

Preventing Dental Caries: School-Based Dental Sealant Delivery Programs

Summary Evidence Table - Economic Review

Study	Study and Population Characteristics	Intervention Description	Effect Size	Program Costs (2014 US\$)	Direct Medical Costs Averted Productivity Losses Averted (2014 US\$)	Full Economic Summary Measure (2014 US\$)
<p>Author (Year): Arrow et. al. (2000)</p> <p>Study Design: NA</p> <p>Economic Method: Resource costs (Cost-minimization analysis of 2 interventions, sealants and topical fluoride vs. professional tooth cleaning and oral health education. Only information of sealant costs were used for economic review)</p>	<p>Location: Australia</p> <p>Sample Size: 71 children</p> <p>Population Characteristics: 6-year-old school children</p> <p>Time Horizon: 1-time application</p>	<p>School dental therapist placed 3.1 glass-ionomer sealants per child; 4 handed delivery (meaning the operator and assistant placed the sealants); sealants not maintained</p>	<p>NA</p>	<p>1994 AU\$ were converted to 1994 US\$ using purchasing power parity conversion factor from the World Bank (1US\$ =1.30 AU\$). The 1994 US\$ were converted to 2014 US\$ using Consumer Price Index for Dental Services (441/197.1).</p> <p>Per child labor cost (did not include time for screening or barrier changes; 3 minutes per tooth) = \$7.42 Supplies =\$2.44 Did not report capital, travel, or overhead costs</p>	<p>NA</p>	<p>NA</p>
<p>Author (Year): Bertrand et al. (2010)</p> <p>Study Design: Economic model</p> <p>Economic Method: Resource costs; Economic benefit; Cost effectiveness</p>	<p>Location: Quebec, Canada</p> <p>Sample Size: 78,732 children</p> <p>Population Characteristics: 8 year old children, 71.55% considered high risk. Decay incidence ranged</p>	<p>Compared offering sealants at no charge in private clinics ('private') to offering sealants at no charge in both private clinics and schools ('school')*. Sealants applied to first permanent molars after complete eruption.</p>	<p>For this review, the per child incremental health outcome of 1.48% increase in caries-free children was calculated as the difference in averted cavities between the school and private programs, divided</p>	<p>\$149.99 per child; \$115.33 labor, \$18.09 supplies, \$9.48 travel, \$7.11 other. Costs for sealants delivered in 'private' were from the Fee Guide and Description of Dental Treatment Services. Costs reported in 2008 Canadian\$, converted to 2008</p>	<p>Direct medical and productivity losses converted to 2014 US\$ in same manner as intervention costs.</p> <p>For this review, an incremental net cost of -\$30.76 was calculated as the total cost of the school based program minus</p>	<p>Offering sealants free of charge in school settings as well as clinical settings saves \$30.76 per child.</p>

Study	Study and Population Characteristics	Intervention Description	Effect Size	Program Costs (2014 US\$)	Direct Medical Costs Averted Productivity Losses Averted (2014 US\$)	Full Economic Summary Measure (2014 US\$)
	<p>from 0.1% (13 year olds) to 11.44% (8 year olds) in the low risk population and from 4.5% (14 years) to 24.44% (8 years) in the high risk population.</p> <p>Time Horizon: 10 years</p>	<p>Average of 3.14 surfaces sealed per child. 4-handed delivery used in the school setting. Reseal 3.91%/year in school setting. In private setting, reseal rate was 100% until 10 years of age and then 3.91%.</p> <p>* Study also included strategy of providing sealants free of charge only to high-risk children in school settings. Reviewers did not include this strategy as sealant prevalence among high-risk children was lower than for the other strategies. One rationale for the Task Force’s recommendation of school sealant programs was that they increase sealant prevalence among school children.</p>	<p>by number of students.</p>	<p>US\$ using purchasing power parity rates from the World Bank, further converted to 2014 US\$ using Consumer Price Index for Dental Services (441/281).</p>	<p>total cost of the private program, divided by number of children.</p> <p>Difference in per child productivity losses between ‘private’ and ‘school’ strategies was \$44.20.</p> <p>To estimate difference in restoration costs per child reviewers assumed per child sealant costs were the same for both strategies. Although initial placement costs per child were 2.5% higher under ‘private’ strategy, reviewers could not estimate difference in intervention costs over study horizon because of insufficient information to estimate sealant replacement costs for later years. Because more children were sealed under ‘school’, sealant cost per child was \$20.7 higher than for private. Difference in restoration costs per child between ‘private’ and ‘school’ would be \$7.1.</p>	

Study	Study and Population Characteristics	Intervention Description	Effect Size	Program Costs (2014 US\$)	Direct Medical Costs Averted Productivity Losses Averted (2014 US\$)	Full Economic Summary Measure (2014 US\$)
<p>Author (Year): Bhuridej et al. (2007)</p> <p>Study Design: Longitudinal cohort*</p> <p>Economic Method: Cost effectiveness</p> <p>* Restoration receipt obtained from longitudinal analysis of Medicaid claims data, costs estimated from American Dental Association survey data, and quality adjusted tooth year weights obtained from literature.</p>	<p>Location: Iowa, U.S.</p> <p>Sample Size: 2411 sealed and 6117 not sealed teeth</p> <p>Population Characteristics: 6 year-olds continuously enrolled in Iowa Medicaid who turned 6 between 1996 and 1999 (children had to be enrolled for at least 2 years)</p> <p>18% of non-sealed teeth received restorations over four years</p> <p>Time Horizon: 4 years</p>	<p>Sealants delivered in dental office.</p>	<p>Analysis conducted at tooth level for each 1st permanent molar. Reduction in probability tooth received restoration attributable to sealant ranged from 58% to 75%. Average reduction for four 1st molars was 64%. Obtained quality adjusted tooth year weights for tooth states, sound=1, restored =0.81, and extracted =0 from published study. Study assumed that all teeth not receiving restoration were sound.</p>	<p>Cost per sealant estimated from national survey data of dental fees. Costs reported in 2001 US\$ converted to 2014 US\$ using Consumer Price Index for dental services (441/269).</p>	<p>Benefit measured by averted treatment cost where reduction in restorative services taken from Medicaid claims data and cost of treatment estimated from national survey of dental fees. Benefit converted from 2001 US\$ to 2014 US\$ in same manner as intervention cost.</p> <p>Reviewers estimated productivity losses to calculate net-cost to society. Productivity losses estimated using average time for dental visit using American Dental Association survey data (1.5 hours) at median hourly wage of \$32.31 multiplied by the averted outcomes.</p>	<p>Costs and outcomes discounted at 3% annual rate</p> <p>Net cost per 1st molar using national fee data ranged from \$5.54 to \$9.39 with average value of \$7.43 (median=\$7.40)</p> <p>Net cost per 1st molar using Medicaid fees in sensitivity analysis ranged from \$3.93 to \$16.07 with average value of \$7.95 (median=\$5.90)</p> <p>Net cost per gained QATY ranged from \$316.4 to \$720.7 with average of \$476.4:</p> <p>Net cost to increase QATY from restored to sound state ranged from \$62,9 to 136.9 with average of \$90.9</p>

Study	Study and Population Characteristics	Intervention Description	Effect Size	Program Costs (2014 US\$)	Direct Medical Costs Averted Productivity Losses Averted (2014 US\$)	Full Economic Summary Measure (2014 US\$)
<p>Author (Year): Calderone et al. (YEAR)</p> <p>Study Design: NA</p> <p>Economic Method: Resource costs</p>	<p>Location: New Mexico, U.S.</p> <p>Sample Size: 4593 children</p> <p>Population Characteristics: 2-3 graders and 5-6 graders</p> <p>Time Horizon: One-time placement of sealants</p>	<p>Dental hygienists applied Delton sealant to molars and bicuspid-No maintenance*; On average, sealed 4.24 teeth per child</p> <p>* Converted to 1997 \$US by multiplying reported value (average of monthly Dental CPI from September 1981 to May 1982)/Dental CPI for 1997.</p>	<p>NA</p>	<p>Study in original economic review. Converted costs from 1997 US\$ to 2014 US\$ using CPI for dental services (441/226.6)</p> <p>Costs included sealant materials, personnel, transportation, overhead, and capital equipment</p> <p>Per child: Labor cost: \$23.5 Equipment cost: \$3.89 Supplies cost: \$5.35 Travel cost: \$3.27 Total cost: \$36.02</p>	<p>NA</p>	<p>NA</p>
<p>Author (Year): Dasanayake et al. (2003)</p> <p>Study Design: Longitudinal retrospective cohort</p> <p>Economic Method: Economic benefit; Cost effectiveness</p>	<p>Location: Alabama, U.S.</p> <p>Sample Size: 2077 children in sealant group, 5631 in no sealant group</p> <p>Population Characteristics: Children who were 5- to 7-years-old by October 1990 and continuously enrolled in Alabama Medicaid from 1990 to 1997</p>	<p>Children who had Medicaid claim for at least one sealant vs. children with no sealant claim</p>	<p>0.23 restoration averted per child</p>	<p>Costs reported in 1990 to 1997 US\$. Converted to 2014 US\$ assuming in 1994\$ using CPI for dental services (441/197.1) Sealant cost were \$44.82 per child</p> <p>Costs and outcomes not discounted</p>	<p>Averted treatment costs, \$81.51, Costs reported in 1994 US\$ converted to 2014 US\$ using Consumer Price Index for Dental Services (441/197.1).</p> <p>Productivity losses estimated by reviewers</p>	<p>From the Medicaid perspective, net cost was -\$36.69 per child sealed. The program is cost saving.</p>

Study	Study and Population Characteristics	Intervention Description	Effect Size	Program Costs (2014 US\$)	Direct Medical Costs Averted Productivity Losses Averted (2014 US\$)	Full Economic Summary Measure (2014 US\$)
	Annual attack rate of 0.048 (calculated at child level) Time Horizon: 8 years					
Author (Year): Garcia et al. (1988) Study Design: NA Economic Method: Resource Costs	Location: 5 state sealant programs Sample Size: 30,331 children Population Characteristics: Children in grades K-12	Sealants delivered in school setting; sealant material and personnel varied by state; At least one program used dental van	NA	Study in original economic review. Converted costs from 1997 US\$ to 2014 US\$ using CPI for dental services (441/226.6) Per child: Labor costs ranged from \$32.87 to \$77.26 Equipment (4% discount rate) costs ranged from \$1.03 to \$4.16 Supplies costs ranged from \$5.27 to \$7.73 Travel costs ranged from \$0.41 to \$3.33 Total costs ranged from \$41.64 to \$90.77	NA	NA

Study	Study and Population Characteristics	Intervention Description	Effect Size	Program Costs (2014 US\$)	Direct Medical Costs Averted Productivity Losses Averted (2014 US\$)	Full Economic Summary Measure (2014 US\$)
<p>Author (Year): Griffin et al. (2002)</p> <p>Study Design: Economic model</p> <p>Economic Method: Economic benefit; Cost effectiveness</p>	<p>Location: U.S.</p> <p>Population Characteristics: Time of first permanent molar eruption: 72-83 months of age.</p> <p>Annual caries increment per 1st molar is 0.0624 surfaces.</p> <p>9 years</p>	<p>Comparison of sealing all children (SA) to sealing no children (SN). Sealants applied in dental office to first permanent molar at time of eruption. One tooth sealed per child. Autopolymerizing resin-based sealant, no re-sealing.</p> <p>Study also included strategy of only delivering sealants to high-risk children. This strategy was not included in this economic review as Community Preventive Services Task Force in effectiveness review reported possible stigmatization of children when SSPs differentiate among children at the same school.</p>	<p>Sealant retention rate of 80% in the first year, 97% years 2-9 and no benefit thereafter.</p> <p>0.28 averted caries.</p>	<p>Sealant costs \$48.17 per tooth. Costs estimated from national survey of dental fees. Assumed no screening costs. Costs reported in 1999 US\$ converted to 2014 US\$ using Consumer Price Index for Dental Services (441/281).</p>	<p>Averted treatment costs, \$36.55, estimated by multiplying averted cavities by cost of restoration (national survey of dental fees). Costs reported in 1999 US\$ converted to 2014 US\$ using Consumer Price Index for Dental Services (441/281).</p> <p>Productivity losses estimated by reviewers</p>	<p>3% discount rate</p> <p>From the payer perspective, net cost is \$11.61 per tooth sealed and \$41.78 per averted caries.</p>
<p>Author (Year): Klein et al. (1985)</p> <p>Study Design: NA</p>	<p>Location: National Dentistry Demonstration Project- 10 U.S. cities</p> <p>Sample Size: 10,566 children</p>	<p>Applied light-cured resin sealant to permanent molars and premolars (up to 10 teeth per child), which was reapplied up to 3 times as needed</p>	<p>NA</p>	<p>Study in original economic review. Converted costs from 1997 US\$ to 2014 US\$ using CPI for dental services 441/226.6)</p>	<p>NA</p>	<p>NA</p>

Study	Study and Population Characteristics	Intervention Description	Effect Size	Program Costs (2014 US\$)	Direct Medical Costs Averted Productivity Losses Averted (2014 US\$)	Full Economic Summary Measure (2014 US\$)
<p>Economic Method: Resource costs (Multi-site randomized controlled trial on effectiveness and costs of school sealant programs. For this review, only cost information was used. Findings on effectiveness were included in Community Guide review of effectiveness.)</p>	<p>Population Characteristics: Children in grades 1, 2 and 5.</p> <p>Time Horizon: 4 years</p>			<p>Costs (not itemized by resource category) include: personnel (dentist, dental hygienist, dental assistant, clerk), overhead, capital equipment* and sealant</p> <p>Total annual cost per child \$116.44</p> <p>*Although study reported that capital costs were amortized it did not specify discount rate.</p>		
<p>Author (Year): Marino et. al. (2012)</p> <p>Study Design: Economic model</p> <p>Economic Method: Resource costs; Economic benefit Cost effectiveness</p>	<p>Location: Chile</p> <p>Sample Size: 80,000 children</p> <p>Population Characteristics: Hypothetical 6 year old children</p> <p>Time Horizon: 6 years</p>	<p>Sealants applied in a community based center, by a dentist. Four first permanent molars sealed per child. Resealing rate of 10% total over the 6 year period.</p>	<p>1.11 averted caries per child</p>	<p>Sealant cost \$33.36 per child. Costs obtained from Ministry of Health fee schedule. Costs reported in 2009 Chilean\$, converted to 2009 US\$ using purchasing power parity rates from the World Bank, further converted to 2014 US\$ using Consumer Price Index for Dental Services (441/281). Labor costs \$7.19, supplies \$25.92, travel \$0.24.</p>	<p>Averted treatment costs estimated by multiplying averted cavities by cost of restoration (from local rates). Costs reported in 2009 Chilean\$, converted to 2009 US\$ using purchasing power parity rates from the World Bank, further converted to 2014 US\$ using Consumer Price Index for Dental Services (441/281).</p> <p>Averted productivity loss calculated from 1.5 hours of lost productivity at minimum wage per</p>	<p>3% discount on costs but not outcomes.</p> <p>Net cost per child \$14.58.</p> <p>Net cost per averted cavity \$13.13.</p>

Study	Study and Population Characteristics	Intervention Description	Effect Size	Program Costs (2014 US\$)	Direct Medical Costs Averted Productivity Losses Averted (2014 US\$)	Full Economic Summary Measure (2014 US\$)
					decayed tooth plus public transportation costs.	
<p>Author (Year): Morgan et. al. (1998)</p> <p>Study Design: NA</p> <p>Economic Method: Resource costs (Study examined cost-effectiveness of sealants but only used findings for costs in this review.)</p>	<p>Location: Victoria, Australia</p> <p>Sample Size: 250 children</p> <p>Population Characteristics: 12 and 13-year olds in grade seven from low-income families attending 5 schools (only schools with above average levels of caries prevalence).</p> <p>Time Horizon: 3 years</p>	<p>Sealed 2nd permanent molars and provided weekly fluoride mouth rinse. Sealants repaired every year</p>	<p>NA</p>	<p>Study in original economic review. Converted costs from 1997 US\$ to 2014 US\$ using CPI for dental services (441/226.6)</p> <p>Annual costs per child: Labor costs \$25.35 Equipment \$3.08 Supplies \$1.64 Travel \$1.43 Other \$3.86 Total \$35.35</p>	<p>NA</p>	<p>NA</p>
<p>Author (Year): Quinonez et al. (2005)</p> <p>Study Design: Economic model</p> <p>Economic Method: Economic benefit; Cost effectiveness</p>	<p>Location: U.S.</p> <p>Sample: Hypothetical population representing U.S.</p> <p>Population Characteristics: 20% of children were high risk, with a 24.0% annual attack rate and 80% were low risk with 4.0% annual attack rate</p>	<p>Sealed permanent first molars in dental office; Re-sealing rate was 3.91% annually; Analysis conducted at tooth level so all costs and benefits are per tooth.</p>	<p>Cumulative retention was 90% after first year and 53% by year 10. Model assumed that tooth with retained sealant could not develop caries (i.e., sealants 100% effective).</p>	<p>Cost per sealant estimated from national survey data of dental fees. Costs reported in 2002 US\$ converted to 2014 US\$ using Consumer Price Index for Dental Services (441/281).</p>	<p>Averted treatment costs estimated by multiplying averted cavities obtained from Markov model by cost of restoration (from national survey data of dental fees). Costs reported in 2002 US\$ converted to 2014 US\$ using Consumer Price Index for Dental Services (441/281).</p> <p>Analysis conducted from payer perspective so did not</p>	<p>Costs associated with sealant and restorations calculated for 3 delivery strategies: Seal all (SA) children \$85.69 Seal no (SN) children \$106.88 Seal only high-risk (SHR) children \$84.43'</p> <p>Incremental cost: SA v. SN -\$21.19 (cost saving to seal all)</p>

Study	Study and Population Characteristics	Intervention Description	Effect Size	Program Costs (2014 US\$)	Direct Medical Costs Averted Productivity Losses Averted (2014 US\$)	Full Economic Summary Measure (2014 US\$)
	<p>Time Horizon: 10 years</p>				<p>include productivity losses and could not be estimated by reviewers as health outcome was caries free months.</p>	<p>SHR v. SN -\$22.44 (cos saving to seal high-risk children)</p>
<p>Author (Year): Scherrer et. al. (2007)</p> <p>Study Design: Economic model</p> <p>Economic Method: Resource costs; Economic benefit; Cost effectiveness</p>	<p>Location: Wisconsin, U.S.</p> <p>Sample Size: 10,697 tooth surfaces (2,670 children)</p> <p>Population Characteristics: Annual attack rate 0.132</p> <p>Time Horizon: 9 years</p>	<p>Sealed permanent first molars in SSP; 4-handed delivery, general supervision, 102 school events of average size 43 students. Average of 4 surfaces per child.</p>	<p>Retention rate of 90% annually. Model assumed that tooth with retained sealant could not develop caries (i.e., sealants 100% effective). 1.85 averted caries per child.</p>	<p>Cost per sealant estimated from program data. Costs reported in 2003 US\$ converted to 2014 US\$ using Consumer Price Index for Dental Services (441/281). Labor costs \$33.57, equipment costs \$0.38.</p>	<p>Averted treatment costs estimated by multiplying averted cavities by cost of restoration (Medicaid reimbursement for state payer perspective and WI survey data of dental fees for social perspective). Costs reported in 2003 US\$ converted to 2014 US\$ using Consumer Price Index for Dental Services (441/281).</p> <p>From societal perspective, productivity losses of 1.5 hours at WI minimum wage (parent's time).</p>	<p>3% discount rate used.</p> <p>Social perspective: net cost of -\$166.81 (cost saving to seal).</p> <p>State payer perspective: net cost \$31.22 and net cost per averted cavity was \$16.88</p>
<p>Author (Year): Weintraub et al. (2001)</p> <p>Study Design: Longitudinal retrospective cohort</p>	<p>Location: North Carolina, U.S.</p> <p>Sample Size: 3,600 children in sealant group and 11,838 children in not sealed group</p>	<p>Children receiving at least one sealant on permanent 1st molar in dental office vs. children who received no sealant on 1st permanent molar. Separate analysis</p>	<p>Averted restorations per child: 0.11 for low risk, 0.29 for medium risk and 0.41 for high risk</p>	<p>Costs reported in 1992 US\$. Converted to 2014 US \$ assuming in 1994\$ using CPI for dental services (441/178.7)</p> <p>Sealant cost were \$28.63 per tooth</p>	<p>Averted treatment costs, \$5.60 for low risk, \$23.54 for medium risk and \$37.54 for high risk. Costs reported in 1992 US\$ converted to 2014 US\$ using Consumer Price Index</p>	<p>From the Medicaid perspective, net cost is \$23.03 (low risk), \$5.08 (medium risk) and -\$8.91 (high risk) per tooth sealed.</p> <p>The program is cost saving when high risk teeth are sealed</p>

Study	Study and Population Characteristics	Intervention Description	Effect Size	Program Costs (2014 US\$)	Direct Medical Costs Averted Productivity Losses Averted (2014 US\$)	Full Economic Summary Measure (2014 US\$)
<p>Economic Method: Economic benefit; Cost effectiveness</p>	<p>Population Characteristics: 5-7 years old children, enrolled in North Carolina Medicaid</p> <p>Annual attack rate Low risk: 0.046 Medium risk: 0.119 High risk: 0.161</p> <p>Time Horizon: Study had 8 years (reviewers used 5 years as difference between sealed and not sealed peaked at year 5)</p>	<p>conducted for each 1st molar.</p> <p>Divided children into 3 risk groups: low (no prior molar restoration); medium (1 prior molar restoration); and high (2 or more prior molar restorations)</p>		<p>No discounting</p>	<p>for Dental Services (441/178.7).</p> <p>Productivity losses estimated by reviewers</p>	<p>and cost \$205.76 (low risk) and \$17.24 (medium risk) per averted restoration</p>
<p>Author (Year): Werner et al. (2000)</p> <p>Study Design: Economic model</p> <p>Economic Method: Resource costs; Economic benefit; Cost effectiveness</p>	<p>Location: Michigan, U.S.</p> <p>Sample Size: 800 children , 2500 tooth surfaces</p> <p>Population Characteristics: 6-7 years old children from high risk schools</p> <p>Annual attack rate of 0.536</p> <p>Time Horizon: 6 years</p>	<p>32% sealant effectiveness,18 minutes sealing time per tooth surface Sealant placed at school based program, screening by dentist and sealant delivery by dental hygienist and dental assistant</p>	<p>0.94 averted caries per child</p>	<p>Costs reported in1991 US\$ converted to 2014 US\$ using Consumer Price Index for Dental Services (441/167.4).</p> <p>Labor costs \$149.52, equipment costs \$1.27 and supplies \$12.37, Total cost per child \$163.16</p> <p>Cost not discounted</p>	<p>Averted treatment costs estimated by multiplying averted cavities by average cost of amalgam restoration in 2014 US\$</p> <p>Productivity losses estimated by reviewers</p>	<p>No discounting</p> <p>From societal perspective net cost \$0.19 per child sealed.</p> <p>Reviewers classified as cost neutral as cost rounds to \$0.</p>