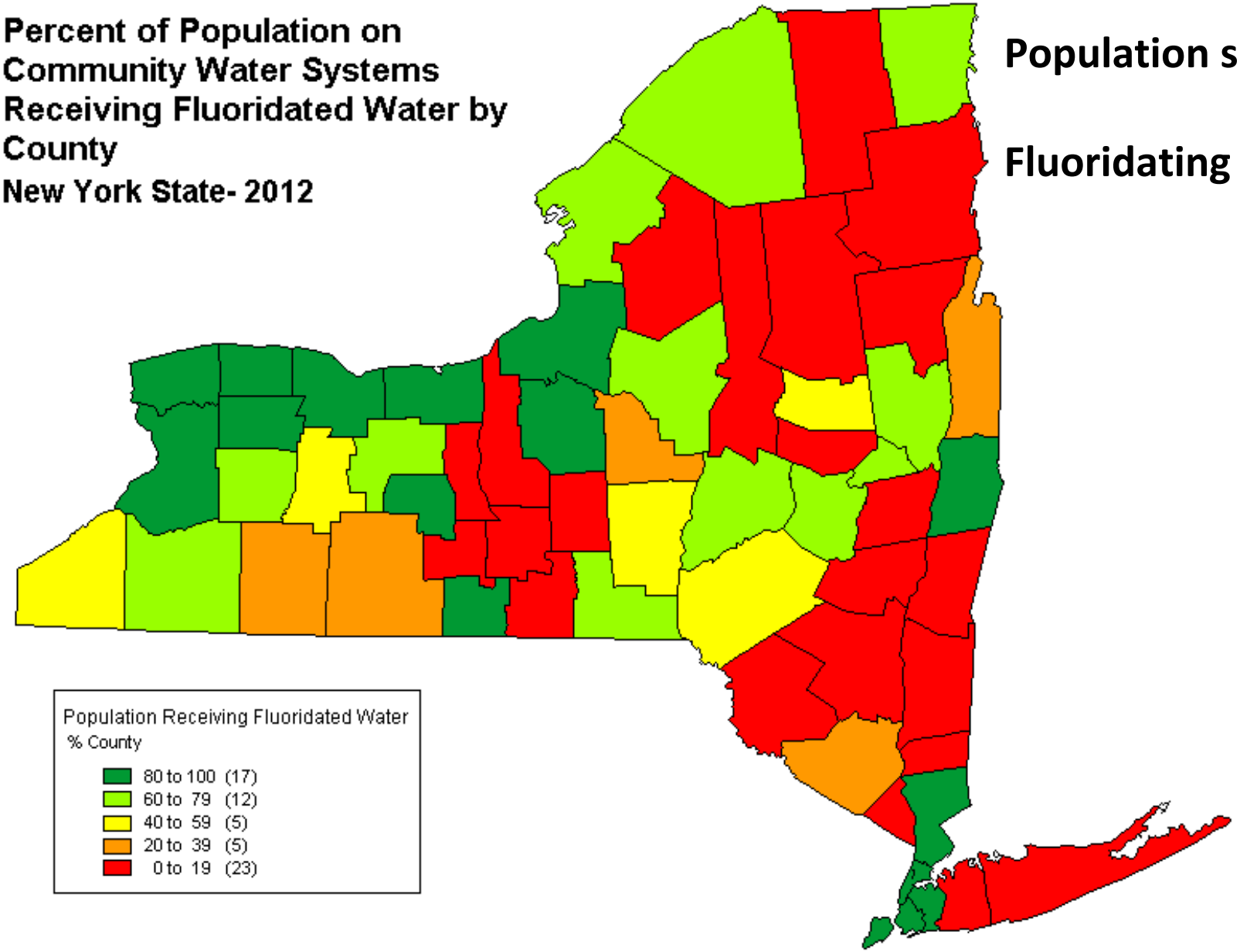
Background

Children (Age < 6) Visiting Emergency Departments (EDs) and Ambulatory Surgery Facilities (ASFs) for Treatment of ECC in New York State , SPARCS 2004-2008, 2010



Fluoridation in New York State

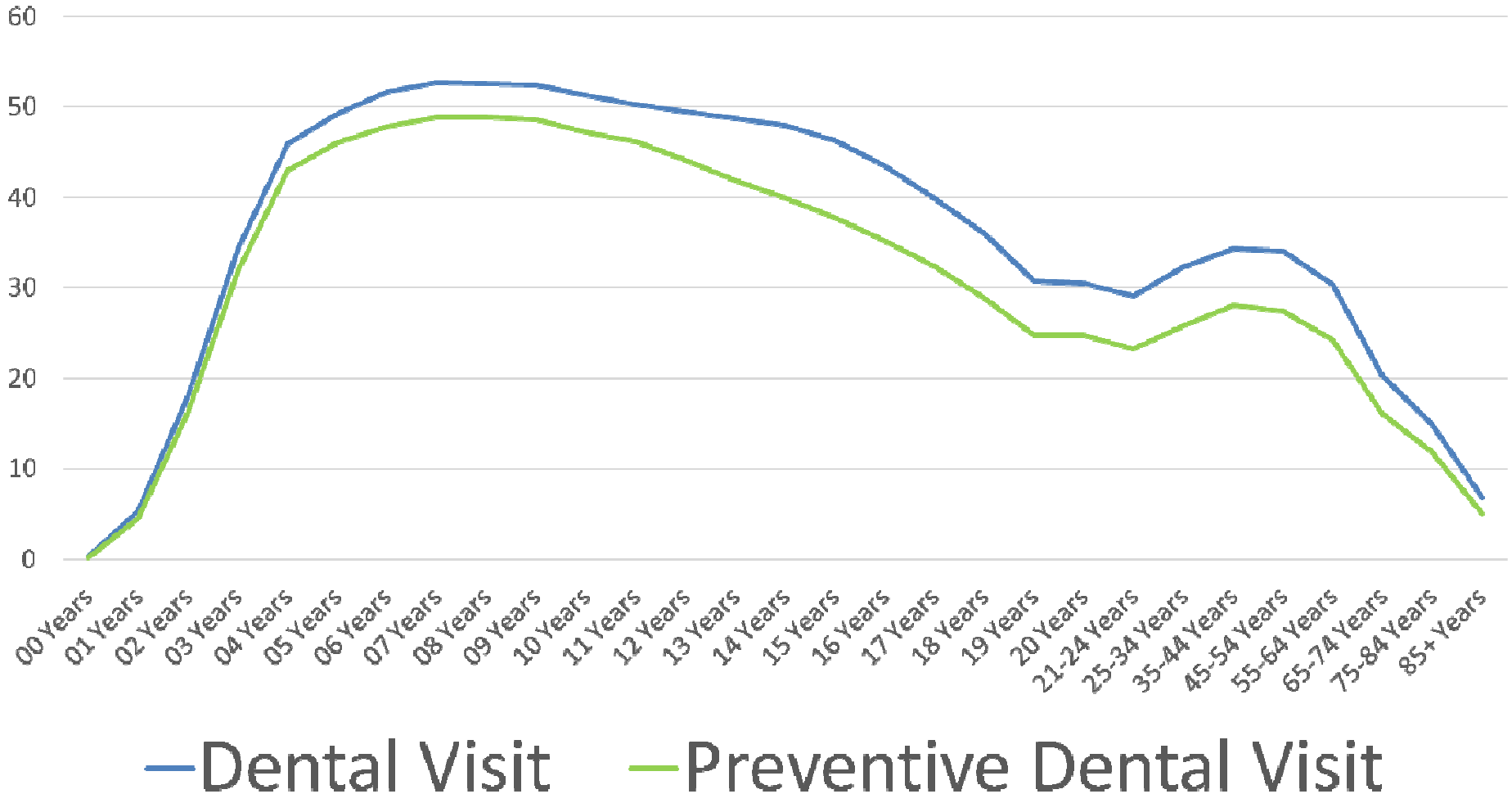
Percent of Population on Community Water Systems Receiving Fluoridated Water by County
New York State- 2012



Population served 12.9 m

Fluoridating Systems 123

Percent with at Least One Dental Visit and One Preventive Dental Visit, NYS Medicaid Program 2011



Goal #5: Reduce the prevalence of dental caries among NYS children

Objective 5-1: By December 31, 2017, reduce the prevalence of tooth decay among NYS children by at least 10%.

Objective 5-2: By December 31, 2017, increase the proportion of NYS children who have protective dental sealants by at least 10%.

Objective 5-3: By December 31, 2017, increase the proportion of NYS children who receive regular dental care by at least 10%.

Objective 5-4: By December 31, 2017, increase the percentage of NYS population receiving fluoridated water by 10%. (71.4% to 78.5%)

Objective 5-5: By December 31, 2017, strengthen systems to improve the oral health of people with special health needs.

Designing Effective Interventions

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People. Saving Money through Prevention.™

PREVENTING CHRONIC DISEASE
PUBLIC HEALTH RESEARCH, PRACTICE, AND POLICY

ORIGINAL RESEARCH

A Simulation Model for Designing Effective Interventions in Early Childhood Caries

Gary B. Hirsch, SM; Burton L. Edelstein, DDS, MPH; Marcy Frosh, JD; Theresa Anselmo, MPH, BSDH, RDH

Population

Effect Size

Reach

Affected teeth

Intervention Cost

Cost of treatment

Reduction in the number of affected teeth

Savings in the cost of treatment

Relative payback

Ten year projections

Population

- NYS Medicaid population under age 6 years
  - households with incomes <133% of the federal poverty level
  - 250, 000 in New York City (41%)
  - 200,000 in Rest Of State (27%)

- Caries risk groups (Data Source: NSCH 2007)
  - Low – 62.9% “excellent or very good”
  - Medium - 25.8% “good”
  - High - 11.3% “fair or poor”

Caries and other outcomes

- Data Source (NHANES 1999-2002)
- Overall prevalence (35%)

	NSCH	Inflated to Reflect	
Overall		20.3%	35.0%
(for 2-5, <133% FPL)			
Low Risk	8.0%	18.1%	
Moderate Risk	34.2%	57.3%	
High Risk	58.6%	77.9%	

- Colorado study methods
  - Proportion of cavities untreated
  - Pre cavitated lesion prevalence

Treatment Cost

- Data Sources
  - NYS Medicaid
  - “SPARCS” – Ambulatory surgery, emergency room
- Dental office restorative care cost - $486
- Emergency room cost for 2.6% of patients - $375
- Operating room cost $4630 for 13.8% of patients
  - Facility cost -$3128 (SPARCS adjusted for charge to cost ratio)
  - Dental treatment cost -$866 (Medicaid)
  - Anesthesia -$485 (Medicaid)
  - Pre-op expenses at $151 (American Academy of Pediatrics)

Interventions and Simulations

1.	Community Water Fluoridation (“CWF”)	2
2.	Fluoride varnish application (FV)	6
3.	Tooth brushing with fluoridated toothpaste	3
4.	Screening for high-risk children by primary care providers & FV application	1
5.	Reducing transmission of caries-causing bacteria from mother to child (<2 years)	2
6.	Motivational interviewing with parents	5
7.	Preventive dental visits	3
8.	Secondary prevention to reduce high-cost cases	2
9.	Combination	3

Selected Interventions	Effect	Cost
2.4 Fluoride Varnish (children ages 6 months to 6 years of age)	22% Wyent et al	$30/claim
3.1 All Medicaid preschoolers assuming a 50% increase in tooth brushing over NYC baseline of 43%	31% Santos	$17/year
4.1 Screening for high risk group combined with four prevention visits/year that include fluoride varnish application	65% Ng et al	$14 at 2 $30/claim
5.1 Reduce transmission among Medicaid preschoolers between birth and 24 months (Xylitol)	64% (7-24) 47% (>2) Soderling, Kohler, Isokangas	$114

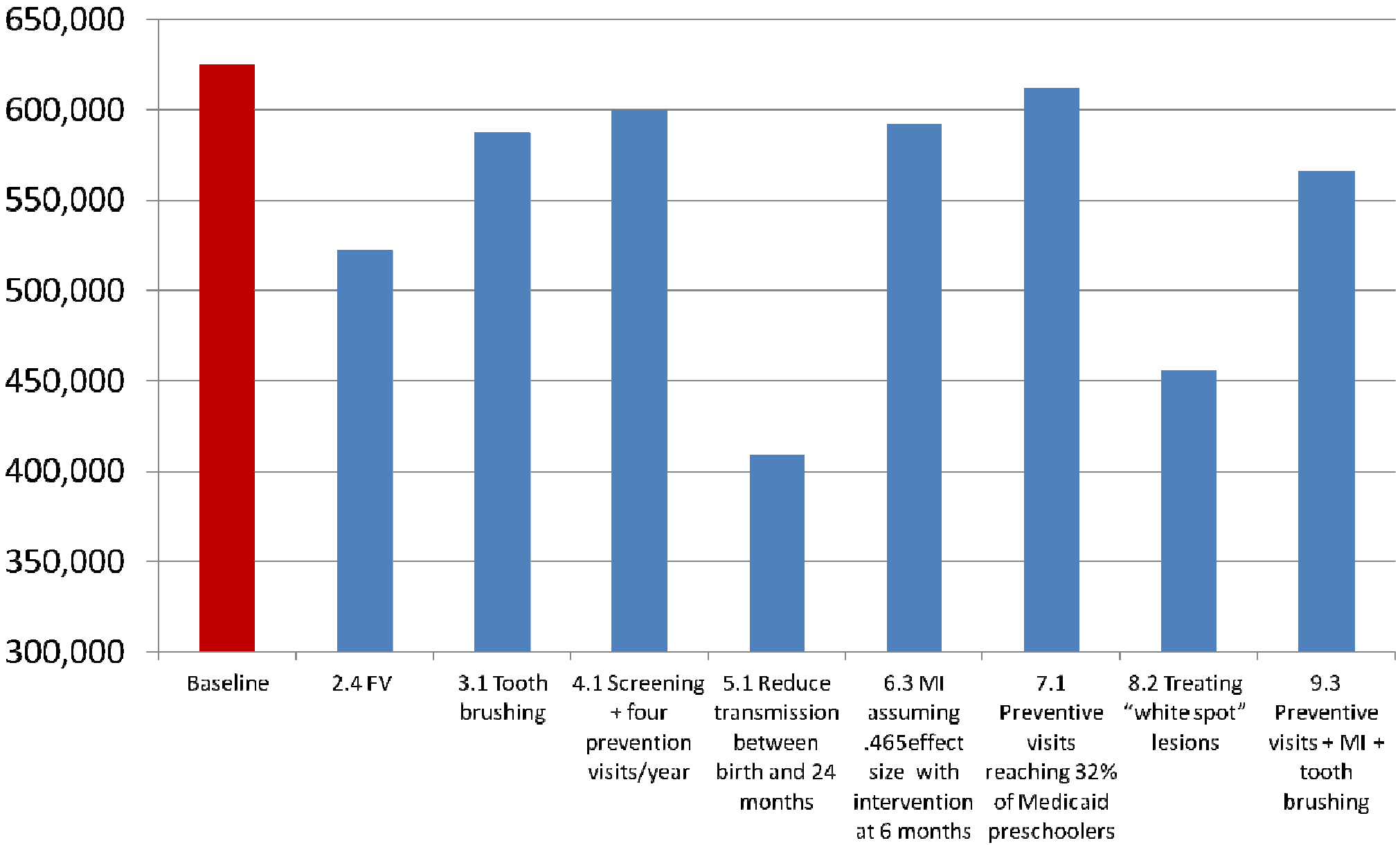
Selected Interventions	Effect	Cost
6.4 Motivational Interviewing with intervention starting at 6 months	46.5% Weinstein et al	$100/session
7.1 Preventive dental visits reaching 32% of Medicaid preschoolers	55% Procedures Beil et al.	$56/claim
8.2 Treating "white spot" lesions prior to cavitation equally aggressively in children 6 months to 2 years and in children 2 to 6 years	20% Low 27% High Expert opinion	$242/child
9.3 All high risk Medicaid preschoolers receiving preventive visits AND MI AND 50% increase in tooth brushing over NYC baseline of 43%	Combined	Combined

Community Water Fluoridation Ten Year Projections

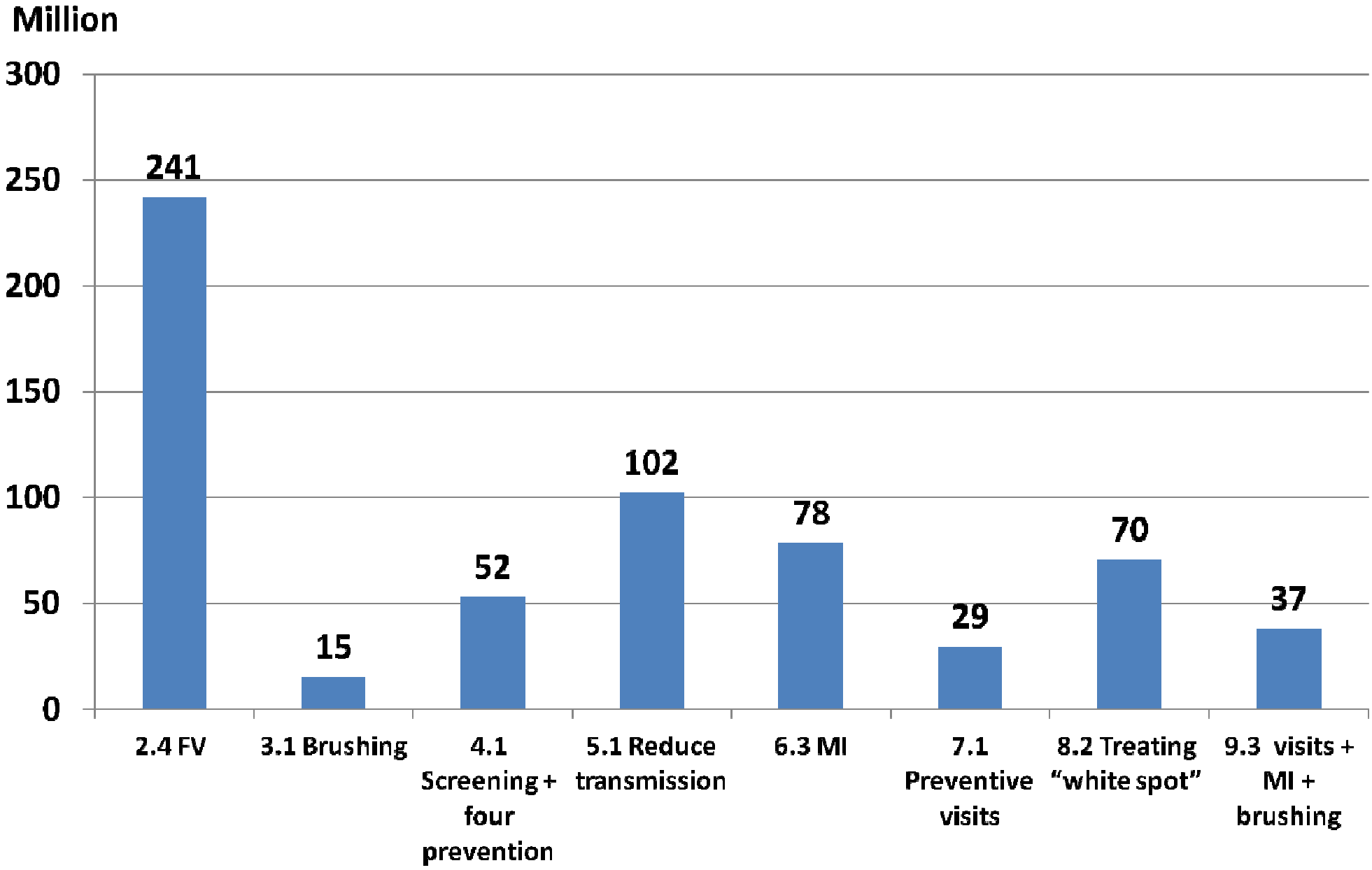
Number of affected teeth	% Reduction in number of affected teeth	Total Intervention Cost (million)	Cumulative Cost of Repair (million)	Savings in Cost of Repair (million)	Ratio of Dollars Saved	Net Savings (million)
Baseline						
625,406	--	$0	$315.9	--	--	--
Increasing Community Water Fluoridation in Rest of State						
605,576	3.2%	$1.2	$303.7	$12.2	$9.99	$10.9
Defluoridating New York City						
710,733	(13.6%)	-$1.7	$371.8	-$55.9	-$32.05	-$54.2

Cost - $1.58 per child per year from Griffin et al, 2001 and MMWR, 1999

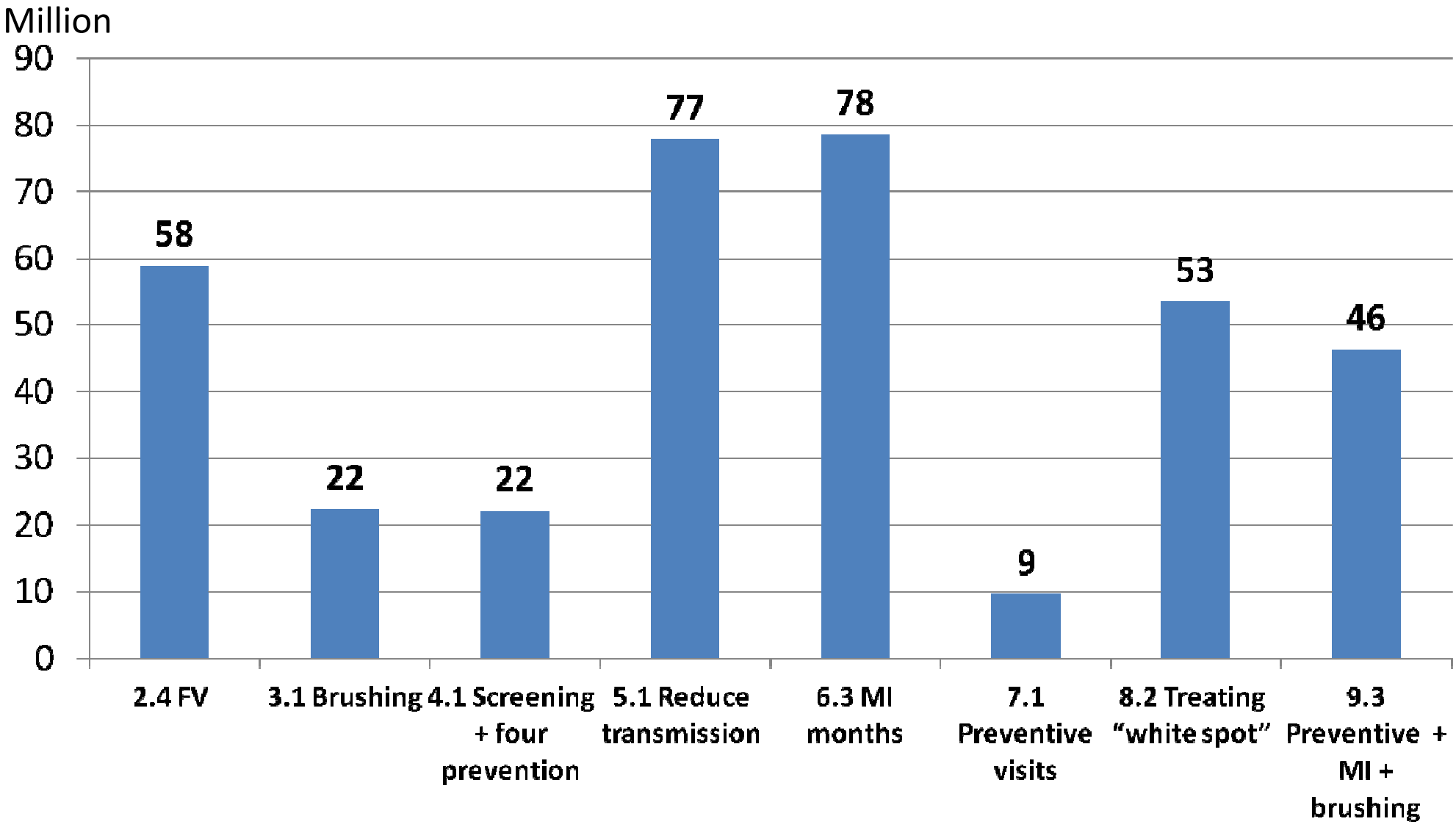
Affected teeth



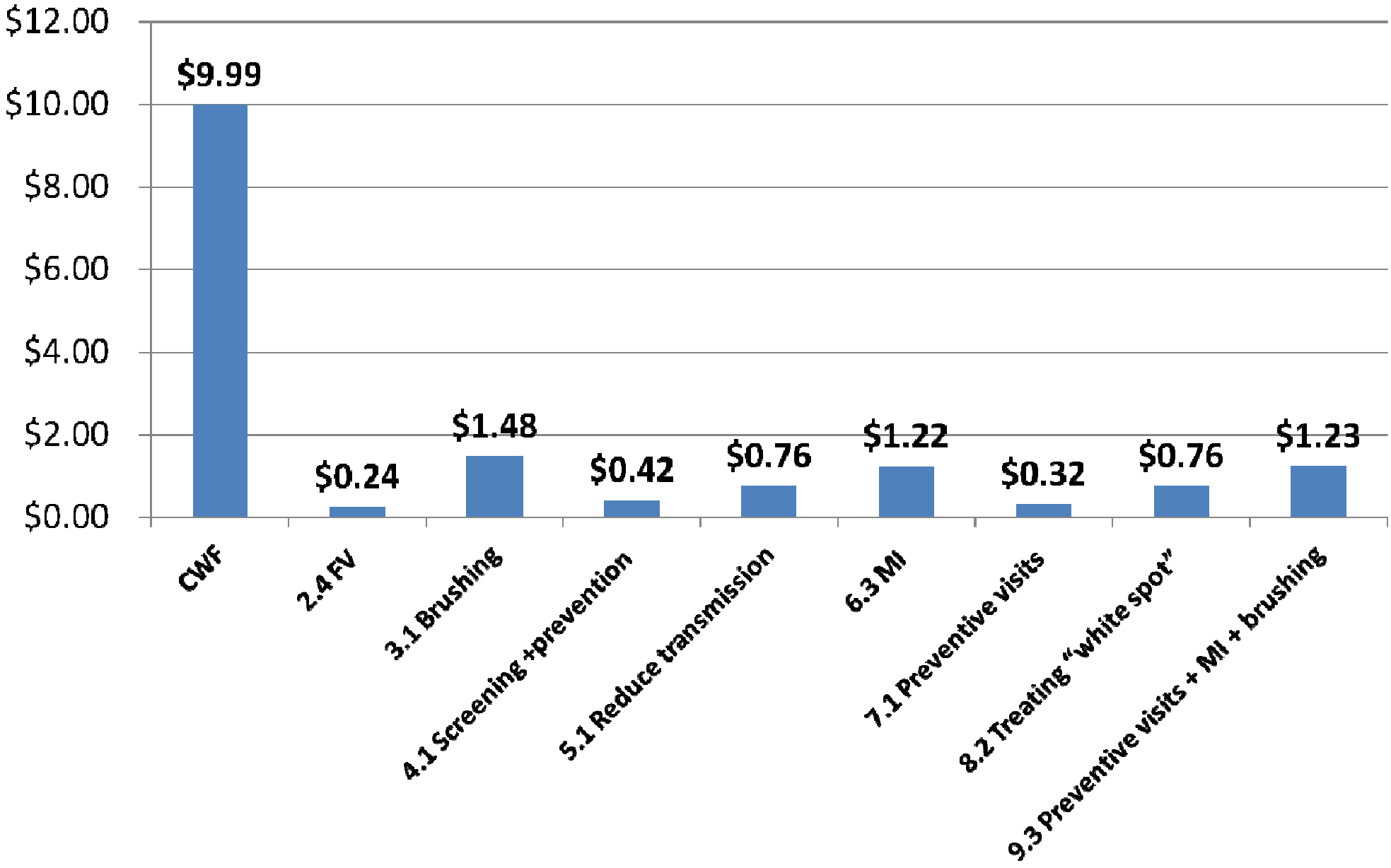
Intervention Cost



Savings in Cost of Repair



Relative Payback for $1 Invested



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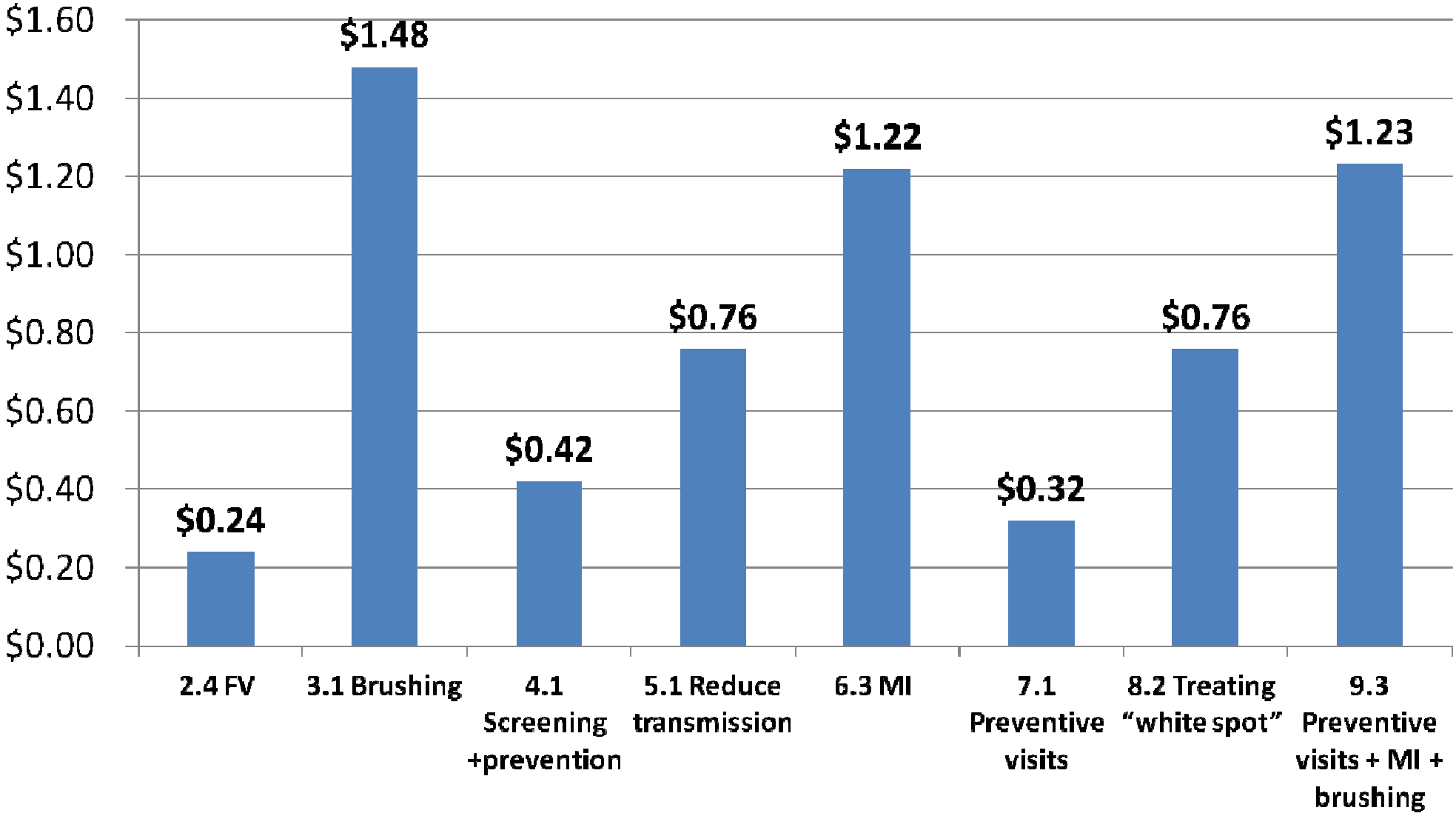

Limitations

- Data quality on effect size of interventions vary
  - Systematic reviews for CWF, Brushing, FV are available but not for other interventions
  - North Carolina provides direct evidence for
- Reach of intervention is not known
- Caries prevalence and number of affected teeth are based on national data
- Considered cost of restorative care only

Conclusions

- Provides information for formulating policies
  - Retaining and expanding community water fluoridation
  - Promoting tooth brushing programs
  - Implementing motivational interviewing
  - Integrating oral health into WIC, Head Start, Day Care and such programs to expand reach
  - Implementing a risk based strategy

Thank you