

Improving Oral Health Through Measurement

GUIDANCE ON CARIES RISK ASSESSMENT IN CHILDREN

A REPORT OF THE EXPERT PANEL FOR USE BY THE DENTAL QUALITY ALLIANCE

June 2018

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Background and Purpose

Dental caries is the most common chronic disease in children in the United States.¹ The American Dental Association (ADA) notes: "Systematic methods of caries detection, classification, and risk assessment, as well as prevention/risk management strategies, can help to reduce patient risk of developing advanced disease and may even arrest the disease process."² There is increasing emphasis on assessing and documenting caries risk not only for the purposes of **patient** education and to guide prevention and treatment planning but also for use in quality improvement, benefit design and payment. The Dental Quality Alliance (DQA) has developed measures that require practices to assess and document caries risk status. With greater interest in using CRA for multiple purposes, it is important that standardized guidance is established for determining and documenting risk status and using this information for individual care planning and population policy.

The ADA, AAPD, and DQA convened a 14-member expert panel (<u>Appendix 1</u>) comprised of cariologists, epidemiologists, pediatric and general dentists, educators, and individuals with expertise in health information technology standards. The panel was tasked with the following:

- review the current state of science on caries risk assessment; and
- develop comprehensive guidance on categorization of risk for the purposes of education, care planning, benefit design and quality improvement.

Identification of Existing CRA Tools

There are several caries risk assessment (CRA) tools in use today including tools from the American Dental Association (ADA) and the American Academy of Pediatric Dentistry (AAPD), tools based on the Caries Management by Risk Assessment (CAMBRA) philosophy, and software-based prediction tools such as Cariogram and PreViser. In addition, several state Medicaid programs are developing their own CRA tools to support quality measurement within their programs.^{3,4} Project staff developed a matrix that compares the data elements contained in 5 commonly used CRA systems (AAPD, ADA, Cariogram, tools based on the CAMBRA philosophy and Previser).

	AAPD	AAPD	ADA	ADA	Cariogram	CAMBRA	CAMBRA	PreViser	PreViser	PreViser
Population/ Age	0 - 5 years	>=6 years	0-6 years	> 6 years		0 - 5 years	> 6 years	1 - 4 years	5 - 18 years	19+ years

Table 1. Caries Risk/Protective Factors in Existing CRA Tools

FACTORS (Pooled domains. Not worded exactly as they appear on the forms)											
	Pit, fissure, White Spot lesion (WSL), non- cavitated or enamel defect	x	x	x	x		x	x	x	x	x
	>=1 interproximal lesion		x		x			x			
Caries Lesions (Active	ADA Caries Classification System (CCS) initial lesion								x	x	x
or past)	ADA CCS moderate or advanced lesion								x	x	x
	dmf/DMF teeth	x				x					
	Obvious Caries					x	х	x			
	Missing due to caries			х	х				х	x	x
	Restorations or cavitated lesions			x	x		x	x			
Saliva flow/Dry mouth			x	x	x	x	x	x	x	x	х
Plaque/poor oral hygiene		x	х	х	х	x	х	x	х	x	х
Diet/frequent snacks/sugary foods/drinks		x	х	x	x	x	x	x	х	x	x
Appliances/ orthodontic appliance, space maintainer or obturator			x	x	x		x	x	x	x	x
General health conditions/major health change/ Special healthcare needs/ development that interferes with brushing/flossing		x	x	x	x	x	x		x	x	x
Eating Disorders					x						
Chemo/radiation therapy					x						
Mother, Caregiver and or siblings	Caries Experience			x	X (age 14)						
	Active Caries	x									
	Last 12 months						x		x		

Bottle Use		x					x		x		
Socio- demographic/Eligible for government programs		x	x	x			х				
Parent/caregiver low health literacy							x		x		
Immigrant		x	x								
Defective restorations			x								
Insufficient dental care frequency									х	x	х
Access to care/ Dental Home		x	x	x	x		x				
Restorations with overhangs/ Open margins					x						
Unusual Tooth Morphology/ Deep P & F					x			x			
Exposed root					x			x			x
Microflora/bacteria culture		x	x			х	х	x	х	x	х
Saliva Buffer						x					
Clinical Judgment						x					
Drug, Alcohol abuse					x			x		x	х
Brushing with fluoride toothpaste		x	x				x	x			
Fluoride exposure/fluoridated water/fluoride nonprescription fluoride product/fluoride varnish		x	x	x	x	x	x	x	x	x	x
Calcium phosphate paste								х			
Chlorhexidine								x			
Xylitol Use			x				x	x			
Chews sugar-free gum										x	х
Number of risk categories											
Low		Φ	Φ	Φ	Φ	Φ	Φ	Φ	Φ	Φ	Φ
Medium		Ф	Φ	Φ	Φ	Φ	Φ	Φ	Φ	Φ	Φ
High		Φ	Φ	Φ	Φ	Φ	Φ	Φ	Φ	Φ	Φ
Extreme							Φ	Φ			

State of Science: Validity of Existing CRA Tools

The ADA's Center for Evidence Based Dentistry (CEBD) reviewed published systematic reviews that have evaluated the validity of existing CRA tools as well as other prediction models. Systematic reviews published between January 2007 and March 2017 were included. There was no language restriction. Searches were conducted in MEDLINE and EMBASE via Ovid. A total of 268 reference titles and abstracts were obtained with 45 full text reviews. Three systematic reviews, representing 62 primary studies, were identified. None of the studies evaluated the current ADA or AAPD tools. Several studies evaluated the Cariogram and CAMBRA-based tools (Table 2). The systematic reviews themselves were assessed to be of moderate to high quality. However, the evidence presented within the reviews was of varied quality. There was large variation on selection criteria of primary studies, inconsistency in estimates reported in the reviews, and inflation in estimates due to potential collinearity issues that was poorly explored in the studies.

Table 2. Sommary of stokies assessing valiany of content CRA 10015										
	AAPD	ADA	Cariogram	CAMBRA						
No. of factors/population included	14/ Children	14/ Children 19/ Adults	9/ Adults	20/ Children 25/ Adults						
Studies assessing predictive accuracy of CRA tools	Not found	Not found	Holgerson et al., 2009 Hänsel P et al., 2010a Hänsel P et al., 2002 Hänsel P et al., 2013 Hänsel P et al., 2010 Gao et al., 2010	Domejean 2011 Chaffee 2015*						
Summary of results	Not available	Not available	Sensitivity: 73 (65-81) Specificity: 60 (54-66)	RR (Low reference) Moderate: 1.01 (0.83-1.23) High: 1.28 (1.10-1.52) Extreme: 1.52 (1.23-1.87)						

A key goal of this project was to reconcile existing tools to develop guidance on categorization of risk for the purposes of education, care planning, benefit design and quality improvement. The panel evaluated the current evidence on (1) individual factors predictive of caries risk to inform the selection of factors that need to be included within a standardized CRA tool and (2) the strength and magnitude of those associations to inform approaches for weighting those factors to determine overall risk status.

Risk Assessment: Identification of factors predictive of risk

Project staff developed a comprehensive list of all factors thought to contribute to caries risk based on: (1) existing CRA tools, (2) factors evaluated within the published studies, and (3) individual panelist recommendations (expert opinion). A total of 57 CRA factors were identified. The panel used a modified Delphi process (2 rounds) along with significant discussions to identify predictive factors. Panel discussions were informed by an additional review of the evidence that was undertaken to evaluate the predictive ability of each risk factor based on published evidence on outcome statistics such as odds ratios, risk ratios, sensitivity and specificity (Appendix 2). This review included 33 primary studies that were rated as moderate to high quality in the three systematic reviews. Staff summarized the findings at the factor level including

the outcome statistic and statistical significance. An additional 3 studies were identified by panel members and were independently assessed (<u>Appendix 3</u>)

Following these discussions, the panel identified the following 15 factors as being predictive of risk and able to be effectively operationalized into a clinical tool (Table 3). <u>Appendix 4</u> provides details of the panel's deliberations on each of the 57 factors initially identified.

Table 3. Factors To Consider When Assessing Risk for New Carious Lesions in Children

PROTECTIVE FACTORS*
Brushes twice a day with toothpaste containing fluoride
Predominantly drinks fluoridated water/ beverages made from fluoridated water
Receives professionally applied fluoride
Uses over the counter fluoride mouth rinse (over age 6 years)
Uses at-home prescription fluoride products (over age 6 years)
RISK FACTORS
Consumes more than 3 sugary beverages or snacks between meals each day (or infants put to bed with a bottle containing beverage with sugar)
Physical or behavioral health issues that impede home care
Clinically, little saliva or dry mouth due to medical condition or medication
Recent caries experience (Past moderate or advanced lesion(s) since last assessment or in the last 3 years)
Parents or siblings have cavitated lesion(s) in the last year (consider for children under age 14 years)
Visible plaque
Un-coalesced and unsealed pits & fissures
Orthodontic or prosthodontic appliances that impede oral hygiene
DISEASE INDICATORS
Current Active initial lesion(s) (i.e., enamel lesions, white spots)
Current Active moderate or advanced lesion(s)

*Most of these "protective" factors can also be viewed as "risk factors" – i.e., lack of protective factors indicates greater risk for disease or presence of disease. Clinicians preferred them to be worded positively; i.e., use "Brushes with fluoridated toothpaste – Yes/No" rather than "Does not brush with fluoridated toothpaste – Yes/No".

Socioeconomic Status: In itself, socioeconomic status (SES) is an indicator for various exposures and behaviors that impact caries risk. SES as a factor in predicting caries risk was discussed at length. Significant evidence exists to support a strong correlation between SES and caries <u>experience.</u>⁵⁻⁹ SES is often used as a risk indicator to target public health interventions (e.g., school based sealant programs). insufficient evidence to determine whether SES is a risk factor outside of the other disease indicators/risk factors identified above. The panel also noted definitional constraints. Family level measures (e.g., income and parental education) may be more appropriate indicators of socioeconomic position for conducting person-level assessments. In many settings, income/parent education are not routinely or easily collected. Specifically "Medicaid Beneficiary" or "Belonging to a government program" may not be good definitions. Consequently, the use of SES may be included in determining an individual's risk status but should be assessed individually according to determinants such as life-time poverty, recent immigration, low health literacy; and not by population-based determinants such as "belonging guidance around SES: "Consider SES of the patient you are treating when such information can be acquired. SES (e.g., life-time poverty, recent immigrants, low health literacy) is strongly associated with caries incidence and is a risk factor. "Belonging to a government program" may not be reflective of caries risk for the individual."

Risk Prediction: Weighting of factors and risk classification

The panel considered the evidence basis for combining/weighting predictive factors to arrive at a risk designation. In general, the panel found limited evidence to guide weighting of the different factors to arrive at risk levels. Further, genome-level risk accounts for substantial variation in caries manifestation (lesion development) and will remain for the foreseeable future a "black box" of unknowable risk that will prevent accurate prediction using any model where genomic data are not included.¹¹⁻¹³ Further, the interaction of risk/protective factors is not well studied. For a person with a set of risk factors and no protective factors, the probability of caries occurrence may be quite different compared with someone with the same risk factors but many more caries protective factors. Any risk factor's predictive ability and thus the validity of any CRA tool will vary with the baseline prevalence of disease in the defined population in which it is being used.

In general, all five CRA tools evaluated in this review classify individuals as being at "low" risk for caries if they do not have any disease indicators or risk factors but have preventive factors. The combination and weighting of factors to arrive at elevated levels of risk (i.e., "moderate" or "high" or "extreme") and the number of levels of risk varies between the current tools. The panel emphasized the lack of evidence to determine which specific risk factors or their combinations lower a person's risk towards "moderate" or increase a person's risk towards "high" or "extreme".

Observations & Recommendations on Risk Assessment

FOR CRA TOOL DEVELOPERS:

- There is evidence that the 15 factors identified in this report may be used to assess caries risk. Many CRA tools evaluated in this report include most of these 15 factors (although variably defined).
- Within published studies, predictive strength of each risk factor is reported relative to the average risk of the population studied. Thus, even strong **single** risk factors may not have the desired predictive ability in the population in which the risk assessment is applied. ¹⁴ Thus it is important to (1) address risk based on combinations of different factors rather than single risk factors, and (2) assess any CRA tool in independent populations in order to determine its utility in assessing risk.
- In general weighting factors differentially to arrive at risk requires an algorithm based electronic tool rather than a paper CRA form. There is, however, limited evidence to identify the combination or weighting of risk factors to define distinct risk categories.

FOR PRACTITIONERS:

- Despite limited evidence on whether assessing caries risk by itself results in improved oral health, it is important to assess caries risk to educate patients and manage modifiable risk factors based on the best available evidence.
- Frequently used CRA tools include most of the 15 factors identified in this report.
- Current tools have derived various methods to categorize risk based on expert consensus. The categorization of risk differs between the tools. However, all tools appear to qualify "low risk" in a similar manner: lack of disease and presence of protective factors. Current CRA tools could be effectively used in identifying "low risk" patients.¹⁵
- Current or recent history of carious lesions is the most valid predictor of elevated caries risk.
- The most important use of a CRA is to measure the effectiveness of an intervention to reduce future caries risk and predict the occurance of new carious lesions.
- One or more carious lesions in younger children (3 years) or soon after tooth eruption is indicative of increased risk. ¹⁶

FOR POLICY MAKERS (benefit design, quality measures, public health interventions):

- A large number of people at low risk may give rise to more cases of disease (i.e. number of people getting cavities) than a small number at high risk. ¹⁹ So when defining group benefit policies (e.g., coverage for fluorides or sealants for commercially insured populations who generally have lower caries incidence compared to those covered by public prorgrams) eliminating access to benefit for primary preventive services based on CRA may be detrimental.
- Within sub-populations with higher caries incidence (e.g., Medicaid), CRA may be used to identify priority populations as a means of sampling to measure improvement. However given the current state of science, CRA cannot be used to create valid population risk profiles based on aggregation of individual risk assessment data.
- Risk factors should not be construed as the "causes" of individual cases of disease;

i.e., eliminating risk factors will not eliminate the potential for disease occurrence because social, economic, genomic, and demographic factors outside the control or of the provider or patient contribute to an individual's risk. ^{17,18} Inclusion of SES on the CRA tool provides some socioeconomic context to understand the person's overall health risks.

• Assessing risk for a group of individuals that share a common social/economic context (i.e., population) to plan for group interventions (i.e., public health interventions) may not benefit from CRA tools intended for individuals. CRA tools included in this study are intended for person-centered individual risk assessment.

In the absence of objective caries risk assessment, the current subjective methods should not be discounted, but rather tested for their reliability and validity. Identified deficiencies in reliability and validity should then be addressed by refining the CRA tool. As more evidence emerges, electronic tools with evidence-based algorithms could provide more granular classification of risk rather than paper forms. Future research should begin by identifying gaps in the data and appropriately selecting where the lack of evidence presents an obstacle to patient-centered care. The science of caries risk assessment to date is mostly subjective and would benefit from increased objectivity, likely from a better understanding of microbiological endpoints, sialochemistry and genomics. Future research should also focus on establishing predictive ability of various risk factors across the life-span and better ways to determine how risk changes with age. Interaction of individual factors in modifying a patient's risk remains largely understudied and could be the focus of future efforts.

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Appendix 1: Caries Risk Assessment Expert Panel

Clifton Carey, PhD, ADA Standards Committee on Dental Informatics
Paul Casamassimo, DDS, MS, American Academy of Pediatric Dentistry
Ralph A. Cooley, DDS, (Chair, Expert Panel), Academy of General Dentistry and Dental Quality Alliance
Brittany Dean, DDS, ADA Council on Dental Benefits Programs/New Dentist Committee
Martin Makowski, DDS, ADA Council on Dental Benefits Programs
John Martin, DDS, Previser
Brian Novy, DDS, DentaQuest Institute
Janice Pliszczak, DDS, Academy of General Dentistry
Rebecca Slayton, DDS, PhD, American Academy of Pediatric Dentistry
Norman Tinanoff, DDS, MS, American Academy of Pediatric Dentistry
Rober Weyant, MS, DMD, DrPH, ADA Council on Scientific Affairs
Joel White, DDS, MS, ADA Standards Committee on Dental Informatics

Appendix 2: Summary of Study Findings of Individual CRA Risk/Protective Factors

Data Element	Results (OR. RD. RR. Sn. Sp)	Population	Relationship Examined	Study
		Note: n represents sample size at		Study
		final follow-up		
Presence of any non-cavitated active enamel le	sion(s) (aka white spots, non-cavitated enamel defect, initial superficial, ADA	CCS initial)		
White spot lesions (sum of lesions on primary and permanent	1.23 (OR) Significant, 1 of 4 cohorts (one Grade 5)	Two cohorts (Grade 1 and Grade 5) at	Backward stepwise logistic regression for outcome: high risk	Disney JA, Graves RC, Stamm JW, Bohannan
tooth surfaces)		two sites (Aiken, SC and Portland, ME)	based on 3-year DMFS increment (final DMFS-baseline DMFS)	HM, Abernathy JR, Zack DD. The University of
Note: Baseline caries experience:	Note: Comparison to "any risk" in Beck et al. 1992 where "any risk" is a DMFS increment of 1 or more (Beck et al. results below):	with 3-year follow-up (n=4158)	where high risk definition varied by cohort	North Carolina Carles Risk Assessment study
Mean dmfs, Grade 1, Aiken: 9.3, Portland: 2.9	<u>[becket al results below]</u> .			prediction. Community Dent Oral Epidemiol
Mean dmfs Grade 5, Aiken: 4.4, Portland: 2.4	1.22-1.36 (OR) Significant, 2 of 4 cohorts (both Grade 5)			1992;20:
Mean DMFS Grade 1, Aiken: 0.3, Portland: 0.2				64–75.
Mean DMFS Grade 5, Alken: 3.0, Portland: 1.7				
Initial caries (loss of translucency and slight roughness on	8.8 (OR, p<0.001) Univariate (manifest caries at 3.5 years)	Children 1 year at baseline with follow	Univariate and logistic multivariate regression for association	Grindefjord M, Dahllöf G, Nilsson B, Modéer
probing (chalky appearance))		up at 2.5 and 3.5 years of age (n=692)	with outcomes: initial/manifest caries at 2.5 years of age and	T. Stepwise prediction of dental caries in
	NA Multivariate (subjects with caries at 2.5 years were excluded from logistic regression analyses for caries outcome	[Stockholm, Sweden]	manifest caries at 3.5 years of age (versus not).	children up to 3.5 years of age. Caries Res
Note: Clinical examinations conducted at 2.5 and 3.5 years of	at 3.5 years)		Initial caries - loss of translucency and slight roughness on	1990,30.230-00.
age.			probing (chalky appearance); Manifest - minimal level verified	
At 2.5 years: 11% had initial or manifest caries; 7% had one or			as a cavity detectable by probing; and catch of probe under	
At 3.5 years: 37% initial/manifest: 29% manifest.			slight pressure for fissures.	
Level 2 - Enamel defects - opacity	3.38 (IDR, p=0.31) Within level multivariable analysis	Children 8 months of age with six month	Generalized estimating equations used to assess relationship	Zhou Y, Yang JY, Lo EC, Lin HC. The
		follow-ups through 32 months of age (2-	with outcome: incidence density of a tooth surface developing	contribution of life course determinants to
	NS Final model with all five levels, using sequential stepwise GEE	year follow up) (n=255 at recruitment;	caries, which is the number of new caries-affected surfaces	early childhood caries: a 2-year cohort study.
		China]		
Level 2 - Enamel defects - hypoplasia	14.55 (IDR, p<0.001) Within level multivariable analysis		Incidence density ratio (IDR) = incidence density among those	
	4.95 (IDD_ p.c0.001) Final model with all five levels, using convential stanuise CEE		exposed and not exposed to independent variable.	
	4.65 (IDR, p<0.001) Final model with all five levels, using sequential stepwise GEE		Sequential stepwise GEE using 5-level model	
	IDR = Incidence density ratio = incidence density among those exposed and not exposed to		(1=socioeconomic/demographic vars; 2=developmental	
Note: ECC prevalence at baseline (8 months) = 0; 14 months =	independent variable.		characteristics; 3=nutritional upbringing including	
0; 20 months =1.6%; 26 months = 11.1%; 32 months=28.4%.			feeding/nutrition; 4=oral health behaviors; 5= S. mutans)	
NS=not significant		1		
OR=Odds Ratio				
RD=Risk Difference				
RR=Risk Ratio				
IRR=Incidence Rate Ratio				
SN=Sensitivity				
SP=Specificity				
ROC=Receiver Operating Characteristic				
AUC=Area under curve				

PCC=Pearson Correlation Coefficient SCC=Spearman Rank Correlation Coefficient

Data Element	Results (OR, RD, RR, Sn, Sp)	Population	Relationship Examined	Study
		Note: n represents sample size at		
		final follow-up		
Initial lesions present (vs absent)	NS Bivariate, 7-8 year olds, DMFT increment>0	7-10 years at baseline (n=765) with 2-	Bivariate associations with outcome: caries experience in the	Kassawara AB, Tagliaferro EP, Cortelazzi KL,
		yaer follow up [Piracicaba, SP, Brazil]	permanent teeth measured as DMFT increment>0 over the 2-	Ambrosano GM, Assaf AV, Meneghim Mde C,
[Initial lesion defined as active carious lesion, which upon visual	1.80 (OR, p=0.045) Bivariate, 9-10 year olds, DMFT increment>0		year period.	et al. Epidemiological assessment of
assessment, has intact surface with no clinically detectable		Participants stratified into two age		predictors of caries increment in 7-10- year-
dental tissue loss, with a whitish/yellowish area of increased		groups for analysis: 7-8 years old and 9-		olds: a 2-year cohort study. J Appl Oral Sci
opacity, roughness, and loss of luster. Also included localized		10 years old at baseline.		2010;18:116-20.
surface defects (active microcavities)restricted to the enamel.j				
Processo of any equitated locion(c) (aka ADA CC)	Emoderate ADA CCE Advanced obvious caries			
Presence of any cavitated resion(s) (aka ADA CC	12.2 (OB, are 001) 0.78 (SN) 0.77 (SD) - Deceling	Kinderserten shildren (meen ege F. y 9m)	Diversiate accessiation and multivariate logistic regression for	Domore M. Drodour IM. Mouton C. Simord Di
haseline dmfs50 (versus 0)	12.5 (OK, p<0.001), 0.78 (SN), 0.77 (SP) Baseline	followed up after one year (n=302)	outcome: at least one new carious surface in primary teeth at	Traban I. Veilleux G. A multivariate model to
	Significant (specific values not reported) Multivariate	[Montreal, Canada]	one-year follow-up	predict caries increment in Montreal children
		[]		aged 5 years. Community Dent Health
				1992;9:273-81.
dmfs at baseline (7 years of age)	1.07 (OR, p<0.001) Follow-Up	7 years old at baseline (n=3,303) with at	1. Cross-sectional multiple logistic regression with outcome:	Vanobbergen J, Martens L, Lesaffre E,
		least one follow-up by age 10 years	dmfs (caries v. no caries) in permanent first molars	Bogaerts K, Declerck D. The value of a
		(n=3,002) [Flanders, Belgium]	(baseline)	baseline caries risk assessment model in the
			2. Stepwise multiple logistic regression with outcome: net	primary dentition for the prediction of caries
			surface affected v. 2 or more additional surfaces affected)	Rec 2001-35-442-50
			calculated by subtracting baseline DMES6 score from last	103 2001,33.442 30.
			available DMFS6 score [follow-up]	
baseline dmfs	1.03 (OR) Significant, 1 of 4 cohorts (one Grade1)	Two cohorts (Grade 1 and Grade 5) at	Backward stepwise logistic regression for outcome: high risk	Disney JA, Graves RC, Stamm JW, Bohannan
		two sites (Aiken, SC and Portland, ME)	based on 3-year DMFS increment (final DMFS-baseline DMFS)	HM, Abernathy JR, Zack DD. The University of
	Note: Comparison to "any risk" in Beck et al. 1992 where "any risk" is a DMFS increment of 1 or more	with 3-year follow-up (n=4158)	where high risk definition varied by cohort	North Carolina Caries Risk Assessment study:
	(Beck et al results below):			further developments in caries risk
	1.04 (OR) Significant, 1 of 4 cohorts (one Grade 1)			prediction. Community Dent Oral Epidemiol
				64-75
baseline DMFS	1.16-1.20 (OR) Significant, 3 of 4 cohorts	Two cohorts (Grade 1 and Grade 5) at	Backward stepwise logistic regression for outcome: high risk	Disney JA, Graves RC, Stamm JW, Bohannan
		two sites (Aiken, SC and Portland, ME)	based on 3-year DMFS increment (final DMFS-baseline DMFS)	HM, Abernathy JR, Zack DD. The University of
Note: Baseline caries experience:	Note: Comparison to "any risk" in Beck et al. 1992 where "any risk" is a DMFS increment of 1 or more	with 3-year follow-up (n=4158)	where high risk definition varied by cohort	North Carolina Caries Risk Assessment study:
Mean dmfs, Grade 1, Aiken: 9.3, Portland: 2.9	(Beck et al results below):			further developments in caries risk
Mean dmfs Grade 5, Aiken: 4.4, Portland: 2.4	1.13-1.51 (OR) Significant, 3 of 4 cohorts			prediction. Community Dent Oral Epidemiol
Mean DMFS Grade 1, Aiken: 0.3, Portland: 0.2				1992;20:
Mean DMFS Grade 5, Aiken: 3.0, Portland: 1.7				64–75.

Data Element	Results (OR, RD,	, RR, Sn, Sp)	Population	Relationship Examined	Study
			Note: n represents sample size at		
			final follow-up		
Different cut-off-points of caries (d1-5fs), predictive power			5 years of age at baseline; followed up	Bivariate association with assignment to "risk" group at 10	Skeie, Raadal, Strand & Espelid. The
All primary molars			Nonway]	inclusion: (1) one or more dentin or filled lesions on the	Dentition at 5 Years of Age and Permanent
>0			Norway]	mesial surface of 6-year molars, and/or (2) same type of	Dentition at 10 Years of Age - A Longitudinal
>1	0.76, AUC; ROC			lesions on any incisor, and/or (3) total D1-5MFS more than 1	Study. Int J Paediatr Dent 2006;16:152-60.
>2	0.93 (SN) 0.40 (SP)			SD above the mean. [Erupted premolars and permanent 2nd	
>3	0.87 (SN) 0.51 (SP)			molars were excluded.]	
>4	0.84 (SN) 0.62 (SP)				
>5	0.78 (SN) 0.67 (SP)				
	0.64 (SN) 0.72 (SP)				
Primary secondary molars	0.56 (5N) 0.79 (5P)				
1	0.75 AUC: ROC				
>2	0.93 (SN) 0.47 (SP)				
>3	0.87 (SN) 0.57 (SP)				
>4	0.76 (SN) 0.72 (SP)	(highest sum)			
>5	0.58 (SN) 0.75 (SP)				
	0.31 (SN) 0.84 (SP)				
Note: Baseline d1-5mft at 5 years old, mean=3.74. At 10 years,	0.15 (SN) 0.89 (SP)				
D1-5DMFT, mean=2.43.					
Baseline caries - d1-3mfs	14.17 (OR. p<0.001)) Univariate	2 years at baseline: followed for 3 years	Bivariate and multivariate (using forward stepwise logistic	Pienihakkinen, Jokela & Alanen, Assessment
	,. ,,,		(n=226) [Saarijarvi, Finland]	regression) association with outcome: 3-year increment of	of Caries Risk in Preschool Children. Caries
Notes:	7.33 (OR, p=0.003)) Multivariate		cavitated carious lesions and/or fillings - measured as the	Res 2004;38:156-162.
degree 1 - opaque/discolored;				increase of d3mfs from age of 2 years (degree 1 -	
degree 2 - early dentinal lesions no clinical cavity;	0.29 (SN), 0.97(SP),	0.63 (AUC)		opaque/discolored;	
degree 3- defect found on surface and restorative treatment				degree 2 - early dentinal lesions no clinical cavity;	
necessary				degree 3- defect found on surface and restorative treatment	
Note: O an an af shill does with an iterated and a still and				necessary)	
(d2mfr>0) at 2 years of are was 2%. At are 5 years 22%					
(USINIS>U) at 2 years of age was 5%. At age 5 years, 25%.	2 10 (IRR p=0.004)	New non-cavitated caries	Children tracked from hirth through 13	Multivariable model of association with: (1) new non-	Chankanka et al. Longitudinal Associations
surfaces at risk.	2.120 (1111) p 0.0001)		years old (n=156) [lowa]	cavitated caries and (2) new cavitated caries (repeated	between Children's Dental Caries and Risk
	3.53 (IRR, p=0.007)	New cavitated caries	,	measures analysis with measurements at 3-5 y, 6-8 y, and 11-	Factors. J Public Health Dent 2011;71:289-
Note: % with new non-cavitated caries at first exam, primary				13 y)	300.
dentition: 21.15%; % with new cavitated caries at first exam,					
primary dentition: 26.28%					
Baseline d16mfs - none as reference	1.6 (IRR, p<0.001)	<7 new d16mfs	Children 0-5 years at baseline followed	Stepwise backward multiple regression, zero-inflated negative	Ismail AI, Sohn W, Lim S, Willem JM.
	2.3 (IRR, p<0.001)	>=7	tor 2 years (n=788) [low-income Atrican-	binomial models with outcomes: caries increment measured	Predictors of dental caries progression in
	2 7 /IPP pc0 001)	<7 now d26mfr	American children in Detroit, Michiganj	as (1) new diamits and (2) new diamits.	primary teeth. J Dent Res 2009;88:
	9.3 (IRR, p<0.001)	>=7			270-3.
	5.5 (mil) p (0.001)				
Baseline caries (dmft>0 versus =0)	7.32 (OR, p<0.05)	Prediction model w/o biological factors	Children aged 3-6 years with one-year	Multiple stepwise logistic regression for association with	Gao XL, Hsu CY, Xu Y, Hwarng HB, Loh T, Koh
		(change dmft>0)	follow-up (n=1,576). [Singapore]	outcome: one-year caries increment measured as change in	D. Building caries risk assessment models for
Note: At baseline, 40.3% of children were affected by caries				dmft. Data from 50% children used for model construction;	children. J Dent Res 2010;89:637-43.
(mean dmft was 1.57). In 1 year, 43.7% of children had dmft	3.95 (OR, p<0.05)	Prediction model w/ biological factors		remainder for model validation. Prediction (all potential	
increment. Mean increase of dmft in 1 year was 0.93.		(change dmft>0)		factors) and risk models (subset of modifiable factors) with	
	No. to should all	Disk we delived a bisis of factors		and without biological tests examined. Also, community	
	Not included	(change dmfts0)		high risk = 25% of children with high caries hurden (haseline	
		(change dimesty		dmft>2 for nonulation studied) At baseline 40.3% of children	
	Not included	Risk model w/biological factors		were affected by caries (mean dmft was 1.57). In 1 year.	
		(change dmft>0)		43.7% of children had dmft increment. Mean increase of dmft	
				in 1 year was 0.93.	
	Not included	Community high risk model; questionnaire			
		(baseline dmft>0)			
	1		1		

Index Description Descripion Description	Data Element	Results (OR, RD, RR, Sn, Sp)	Population	Relationship Examined	Study
Interface Interface up Interface up <td></td> <td></td> <td>Note: n represents sample size at</td> <td></td> <td></td>			Note: n represents sample size at		
Number of descend where bardies cales where is the descend where is th			final follow-up		
Continuent d. 14.000, methods and sector descent second descent sector descent sector descent second descent sector	Number of decayed surfaces (baseline carious surfaces,	1.03 (RR, p<0.001) Multivariate, 5-year net increment carious TEETH	6-10 years old at baseline followed for 5	Bivariate and multivariable associations with two outcomes:	Maserejian NN, Tavares MA, Hayes C,
Note: Image: Automatical bases of the sector o	continuous n)	1.03 (RR, p<0.001) Multivariate, 5-year net increment carious SURFACES	years (n=429) [Boston, MA and	(1) 5-year increment of carious teeth and (2) 5-year increment	Soncini JA, Trachtenberg FL. Prospective
Note		Mean 5-year increment carious teeth	Farmingnam, MEJ	date of baseline visit through date of final study dental visit	children receiving comprehensive dental care
Institute construction (intendice) Destitute construction (intendice)	Note:	Baseline carious surfaces	Note: Sample were high-risk children	Caries in both primary and permanent dentition were summed	in the New England children's amalgam trial.
Sign of Tables, as the sense at a fails a state of a fail of the sense sense of the sense of the sense of the sense o	Baseline carious surfaces (mean): 9.4	2-3 surfaces: 3.6 mean increment	enrolled in the New England Children's	to obtain cumulative incident disease burden (net caries	Community Dent Oral Epidemiol
All yes Production of the second of the		4-8: 4.0	Amalgam Trial - additional inclusion	increment).	009;37:9–18.
a) Area J increase intervention with constraints of the intervention of the interventin of the intervention of the intervention of the interven	At 5-year following, net increment of carious surfaces (mean):	8-14: 4.6	criteria were no prior amalgam	Factors associated with cories increment at a level of mO 15	
Mass Springer Mass Springer Participant springer Partipant springer Partipant springer	0.9	2=14 5.7	decayed posterior occulsal surfaces. All	entered into preliminary multivariate model: final multivariate	
Building cards suffices Building cards suffices Building cards suffices Building cards suffices Definition Definition <thdefinition< <="" td=""><td></td><td>Mean 5-year increment carious surfaces</td><td>participants received restorations of</td><td>model included variables significant at p<0.05 or changed</td><td></td></thdefinition<>		Mean 5-year increment carious surfaces	participants received restorations of	model included variables significant at p<0.05 or changed	
Private data data data data data data data d		Baseline carious surfaces	baseline caries and sealants and	coefficients of other variables more than 10%. Multivariate	
DRT-0 and darb-0 is backler (n. both-0) No Notation, 9.10 year of 0, DMT incremented No No </td <td></td> <td>2-3 surfaces: 5.5 mean increment</td> <td>comprehensive semiannual dental care.</td> <td>analyses conducted using negative binomial model.</td> <td></td>		2-3 surfaces: 5.5 mean increment	comprehensive semiannual dental care.	analyses conducted using negative binomial model.	
Index <th< td=""><td></td><td>4-8: 6.1</td><td></td><td></td><td></td></th<>		4-8: 6.1			
DMTF-d and drift-d at baseline (vs. both) K Norther state (MT, Contract R, Contrad		>=14 8.8			
DMPTD and dmPtd (xstande (xs. both)) No Beachty, 74 year dds, DMPT incremento) Prof. Beachter (xs. both) Both at bactelie (xs. both at bactelie (xs. both) Both at bactelie (xs. both at bat bactelie (xs. both at bactelie (xs. both at bactelie (xs. both					
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Definition of direction is tabled in the control of the contro of the control of the control of the control of the con		NS Bivariate, 9-10 year olds. DMET increment>0	yaer follow up [Piracicaba, SP, Brazil]	vear period.	Ambrosano GM, Assaf AV, Meneghim Mde C, et al. Epidemiological assessment of
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Barry Otes - DCC Barry Otes - DCCC Bivariate - 74 year dds, DMT IncrementO Di years dd at baseline. Di years dd at	DMFT>0 and dfmt>0 at baseline (vs. both=0)		groups for analysis: 7-8 years old and 9-		olds: a 2-year cohort study. J Appl Oral Sci
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mean DMFT, PADD1 (Mam-Whithey u-test) Bivariate performed at 6 and 12 years of age Poisson regression to generate relative risk ratio and logistic ideterminants and predictos in children aged Primary dental caries at 6 yrs: decayed teeth; 0; 1-3; 4-19 initial Bivariate Tests Bivariate initial Bivariate Tests community Dent Cola [gdermin] 22 years. 22 yea	Not shown in multivariable regressions	DMFT>=1. p<0.01 (chi-square/Fischer exact test) Bivariate	cohort with dental exams and interviews	at 12 years old. Multivariate analyses were conducted using	Menezes AM. Life course dental caries
Primary dental caries at 6 yrs: missing teeth: >=1 vs. 0 Initial Bivariate Tests mean DMT, pc.0.01 (Man-Whitey u-test) Bivariate Bivariate (n=339) [Pelotas, Brazil] regression (backward stepwise) to predict dental caries at a ge DMT pc.0.01 (Man-Whitey u-test) 12 years: a population-based birth cohort. 22 years: a population-based birth cohort. Primary dental caries at 6 yrs: decayed teeth; 0; 1-3; 4-19 Initial Bivariate Tests DMT>-1, pc.001 (chi-square/Fischer exact test) Bivariate mean DMT, pc.001 (Man-Whitey u-test) Bivariate Yariables grouped into hierarchical model with 6 level; 10 socioeconomic/demographic, (2) nutrional dental service use at age 6, (A) primary dental caries at 6 yrs: decayed teeth; 0; 1-3; 4-19 Initial Bivariate Tests Bivariate DMT>-1, pc.001 (chi-square/Fischer exact test) Bivariate Bivariate Primary dental caries at 6 yrs: decayed teeth; 0; 1-3; 4-19 Manon Whitey u-test) Bivariate 2.56 (RR, pc.001) Decayed teeth 4-19 (vs. 0) Univariate 2.01 (RR, pc.001) Decayed teeth 4-19 (vs. 0) Univariate At each level, variables excluded if pp.25. Final model Initial Bivariate Tests 2.66 (RR, pc.001) Decayed teeth 1-3 (vs. 0) Multivariable Caries prediction Logistic Regression At each level, variables excluded if pp.25. Final model Initial Bivariate Tests Initial Bivariate Tests <td></td> <td>mean DMFT, p<0.01 (Mann-Whitney u-test) Bivariate</td> <td>performed at 6 and 12 years of age</td> <td>Poisson regression to generate relative risk ratio and logistic</td> <td>determinants and predictors in children aged</td>		mean DMFT, p<0.01 (Mann-Whitney u-test) Bivariate	performed at 6 and 12 years of age	Poisson regression to generate relative risk ratio and logistic	determinants and predictors in children aged
• Not shown in multivariable regressions DMFD=1, p=0.01 (chi-square/fischer exact test) Bivariate 2 years. Community Dem Oral Epidemiol 2009;37:123–33. Primary dental caries at 6 yrs: decayed teeth; 0; 1-3; 4-19 Initial Bivariate Tests Bivariate Variables grouped into hierarchical model with 6 levels: (1) socioeconomic/demographic, (2) nutritional/development Characteristics, 31 00 heaviors and dental service use at 12 yrs. (6) OH related behaviors and dental service use at 22 yrs. Variables grouped into hierarchical model with 6 levels: (1) socioeconomic / demographic, (2) nutritional/development Characteristics, 31 00 heaviors and dental service use at 22 yrs. (6) Amily economic levels at 6 yrs: f(6) Amily economic levels at 6 yrs: f(6) Amily economic levels at 6 yrs: missing teeth: >=1 vs. 0 Initial Bivariate Tests Variables grouped into hierarchical model with 6 levels: (1) socioeconomic / demographic, (2) nutritional/development Characteristics, 31 00 heaviors and dental service use at 22 yrs. (6) Amily economic level at 12 yrs, (6) Amily economic level at 12 yrs, (6) OH related behaviors and dental service use at 12 yrs. (6) OH related behaviors and dental service use at 12 yrs. (6) OH related behaviors and dental service use at 22 yrs. (7) (7, 6, 7, 6, 0, 0, 0) Decayed teeth 1-3 (vs. 0) Multivariable At each level, variables retained if p=0.25. Final model Initial Bivariate Tests Primary dental caries at 6 yrs: missing teeth: >=1 vs. 0 Initial Bivariate Tests Initial useries Test Initial Bivaria	Primary dental caries at 6 yrs: DMFT 0; 1-3; 4-19	Initial Bivariate Tests	(n=339) [Pelotas, Brazil]	regression (backward stepwise) to predict dental caries at age	12 years: a population-based birth cohort.
Primary dental caries at 6 yrs: decayed teeth; 0; 1-3; 4-19 Initial Bivariate Tests Dison Regressions 2.76 (RR, pc.001) Decayed teeth 1-3 (vs. 0) Univariate 2.66 (RR, pc.001) Decayed teeth 1-3 (vs. 0) Multivariable 2.66 (RR, pc.001) Decayed teeth 1-3 (vs. 0) Multivariable 3.66 (RR, pc.002) Univariate NS Multivariable Initial Bivariate Tests 1.66 (RR, pc.002) Univariate NS Multivariable Initial Bivariate Tests	Not shown in multivariable regressions	DMFT>=1, p<0.01 (chi-square/Fischer exact test) Bivariate		12 years.	Community Dent Oral Epidemiol
Primary dental caries at 6 yrs: decayed teeth; 0; 1-3; A-19 Initial Bivariate Tests Socieconomic/demographic, (2) nutritional/development DMFT>=1, p>C0.01 (hann-Whitney u-test) Bivariate Bivariate characteristic, 2) nutritional/development Primary dental caries at 6 yrs: rissing teeth: >=1 vs. 0 Initial Bivariate Tests Bivariate activational development Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests Bivariate activational development Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests Bivariate bivariate Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests Bivariate bivariate Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests Multivariable activational development Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests Multivariable activational development Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests Multivariable activational development activational development Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests Multivariable activational development activational development Primary denta		mean DMFT, p<0.01 (Mann-Whitney u-test) Bivariate		Variables grouped into biorarchical model with 6 lovels: (1)	2009;37:123-33.
DMFT>=1, p<0.01 (chi-square/Fischer exact test) Bivariate	Primary dental caries at 6 yrs: decayed teeth; 0; 1-3; 4-19	Initial Bivariate Tests		socioeconomic/demographic, (2) nutritional/development	
mean DMFT, pc.001 (Mann-Whitney u-test) Bivariate age 6, (4) primary dental caries at 6 yrs, (5) family economic Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Decayed teeth 1-3 (vs. 0) Univariate usatify Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests Multivariable ale (-4) (4 primary dental caries at 6 yrs, (5) family economic Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests No Multivariable ale (-4) (4 primary dental caries at 6 yrs; (5) family economic Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests No Multivariable ale (-4) (-4) (-4) (-4) (-4) (-4) (-4) (-4)	.,,,,,,,,,,,	DMFT>=1, p<0.01 (chi-square/Fischer exact test) Bivariate		characteristics, (3) OH behaviors and dental service use at	
Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests Initial Bivariate Tests Initial Bivariate Tests Initial Bivariate Tests Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests NS Multivariable Initial Bivariate Tests		mean DMFT, p<0.01 (Mann-Whitney u-test) Bivariate		age 6, (4) primary dental caries at 6 yrs, (5) family economic	
Primary dental caries at 6 yrs: rilisong teeth: >=1 vs. 0 Initial Bivariate Tests Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests		Poisson Regressions		level at 12 yrs, (6) OH related behaviors and dental service	
Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests NS Multivariable At each level, variables excluded if p<0.25. Final model		2.16 (KR, p<0.001) Decayed teeth 1-3 (vs. 0) Univariate		use at 12 yrs.	
2.66 (RR, p<0.001) Decayed teeth 4-19 (vs. 0) Multivariable		2.01 (RR, p<0.001) Decayed teeth 1-3 (vs. 0) Multivariable		At each level, variables excluded if p>0.25. Final model	
Caries Prediction Logistic Regression 2.76 (RR, p<0.01) Decayed teeth 1-3 (vs. 0) Multivariable		2.66 (RR, p<0.001) Decayed teeth 4-19 (vs. 0) Multivariable		variables retained if p<=0.05.	
2.76 (RR, pc0.01) Decayed teeth 1-3 (vs. 0) Multivariable Primary dental caries at 6 yrs: missing teeth: >=1 vs. 0 Initial Bivariate Tests NS but pc0.10 Multivariable Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests NS Multivariable Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests Initial Bivariate Tests Initial Bivariate Tests NS Multivariable Multivariable		Caries Prediction Logistic Regression			
Primary dental carles at 6 yrs: missing teeth: >=1 vs. 0 Initial Bivariate Tests NS but p<0.10		2.76 (RR, p<0.01) Decayed teeth 1-3 (vs. 0) Multivariable			
Primary dental caries at 6 yrs: missing teeth: >=1 vs. 0 NS but p<0.10 Poisson Regressions 1.65 (Rk, p=0.009) Univariate NS Multivariable Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests Initial Bivariate Tests		S.66 (KK, p<0.01) Decayed teeth 4-19 (vs. 0) Multivariable			
NS but p<0.10	Primary dental caries at 6 yrs: missing teeth: >=1 vs. 0	Initial Bivariate Tests			
Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests		NS but p<0.10			
1.65 (RR, p=0.009) Univariate NS Multivariable Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests		Poisson Regressions			
Primary dental caries at 6 yrs: Filled teeth: >=1 vs. 0 Initial Bivariate Tests		1.65 (RR, p=0.009) Univariate			
Initial Bivariate Tests	Primary dental caries at 6 yrs: Filled teeth: >=1 ys_0				
		Initial Bivariate Tests			

Data Element	Results (OR, RD, RR, Sn, Sp)	Population	Relationship Examined	Study
		Note: <i>n</i> represents sample size at final follow-up		
Baseline caries experience (dmf+DMFS) Note: Baseline: 42% caries free; dmfs(mean) 5.5; DMFS(mean) 0.1 At 4 yrs: 29% caries free; dmfs(mean) 4.6; DMFS(mean) 0.6	p=0.0001 (Pearson chi-square/Fisher exact test) Bivariate 12.86 (OR, p=0.0001) Multivariable AUC/ROC: 0.79	6 years followed for 4 years (n=95) [Mexico City, Mexico]	Bivariate and multivariable (multiple logistic regression) associations with outcome: caries increment dichotomized as 0 newly affected vs. >=1 new surface affected. ROC/AUC calculated. Caries experience calculated as dmfs, DMFS and dfm+DMFS using WHO criteria. Two groups identified: caries-free and >=1 dmf+DMFS. Caries increment was most recent dmfs/DMFS score - baseline score.	Sanchez-Perez L, Golubov J, Irigoyen- Camacho ME, Moctezuma PA, Acosta-Gio E. Clinical, salivary, and bacterial markers for carles risk assessment in schoolchildren: a 4- year follow-up. Int J Paediatr Dent 2009;19:186–92.
Number decayed/filled permanent teeth (scored using WHO criteria) Note: Baseline: DF=0.054	Logistic Regression 1.12 (OR, p=0.002) Multivariate, all factors 1.12 (OR, p=0.001) Multivariate, stepwise NS Multivariate, most robust based on balancing technique Note: Overall study finding: decision analysis produced better prediction models than logistic regression or neural network approaches. Significant predictors in this approach were MS levels, LB, salivary pH, gender, and sweet beverages.	5-6 years at baseline, followed for 3 years (n=500) [Gifu Prefecture, Japan]	Outcome: new incident dental caries of the permanent teeth; 3 approaches: (1) conventional modeling, (2) neural network, CS.0 - tool for discovering patterns in databases and used to make predictions. Logistic regression analyses were conducted for a full model with all variables as well as using stepwise selection. Neural network model had 12 input layers, 3 hidden layers, and 1 output layer. CS.0 models work by sequenced sample splitting based on fields providing the maximum information gained. Balancing technique applied. Total of 10 balanced sample sets applied to the models. Model selection based on highest mean of sum of SN and SP.	Tamaki Y, Nomura Y, Katsumura S, Okada A, Yamada H, Tsuge S, et al. Construction of a dental caries prediction model by data mining. J Oral Sci 2009;51:61–8.
Baseline caries experience (with/without lesions) Note: Baseline caries prevalence: 32.7% Caries prevalence at 1-year follow-up: 56.4%	p<0.001, Mann-Whitney U Test, Caries incidence mean at follow up SN (1.0), SP (0.74), % correctly classified: 76%	12-30 months at baseline with one-year follow up (n=101) [Piracicaba, SP, Brazil]	Bivariate associations with outcomes: (1) caries incidence at follow up and (2) high caries incidence at follow up. Caries definitions •Initial caries lesion: demineralized surface having only loss of translucency •Manifest lesion: lesion with definite cavitation •Caries incidence: sum of new initial and manifest caries plus initial caries detected at baseline that progress to manifest caries during study •High caries incidence: development of 3 or more new manifest lesions during one-year follow-up	R.O. Mattos-Graner, D.J. Smith, W.F. King, M.P. Mayer, Water-insoluble glucan synthesis by mutans streptococcal strains correlates with caries incidence in 12- to 30- month-old children, J. Dent. Res. 79 (2000) 1371–1377.
Manifest caries (minimal level verified as a cavity detectable by probing) Note: Clinical examinations conducted at 2.5 and 3.5 years of age. At 2.5 years: 11% had initial or manifest caries; 7% had one or more manifest lesions. At 3.5 years: 37% initial/manifest; 29% manifest.	13.5 (OR, p<0.001) Univariate (manifest caries at 3.5 years) NA Multivariate (subjects with caries at 2.5 years were excluded from logistic regression analyses for caries outcome at 3.5 years)	Children 1 year at baseline with follow up at 2.5 and 3.5 years of age (n=692) [Stockholm, Sweden]	Univariate and logistic multivariate regression for association with outcomes: initial/manifest caries at 2.5 years of age and manifest caries at 3.5 years of age (versus not). Initial caries - loss of translucency and slight roughness on probing (chalky appearance); Manifest - minimal level verified as a cavity detectable by probing; and catch of probe under slight pressure for fissures.	Grindefjord M, Dahllöf G, Nilsson B, Modéer T. Stepwise prediction of dental caries in children up to 3.5 years of age. Caries Res 1996;30:256–66.

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Data Element	Results (OR, RD, RR, Sn, Sp)	Population	Relationship Examined	study
		Note: n represents sample size at		
		final follow-up		
dmfs/DMFS at baseline measured as ICDAS>=3	Multivariate Caries Risk Models	5-13 years of age with 2-year follow-up	Logistic regression for progression outcomes (see below) at	Fontana M, Santiago E, Eckert GJ, Ferreira-
	Note: Total of 12 Multivariate Caries Risk Models: 2 outcomes, 2 time periods, 3 ways of handling	(n=395) [Aguas Buenas, Puerto Rico]	12/24 months; for each predictor individually; multiple	Zandona AG. Risk factors of caries
(added last in models for use in non-dental settings; added first	baseline dmfs/DMFS (not included, added last, added first)		regression developed using backward elimination retaining	progression in a Hispanic school-aged
in models for use in dental setting)			predictors p<0.05 with AUC/ROC calculated for final models	population. J Dent Res 2011;90:1189-96.
	-Not included in 4 models where dmfs/DMFS not included at all		at model level; Poisson regression for number of lesions with	
Note: Baseline mean age was 9.7 years	-Significant in 7 of 8 remaining models		progression	
Baseline mean ICDAS>=1: 15.7				
Baseline mean ICDAS>=3: 8.2	Reporting results for model with highest combined SN/SP in each of three model groups		Two Outcomes:	
	1. No dmfs/DMFS - N/A		 Any progression (ICDAS>=1): at least one new lesion 	
12-month mean ICDAS>=1: 17.9			ICDAS>=1, one new filling, and/or progression of lesion from	
-89% of children	dmts/DMFS added last, 12 month follow-up, ICDAS>=3 (model SN=.81, SP=.58, AUC=0.77)		scores of 1-2 to 3 to higher or from 3-4 to 5 to higher between	
12-month mean ICDAS>=3: 8.4			the two exams.	
-61% of children	1.17 (OR, p=0.0065)		 Progession toward cavitation (ICDAS>=3): at least one new 	
24	2 June (DMEC - Her King A2 month follow up ICDAC: 2 (model CNI 04 CD F7 ALIC 0 70)		lesion ICDAS>=3, one new filling, and/or progression of lesion	
24-month mean ICDAS>=1: 16.8	3. dmts/DivirS added first, 12 month follow-up, ICDAS>=3 (model SN=.81, SP=.57, AUC=0.79)		from score of 1-2 to 3 or nigher or from 3-4 to 5 or nigher	
-91% of children	1 14 (OB p=0.0260)		between the two exams.	
69% of childron	1.14 (OK, p=0.0200)		Models run for outcomes at 12 and 24 months:	
	Multivariate Caries Risk Model for Identification of Number of Lesions Progressing		Models run without any baseline ICDAS: models run adding	
	Note: Total of 12 Multivariate Caries Risk Models: 2 outcomes 2 time periods 3 ways of bandling		haseline ICDAS last: models run starting with baseline ICDAS	
	haseline dmfs/DMFS		score	
	-Not included in 4 models where dmfs/DMFS not included at all			
	-Significant in 8 of 8 remaining models			
dmft at baseline (1st grade)	Spearman Rank Correlation Coefficient between dmft and DMFT	Two cohorts of Japanese girls born in	Association between caries experience in primary teeth and	Motohashi M, Yamada H, Genkai F, Kato H,
	0.441 (p=0.002), cohort 1	1982/82 (n=45) and 1989/1990 (n=53)	permanent teeth evaluated using correlation coefficient, ROC	Imai T, Sato S, et al. Employing dmft score as
	0.597 (p=0.001), cohort 2	with baseline examinations in 1st grade	analysis, and risk ratios using different dmft score cutoff	a risk predictor for caries development in the
		and follow-up in sixth grade. [Tokyo,	points.	permanent teeth in Japanese primary school
Note: Baseline caries experience in 1st grade (dmft>=1): cohort	ROC Analysis (baseline dmft score screening criterion; change DMFT>0 validation criterion)	Japan]		girls. J Oral Sci 2006;48:233-7.
1: 77.8%; cohort 2: 67.9%. Caries experience in 6th grade	Area under curve: 0.717; optimal cut off: dmft>=4 with 0.74(SN) 0.72(SP), cohort 1		Caries recorded when lesion had unmistakable cavity. White,	
(DMFT>=1): cohort 1: 60%; cohort 2: 50.9%.: Baseline caries	Area under curve: 0.768; optimal cut off: dmft>=5 with 0.52(SN) 0.92(SP), cohort 2		chalky, discolored spots with no visual cavity and	
experience in 1st grade (dmft>=1): cohort 1: 77.8%; cohort 2:			stained/sticky pits/fissures without visual undermined enamel	
67.9%. Caries experience in 6th grade (DMFT>=1): cohort 1:	Risk Ratios for change DMFT>0 for different cut-offs of baseline dmft		not recorded as caries.	
60%; cohort 2: 50.9%.	>=1 dmft NS, cohort 1; NS cohort 2			
	>=2 dmft 2.60, cohort 1; 2.68 cohort 2			
	>=3 amrt 2.20, conort 1; 2.05 conort 2			
	>=4 amrt 2.29, conort 1; 2.40 conort 2			
	>=5 unit: 1.94, conort 1; 2.49 conort 2			
	>=0 unit 1.02, cohort 1; 2.23 cohort 2			
	>=8 dmft_NS_cohort_1; 2.23 cohort_2			

Data Element	Bocults (OB BD BB Sn Sn)	Bonulation	Polationship Examined	Study
Data Element	הפטונג (טה, הט, הה, גוו, גיי)	Population	Relationship Examined	Study
		Note: n represents sample size at		
		final follow-up		
dmfs/DMFS at baseline measured as ICDAS>=3	Multivariate Caries Risk Models	5-13 years of age with 2-year follow-up	Logistic regression for progression outcomes (see below) at	Fontana M, Santiago E, Eckert GJ, Ferreira-
	Note: Total of 12 Multivariate Caries Risk Models: 2 outcomes, 2 time periods, 3 ways of handling	(n=395) [Aguas Buenas, Puerto Rico]	12/24 months; for each predictor individually; multiple	Zandona AG. Risk factors of caries
(added last in models for use in non-dental settings; added first	baseline dmfs/DMFS (not included, added last, added first)		regression developed using backward elimination retaining	progression in a Hispanic school-aged
in models for use in dental setting)			predictors p<0.05 with AUC/ROC calculated for final models	population. J Dent Res 2011;90:1189-96.
	-Not included in 4 models where dmfs/DMFS not included at all		at model level; Poisson regression for number of lesions with	
Note: Baseline mean age was 9.7 years	-Significant in 7 of 8 remaining models		progression	
Baseline mean ICDAS>=1: 15.7				
Baseline mean ICDAS>=3: 8.2	Reporting results for model with highest combined SN/SP in each of three model groups		Two Outcomes:	
	1. No dmfs/DMFS - N/A		 Any progression (ICDAS>=1): at least one new lesion 	
12-month mean ICDAS>=1: 17.9			ICDAS>=1, one new filling, and/or progression of lesion from	
-89% of children	dmfs/DMFS added last, 12 month follow-up, ICDAS>=3 (model SN=.81, SP=.58, AUC=0.77)		scores of 1-2 to 3 to higher or from 3-4 to 5 to higher between	
12-month mean ICDAS>=3: 8.4			the two exams.	
-61% of children	1.17 (OR, p=0.0065)		2. Progession toward cavitation (ICDAS>=3): at least one new	
			lesion ICDAS>=3, one new filling, and/or progression of lesion	
24-month mean ICDAS>=1: 16.8	3. dmfs/DMFS added first, 12 month follow-up, ICDAS>=3 (model SN=.81, SP=.57, AUC=0.79)		from score of 1-2 to 3 or higher or from 3-4 to 5 or higher	
-91% of children			between the two exams.	
242-month mean ICDAS>=3: 8.4	1.14 (OR, p=0.0260)			
-68% of children			Models run for outcomes at 12 and 24 months;	
	Multivariate Caries Risk Model for Identification of Number of Lesions Progressing		Models run without any baseline ICDAS; models run adding	
	Note: Total of 12 Multivariate Carles Risk Models: 2 outcomes, 2 time periods, 3 ways of handling		baseline ICDAS last: models run starting with baseline ICDAS	
	baseline dmfs/DMFS		score	
	-Not included in 4 models where dmfs/DMFS not included at all			
	-Significant in 8 of 8 remaining models			
dmft at baseline (1st grade)	Spearman Rank Correlation Coefficient between dmft and DMFT	Two cohorts of Japanese girls born in	Association between caries experience in primary teeth and	Motohashi M, Yamada H, Genkai F, Kato H,
	0.441 (p=0.002), cohort 1	1982/82 (n=45) and 1989/1990 (n=53)	permanent teeth evaluated using correlation coefficient, ROC	Imai T, Sato S, et al. Employing dmft score as
	0.597 (p=0.001), cohort 2	with baseline examinations in 1st grade	analysis, and risk ratios using different dmft score cutoff	a risk predictor for caries development in the
		and follow-up in sixth grade. [Tokyo,	points.	permanent teeth in Japanese primary school
Note: Baseline caries experience in 1st grade (dmft>=1): cohort	ROC Analysis (baseline dmft score screening criterion; change DMFT>0 validation criterion)	Japan]		girls. J Oral Sci 2006;48:233-7.
1: 77.8%; cohort 2: 67.9%. Caries experience in 6th grade	Area under curve: 0.717; optimal cut off: dmft>=4 with 0.74(SN) 0.72(SP), cohort 1		Caries recorded when lesion had unmistakable cavity. White,	
(DMFT>=1): cohort 1: 60%; cohort 2: 50.9%.: Baseline caries	Area under curve: 0.768; optimal cut off: dmft>=5 with 0.52(SN) 0.92(SP), cohort 2		chalky, discolored spots with no visual cavity and	
experience in 1st grade (dmft>=1): cohort 1: 77.8%; cohort 2:			stained/sticky pits/fissures without visual undermined ename	
67.9%. Caries experience in 6th grade (DMFT>=1): cohort 1:	Risk Ratios for change DMFT>0 for different cut-offs of baseline dmft		not recorded as caries.	
60%; cohort 2: 50.9%.	>=1 dmft NS, cohort 1; NS cohort 2			
	>=2 dmft 2.60, cohort 1; 2.68 cohort 2			
	>=3 dmft 2.20, cohort 1; 2.05 cohort 2			
	>=4 dmft 2.29, cohort 1; 2.40 cohort 2			
	>=5 dmft 1.94, cohort 1; 2.49 cohort 2			
	>=6 dmft 1.62, cohort 1; 2.23 cohort 2			
	>=7 dmft NS, cohort 1; 2.25 cohort 2			
	>=8 dmft NS, cohort 1; NA cohort 2			
Baseline dft	Caries risk proportions (p=0.013)	Children 6-7 years old followed for 24	Bivariate association with outcome: caries risk defined as at	Baca P, Parejo E, Bravo M, Castillo A,
0	0.744	months at 6-month intervals (n=95)	least one new caries in permanent or deciduous dentition	Liebana J. Discriminant ability for caries risk
1	0.700	[Granada, Spain]	during the 2-year period, detected in any one of the 6-month	of modified colorimetric tests. Med
2	0.818		visits. Also calculated area under ROC curve.	Oral Patol Oral Cir Bucal 2011;16:e978–83.
>=3	0.968			
1			Used WHO caries criteria.	
	AUC (ROC): 0.674			
Note: At baseline, mean decayed and filled deciduous teeth				
and surfaces were 2.21 and 4.04.				
1				
1				

Data Element	Baculte (OR BD BB Sn Sn)		Population	Polationship Examined	Study
Data Element	results (OR, RD, RR, SII, SP)		Nete: n represents sample size at	Relationship Examined	Study
			final fallow we		
			tinal tollow-up		
Baseline (1st grade) dmfs+DMFS	AUC/ROC		1st grade at baseline, followed up at 4th	Bivariate and multivariate (logistic regression) association of	R.L. Badovinac, K.E. Morgan, J. Lefevre, S.
Note:	Child-level analysis: AUC/ROC for 1st grade dmfs+	JMFS=0.65	grade (n=204) [Cambridge, MA]	dmfs+DMFS at 1st grade with outcome: carious lesion	Wadhawan, L. Mucci, L. Schoeff, et al., Risk
Baseline caries experience in first permanent molars in 1st	Molar-level analysis: AUC/RUC for 1st grade dmfs+	JMFS=0.69		experience (D or F) in permanent first molars in 4th grade.	assessment criteria applied to a screening
grade: 11.3%	Child Issue I a statis as a statistic for any distant durfs. Dt	AFC- 0 (Child-level analyses: excluded children	CN/CD and a local data of a second state of the second state of the	exam: implications for improving the
Follow up sovies superionse in 1st normanent malem in 4th	2.72 (OP ==0.012) University	/FS>0 (VS. 0)	who had carlous lesions in first	SN/SP calculated; best performance identified as test with	efficiency of a sealant program, J. Public
Follow-up caries experience in 1st permanent molars in 4th	2.72 (OR, p=0.012) Univariate		permanent molar by 1st grade	nignest sensitivity and negative predictive value.	Health Dent. 65 (2005) 203–208.
grade: 24.5%	2.76 (OR, p-0.012) Multivariate		Males level and be as such deal	Coulos alessification used definitions used in AlliANICO	
	Table pasted from article below		wolar-level analyses: excluded	caries classification used definitions used in NHANES.	
	lable pasted from article below:		decayed/filled molars by 1st grade	amrs/DWFS Indices	
	TABLE 14				
	Relationship between thresholds of dmfs	+ DMES in 1st grade and carious			
	lesion experience in the 1 st norma	nent molars in 4 th grade			
	resion experience in the r perina	nem motars in 4 grade			
	Threshold* Sensitivity (%	Specificity (%)			
	dmfs+DMFS>0 69.4	54.5			
	dmfs+DMFS>1 50.0	64.8			
	dmfs+DMFS>2 47.2	73.1			
	dmfs+DMFS>3 38.9	80.7			
	dmfs+DMFS>4 36.1	82.1			
	dmts+DMFS>5 30.6	88.3			
	dmis+DMF5>6 22.2 dmfs+DMF5>7 10.4	90.3			
	dmfs+DMF5>7 19.4	93.1			
	dmfs+DMFS>9 13.9	94.5			
		55.2			
	"Inreshold number of dmfs + DMFS				
Approximal Caries Lesions at Baseline	-		11-13 years at baseline, followed to 21-	Bivariate analysis of association of baseline approximal caries	Stenlund H, Mejàre I, Källestal C. Caries rates
0	Reference cat		22 years of age (n=534) [Stockholm,	with future approximal caries, examining 2 outcomes: (1)	related to approximal caries at ages 11-13: a
1	1.61 (RR, p<0.05) Individual based caries rate; 1.49	[RR, p<0.05) surface-based caries rate	Sweden]	individual-based incidence of first new approximal caries	10-year follow-up study in Sweden. J Dent
2	2.06 (RR, p<0.05) Individual based caries rate; 1.55	[RR, p<0.05) surface-based caries rate		lesion and (2) surface-based incidence of approximal lesions.	Res 2002;81:455-8.
3	3.55 (RR, p<0.05) Individual based caries rate; 1.87	RR, p<0.05) surface-based caries rate			
4-8	3.62 (RR, p<0.05) Individual based caries rate; 2.29	RR, p<0.05) surface-based caries rate		Time to first approximal lesion assessed and individual based	
>8	4.85 (RR, p<0.05) Individual based caries rate; 3.18	RR, p<0.05) surface-based caries rate		caries rate calculated. Surface-based caries rate based on	
				total number of approximal surfaces that progressed to a	
				caries state per 100 tooth surface-years. Poisson regression	
Note:				with over-dispersion used to calculate relative risk of	
Baseline: 4.9% of all approximal surfaces were in a caries state				developing new approximal lesions related to approximal	
or restored.				caries.	

Data Element	Results (OR, RD, RR, Sn, Sp)	Population	Relationship Examined	Study
		Note: n represents sample size at		-
		final follow-up		
NON-CLINICAL: Caregiver Report	Bivariate association with Caries Progression (significant or NS using logistic regression - specific	5-13 years of age with 2-year follow-up	Logistic regression for progression outcomes (see below) at	Fontana M, Santiago E, Eckert GJ, Ferreira-
	values not reported)	(n=395) [Aguas Buenas, Puerto Rico]	12/24 months; for each predictor individually; multiple	Zandona AG. Risk factors of caries
CG report: child had tooth extracted	New ICDAS>=1 at 24 months: Significant		regression developed using backward elimination retaining	progression in a Hispanic school-aged
	New ICDAS>=3 at 24 months: Significant		predictors p<0.05 with AUC/ROC calculated for final models	population. J Dent Res 2011;90:1189-96.
			at model level; Poisson regression for number of lesions with	
Note: Baseline mean age was 9.7 years	Multivariate Caries Risk Models		progression	
Baseline mean ICDAS>=1: 15.7	Note: Total of 12 Multivariate Caries Risk Models: 2 outcomes, 2 time periods, 3 ways of handling			
Baseline mean ICDAS>=3: 8.2	baseline dmfs/DMFS (not included, added last, added first)		I wo Outcomes:	
12-month mean ICDAS>=1: 17.9	-Significant in 6 of 12 models (all 12-month follow up models)		ICDASS=1 one new filling and/or progression of lesion from	
-89% of children	-Not included in the 24-month follow-up models		scores of 1-2 to 3 to higher or from 3-4 to 5 to higher between	
12-month mean ICDAS>=3: 8.4			the two exams.	
-61% of children	Reporting results for best model for "any progression" and "progression to cavitation"		2. Progession toward cavitation (ICDAS>=3): at least one new	
	1. dmfs/DMFS excluded, 24-month follow-up, ICDAS>=1 (model SN=.82, SP=.59, AUC=0.75)		lesion ICDAS>=3, one new filling, and/or progression of lesion	
24-month mean ICDAS>=1: 16.8			from score of 1-2 to 3 or higher or from 3-4 to 5 or higher	
-91% of children	NS (not included in final model)		between the two exams.	
242-month mean ICDAS>=3: 8.4				
-68% of children	dmfs/DMFS added last, 12 month follow-up, ICDAS>=3 (model SN=.81, SP=.58, AUC=0.77)		Models run for outcomes at 12 and 24 months;	
			Models run without any baseline ICDAS; models run adding	
	1.97 (OR, p=0.0111)		baseline ICDAS last; models run starting with baseline ICDAS	
	2 donte /DAREC added first 12 month follow up ICDACS -2 (model CAL OI CD_ E7 AUC-0.70)		score	
NON-CLINICAL: Caregiver Report	Bivariate association with Caries Progression (significant or NS using logistic regression - specific	5-13 years of age with 2-year follow-up	Logistic regression for progression outcomes (see below) at	Fontana M, Santiago E, Eckert GJ, Ferreira-
	values not reported)	(n=395) [Aguas Buenas, Puerto Rico]	12/24 months; for each predictor individually; multiple	Zandona AG. Risk factors of caries
CG report: child had tooth restored	New ICDAS>=1 at 24 months: Significant		regression developed using backward elimination retaining	progression in a Hispanic school-aged
	New ICDAS>=3 at 24 months: Significant		predictors p<0.05 with AUC/ROC calculated for final models	population. J Dent Res 2011;90:1189–96.
	Marini and Cardes Disk Marida		at model level; Poisson regression for number of lesions with	
Note: Baseline mean age was 9.7 years	Multivariate Carles Risk Models		progression	
Baseline mean ICDAS>=1: 13:7	haseline dmfs/DMFS (not included, added last, added first)		Two Outcomes:	
			 Any progression (ICDAS>=1): at least one new lesion 	
12-month mean ICDAS>=1: 17.9	-Significant in 7 of 12 models (all 12-month follow up models)		ICDAS>=1, one new filling, and/or progression of lesion from	
-89% of children			scores of 1-2 to 3 to higher or from 3-4 to 5 to higher between	
12-month mean ICDAS>=3: 8.4			the two exams.	
-61% of children	Reporting results for best model for "any progression" and "progression to cavitation"		Progession toward cavitation (ICDAS>=3): at least one new	
	 dmfs/DMFS excluded, 24-month follow-up, ICDAS>=1 (model SN=.82, SP=.59, AUC=0.75) 		lesion ICDAS>=3, one new filling, and/or progression of lesion	
24-month mean ICDAS>=1: 16.8	2.24 (00 - 0.0224)		from score of 1-2 to 3 or higher or from 3-4 to 5 or higher	
-91% of children	2.31 (OR, p=0.0321)		between the two exams.	
-68% of children	2 dmfc/DMFS added last 12 month follow-up_ICDAS>=3 (model SN= 81_SD= 58_AUC=0.77)		Models run for outcomes at 12 and 24 months	
			Models run without any baseline ICDAS: models run adding	
	1.74 (OR, p=0.0323)		baseline ICDAS last; models run starting with baseline ICDAS	
			score	
NON CUNICAL: Parent actimation of number of decayed tooth	2 dmfc/DMEC added first 12 month follow up ICDACS-2 (model SN= 91 SD= 57 ALIC=0.70)	Children aged 2.6 years with one year	Multiple stopwise logistic regression for accoriation with	Goo XI, Hou CV, Xu X, Hwarps HP, Joh T, Koh
NON-CLINICAL: Parent estimation of number of decayed teeth	(change dmft>0)	follow-up (n=1.576) [Singapore]	outcome: one-year caries increment measured as change in	D Building caries risk assessment models for
	(change different)	Tonow up (II-1,570). [Singapore]	dmft. Data from 50% children used for model construction:	children. I Dent Res 2010:89:637–43.
Note: At baseline, 40.3% of children were affected by caries	NS Prediction model w/ biological factors		remainder for model validation. Prediction (all potential	
(mean dmft was 1.57). In 1 year, 43.7% of children had dmft	(change dmft>0)		factors) and risk models (subset of modifiable factors) with	
increment. Mean increase of dmft in 1 year was 0.93.			and without biological tests examined. Also, community	
	NS Risk model w/o biological factors		screening model for identify "high risk" using a questionnaire	
	(change dmft>0)		high risk = 25% of children with high caries burden (baseline	
			dmft>2 for population studied). At baseline, 40.3% of children	
	NS Risk model w/biological factors		were affected by caries (mean dmft was 1.57). In 1 year,	
	(change dmft>0)		43.7% of children had dmft increment. Mean increase of dmft	
			in 1 year was 0.93.	
Any cavitated lesion in last 3 years for new patie	ent or since last caries risk assessment for existing patients			

Summary of Study Results by Data Element: PROTECTIVE FACTORS				
Data Element	Results (OR, RD, RR, Sn, Sp)	Population Note: n represents sample size at final follow-up	Relationship Examined	Study
Brushes twice a day with fluoridated toothpaste				
Brushes less than once a day (versus at least once a day)	1.26 (OR, p=0.03) Baseline 2.24 (OR <0.0001) Follow-Up	7 years old at baseline (n=3,303) with at least one follow-up by age 10 years (n=3,002) [Flanders, Belgium]	1. Cross-sectional multiple logistic regression with outcome: dmfs (caries v. no caries) in permanent first molars (baseline) 2. Stepwise multiple logistic regression with outcome: net caries increment on permanent first molars (0/1 additional surface affected v. 2 or more additional surfaces affected) calculated by subtracting baseline DMFS6 score from last available DMFS6 score [follow-up]	Vanobbergen J, Martens L, Lesaffre E, Bogaerts K, Declerck D. The value of a baseline caries risk assessment model in the primary dentition for the prediction of caries incidence in the permanent dentition. Caries Res 2001;35:442–50.
Toothbrushing frequency with fluoride toothpaste (each one per day increase in frequency) Note: % with new non-cavitated caries at first exam, primary dentition: 21.15%, % with new cavitated caries at first exam, primary dentition: 26.28%	0.67 (IRR, p=0.044) New non-cavitated caries NS New cavitated caries	Children tracked from birth through 13 years old (n=156) [lowa]	Multivariable model of association with: (1) new non- cavitated caries and (2) new cavitated caries (repeated measures analysis with measurements at 3-5 y, 6-8 y, and 11- 13 γ)	Chankanka et al. Longitudinal Associations between Children's Dental Caries and Risk Factors. J Public Health Dent 2011;71:289- 300.
Brushing teeth with fluoride toothpaste Once/day (versus <1/day)	change DMFS>=1: 0.31 (OR, p=0.026) Bivariate change DMFS>=3: NS Bivariate change DMFS>=5: NS Bivariate **Note: Table indicated 0.31. But authors stated in text that OR was 3.2.	11-12 year olds with 4-year follow-up (n=497) [Pori, Finland]	Randomized clinical trial. Intervention/experimental group: received individually, designed patient-centered regimen for caries control. Control: standard dental care	Hietasalo P, Tolvanen M, Seppa L, Lahti S, Poutanen R, Niinimaa A, et al. Oral health- related behaviors predictive of failures in caries control among 11-12-yr-old Finnish schoolchildren. Eur J Oral Sci
Twice/day (Versus <1/day)	change DMFS>=1: NS Bivariate change DMFS>=3: NS Bivariate change DMFS>=5: NS Bivariate		Outcome: DMFS increment defined as difference in scores between baseline and -year follow-up. Three definitions of failure considered: (1) increment>=1; (2) increment >=3; (3) increment >=5.	2008;116:267–71.
Note: Baseline mean DMFS experimental group: 2.1 control group: 2.3			Bivariate association between oral health behaviors at baseline and outcome using logistic regression for experimental group.	
Mean DMFS after 4 years: experimental: 4.7 control: 6.9			Caries status used criteria in Nyvad et al. DMFS score included surfaces with active or inactive caries lesions with cavitation (scores 5 and 6), those with a filling, those extracted due to caries, and those with caries extending to inner or middle third of dentin or the pulp in radiographs.	
Brushing frequency at 6 yrs (<1/day, 1-2/day, >2/day) Note: The following variables were not significant in initial bivariate tests. However, 95% of children brushed at least once a day and used toothpaste. The authors referenced fluoridated toothpaste although it is not clear if this was explicit in the questionnaire or inferred. •Use of toothpaste at 6 yrs (yes vs. no) •Use of toothpaste at 12 yrs (yes vs. no) •Brushing frequency at 12 yrs (>=2/day vs. <2/day) Note: Baseline primary dental caries at 6 yrs (DMFT>0): 63%	Initial Bivariate Tests DMFT>=1, p<0.01 (chi-square/Fischer exact test) Bivariate mean DMFT, NS (Mann-Whitney u-test) Bivariate <u>Poisson Regressions</u> NS Univariate and Multivariate	Study nested within a population based cohort with dental exams and interviews performed at 6 and 12 years of age (n=339) [Pelotas, Brazil]	Bivariate and multivariable associations with outcome: DMFT at 12 years old. Multivariate analyses were conducted using Poisson regression to generate relative risk ratio and logistic regression (backward stepwise) to predict dental caries at age 12 years. Variables grouped into hierarchical model with 6 levels: (1) socioeconomic/demographic, (2) nutritional/development characteristics, (3) OH behaviors and dental service use at age 6, (4) primary dental caries at 6 yrs, (5) family economic level at 12 yrs, (6) OH related behaviors and dental service use at 12 yrs. At each level, variables excluded if p>0.25. Final model variables retained if p<=0.05.	Peres MA, Barros AJ, Peres KG, Araujo CL, Menezes AM. Life course dental carles determinants and predictors in children aged 12 years: a population-based birth cohort. Community Dent Oral Epidemiol 2009;37:123–33.

Data Element	Results (OR, RD, RR, Sn, Sn)	Population	Relationship Examined	Study
		Note: n represents sample size at		
		final follow-up		
Daily use of fluoride toothpaste (yes/no)	Logistic Regression	5-6 years at baseline, followed for 3	Outcome: new incident dental caries of the permanent teeth:	Tamaki Y. Nomura Y. Katsumura S. Okada A.
	NS, Multivariate, all factors	years (n=500) [Gifu Prefecture, Japan]	3 approaches: (1) conventional modeling, (2) neural network,	Yamada H, Tsuge S, et al. Construction of a
Note:	Not included, Multivariate, stepwise		C5.0 - tool for discovering patterns in databases and used to	dental caries prediction model by data
Baseline: DF=0.054	Not included, Multivariate, most robust based on balancing technique		make predictions.	mining. J Oral Sci 2009;51:61-8.
			Logistic regression analyses were conducted for a full model	
	Note: Overall study finding: decision analysis produced better prediction models than logistic		with all variables as well as using stenwise selection. Neural	
	regression or neural network approaches. Significant predictors in this approach were MS		network model had 12 input layers, 3 hidden layers, and 1	
	levels, LB, salivary pH, gender, and sweet beverages.		output layer. C5.0 models work by sequenced sample	
			splitting based on fields providing the maximum information	
			gained. Balancing technique applied. Total of 10 balanced	
			highest mean of sum of SN and SP	
			ingliest mean of sum of sit and sit.	
Tooth-brushing fluoride not specified but authors noted that almost	t	12 years old at baseline followed for 4	Bivariate and multivariable associations with two outcomes:	Källestal C, Fjelddahl A. A four-year cohort
all toothpastes in Sweden contain fluoride so it was implied		years (n=3,373) [Sweden]	(1) DMFS increment and (2) DeMFS increment -enamel caries	study of caries and its risk factors in
Reporting $2-2x/day$ at 2 of the 3 examp at which questionnaires were	1.06 (RR, nr0.05) Universite increment DMES total study group		on proximal surfaces included in index. Poisson regression with over-dispersion used to applyze incidence rate	adolescents with high and low risk at baseline. Swed Dept I 2007:31:11–25
administered (vs reporting >=2x/day at all 3 exams)	1.05 (RR, p<0.05) Multivariable, increment DMFS, total study group		with over dispersion used to analyze incluence rate.	basenne. Swed Denes 2007,51.11 25.
	1.11 (RR, p<0.05) Univariate, increment DeMFS, total study group		Evaluated for total population and "high risk."	
	1.15 (RR, p<0.05) Multivariable, increment DeMFS, total study group			
	1.08 (RR, p<0.05) Univariate, increment DMFS, high risk group		High risk identified as	
	1.06(RR, p<0.05) Univariate increment DeMES high risk group		caries filled proximal surface or missing tooth because of	
	1.15 (RR, p<0.05) Multivariable, increment DeMFS, high risk group		caries, or	
			-dentist found patient had high risk due to mental/physical	
Reporting >=2x/day at 1 of the 3 exams (vs >=2x/day at all 3)	1.11 (RR, p<0.05) Univariate, increment DMFS, total study group		disability or chronic disease, or	
	1.09 (RR, p<0.05) Multivariable, increment DMFS, total study group		-CFU>10(5) - lactobacillus test	
	1.17 (RR, p<0.05) Multivariable, increment DeMFS, total study group		Children randomly assigned to one of our preventive	
	1.14 (RR, p<0.05) Univariate, increment DMFS, high risk group		programs: (1) tooth-brushing, (2) fluoride lozenges	
	1.14 (RR, p<0.05) Multivariable, increment DMFS, high risk group		prescription, (3) fluoride varnish, (4) individual program -	
	1.22 (RR, p<0.05) Univariate, increment DeMFS, high risk group		counseling dental hygiene and nutrition; professional cleaning	
	1.17 (RR, p<0.05) Multivariable, increment DeMFS, high risk group		and FV.	
Reporting <2x/day at all 3 exams (vs >=2x/day at all 3)	1.06 (RR, p<0.05) Univariate, increment DMFS, total study group			
	NS Multivariable, increment DMFS, total study group			
	1.09 (RR, p<0.05) Univariate, increment DeMFS, total study group			
	NS (RR, p<0.05) Multivariable, increment DeMFS, total study group			
Toothbrushing<1/day	1.8 (OR. p<0.01) Univariate Group B v. Group A	Children 2.5 years at baseline with 1-	Univariate analysis of each variable comparing children (A)	Grindefiord M. Dahllöf G. Modéer T. Caries
Fluoride not specified - separate question about fluoride		year follow-up (n=692) [Stockholm,	caries free at baseline and follow-up, (B) caries free at	development in children from 2.5 to 3.5 years
toothpaste that was NS	NS Group C v. Group B	Sweden]	baseline with caries at follow-up, (C) caries at baseline and	of age: a longitudinal study. Caries Res
			follow-up - (A) and (B) compared; (B) and (C) compared.	1995;29:449–54.
Comparing three groups of children: (A) caries free at baseline and				
caries at baseline and follow-up. Two comparisons among the three				
groups: (A) and (B) compared; (B) and (C) compared.				
Notes Official complexities and bated				
Note: Clinical examinations conducted				
At 2.5 years (baseline for this study): 11% bad initial or manifest				
caries.				
At 3.5 years: 37% initial/manifest.				
1		1		1

Data Element	Results (OR, RD,	RR. Sn. Sp)	Population	Relationship Examined	Study
		7 · 7 · [7	Note: n represents sample size at		···· ,
			final follow-up		
Toothbrushing<1/day	2.7 (OR, p<0.001)	Univariate (manifest caries at 3.5 years)	Children 1 year at baseline with follow	Univariate and logistic multivariate regression for association	Grindefjord M, Dahllöf G, Nilsson B, Modéer
Fluoride not specified - separate question about fluoride			up at 2.5 and 3.5 years of age (n=692)	with outcomes: initial/manifest caries at 2.5 years of age and	T. Stepwise prediction of dental caries in
toothpaste	NS	Multivariate (initial/manifest at 2.5 y)	[Stockholm, Sweden]	manifest caries at 3.5 years of age (versus not).	children up to 3.5 years of age. Caries Res 1996;30:256–66.
Note: Clinical examinations conducted	NS	Multivariate (manifest at 3.5 y)		Initial caries - loss of translucency and slight roughness on	
at 2.5 and 3.5 years of age.				probing (chalky appearance); Manifest - minimal level verified	
At 2.5 years: 11% had initial or manifest caries; 7% had one or more				as a cavity detectable by probing; and catch of probe under	
manifest lesions.				slight pressure for fissures.	
At 3.5 years: 37% initial/manifest; 29% manifest.					
No fluoride toothpaste	1.5 (OR, p<0.05)	Univariate (manifest caries at 3.5 years)	Children 1 year at baseline with follow	Univariate and logistic multivariate regression for association	Grindefjord M, Dahllöf G, Nilsson B, Modéer
(separate question from toothbrushing)			up at 2.5 and 3.5 years of age (n=692)	with outcomes: initial/manifest caries at 2.5 years of age and	T. Stepwise prediction of dental caries in
	NS	Multivariate (initial/manifest at 2.5 y)	[Stockholm, Sweden]	manifest caries at 3.5 years of age (versus not).	children up to 3.5 years of age. Caries Res
					1996;30:256-66.
Note: Clinical examinations conducted at 2.5 and 3.5 years of age.	NS	Multivariate (manifest at 3.5 y)		Initial caries - loss of translucency and slight roughness on	
At 2.5 years: 11% had initial or manifest caries; 7% had one or more				probing (chalky appearance); Manifest - minimal level verified	
manifest lesions.				as a cavity detectable by probing.	
At 3.5 years. 57 % mitual/manifest, 25% manifest.					
Toothbrushing frequency (separate variables for at least once daily	NS		Two cohorts (Grade 1 and Grade 5) at	Backward stepwise logistic regression for outcome: high risk	Disney JA, Graves RC, Stamm JW, Bohannan
and at least twice daily); fluoride not specified			two sites (Aiken, SC and Portland, ME)	based on 3-year DMFS increment (final DMFS-baseline DMFS)	HM, Abernathy JR, Zack DD. The University of
Nata, Dasalina sarias aurarianaa	Note: Comparison to	"any risk" in Dack et al. 1002 where "any risk" is a DMEC increment of 1 ar	with 3-year follow-up (n=4158)	where high risk definition varied by conort	North Carolina Carles Risk Assessment study:
Mean dmfs, Grade 1, Aiken: 9.3, Portland: 2.9	more:	any fisk in beck et al. 1992 where any fisk is a Divirs increment of 1 of			prediction Community Dent Oral Enidemiol
Mean dmfs Grade 5. Aiken: 4.4. Portland: 2.4	0.93 - 2.03 (OR) Sign	ficant in 2 of 4 cohorts, but opposite signs			1992:20:
Mean DMFS Grade 1, Aiken: 0.3, Portland: 0.2					64–75.
Mean DMFS Grade 5, Aiken: 3.0, Portland: 1.7					
Note: Dependent variable is *no* carious lesions at 3 vrs	Stenwise Multivariat	a Logistic Regression Results	1 year at baseline followed for 2 years	Bivariate and multivariate (stenwise logistic regression)	Wendt I K Hallonsten Al Koch G Birkhed D
Note. Dependent variable is no canous resions at 5 yrs	Stepwise Multivariat		(n=289) [lonkoping, Sweden]	association with outcome: absence of carious lesions	Analysis of caries-related factors in infants
Baseline toothbrushing frequency (>=1/day)	NS			(manifest or initial) at 3 years of age.	and toddlers living in Sweden. Acta Odontol
Toothbrushing frequency at 2 years of age	2.86 (OR, p=0.002)				Scand 1996;54:131-7.
Tooth brushing frequency (<1/day, 1/day, 2+/day)			6-10 years old at baseline followed for 5	Bivariate and multivariable associations with two outcomes:	Maserejian NN, Tavares MA, Hayes C,
Fluoride not specified.			years (n=429) [Boston, MA and	(1) 5-year increment of carious teeth and (2) 5-year increment	Soncini JA, Trachtenberg FL. Prospective
			Farmingham, ME]	of carious surfaces. Carious/filled surfaces measured from	study of 5-year caries incre-ment among
<1/day (vs. 2+/day)	1.37 (RR, p=0.04)	Multivariate, 5-year net increment carious TEETH		date of baseline visit through date of final study dental visit.	children receiving comprehensive dental care
	1.45 (RR, p=0.04)	Vultivariate, 5-year net increment carious SURFACES	Note: Sample were high-risk children	Carles in both primary and permanent dentition were summed	in the New England children's amalgam trial.
1/day (vs. 2+day)	NS	Multivariate 5-year net increment carious TEETH	Amalgam Trial - additional inclusion	to obtain cumulative incident disease burden (net carles	
1/009 (V3. 2+009)	NS	Multivariate, 5-year net increment carious SURFACES	criteria were no prior amalgam	incrementy.	005,57.5 10.
Note:			restorations and having at least two	Factors associated with caries increment at a level of p>0.15	
Baseline carious surfaces (mean): 9.4	Mean 5-year increme	nt carious teeth	decayed posterior occulsal surfaces All	entered into preliminary multivariate model; final multivariate	
	Toothbrushing freque	ency	participants received restorations of	model included variables significant at p<0.05 or changed	
At 5-year following, net increment of carious surfaces (mean): 6.9	<1/day: 5.6 mean inc	rement	baseline caries and sealants and	coefficients of other variables more than 10%. Multivariate	
	1/day: 4.5		comprehensive semiannual dental care.	analyses conducted using negative binomial model.	
	2+/day: 4.2				
	Mean 5-year increme	nt carious surfaces			
	Toothbrushing freaue	ency			
	<1/day: 9.0 mean inc	rement			
	1/day: 7.2				
	2+/day: 6.3				

Data Element	Results (OR, RD, RR, Sn, Sp)	Population	Relationship Examined	Study
		Note: n represents sample size at final follow-up		
Child brushes less than twice a day fluoride not specified	Bivariate association with Caries Progression (significant or NS using logistic regression - specific values not reported) New ICDAS>=1 at 24 months: NS New ICDAS>=3 at 24 months: NS	5-13 years of age with 2-year follow-up (n=395) [Aguas Buenas, Puerto Rico]	Logistic regression for progression outcomes (see below) at 12/24 months; for each predictor individually; multiple regression developed using backward elimination retaining predictors p<0.05 with AUC/ROC calculated for final models at model level; Poisson regression for number of lesions with	Fontana M, Santiago E, Eckert GJ, Ferreira- Zandona AG. Risk factors of caries progression in a Hispanic school-aged population. J Dent Res 2011;90:1189–96.
Note: Baseline mean age was 9.7 years Baseline mean ICDAS>=1: 15.7 Baseline mean ICDAS>=3: 8.2 12-month mean ICDAS>=1: 17.9 -89% of children 12-month mean ICDAS>=3: 8.4 -61% of children 24-month mean ICDAS>=1: 16.8 -91% of children 242-month mean ICDAS>=3: 8.4 -68% of children	Multivariate Caries Risk Models NS - Not included in any of the final models		progression Two Outcomes: 1. Any progression (ICDAS>=1): at least one new lesion ICDAS>=1, one new filling, and/or progression of lesion from scores of 1-2 to 3 to higher or from 3-4 to 5 to higher between the two exams. 2. Progression toward cavitation (ICDAS>=3): at least one new lesion ICDAS>=3, one new filling, and/or progression of lesion from score of 1-2 to 3 or higher or from 3-4 to 5 or higher between the two exams. Models run for outcomes at 12 and 24 months; Models run without any baseline ICDAS; models run adding baseline ICDAS last; models run starting with baseline ICDAS score	
Toothbrushing frequency during preceding week (<7 days or >=7 days); NOTE: could be with or without toothpaste	NS	Children 0-5 years at baseline followed for 2 years (n=788) [low-income African- American children in Detroit, Michigan]	Stepwise backward multiple regression, zero-inflated negative binomial models with outcomes: caries increment measured as (1) new d16mfs and (2) new d36mfs.	Ismail AI, Lim S, Sohn W, Willem JM. Determinants of early childhood caries in low- income African American young children. Pediatr Dent 2008;30:289–96.
Toothbrushing of child by mother (never or sometimes versus everyday) fluoride not specified Note: Baseline caries experience among 3 year olds was 41% with mean dmft of 1.70.	NS	646 mother-child pairs; children aged 1.5 and 3 years during examinations conducted between 1992 to 2005. [Ishii town, Tokushima Prefecture, Japan]	Multiple logistic regression of factors associated with outcome: presence of dental caries at age 3 years. Caries was based on WHO methodology; recorded as present when lesion in pit/fissure, or on a smooth tooth surface, has detectably softened floor, undermined enamel, or softened wall; dmft recorded.	Niji R, Arita K, Abe Y, Lucas ME, Nishino M, Mitome M. Matemal age at birth and other risk factors in early childhood caries. Pediatr Dent 2010;32:493–8.
Supervised brushing=brushed at least twice a day (vs less frequently) fluoride not specified Note: Baseline caries prevalence among 3 year olds was 20.1% d1-5 mfs and 6.6% d3-5 mfs. Caries prevalence at 5 years was 48.0% d15mfs and 19.1% d3-5mfs.	2.5 (0R, p<0.05) Bivariate NS Multivariate	Children 3 years of age followed up at age 5 years (n=304) [Oslo, Norway]	Bivariate and multiple logistic regression of factors associated with outcome: positive severe caries increment (change in d3-5mfs). 5 grade caries diagnostic system: grades 1-2=enamel lesions; 3-5 dentine lesions. Caries increment=change d1-5mfs Severe caries increment=change d3-5mfs Molar-approximal caries excluded from caries increment calculations.	Skeie MS, Espelid I, Riordan PJ, Klock KS. Caries increment in children aged 3-5 years in relation to parents' dental attitudes: Oslo, Norway 2002 to 2004. Community Dent Oral Epidemiol 2008;36:441–50.
Level 4 - Frequency of tooth brushing >=1 time per day (vs. less) fluoride not specified Note: ECC prevalence at baseline (8 months) = 0; 14 months = 0; 20 months =1.6%; 26 months = 11.1%; 32 months=28.4%.	NS Within level multivariable analysis Not included Final model with all five levels, using sequential stepwise GEE IDR = Incidence density ratio = incidence density among those exposed and not exposed to independent variable.	(Children & months of age with six month follow-ups through 32 months of age (2- year follow up) (n=255 at recruitment; 155 at last follow-up) [Guangzhou, China]	Generalized estimating equations used to assess relationship with outcome: incidence density of a tooth surface developing carles, which is the number of new carles-affected surfaces per surface time at risk. Incidence density ratio = incidence density among those exposed and not exposed to independent variable. Sequential stepwise GEE using 5-level model (1=socioeconomic/demographic vars; 2=developmental characteristics; 3=nutritional upbringing including feeding/nutrition; 4=oral health behaviors; 5= S. mutans)	Zhou Y, Yang JY, Lo EC, Lin HC. The contribution of life course determinants to early childhood caries: a 2–year cohort study. Caries Res 2012;46:87–94.

Data Element	Results (OR, RD, RR, Sn, Sp)	Population Note: n represents sample size at final follow-up	Relationship Examined	Study
Fluoride "regular" uses (not well defined) Note: Occurrence of children with cavitated caries or fillings (d3mfs>0) at 2 years of age was 3%. At age 5 years, 23%.	NS Univariate 0.53 (SN), 0.59 (SP), 0.56 (AUC)	2 years at baseline; followed for 3 years (n=226) [Saarijarvi, Finland]	Bivariate and multivariate (using forward stepwise logistic regression) association with outcome: 3-year increment of cavitated carious lesions and/or fillings - measured as the increase of d3mfs from age of 2 years	Pienihakkinen, Jokela & Alanen. Assessment of Caries Risk in Preschool Children. Caries Res 2004;38:156-162.
Drinks fluoridated water				
Composite water fluoride levels based on main sources of water Note: % with new non-cavitated caries at first exam, primary dentition: 21.15% % with new cavitated caries at first exam, primary dentition: 26.28%	NS New non-cavitated caries NS New cavitated caries	Children tracked from birth through 13 years old (n=156) [lowa]	Multivariable model (GLMM based on negative binomial distribution) of association with: (1) new non-cavitated caries and (2) new cavitated caries (repeated measures analysis with measurements at 3-5 y, 6-8 y, and 11-13 y)	Chankanka et al. Longitudinal Associations between Children's Dental Caries and Risk Factors. J Public Health Dent 2011;71:289- 300.
Never lived in non-fluoridated community Note: At baseline, 40.3% of children were affected by caries (mean dmft was 1.57). In 1 year, 43.7% of children had dmft increment. Mean increase of dmft in 1 year was 0.93.	NS Prediction model w/o biological factors (change dmft>0) NS Prediction model w/ biological factors (change dmft>0) 0.68 (OR, p<0.05)	Children aged 3-6 years with one-year follow-up (n=1,576). [Singapore]	Multiple stepwise logistic regression for association with outcome: one-year caries increment measured as change in dmft. Data from 50% children used for model construction; remainder for model validation. Prediction (all potential factors) and risk models (subset of modifiable factors) with and without biological tests examined. Also, community screening model for identify "high risk" using a questionnaire high risk = 25% of children with high caries burden (baseline dmft>2 for population studied).	Gao XL, Hsu CY, Xu Y, Hwarng HB, Loh T, Koh D. Building caries risk assessment models for children. J Dent Res 2010;89:637–43.
Fluoride in drinking level (based on clinic nurse report) <1.0 ppm vs. >=1.0 ppm Note: Baseline total population % with DMFS=0: 47% Baseline high risk % with DMFS=0: 28% Baseline DMFS, total population, 12 yrs old (mean)=1.67 Baseline DMFS, high risk, 12 yrs old (mean)=2.87 Baseline DeMFS, total population, 12 years old (mean)=2.40 Baseline DeMFS, high risk, 12 yrs old (mean)=4.67 DMFS, total population, 16 yrs old (mean)=3.69 DMFS, total population, 16 years old (mean)=6.42 DeMFS, high risk, 16 yrs old (mean)=10.03	 1.05 (RR, p<0.05) Univariate, increment DMFS, total study group 1.05 (RR, p<0.05) Multivariable, increment DMFS, total study group 1.10 (RR, p<0.05) Univariate, increment DeMFS, total study group NS Multivariable, increment DeMFS, total study group NS in any of the high risk group models. 	12 years old at baseline followed for 4 years (n=3,373) [Sweden]	Bivariate and multivariable associations with two outcomes: (1) DMFS increment and (2) DeMFS increment -enamel carles on proximal surfaces included in index. Poisson regression with over-dispersion used to analyze incidence rate. Evaluated for total population and "high risk." High risk identified as -having >1 decayed proximal surface, enamel or dentine carles, filled proximal surface or missing tooth because of carles, or -dentist found patient had high risk due to mental/physical disability or chronic disease, or -CFU>10(5) - lactobacillus test Children randomly assigned to one of our preventive programs: (1) tooth-brushing, (2) fluoride lozenges prescription, (3) fluoride varnish, (4) individual program - counseling dental hygiene and nutrition; professional cleaning and FV.	Källestal C, Fjelddahl A. A four-year cohort study of caries and its risk factors in adolescents with high and low risk at baseline. Swed Dent J 2007;31:11–25.
Drinking water type (bottled vs tap) Water source (well vs municipal supply) Note: Baseline carious surfaces (mean): 9.4 At 5-year following, net increment of carious surfaces (mean): 6.9	Neither of these variables were significantly associated with 5-year increment in bivariate/multivariate models.	6-10 years old at baseline followed for 5 years (n=429) [Boston, MA and Farmingham, ME] Note: Sample were high-risk children enrolled in the New England Children's Amalgam Trial - additional inclusion criteria were no prior amalgam restorations and having at least two decayed posterior occulsal surfaces All participants received restorations of baseline caries and sealants and comprehensive semiannual dental care.	Bivariate and multivariable associations with two outcomes: (1) 5-year increment of carious teeth and (2) 5-year increment of carious surfaces. Carious/filled surfaces measured from date of baseline visit through date of final study dental visit. Caries in both primary and permanent dentition were summed to obtain cumulative incident disease burden (net caries increment). Factors associated with caries increment at a level of p>0.15 entered into preliminary multivariate model; final multivariate model included variables significant at p<0.05 or changed coefficients of other variables more than 10%. Multivariate analyses conducted using negative binomial model.	Maserejian NN, Tavares MA, Hayes C, Soncini JA, Trachtenberg FL. Prospective study of 5-year caries incre-ment among children receiving comprehensive dental care in the New England children's amalgam trial. Community Dent Oral Epidemiol 009;37:9–18.

Data Element	Results (OR, RD, RR, Sn, Sp)	Population Note: n represents sample size at	Relationship Examined	Study
Type of water child drinks (well, bottled, tap) Note: Baseline mean age was 9.7 years Baseline mean ICDAS>=1: 15.7 Baseline mean ICDAS>=3: 8.2 12-month mean ICDAS>=3: 8.2 12-month mean ICDAS>=3: 8.4 -61% of children 24-month mean ICDAS>=1: 16.8 -91% of children 242-month mean ICDAS>=3: 8.4 -68% of children	Bivariate association with Carles Progression (significant or NS using logistic regression - specific values not reported) New ICDAS>=3 at 24 months: NS New ICDAS>=3 at 24 months: NS <u>Multivariate Carles Risk Models</u> NS - Not included in any of the final models	(n=395) [Aguas Buenas, Puerto Rico]	Logistic regression for progression outcomes (see below) at 12/24 months; for each predictor individually; multiple regression developed using backward elimination retaining predictors pc0.05 with AUC/ROC calculated for final models at model level; Poisson regression for number of lesions with progression Two Outcomes: 1. Any progression (ICDAS>=1): at least one new lesion ICDAS>=1, one new filling, and/or progression of lesion from scores of 1-2 to 3 to higher or from 3-4 to 5 to higher between the two exams. 2. Progession toward cavitation (ICDAS>=3): at least one new lesion ICDAS>=3, one new filling, and/or progression of lesion from score of 1-2 to 3 or higher or from 3-4 to 5 or higher between the two exams. Models run for outcomes at 12 and 24 months; Models run without any baseline ICDAS; models run adding baseline ICDAS last; models run starting with baseline ICDAS	Fontana M, Santiago E, Eckert GJ, Ferreira- Zandona AG. Risk factors of caries progression in a Hispanic school-aged population. J Dent Res 2011;90:1189–96.
Piped water supply (yes vs. no) Note: Baseline primary dental caries at 6 yrs (DMFT>0): 63%	NS in initial bivariate tests	Study nested within a population based cohort with dental exams and interviews performed at 6 and 12 years of age (n=339) [Pelotas, Brazil]	Bivariate and multivariable associations with outcome: DMFT at 12 years old. Multivariate analyses were conducted using Poisson regression to generate relative risk ratio and logistic regression (backward stepwise) to predict dental caries at age 12 years. Variables grouped into hierarchical model with 6 levels: (1) socioeconomic/demographic, (2) nutritional/development characteristics, (3) OH behaviors and dental service use at age 6, (4) primary dental caries at 6 yrs, (5) family economic level at 12 yrs. At each level, variables excluded if p>0.25. Final model variables retained if p<=0.05.	Peres MA, Barros AJ, Peres KG, Araujo CL, Menezes AM. Life course dental caries determinants and predictors in children aged 12 years: a population-based birth cohort. Community Dent Oral Epidemiol 2009;37:123–33.
Prescription home-use products (e.g. high concentrat	ion fluoride toothpastes)	1	1	
Assigned preventive program: prescription fluoride lozenges (vs. tooth- brushing) Note: Baseline total population % with DMFS=0: 47% Baseline high risk % with DMFS=0: 28% Baseline DMFS, total population, 12 yrs old (mean)=1.67 Baseline DMFS, high risk, 12 yrs old (mean)=2.87 Baseline DeMFS, total population, 12 years old (mean)=2.40 Baseline DeMFS, high risk, 12 yrs old (mean)=3.69 DMFS, total population, 16 yrs old (mean)=3.69 DMFS, total population, 16 years old (mean)=6.42 DeMFS, total population, 16 years old (mean)=6.42 DeMFS, high risk, 16 yrs old (mean)=10.03	NS Univariate, increment DeMFS, total study group NS Multivariable, increment DeMFS, total study group NS (RR, p<0.05) Univariate, increment DeMFS, high risk group NS (RR, p<0.05) Multivariable, increment DeMFS, high risk group	12 years old at baseline followed for 4 years (n=3,373) [Sweden]	Bivariate and multivariable associations with two outcomes: (1) DMFS increment and (2) DeMFS increment -enamel caries on proximal surfaces included in index. Poisson regression with over-dispersion used to analyze incidence rate. Evaluated for total population and "high risk." High risk identified as -having >1 decayed proximal surface, enamel or dentine caries, or -dentist found patient had high risk due to mental/physical disability or chronic disease, or -CFU>10(5) - lactobacillus test Children randomly assigned to one of our preventive programs: (1) tooth-brushing, (2) fluoride lozenges prescription, (3) fluoride varnish, (4) individual program - counseling dental hygiene and nutrition; professional cleaning and FV.	Källestal C, Fjelddahl A. A four-year cohort study of caries and its risk factors in adolescents with high and low risk at baseline. Swed Dent J 2007;31:11–25.

	Note: n represents sample size at		
	final follow-up		
sh)			
Bivariate association with Caries Progression (significant or NS using logistic regression - specific values not reported) New (ICDAS>=1 at 24 months: NS New ICDAS>=3 at 24 months: NS	5-13 years of age with 2-year follow-up (n=395) [Aguas Buenas, Puerto Rico]	Logistic regression for progression outcomes (see below) at 12/24 months; for each predictor individually; multiple regression developed using backward elimination retaining predictors p<0.05 with AUC/ROC calculated for final models at model level; Poisson regression for number of lesions with programming and the second seco	Fontana M, Santiago E, Eckerf GJ, Ferreira- Zandona AG. Risk factors of caries progression in a Hispanic school-aged population. J Dent Res 2011;90:1189–96.
NS - not included in any of the final models.		progression	
		Two Outcomes: 1. Any progression (ICDAS>=1): at least one new lesion ICDAS>=1, one new filling, and/or progression of lesion from scores of 1-2 to 3 to higher or from 3-4 to 5 to higher between the two exams. 2. Progession toward cavitation (ICDAS>=3): at least one new lesion ICDAS>=3, one new filling, and/or progression of lesion from score of 1-2 to 3 or higher or from 3-4 to 5 or higher between the two exams. Models run for outcomes at 12 and 24 months:	
		Models run without any baseline ICDAS; models run adding baseline ICDAS last; models run starting with baseline ICDAS score	
0.93 (RR, p<0.05) Univariate, increment DeMFS, total study group 0.90 (RR, p<0.05) Multivariable, increment DeMFS, total study group 0.93 (RR, p<0.05) Univariate, increment DeMFS, high risk group 0.90 (RR, p<0.05) Multivariable, increment DeMFS, high risk group	12 years old at baseline followed for 4 years (n=3,373) [Sweden]	Bivariate and multivariable associations with two outcomes: (1) DMFS increment and (2) DeMFS increment -enamel caries on proximal surfaces included in index. Poisson regression with over-dispersion used to analyze incidence rate. Evaluated for total population and "high risk." High risk identified as -having >1 decayed proximal surface, enamel or dentine caries, filled proximal surface or missing tooth because of	Källestal C, Fjelddahl A. A four-year cohort study of caries and its risk factors in adolescents with high and low risk at baseline. Swed Dent J 2007;31:11–25.
		caries, or -dentist found patient had high risk due to mental/physical disability or chronic disease, or -CFU>10(5) - lactobacillus test Children randomly assigned to one of our preventive programs: (1) tooth-brushing, (2) fluoride lozenges orescription. (3) fluoride variush, (4) individual program -	
		counseling dental hygiene and nutrition; professional cleaning and FV.	
Logistic Regression NS, Multivariate, all factors Not included, Multivariate, stepwise Not included, Multivariate, most robust based on balancing technique	5-6 years at baseline, followed for 3 years (n=500) [Gifu Prefecture, Japan]	Outcome: new incident dental caries of the permanent teeth; 3 approaches: (1) conventional modeling, (2) neural network, CS.0 - tool for discovering patterns in databases and used to make predictions. Logistic regression analyses were conducted for a full model	Tamaki Y, Nomura Y, Katsumura S, Okada A, Yamada H, Tsuge S, et al. Construction of a dental caries prediction model by data mining. J Oral Sci 2009;51:61–8.
Note: Overall study finding: decision analysis produced better prediction models than logistic regression or neural network approaches. Significant predictors in this approach were MS levels, LB, salivary pH, gender, and sweet beverages.		with all variables as well as using stepwise selection. Neural network model had 12 input layers, 3 hidden layers, and 1 output layer. CS.0 models work by sequenced sample splitting based on fields providing the maximum information gained. Balancing technique applied. Total of 10 balanced sample sets applied to the models. Model selection based on highest mean of sum of SN and SP.	
	b) Slavitate association with Carles Progression (significant or NS using logistic regression - specific values not reported) Wew (CDAS>=1 at 24 months: NS Yew (CDAS>=3 at 24 months: NS Sufficient of the final models. D.93 (RR, p<0.05) Univariate, increment DeMFS, total study group 0.90 (RR, p<0.05) Univariate, increment DeMFS, high risk group 0.90 (RR, p<0.05) Univariate, increment DeMFS, high risk group 0.90 (RR, p<0.05) Univariate, increment DeMFS, high risk group 0.90 (RR, p<0.05) Multivariable, increment DeMFS, high risk group 1.90 (RR, p<0.05) Multivariate, all factors Not included, Multivariate, stepwise Not included, Multivariate, stepwise Not included, Multivariate, stepwise Not included, Multivariate, most robust based on balancing technique Net: Overall study finding: decision analysis produced better prediction models than logistic regression on reural network approaches. Significant predictors in this approach were MS levels, LB, salivary pH, gender, and sweet beverages.	b) 13 years of age with 2-year follow-up models association with Carles Progression (significant or NS using logistic regression. In the second of the s	Image: Second

Data Element	Results (OR, RD, RR, Sn, Sp)	Population Note: n represents sample size at	Relationship Examined	Study
	A	final follow-up		
Over the counter fluoride products (e.g. mouth rinses				
Note: Baseline caries experience: Mean dmfs, Grade 1, Alken: 9.3, Portland: 2.9 Mean dmfs Grade 5, Alken: 4.4, Portland: 2.4 Mean DMFS Grade 1, Alken: 0.3, Portland: 0.2 Mean DMFS Grade 5, Alken: 3.0, Portland: 1.7	NS Note: Comparison to "any risk" in Beck et al. 1992 where "any risk" is a DMFS increment of 1 or more: NS	I wo conorts (Grade 1 and Grade 3) at two sites (Aiken, SC and Portland, ME) with 3-year follow-up (n=4158)	Backward stepwise logistic regression for outcome: high risk based on 3-year DMFS increment (final DMFS-baseline DMFS) where high risk definition varied by cohort	Dishey JA, Graves KC, Stamm JW, Bonandan HM, Abernathy JR, Zack DD. The University of North Carolina Caries Risk Assessment study further developments in caries risk prediction. Community Dent Oral Epidemiol 1992;20:64–75.
Fluoride mouthwash daily use (yes/no)	Logistic Regression NS, Multivariate, all factors Not included, Multivariate, stepwise 0.45 (OR, p=0.03), Multivariate, most robust based on balancing technique	5-6 years at baseline, followed for 3 years (n=500) [Gifu Prefecture, Japan]	Outcome: new incident dental caries of the permanent teeth; 3 approaches: (1) conventional modeling, (2) neural network, C5.0 - tool for discovering patterns in databases and used to make predictions. Logistic regression analyses were conducted for a full model	Tamaki Y, Nomura Y, Katsumura S, Okada A, Yamada H, Tsuge S, et al. Construction of a dental caries prediction model by data mining. J Oral Sci 2009;51:61–8.
Note: Baseline: DF=0.054	Note: Overall study finding: decision analysis produced better prediction models than logistic regression or neural network approaches. Significant predictors in this approach were MS levels, LB, salivary pH, gender, and sweet beverages.		with all variables as well as using stepwise selection. Neural network model had 12 input layers, 3 hidden layers, and 1 output layer. C5.0 models work by sequenced sample splitting based on fields providing the maximum information gained. Balancing technique applied. Total of 10 balanced sample sets applied to the models. Model selection based on highest mean of sum of SN and SP.	
Regular use of systemic fluoride supplements	1.54 (OR, p<0.001) Baseline NS Follow-Up	7 years old at baseline (n=3,303) with at least one follow-up by age 10 years (n=3,002) [Flanders, Belgium]	 Cross-sectional multiple logistic regression with outcome: dmfs (caries v. no caries) in permanent first molars (baseline) Stepwise multiple logistic regression with outcome: net caries increment on permanent first molars (0/1 additional surface affected v. 2 or more additional surfaces affected) calculated by subtracting baseline DMFS6 score from last available DMFS6 score 	Vanobbergen J, Martens L, Lesaffre E, Bogaerts K, Declerck D. The value of a baseline caries risk assessment model in the primary dentition for the prediction of caries incidence in the permanent dentition. Caries Res 2001;35:442–50.
Use of fluoride drops, tablets, or vitamins (yes 0/no 1) Note: Baseline caries experience: Mean dmfs, Grade 1, Aiken: 9.3, Portland: 2.9 Mean dmfs Grade 5, Aiken: 4.4, Portland: 2.4 Mean DMFS Grade 1, Aiken: 0.3, Portland: 0.2 Mean DMFS Grade 5, Aiken: 3.0, Portland: 1.7	NS Note: Comparison to "any risk" in Beck et al. 1992 where "any risk" is a DMFS increment of 1 or more: 1.55 (OR) Significant in 1 of 4 cohorts (One Grade 1)	Two cohorts (Grade 1 and Grade 5) at two sites (Aiken, SC and Portland, ME) with 3-year follow-up (n=4158)	Backward stepwise logistic regression for outcome: high risk based on 3-year DMFS increment (final DMFS-baseline DMFS) where high risk definition varied by cohort	Disney JA, Graves RC, Stamm JW, Bohannan HM, Abernathy JR, Zack DD. The University of North Carolina Caries Risk Assessment study: further developments in caries risk prediction. Community Dent Oral Epidemiol 1992;20: 64–75.
Previous use of fluoride supplements (versus not)	2.1 (OR, p=0.002), 0.55 (SN), 0.63 (SP) Baseline NS Multivariate	Kindergarten children (mean age 5 y 8m) followed up after one year (n=302) [Montreal, Canada]	Bivariate association and multivariate logistic regression for outcome: at least one new carious surface in primary teeth at one-year follow-up	Demers M, Brodeur JM, Mouton C, Simard PL, Trahan L, Veilleux G. A multivariate model to predict caries increment in Montreal children aged 5 years. Community Dent Health 1992;9:273–81.
No fluoride tablets Comparing three groups of children: (A) caries free at baseline and follow-up, (B) caries free at baseline with caries at follow-up, (C) caries at baseline and follow-up. Two comparisons among the three groups: (A) and (B) compared; (B) and (C) compared. Note: Clinical examinations conducted at 2.5 and 3.5 years of age. At 2.5 years (baseline for this study): 11% had initial or manifest caries.	2.0 (OR, p<0.05) Univariate Group B v. Group A NS Group C v. Group B	Children 2.5 years at baseline with 1- year follow-up (n=692) [Stockholm, Sweden]	Univariate analysis of each variable comparing children (A) caries free at baseline and follow-up, (B) caries free at baseline with caries at follow-up, (C) caries at baseline and follow-up - (A) and (B) compared; (B) and (C) compared.	Grindefjord M, Dahllöf G, Modéer T. Caries development in children from 2.5 to 3.5 years of age: a longitudinal study. Caries Res 1995;29:449–54.
At 3.5 years: 37% initial/manifest.				

Data Element	Results (OR. RD. RR. Sn. Sp)	Population	Relationship Examined	Study
		Note: n represents sample size at		,
		final follow-up		
Lice of fluorides other than fluoride tootheaste	NS Dradiction model w/o biological factors	Children aged 2 6 years with one year	Multiple stepuise logistic regression for accessizion with	Goo XI, Hey CV, Xu X, Hwarne HP, Joh T, Koh
ose of nuonues other man nuonue toothpaste	(change dmft>0)	follow-up (p=1.576) [Singapore]	outcome: one-year caries increment measured as change in	D Building caries risk assessment models for
Note: At baseline 40.3% of children were affected by caries (mean	(change drifters)	ionow up (n=1,570). [Singapore]	dmft Data from 50% children used for model construction:	children Dent Res 2010:89:637–43
dmft was 1 57) In 1 year, 43 7% of children had dmft increment	0.42 (OR p<0.05) Prediction model w/ biological factors		remainder for model validation Prediction (all notential	cindicit. 5 Dent Nes 2010,05.057 45.
Mean increase of dmft in 1 year was 0.93.	(change dmft>0)		factors) and risk models (subset of modifiable factors) with	
,	(and without biological tests examined. Also, community	
	NS Risk model w/o biological factors		screening model for identify "high risk" using a questionnaire	
	(change dmft>0)		high risk = 25% of children with high caries burden (baseline	
			dmft>2 for population studied). At baseline, 40.3% of children	
	NS Risk model w/biological factors		were affected by caries (mean dmft was 1.57). In 1 year,	
	(change dmft>0)		43.7% of children had dmft increment. Mean increase of dmft	
			in 1 year was 0.93.	
	2.63 (OR, p<0.05) Community high risk model; questionnaire			
	(baseline dmft>0)			
Child uses additional fluoride products at home (yes no)	Bivariate association with Caries Progression (significant or NS using logistic regression -	5-13 years of age with 2-year follow-up	Logistic regression for progression outcomes (see below) at	Fontana M, Santiago E, Eckert GJ, Ferreira-
	specific values not reported)	(n=395) [Aguas Buenas, Puerto Rico]	12/24 months; for each predictor individually; multiple	Zandona AG. Risk factors of caries
Note: Baseline mean age was 9.7 years	New ICDAS=1 at 24 months: NS		regression developed using backward elimination retaining	progression in a Hispanic school-aged
Baseline mean ICDAS>=1: 15.7	New ICDAS>=3 at 24 months: NS		at model level: Reisson regression for number of locions with	population. J Dent Res 2011;90:1189-96.
baseline mean (CDASZ=3, 8.2	Multivariate Caries Risk Models		progression	
12-month mean ICDAS>=1: 17.9	Note: Total of 12 Multivariate Caries Risk Models: 2 outcomes, 2 time periods, 3 ways of		progression	
-89% of children	handling baseline dmfs/DMFS (not included, added last, added first)		Two Outcomes:	
12-month mean ICDAS>=3: 8.4			1. Any progression (ICDAS>=1): at least one new lesion	
-61% of children	NS- Not included in any of these models.		ICDAS>=1, one new filling, and/or progression of lesion from	
			scores of 1-2 to 3 to higher or from 3-4 to 5 to higher between	
24-month mean ICDAS>=1: 16.8	Multivariate Caries Risk Model for Identification of Number of Lesions Progressing		the two exams.	
-91% of children	Note: Total of 12 Multivariate Caries Risk Models: 2 outcomes, 2 time periods, 3 ways of		2. Progession toward cavitation (ICDAS>=3): at least one new	
242-month mean ICDAS>=3: 8.4	handling baseline dmfs/DMFS		lesion ICDAS>=3, one new filling, and/or progression of lesion	
-68% of children			from score of 1-2 to 3 or higher or from 3-4 to 5 or higher	
	-Significant in 4 of 12 models		between the two exams.	
			Models run for outcomes at 12 and 24 months;	
			hoseline ICDAS last models run starting with baseline ICDAS	
			baseline icDAS fast; models full starting with baseline icDAS	
			score	
Self-administered fluoride (e.g., fluoride rinses, gums or lozenges)	NS in any of the models	12 years old at baseline followed for 4	Bivariate and multivariable associations with two outcomes:	Källestal C Fielddabl A A four-vear cohort
none vs. any kind		years (n=3.373) [Sweden]	(1) DMES increment and (2) DeMES increment -enamel caries	study of caries and its risk factors in
		,	on proximal surfaces included in index. Poisson regression	adolescents with high and low risk at
Note:			with over-dispersion used to analyze incidence rate.	baseline. Swed Dent J 2007;31:11-25.
Baseline total population % with DMFS=0: 47%				
Baseline high risk % with DMFS=0: 28%			Evaluated for total population and "high risk."	
Baseline DMFS, total population, 12 yrs old (mean)=1.67			High risk identified as	
Baseline DMFS, high risk, 12 yrs old (mean)=2.87			-having >1 decayed proximal surface, enamel or dentine	
			caries, filled proximal surface or missing tooth because of	
			caries, or	
Baseline DeMFS, total population, 12 years old (mean)=2.40			-dentist found patient had high risk due to mental/physical	
Baseline DeMFS, high risk, 12 yrs old (mean)=4.67			disability or chronic disease, or	
DMES total population 16 um old (mean)=2.60				
DMFS, total population, 16 yrs old (mean)=5.69			Children randomly accigned to one of our proventive	
Sivin 5, mgn 115k, 10 yrs old (mean)-5.55			programs: (1) tooth-brushing (2) fluoride lozenges	
DeMES total population 16 years old (mean)=6.42			programs. (1) toothondshing, (2) hounde lozenges	
DeMES, high risk, 16 yrs old (mean)=10.03			counseling dental hygiene and nutrition; professional cleaning	
			and FV.	
1				

Data Element	Results (OR, RD, RR, Sn, Sp)	Population Note: n represents sample size at final follow-up	Relationship Examined	Study
Deep pits and fissures				
Pit and fissure morphology score (shallow, moderate or deep) Note: Baseline caries experience: Mean dmfs, Grade 1, Aiken: 9.3, Portland: 2.9 Mean dmfs Grade 5, Aiken: 4.4, Portland: 2.4 Mean DMFS Grade 1, Aiken: 0.3, Portland: 0.2 Mean DMFS Grade 5, Aiken: 3.0, Portland: 1.7	1.08-1.10 (OR) Significant, 3 of 4 cohorts Note: Comparison to "any risk" in Beck et al. 1992 where "any risk" is a DMFS increment of 1 or more (Beck et al results below): 1.06-1.14 (OR) Significant, 2 of 4 cohorts	Two cohorts (Grade 1 and Grade 5) at two sites (Aiken, SC and Portland, ME) with 3-year follow-up (n=4158)	Backward stepwise logistic regression for outcome: high risk based on 3-year DMFS increment (final DMFS-baseline DMFS) where high risk definition varied by cohort	Disney JA, Graves RC, Stamm JW, Bohannan HM, Abernathy JR, Zack DD. The University of North Carolina Caries Risk Assessment study: further developments in caries risk prediction. Community Dent Oral Epidemiol 1992;20:64–75.
Fissure morphology Note: Fissure morphology determined based on degree of penetration of the periodontal probe-tine in both permanent first lower molars scored as: no penetration, minimal, and deep. Note: Baseline: 42% caries free; dmfs(mean) 5.5; DMFS(mean) 0.1 At 4 yrs: 29% caries free; dmfs(mean) 4.6; DMFS(mean) 0.6	p=0.011 (Pearson chi-square/Fisher exact test) Bivariate 19.10 (OR, p=0.024) Multivariable AUC/ROC: 0.57	6 years followed for 4 years (n=95) [Mexico City, Mexico]	Bivariate and multivariable (multiple logistic regression) associations with outcome: caries increment dichotomized as 0 newly affected vs. >=1 new surface affected. ROC/AUC calculated. Caries experience calculated as dmfs, DMFS and dfm+DMFS using WHO criteria. Two groups identified: caries-free and >=1 dmf-DMFS. Caries increment was most recent dmfs/DMFS score - baseline score.	Sanchez-Perez L, Golubov J, Irigoyen- Camacho ME, Moctezuma PA, Acosta-Gio E. Clinical, salivary, and bacterial markers for caries risk assessment in schoolchildren: a 4- year follow-up. Int J Paediatr Dent 2009;19:186–92.
Vicible plaque en teeth				
	2.52 (OP p=0.02) Universite	2 years at baseline: followed for 2 years	Rivariate and multivariate (using forward storwise logistic	Pionibakkingn Jokola & Alanon Accoccmont
Note: Occurrence of children with cavitated caries or fillings (d3mfs>0) at 2 years of age was 3%. At age 5 years, 23% .	NS Multivariate # sextants with visible plaque (012 versus 34+): 0.23 (SN), 0.95 (SP), 0.58 (AUC)	(n=226) [Saarijarvi, Finland]	Invariant and influctionate (Using Visita) seepsition (Using Visita) and (Using Visita) association with outcome: 3-year increment of cavitated carious lesions and/or fillings - measured as the increase of d3mfs from age of 2 years (degree 1 - opaque/discolored; degree 2 - early dentinal lesions no clinical cavity; degree 3 - defect found on surface and restorative treatment necessary)	reimakkinen, jokei a krainen, zosessinen of Caries Riski in Preschool Children. Caries Res 2004;38:156-162.
Plaque index (average Plaque Index, continuous) Note: At baseline, 40.3% of children were affected by caries (mean dmft was 1.57). In 1 year, 43.7% of children had dmft increment. Mean increase of dmft in 1 year was 0.93.	5.05 (OR, p<0.05)	Children aged 3-6 years with one-year follow-up (n=1,576). [Singapore]	Multiple stepwise logistic regression for association with outcome: one-year caries increment measured as change in dmft. Data from 50% children used for model construction; remainder for model validation. Prediction (all potential factors) and risk models (subset of modifiable factors) with and without biological tests examined. Also, community screening model for identify "high risk" using a questionnaire high risk = 25% of children with high caries burden (baseline dmft>2 for population studied). At baseline, 40.3% of children were affected by caries (mean dmft was 1.57). In 1 year, 43.7% of children had dmft increment. Mean increase of dmft in 1 year was 0.93.	Gao XL, Hsu CY, Xu Y, Hwarng HB, Loh T, Koh D. Building caries risk assessment models for children. J Dent Res 2010;89:637–43.

Data Element	Results (OR, RD, RR, Sn, Sp)	Population	Relationship Examined	Study
		Note: n represents sample size at		
		final follow-up		
Visible plaque at 3 years of age	NS Association with caries experience at age 6.	Children 3 years at baseline with follow	Bivariate association between factors (sweet intake and	Karjalainen S, Söderling E, Sewon L,
"No visible plaque" = no or minor amount of loose plaque		up at 6 years of age (n=135) [Turku, Finland]	visible plaque) and outcome: caries experience by age 6. Caries experience is total experience and not increment.	Lapinleimu H, Simell O. A prospective study on sucrose consumption, visible plaque and
"Visible plaque" = firmly attached plaque found on some or all			Laries experience includes enamel lesions as well as dentin lesions/fillings.	Community Dent Oral Epidemiol
teeth				01;29:136–42.
Note: At 3 years of age (baseline): 16% (n=21) had caries experience including enamel lesions. At 6 years of age, this increased to 40% (n=54).				
Level 4 - Visible plaque proportion >=20% (vs. 0)	1.67 (IDR, p=0.007 Within level multivariable analysis	Children 8 months of age with six month	Generalized estimating equations used to assess relationship	Zhou Y, Yang JY, Lo EC, Lin HC. The
	Not included Final model with all five levels, using sequential stepwise GEE	follow-ups through 32 months of age (2- year follow up) (n=255 at recruitment; 155 at last follow-up) [Guangzhou, China]	with outcome: incidence density of a tooth surface developing caries, which is the number of new caries-affected surfaces per surface time at risk.	g contribution of life course determinants to early childhood caries: a 2-year cohort study. Caries Res 2012;46:87-94.
Level 4 - Visible plaque proportion <20% (vs. 0)	9.11 (IDR, p=0.10) Within level multivariable analysis			
	NS Final model with all five levels, using sequential stepwise GEE		exposed and not exposed to independent variable.	
Used visible plaque index.				
Note: ECC prevalence at baseline (8 months) = 0: 14 months =			Sequential stepwise GEE using 5-level model (1=socioeconomic/demographic vars: 2=developmental	
0; 20 months =1.6%; 26 months = 11.1%; 32 months =28.4%.			characteristics; 3=nutritional upbringing including	
Note: Dependent variable is *no* carious lesions at 3 yrs	Stepwise Multivariate Logistic Regression Results	1 year at baseline, followed for 2 years (n=289) [Jonkoping, Sweden]	Bivariate and multivariate (stepwise logistic regression) association with outcome: absence of carious lesions	Wendt LK, Hallonsten AL, Koch G, Birkhed D. Analysis of caries-related factors in infants
No visible plaque at baseline	4.50 (OR, p=0.005		(manifest or initial) at 3 years of age.	and toddlers living in Sweden. Acta Odontol
No visible plaque at 2 yrs of age *Plaque noted when visible on buccal surfaces of maxillary incisors	3.55 (UK, p=0.005)			Scand 1996;54:131-7.
Baseline visible plaque on labial surfaces of upper incisors	NS, Bivariate, Caries incidence mean at follow up	12-30 months at baseline with one-year	Bivariate associations with outcomes: (1) caries incidence at	R.O. Mattos-Graner, D.J. Smith, W.F. King,
	SN (0.78), SP (0.58), % correctly classified: 59%	rollow up (n=101) [Piracicaba, SP, Brazil]	ronow up and (2) high carles incidence at follow up.	synthesis by mutans streptococcal strains
Note: Baseline caries prevalence: 32.7%			Caries definitions	correlates with caries incidence in 12- to 30-
Caries prevalence at 1-year follow-up: 56.4%			 Initial caries lesion: demineralized surface having only loss of translucency 	month-old children, J. Dent. Res. 79 (2000)
			Manifest lesion: lesion with definite cavitation	15/1-15/7.
			•Caries incidence: sum of new initial and manifest caries plus	
			initial caries detected at baseline that progress to manifest	
			High caries incidence: development of 3 or more new	
			manifest lesions during one-year follow-up	
Difficulty with home care due to physical or beh	avioral reasons			
- growing that nome cure due to physical of ben				

Data Element	Results (OR, RD, RR, Sn, Sp)	Population	Relationship Examined	Study
		Note: n represents sample size at final follow-up		
Frequent sugar consumption (e.g. sugary drinks,	snacks rich in fermentable carbohydrates)	1	1	
Snacking between meals (sugar/chips/cereal versus all other) Note: Baseline caries experience: Mean dmfs, Grade 1, Aiken: 9.3, Portland: 2.9 Mean dmfs Grade 5, Aiken: 4.4, Portland: 2.4 Mean DMFS Grade 1, Aiken: 0.3, Portland: 0.2 Mean DMFS Grade 5, Aiken: 3.0, Portland: 1.7	NS Note: Comparison to "any risk" in Beck et al. 1992 where "any risk" is a DMFS increment of 1 or more (Beck et al results below): NS	Two cohorts (Grade 1 and Grade 5) at two sites (Aiken, SC and Portland, ME) with 3-year follow-up (n=4158)	Backward stepwise logistic regression for outcome: high risk based on 3-year DMFS increment (final DMFS-baseline DMFS) where high risk definition varied by cohort	Disney JA, Graves RC, Stamm JW, Bohannan HM, Abernathy JR, Zack DD. The University of North Carolina Caries Risk Assessment study: further developments in caries risk prediction. Community Dent Oral Epidemiol 1992;20: 64–75.
Note: Dependent variable is *no* carious lesions at 3 yrs No intake sugar-containing liquid in bottle at baseline No intake sugar-containing liquid in bottle at 2 yrs old No intake sugar-containing liquid when thirsty at baseline No intake sugar-containing liquid when thirsty at 2 yrs old No intake sugar-containing liquid during the night at baseline No intake sugar-containing liquid during the night at 2 yrs old Softdrinks at baseline Soft drinks less than 2/week at 2 yrs old Ice cream at baseline Ice cream at 2 yrs old Sweets at baseline Sweets at 2 years old	Stepwise Multivariate Logistic Regression Results NS NS 2.26 (OR, p=0.002) NS 23.66 (OR, p=0.010) NS 2.42 (OR, p=0.021) NS NS NS NS NS	1 year at baseline, followed for 2 years (n=289) [Jonkoping, Sweden]	Bivariate and multivariate (stepwise logistic regression) association with outcome: absence of carious lesions (manifest or initial) at 3 years of age.	Wendt LK, Hallonsten AL, Koch G, Birkhed D. Analysis of caries-related factors in infants and toddlers living in Sweden. Acta Odontol Scand 1996;54:131–7.
Level 4 - Frequency of eating sweets >=1 time per day (vs. less) Note: ECC prevalence at baseline (8 months) = 0; 14 months = 0; 20 months =1.6%; 26 months = 11.1%; 32 months=28.4%.	 1.35 (IDR, p=0.098) Within level multivariable analysis *Although p<0.05, retained all variables p<0.25 in stepwise regression 2.25 (IDR,p=0.13) Final model with all five levels, using sequential stepwise GEE 	Children 8 months of age with six month follow-ups through 32 months of age (2- year follow up) (n=255 at tercultment; 155 at last follow-up) [Guangzhou, China]	Generalized estimating equations used to assess relationship with outcome: incidence density of a tooth surface developing caries, which is the number of new caries-affected surfaces per surface time at risk. Incidence density ratio = incidence density among those exposed and not exposed to independent variable. Sequential stepwise GEE using 5-level model (1=socioeconomic/demographic vars; 2=developmental characteristics; 3=nutritional upbringing including feeding/nutrition; 4=oral health behaviors; 5= S. mutans)	Zhou Y, Yang JY, Lo EC, Lin HC. The contribution of life course determinants to early childhood caries: a 2-year cohort study. Caries Res 2012;46:87–94.
Frequent sugar = high sugar related intake (eating/drinking) every day Note: Baseline caries prevalence among 3 year olds was 20.1% d1-5 mfs and 6.6% d3-5 mfs. Caries prevalence at 5 years was 48.0% d15mfs and 19.1% d3- 5mfs.	2.5 (OR, p<0.05) Bivariate NS Multivariate	Children 3 years of age followed up at age 5 years (n=304) [Oslo, Norway]	Bivariate and multiple logistic regression of factors associated with outcome: positive severe caries increment (change in d3-5mfs). 5 grade caries diagnostic system: grades 1-2=enamel lesions; 3-5 dentine lesions. Caries increment=change d1-5mfs Severe caries increment=change d3-5mfs Molar-approximal caries excluded from caries increment calculations.	Skeie MS, Espelid I, Riordan PJ, Klock KS. Caries increment in children aged 3-5 years in relation to parents' dental attitudes: Oslo, Norway 2002 to 2004. Community Dent Oral Epidemiol 2008;36:441–50.

	1			1
Sweet consumption at 6 yrs (<1/day vs. >=1/day)	NS in initial bivariate tests.	Study nested within a population based	Bivariate and multivariable associations with outcome: DMFT	Peres MA, Barros AJ, Peres KG, Araujo CL,
		cohort with dental exams and interviews	at 12 years old. Multivariate analyses were conducted using	Menezes AM. Life course dental caries
Note:		performed at 6 and 12 years of age	Poisson regression to generate relative risk ratio and logistic	determinants and predictors in children aged
Baseline primary dental caries at 6 yrs (DMFT>0): 63%		(n=339) [Pelotas, Brazil]	regression (backward stepwise) to predict dental caries at age	12 years: a population-based birth cohort.
			12 years.	Community Dent Oral Epidemiol
				2009-37-123-33
			Variables grouped into biorarchical model with 6 lovels: (1)	2005,57.125 55.
			variables grouped into inerarchical model with o levels. (1)	
			socioeconomic/demographic, (2) nutritional/development	
			characteristics, (3) OH behaviors and dental service use at	
			age 6, (4) primary dental caries at 6 yrs, (5) family economic	
			level at 12 yrs, (6) OH related behaviors and dental service	
			use at 12 yrs.	
			At each level, variables excluded if p>0.25. Final model	
			variables retained if p<=0.05.	
			· · · · · · · · · · · · ·	
Candies daily (vs. several times a week/once a week or less)	6.22 (OR. p<0.001) Univariate	2 years at baseline: followed for 3 years	Bivariate and multivariate (using forward stepwise logistic	Pienihakkinen, Jokela & Alanen, Assessment
		(n=226) [Saarijan/i Finland]	regression) association with outcome: 3-year increment of	of Caries Risk in Preschool Children, Caries
Note: Occurrence of children with cavitated carios or fillings	2.64 (OR n=0.004) Multivariate	(n=220) [Saanjarvi, milanaj	cavitated carious losions and/or fillings measured as the	Poc 2004-29-156 162
(d2mfs)() at 2 years of are use 2%. At are 5 years 23%	3.04 (OK, p=0.004) Multivariate		increase of damfs from age of a years	Nes 2004,38.130-102.
(USITIS>O) at 2 years of age was 5%. At age 5 years, 25%.			increase of usinis from age of 2 years	
	0.84 (SN), 0.55 (SP) - Comparison is 1/week of less versus several times/wk of daily			
	0.70 (AUC)			
Candy >=1/y	2.7 (OR pc0.001) Univariate Group B v Group A	Children 2.5 years at baseline with 1-	Univariate analysis of each variable comparing children (A)	Grindefiord M. Dahllöf G. Modéer T. Caries
candy >=1/V	2.7 (or, protoc) of variate cloup by cloup A	voar follow up (n=602) [Stockholm	carios fron at has alino and follow up. (P) carios fron at	development in children from 2 E to 2 E voar
Comparing three groups of shildrens (A) spring free at baseling	NG Crown C y Crown B	Sundani	baseline with spring at follow up, (C) spring at baseline and	of ages a longitudinal study. Carios Bas
Comparing three groups of children. (A) caries free at baseline	NS Group C V. Group B	Swedenj	baseline with carles at follow-up, (c) carles at baseline and	of age, a folgitudinal study. Carles Res
and follow-up, (B) caries free at baseline with caries at follow-			follow-up - (A) and (B) compared; (B) and (C) compared.	1995;29:449-54.
up, (C) caries at baseline and follow-up. Two comparisons				
among the three groups: (A) and (B) compared; (B) and (C)				
compared.				
Note: Clinical examinations conducted				
at 2.5 and 3.5 years of age.				
At 2.5 years (baseline for this study): 11% had initial or manifest				
caries.				
At 3.5 years: 37% initial/manifest.				
, .				
Candy >=1/week	2.9 (OR, p<0.001) Univariate (manifest caries at 3.5 years)	Children 1 year at baseline with follow	Univariate and logistic multivariate regression for association	Grindetjord M, Dahllöt G, Nilsson B, Modéer
		up at 2.5 and 3.5 years of age (n=692)	with outcomes: initial/manifest caries at 2.5 years of age and	T. Stepwise prediction of dental caries in
Note: Clinical examinations conducted at 2.5 and 3.5 years of	2.28 (OR, p=0.005) Multivariate (initial/manifest at 2.5 y)	[Stockholm, Sweden]	manifest caries at 3.5 years of age (versus not).	children up to 3.5 years of age. Caries Res
age.	[standardized beta coefficient: 0.823]			1996;30:256-66.
At 2.5 years: 11% had initial or manifest caries; 7% had one or			Initial caries - loss of translucency and slight roughness on	
more manifest lesions.	1.63 (OR, p=0.032) Multivariate (manifest at 3.5 y)		probing (chalky appearance); Manifest - minimal level verified	
At 3.5 years: 37% initial/manifest; 29% manifest.	[standardized beta coefficient: 0.489]		as a cavity detectable by probing; and catch of probe under	
			slight pressure for fissures.	
	Note: Logistic regression ORs are standardized for each factor.			
	I. Construction of the second s	1	1	1

Data Element	Results (OR, RD, RR, Sn, Sp)		Population	Relationship Examined	Study
			Note: n represents sample size at		
			final follow-up		
Snacking on treats >=1/day (Treats included items containing fermentable carbs; does not include snacks consumed as planned meals) Note: Baseline mean DMFS experimental group: 2.1 control group: 2.3 Mean DMFS after 4 years: experimental: 4.7 control: 6.9	change DMFS>=1: NS change DMFS>=3: NS change DMFS>=5: NS	Bivariate Bivariate Bivariate	11-12 year olds with 4-year follow-up (n=497) [Pori, Finland]	Randomized clinical trial. Intervention/experimental group: received individually, designed patient-centered regimen for caries control. Control: standard dental care Outcome: DMFS increment defined as difference in scores between baseline and 4-year followup. Three definitions of failure considered: (1) increment>=1; (2) increment >=3; (3) increment >=5. Compared outcome between experimental and control group. Bivariate association between oral health behaviors at baseline and outcome using logistic regression for experimental group. Caries status used criteria in Nyvad et al. DMFS score included surfaces with active or inactive caries lesions with cavitation (scores 5 and 6), those with a filling, those extracted due to caries, and those with arise extending to inner or middle third of dentin or the pulp in radiographs.	Hietasalo P, Tolvanen M, Seppa L, Lahti S, Poutanen R, Niinimaa A, et al. Oral health- related behaviors predictive of failures in caries control among 11-12-yr-old Finnish schoolchildren. Eur J Oral Sci 2008;116:267–71.
Eating candy >=1/day Note: Baseline mean DMFS experimental group: 2.1 control group: 2.3 Mean DMFS after 4 years: experimental: 4.7 control: 6.9	change DMFS>=1: NS change DMFS>=3: 2.31 (OR, p=0.008) change DMFS>=5: 2.72 (OR, p=0.008)	Bivariate Bivariate Bivariate	11-12 year olds with 4-year follow-up (n=497) [Pori, Finland]	Randomized clinical trial. Intervention/experimental group: received individually, designed patient-centered regimen for caries control. Control: standard dental care Outcome: DMFS increment defined as difference in scores between baseline and 4-year followup. Three definitions of failure considered: (1) increment>=1; (2) increment>=3; (3) increment>=5. Compared outcome between experimental and control group. Bivariate association between oral health behaviors at baseline and outcome using logistic regression for experimental group. Carles status used criteria in Nyvad et al. DMFS score included surfaces with active or inactive carles lesions with cavitation (scores 5 and 6), those with a filling, those extracted due to caries, and those with caries extending to inner or middle third of dentin or the pulp in radiographs.	Hietasalo P, Tolvanen M, Seppa L, Lahti S, Poutanen R, Niinimaa A, et al. Oral health- related behaviors predictive of failures in caries control among 11-12-yr-old Finnish schoolchildren. Eur J Oral Sci 2008;116:267–71.

Data Element	Results (OR. RD. RR. Sn. Sp)	Population	Relationship Examined	Study
		Note: n represents sample size at		
		final follow-up		
Candy (self-reported frequency)		12 years old at baseline followed for 4	Bivariate and multivariable associations with two outcomes:	Källestal C. Eielddabl A. A four-vear cobort
candy (sen-reported frequency)		vears (n=3 373) [Sweden]	(1) DMFS increment and (2) DeMFS increment -enamel caries	study of caries and its risk factors in
daily or more frequent reported at 1 of 3 exams where	NS Univariate. increment DMFS, total study group	,, (,	on proximal surfaces included in index. Poisson regression	adolescents with high and low risk at
questionnaire administered (vs. less frequent)	NS Multivariable, increment DMFS, total study group		with over-dispersion used to analyze incidence rate.	baseline. Swed Dent J 2007;31:11–25.
			, , , , , , , , , , , , , , , , , , , ,	
	NS Univariate, increment DeMFS, total study group		Evaluated for total population and "high risk."	
	NS Multivariable, increment DeMFS, total study group			
			High risk identified as	
	NS Univariate, increment DMFS, high risk group		-having >1 decayed proximal surface, enamel or dentine	
	NS Multivariable, increment DMFS, high risk group		caries, filled proximal surface or missing tooth because of	
			caries, or	
	NS Univariate, increment DeMFS, high risk group		-dentist found patient had high risk due to mental/physical	
	NS Multivariable, increment DeMFS, high risk group		disability or chronic disease, or	
			-CFU>10(5) - lactobacillus test	
daily or more frequent reported at 2-3 of 3 exams (vs. less				
frequent)	1.04 (RR, p<0.05) Univariate, increment DMFS, total study group		Children randomly assigned to one of our preventive	
	NS Multivariable, increment Divies, total study group		programs: (1) tooth-prushing, (2) fluoride lozenges	
Questionnaires administered at events at 12 urs 14 urs and 16	1.0E (DD, pr0.0E) Universite increment DeMES total study group		prescription, (3) fluoride varnish, (4) Individual program -	
Questionnaires auministereu at exams at 12 yrs, 14 yrs, and 16	1.00 (RR, p<0.05) Onivariate, Increment DeMFS, total study group		and EV	
ý15	1.05 (nn, p<0.05) Multivariable, inclement Delvirs, total study group			
Note:	NS Univariate, increment DMFS, high risk group			
Baseline total population % with DMFS=0: 47%	NS Multivariable, increment DMFS, high risk group			
Baseline high risk % with DMFS=0: 28%				
Ť	1.08 (RR, p<0.05) Univariate, increment DeMFS, high risk group			
Baseline DMFS, total population, 12 yrs old (mean)=1.67	1.09 (RR, p<0.05) Multivariable, increment DeMFS, high risk group			
Sweet intake at 3 years of age (>1/week)	NS Association with caries experience at age 6.	Children 3 years at baseline with follow	Bivariate association between factors (sweet intake and	Karjalainen S, Söderling E, Sewon L,
		up at 6 years of age (n=135) [Turku, Finland]	visible plaque) and outcome: caries experience by age 6.	Lapinleimu H, Simell O. A prospective study
	0.61 (SN), 0.54 (SP)		Caries experience is total experience and not increment.	on sucrose consumption, visible plaque and
			Caries experience includes enamel lesions as well as dentin	caries in children from 3 to 6 years of age.
Note: At 3 years of age (baseline): 16% (n=21) had caries			lesions/fillings.	Community Dent Oral Epidemiol
experience including enamel lesions. At 6 years of age, this	Note: Authors did find a statistically significant greater consumption of sucrose among children			01;29:136–42.
increased to 40% (n=54).	with caries experience compared with children without caries experience at both 3 and 6 years			
	or age. But consumption at age 3 was not significantly associated with carles experience at			
Frequency of between meal sweets per day	dge o. 1.27 (OR not 0.5) Prediction model w/o biological factors	Children agod 2 6 years with one year	Multiple stopwise logistic regression for association with	Goo XI, Hou CV, Xu X, Hworpg HR, Joh T, Koh
requercy of between-mean sweets per day	(change dmfts0)	follow-up (n=1 576) [Singapore]	outcome: one-year caries increment measured as change in	D Building caries risk assessment models for
(Categories: none_once_2-3 times_4-5 times_>5 times)	(change annes)	tonow up (n=1,570). [Singapore]	dmft Data from 50% children used for model construction:	children Dent Res 2010;89:637-43
(categories none, once, 2 5 times, 4 5 times, 5 times,	NS Prediction model w/ biological factors		remainder for model validation. Prediction (all potential	
Note: At baseline, 40.3% of children were affected by caries	(change dmft>0)		factors) and risk models (subset of modifiable factors) with	
(mean dmft was 1.57). In 1 year, 43.7% of children had dmft			and without biological tests examined. Also, community	
increment. Mean increase of dmft in 1 year was 0.93.	1.34 (OR, p<0.05) Risk model w/o biological factors		screening model for identify "high risk" using a questionnaire	
	(change dmft>0)		high risk = 25% of children with high caries burden (baseline	
			dmft>2 for population studied). At baseline, 40.3% of children	
	NS Risk model w/biological factors		were affected by caries (mean dmft was 1.57). In 1 year,	
	(change dmft>0)		43.7% of children had dmft increment. Mean increase of dmft	
1			in 1 year was 0.93.	
1	NS Community high risk model; questionnaire			
1	(baseline dmft>0)			

Data Element	Results (OR, RD, RR, Sn, Sp)	Population	Relationship Examined	Study
		Note: n represents sample size at		
		final follow-up		
Relative risk of caries increment by highest quartile of total daily	(1.22 (RB, pc0.05) any DMES increment	10-15 year olds with 3-year follow-up	Calculated relative risk of caries increment among	Burt BA Szoupar SM The Michigan study: the
sugar consumption (daily mean=175 g) compared with lowest	1.80 (RB p<0.05) any proximal increment	(n=499) [Coldwater_Ouincy & Union City	narticinants by highest quartile of sugar consumption	relationship between sugars intake and
quartile (daily mean=109 g)	NS any pit and fissure increment	Michigan]	compared to lowest quartile	dental caries over three years. Int Dent I
daartine (daarij mean 105 g)		incingun]		1994:44:230-40.
Relative risk of caries increment by highest quartile of between-			Outcomes: Any DMFS increment; any proximal increment; any	
meal sugar consumption (daily mean=175 g) compared with			pit and fissure increment.	
lowest quartile (daily mean=109 g)	NS any DMFS increment			
	1.65 (RR, borderline) any proximal increment			
Note: Baseline mean DMFS	NS any pit and fissure increment			
boys: 4.1				
girls: 4.5	Note: Reported using multiple linear regression to examine sugar consumption and fluoride use			
	on caries incidence controlling for gender and age. Found "in a few models consumption of			
Mean DMFS after 3 years:	sugars was weakly associated with caries incidence, but when baseline caries was added to the			
boys: 6.8	model these associations became small and non-significant. Baseline caries prevalence was			
girls: 7.7	the strongest predictor of caries incidence in most of the equations." Authors concluded that			
	the study "results make it hard to argue that intake of sugars is directly relate to caries			
	incidence in this population "[No model results presented in paper.]			
Sweet snacks (1/day, 2/day, 3/day, 4+day in questionnaire;	Logistic Regression	5-6 years at baseline, followed for 3	Outcome: new incident dental caries of the permanent teeth;	Tamaki Y, Nomura Y, Katsumura S, Okada A,
unclear how defined in model)	NS, Multivariate, all factors	years (n=500) [Gifu Prefecture, Japan]	3 approaches: (1) conventional modeling, (2) neural network,	Yamada H, Tsuge S, et al. Construction of a
	Not included, Multivariate, stepwise		C5.0 - tool for discovering patterns in databases and used to	dental caries prediction model by data
	Not included, Multivariate, most robust based on balancing technique		make predictions.	mining. J Oral Sci 2009;51:61-8.
Note:				
Baseline: DF=0.054			Logistic regression analyses were conducted for a full model	
	Note: Overall study finding: decision analysis produced better prediction models than logistic		with all variables as well as using stepwise selection. Neural	
	regression or neural network approaches. Significant predictors in this approach were MS		network model had 12 input layers, 3 hidden layers, and 1	
	levels, LB, salivary pH, gender, and sweet beverages.		output layer. CS.0 models work by sequenced sample	
			spinuing based on neids providing the maximum mormation	
			sample sets applied to the models. Model selection based on	
			highest mean of sum of SN and SP	
			ingliest mean of sum of sit and sit.	
Child chews sugar-containing gum (yes no)	Bivariate association with Caries Progression (significant or NS using logistic regression -	5-13 years of age with 2-year follow-up	Logistic regression for progression outcomes (see below) at	Fontana M, Santiago E, Eckert GJ, Ferreira-
	specific values not reported)	(n=395) [Aguas Buenas, Puerto Rico]	12/24 months; for each predictor individually; multiple	Zandona AG. Risk factors of caries
Note: Baseline mean age was 9.7 years	New ICDAS>=1 at 24 months: NS		regression developed using backward elimination retaining	progression in a Hispanic school-aged
Baseline mean ICDAS>=1: 15.7	New ICDAS>=3 at 24 months: NS		predictors p<0.05 with AUC/ROC calculated for final models	population. J Dent Res 2011;90:1189-96.
Baseline mean ICDAS>=3: 8.2			at model level; Poisson regression for number of lesions with	
	Multivariate Caries Risk Models		progression	
12-month mean ICDAS>=1: 17.9	NS - Not included in any final models.			
-89% of children			Two Outcomes:	
12-month mean ICDAS>=3: 8.4			 Any progression (ICDAS>=1): at least one new lesion 	
-61% of children			ICDAS>=1, one new filling, and/or progression of lesion from	
			scores of 1-2 to 3 to higher or from 3-4 to 5 to higher between	
24-month mean ICDAS>=1: 16.8			the two exams.	
-91% of children			 Progression toward cavitation (ICDAS>=3): at least one 	
242-month mean ICDAS>=3: 8.4			new lesion ICDAS>=3, one new filling, and/or progression of	
-68% of children			lesion from score of 1-2 to 3 or higher or from 3-4 to 5 or	
1			nigher between the two exams.	
			Models run for outcomes at 12 and 24 months:	
			Models run without any baseline ICDAS: models run adding	
			baseline ICDAS last: models run starting with baseline ICDAS	
			score	

Data Element	Results (OR, RD, RR, Sn, Sp)		Population	Relationship Examined	Study
			Note: n represents sample size at		
			final follow-up		
Bedtime sweets	NS	Prediction model w/o biological factors	Children aged 3-6 years with one-year	Multiple stepwise logistic regression for association with	Gao XL, Hsu CY, Xu Y, Hwarng HB, Loh T, Koh
		(change dmft>0)	follow-up (n=1,576). [Singapore]	outcome: one-year caries increment measured as change in	D. Building caries risk assessment models for
(Categories: never, occasionally, frequently, almost every night)				dmft. Data from 50% children used for model construction;	children. J Dent Res 2010;89:637-43.
	NS	Prediction model w/ biological factors		remainder for model validation. Prediction (all potential	
Note: At baseline, 40.3% of children were affected by caries		(change dmft>0)		factors) and risk models (subset of modifiable factors) with	
increment Mean increase of dmft in 1 year was 0.93	1 33 (OR n<0.05)	Risk model w/o biological factors		screening model for identify "high risk" using a questionnaire	
nerenena maarmaraise or annen 1 year was olss.	1.55 (010) p 10.05)	(change dmft>0)		high risk = 25% of children with high caries burden (baseline	
				dmft>2 for population studied). At baseline, 40.3% of children	
	NS	Risk model w/biological factors		were affected by caries (mean dmft was 1.57). In 1 year,	
		(change dmft>0)		43.7% of children had dmft increment. Mean increase of dmft	
				in 1 year was 0.93.	
	NS	Community high risk model; questionnaire			
Bedtime feeding at 1 year old (breast milk/formula/iuice/sweets	NS	Prediction model w/o biological factors	Children aged 3-6 years with one-year	Multiple stepwise logistic regression for association with	Gao XL, Hsu CY, Xu Y, Hwarng HB, Loh T, Koh
versus nothing/water/pacifier)		(change dmft>0)	follow-up (n=1,576). [Singapore]	outcome: one-year caries increment measured as change in	D. Building caries risk assessment models for
				dmft. Data from 50% children used for model construction;	children. J Dent Res 2010;89:637-43.
Note: At baseline, 40.3% of children were affected by caries	NS	Prediction model w/ biological factors		remainder for model validation. Prediction (all potential	
(mean dmft was 1.57). In 1 year, 43.7% of children had dmft		(change dmft>0)		factors) and risk models (subset of modifiable factors) with	
increment. Mean increase of dmft in 1 year was 0.93.	1 48 (OP p<0.05)	Rick model w/e biological factors		and without biological tests examined. Also, community	
	1.48 (OK, p<0.03)	(change dmft>0)		high risk = 25% of children with high caries burden (baseline]
		(8		dmft>2 for population studied). At baseline, 40.3% of children	
	NS	Risk model w/biological factors		were affected by caries (mean dmft was 1.57). In 1 year,	
		(change dmft>0)		43.7% of children had dmft increment. Mean increase of dmft	
	NG	Community black side and all acception and		in 1 year was 0.93.	
	NS	(baseline dmft>0)			
Consumption sugar-containing beverages at night	1.2 (OR. p<0.001) U	Jnivariate Group B v. Group A	Children 2.5 years at baseline with 1-	Univariate analysis of each variable comparing children (A)	Grindefiord M. Dahllöf G. Modéer T. Caries
	(*), * * * , *	· · · · · · · · · · · · · · · · · · ·	year follow-up (n=692) [Stockholm,	caries free at baseline and follow-up, (B) caries free at	development in children from 2.5 to 3.5 years
Comparing three groups of children: (A) caries free at baseline	NS	Group C v. Group B	Sweden]	baseline with caries at follow-up, (C) caries at baseline and	of age: a longitudinal study. Caries Res
and follow-up, (B) caries free at baseline with caries at follow-				follow-up - (A) and (B) compared; (B) and (C) compared.	1995;29:449–54.
up, (C) caries at baseline and follow-up. Two comparisons					
compared					
compared.					
Note: Clinical examinations conducted					
at 2.5 and 3.5 years of age.					
At 2.5 years (baseline for this study): 11% had initial or manifest					
caries.					
At 3.5 years: 37% initial/manifest.					
	2.2 (2.2				
Consumption sugar-containing beverages at night	2.2 (OR, p<0.001)	Univariate (manifest caries at 3.5 years)	Children 1 year at baseline with follow	Univariate and logistic multivariate regression for association	Grindetjord M, Dahllot G, Nilsson B, Modeer
Note: Clinical examinations conducted at 2.5 and 3.5 years of	NS	Multivariate (initial/manifest at 2.5 v)	[Stockholm Sweden]	manifest caries at 3.5 years of age (versus not)	children up to 3.5 years of age. Caries Res
age.			[stockholm, sweden]		1996;30:256–66.
At 2.5 years: 11% had initial or manifest caries; 7% had one or	NS	Multivariate (manifest at 3.5 y)		Initial caries - loss of translucency and slight roughness on	
more manifest lesions.				probing (chalky appearance); Manifest - minimal level verified	
At 3.5 years: 37% initial/manifest; 29% manifest.				as a cavity detectable by probing; and catch of probe under	
				slight pressure for fissures.	

Data Element	Results (OR, RD, RR, Sn, Sp)	Population	Relationship Examined	Study
		Note: <i>n</i> represents sample size at final follow-up		
Sugary drink at bedtime at 3 years of age (yes vs no) Note: Baseline caries prevalence among 3 year olds was 20.1% d1-5 mfs and 6.6% d3-5 mfs. Caries prevalence at 5 years was 48.0% d15mfs and 19.1% d3- 5mfs.	3.9 (OR, p<0.05) Bivariate NS Multivariate	Children 3 years of age followed up at age 5 years (n=304) [Oslo, Norway]	Bivariate and multiple logistic regression of factors associated with outcome: positive severe caries increment (change in d3-5mfs). 5 grade caries diagnostic system: grades 1-2=enamel lesions; 3-5 dentine lesions. Caries increment=change d1-5mfs Severe caries increment=change d3-5mfs Molar-approximal caries excluded from caries increment calculations.	Skeie MS, Espelid I, Riordan PJ, Klock KS. Caries increment in children aged 3-5 years in relation to parents' dental attitudes: Oslo, Norway 2002 to 2004. Community Dent Oral Epidemiol 2008;36:441–50.
Daily use of sugar containing drinks between meals (yes versus no)	1.37 (OR, p<0.001) Baseline 1.25 (OR, p=0.049) Follow-Up	7 years old at baseline (n=3,303) with at least one follow-up by age 10 years (n=3,002) [Flanders, Belgium]	 Cross-sectional multiple logistic regression with outcome: dmfs (caries v. no caries) in permanent first molars (baseline) Stepwise multiple logistic regression with outcome: net caries increment on permanent first molars (0/1 additional surface affected v. 2 or more additional surfaces affected) calculated by subtracting baseline DMFS6 score from last available DMFS6 score [follow-up] 	Vanobbergen J, Martens L, Lesaffre E, Bogaerts K, Declerck D. The value of a baseline caries risk assessment model in the primary dentition for the prediction of caries incidence in the permanent dentition. Caries Res 2001;35:442–50.
Consumption sugar-containing beverages >=2 per day Comparing three groups of children: (A) caries free at baseline and follow-up, (B) caries free at baseline with caries at follow- up, (C) caries at baseline and follow-up. Two comparisons among the three groups: (A) and (B) compared; (B) and (C) compared. Note: Clinical examinations conducted at 2.5 and 3.5 years (baseline for this study): 11% had initial or manifest caries. At 3.5 years: 37% initial/manifest.	2.1 (OR, p<0.01) Univariate Group B v. Group A NS Group C v. Group B	Children 2.5 years at baseline with 1- year follow-up (n=692)	Univariate analysis of each variable comparing children (A) caries free at baseline and follow-up, (B) caries free at baseline with caries at follow-up, (C) caries at baseline and follow-up - (A) and (B) compared; (B) and (C) compared.	Grindefjord M, Dahllöf G, Modéer T. Caries development in children from 2.5 to 3.5 years of age: a longitudinal study. Caries Res 1995;29:449–54.
Consumption sugar-containing beverages >2 per day Note: Clinical examinations conducted at 2.5 and 3.5 years of age. At 2.5 years: 11% had initial or manifest caries; 7% had one or more manifest lesions. At 3.5 years: 37% initial/manifest; 29% manifest.	2.6 (OR, p<0.001) Univariate (manifest caries at 3.5 years) NS Multivariate (initial/manifest at 2.5 y) 0.58 (OR, p=0.045) Multivariate (manifest at 3.5 y) [standardized beta coefficient: 0.580] Note: Logistic regression ORs are standardized for each factor.	Children 1 year at baseline with follow up at 2.5 and 3.5 years of age (n=692) [Stockholm, Sweden]	Univariate and logistic multivariate regression for association with outcomes: initial/manifest caries at 2.5 years of age and manifest caries at 3.5 years of age (versus not). Initial caries - loss of translucency and slight roughness on probing (chalky appearance); Manifest - minimal level verified as a cavity detectable by probing; and catch of probe under slight pressure for fissures.	Grindefjord M, Dahilöf G, Nilsson B, Modéer T. Stepwise prediction of dental caries in children up to 3.5 years of age. Caries Res 1996;30:256–66.

Data Element	Results (OR, RD, RR, Sn, Sp)	Population	Relationship Examined	Study
		Note: n represents sample size at		
		final follow-up		
Child drinks soda between meals yes no	Bivariate association with Caries Progression (significant or NS using logistic regression -	5-13 years of age with 2-year follow-up	Logistic regression for progression outcomes (see below) at	Fontana M, Santiago E, Eckert GJ, Ferreira-
	specific values not reported)	(n=395) [Aguas Buenas, Puerto Rico]	12/24 months; for each predictor individually; multiple	Zandona AG. Risk factors of caries
Note: Baseline mean age was 9.7 years	New ICDAS>=1 at 24 months: NS		regression developed using backward elimination retaining	progression in a Hispanic school-aged
Baseline mean ICDAS>=1: 15:7 Baseline mean ICDAS>=3: 8.2	New ICDAS>=3 at 24 months. NS		at model level: Poisson regression for number of lesions with	population: J Dent Res 2011,90.1189-96.
	Multivariate Caries Risk Models		progression	
12-month mean ICDAS>=1: 17.9	Note: Total of 12 Multivariate Caries Risk Models: 2 outcomes, 2 time periods, 3 ways of			
-89% of children	handling baseline dmfs/DMFS (not included, added last, added first)		Two Outcomes:	
12-month mean ICDAS>=3: 8.4	Complicant in 1 of 12 models (not included in the other 11 final models)		1. Any progression (ICDAS>=1): at least one new lesion	
-61% of children	-significant in 1 of 12 models (not included in the other 11 mar models)		scores of 1-2 to 3 to higher or from 3-4 to 5 to higher between	
24-month mean ICDAS>=1: 16.8	Reporting results for best model for "any progression" and "progression to cavitation"		the two exams.	
-91% of children	1. dmfs/DMFS excluded, 24-month follow-up, ICDAS>=1 (model SN=.82, SP=.59, AUC=0.75)		2. Progression toward cavitation (ICDAS>=3): at least one	
242-month mean ICDAS>=3: 8.4			new lesion ICDAS>=3, one new filling, and/or progression of	
-68% of children	NS-Not included		lesion from score of 1-2 to 3 or higher or from 3-4 to 5 or	
	2 dmfs/DMFS added last 12 month follow-up ICDASS=3 (model SN= 81 SP= 58 AUC=0.77)		nigher between the two exams.	
			Models run for outcomes at 12 and 24 months:	
	NS-Not included		Models run without any baseline ICDAS; models run adding	
			baseline ICDAS last; models run starting with baseline ICDAS	
	 dmfs/DMFS added first, 12 month follow-up, ICDAS>=3 (model SN=.81, SP=.57, AUC=0.79) 		score	
	1.75 (OP n=0.0406)			
Child drinks juices between meals (yes no)	Bivariate association with Caries Progression (significant or NS using logistic regression -	5-13 years of age with 2-year follow-up	Logistic regression for progression outcomes (see below) at	Fontana M, Santiago E, Eckert GJ, Ferreira-
Note: Decelling more and use 0.7 more	specific values not reported)	(n=395) [Aguas Buenas, Puerto Rico]	12/24 months; for each predictor individually; multiple	Zandona AG. Risk factors of caries
Note: Baseline mean age was 9.7 years Baseline mean ICDAS>=1: 15.7	New ICDAS>=1 at 24 months: NS		regression developed using backward elimination retaining	progression in a Hispanic school-aged
Baseline mean ICDAS>=3: 8.2			at model level; Poisson regression for number of lesions with	
	Multivariate Caries Risk Models		progression	
12-month mean ICDAS>=1: 17.9	NS - Not included in any final models			
-89% of children			Two Outcomes:	
-61% of children			I. Any progression (ICDAS>=1): at least one new lesion	
			scores of 1-2 to 3 to higher or from 3-4 to 5 to higher between	
24-month mean ICDAS>=1: 16.8			the two exams.	
-91% of children			Progression toward cavitation (ICDAS>=3): at least one	
242-month mean ICDAS>=3: 8.4			new lesion ICDAS>=3, one new filling, and/or progression of	
-68% of children			lesion from score of 1-2 to 3 or higher or from 3-4 to 5 or	
			Models run for outcomes at 12 and 24 months;	
			Models run without any baseline ICDAS; models run adding	
			baseline ICDAS last; models run starting with baseline ICDAS	
			score	
Child has sweet drinks between meals (never, 1x/day, 2x/day,	Bivariate association with Caries Progression (significant or NS using logistic regression -	5-13 years of age with 2-year follow-up	Logistic regression for progression outcomes (see below) at	Fontana M, Santiago E, Eckert GJ, Ferreira-
>2x /day)	specific values not reported)	(n=395) [Aguas Buenas, Puerto Rico]	12/24 months; for each predictor individually; multiple	Zandona AG. Risk factors of caries
	New ICDAS>=1 at 24 months: NS		predictors p<0.05 with AUC/ROC calculated for final models	population. I Dent Res 2011:90:1189–96.
			at model level; Poisson regression for number of lesions with	
	Multivariate Caries Risk Models		progression	
Note: Baseline mean age was 9.7 years	NS - Not included in any final models.			
Baseline mean ICDAS>=1: 15.7			Two Outcomes:	
Discinc mean ICDASZ-3. 0.2			ICDAS>=1, one new filling, and/or progression of lesion from	
12-month mean ICDAS>=1: 17.9			scores of 1-2 to 3 to higher or from 3-4 to 5 to higher between	
-89% of children			the two exams.	
12-month mean ICDAS>=3: 8.4			2. Progression toward cavitation (ICDAS>=3): at least one	
-61% of children			new resion ICDAS>=3, one new filling, and/or progression of	
24-month mean ICDAS>=1: 16.8			higher between the two exams.	
-91% of children				
242-month mean ICDAS>=3: 8.4			Models run for outcomes at 12 and 24 months;	
-68% of children			Models run without any baseline ICDAS; models run adding	
			baseline ICDAS last; models run starting with baseline ICDAS	
			store	

Data Element	Results (OR RD RR Sn Sn)	Population	Relationshin Examined	Study
		Neter a represente comple size et		Study
		final fallow we		
		final follow-up		
Soda consumption, 4 categories (none; 1 day/week; 2-6 days;	1.5 (IRR, p<0.001) 2-6 days new d16mfs	Children 0-5 years at baseline followed	Stepwise backward multiple regression, zero-inflated negative	Ismail AI, Sohn W, Lim S, Willem JM.
every day)	1.9 (IRR, p<0.001) 2-6 days new d36mfs	American children in Detroit, Michigan]	as (1) new d16mfs and (2) new d36mfs.	primary teeth. J Dent Res 2009;88:
	Note: 1 day and every day per week NS.			270-5.
Drinking soft drinks >=1/day	change DMFS>=1: NS Bivariate change DMFS>=3: NS Bivariate change DMFS>=5: NS Bivariate	11-12 year olds with 4-year follow-up (n=497) [Pori, Finland]	Randomized clinical trial. Intervention/experimental group: received individually, designed patient-centered regimen for caries control. Control: standard dental care	Hietasalo P, Tolvanen M, Seppa L, Lahti S, Poutanen R, Niinimaa A, et al. Oral health- related behaviors predictive of failures in caries control among 11-12-yr-old Finnish schoolchildren. Eur J Oral Sci
Note: Baseline mean DMFS experimental group: 2.1 control group: 2.3			Outcome: DMFS increment defined as difference in scores between baseline and 4-year followup. Three definitions of failure considered: (1) increment>=1; (2) increment>=3; (3) increment>=5.	2008;116:267-71.
Mean DMFS after 4 years: experimental: 4.7 sentrol: 6.0			Compared outcome between experimental and control group.	
contor. 0.9			Bivariate association between oral health behaviors at baseline and outcome using logistic regression for experimental group.	
			Caries status used criteria in Nyvad et al. DMFS score included surfaces with active or inactive caries lesions with cavitation (scores 5 and 6), those with a filling, those extracted due to caries, and those with caries extending to inner or middle third of dentin or the pulp in radiographs.	
100% juice exposure - high (versus low); other beverage exposure examined not significant Note: % with new non-cavitated caries at first exam, primary	0.50 (IRR, p=0.02) New non-cavitated caries 0.52 (IRR, p=0.03) New cavitated caries	Children tracked from birth through 13 years old (n=156) [lowa]	Multivariable model (GLMM based on negative binomial distribution) of association with: (1) new non-cavitated caries and (2) new cavitated caries (repeated measures analysis with measurements at 3-5 y, 6-8 y, and 11-13 y)	Chankanka et al. Longitudinal Associations between Children's Dental Caries and Risk Factors. J Public Health Dent 2011;71:289- 300.
dentition: 21.15%; % with new cavitated caries at first exam, primary dentition: 26.28%				
Soft drinks (self-reported frequency) more than once a week (vs less frequent)	NS in any of the models	12 years old at baseline followed for 4 years (n=3,373) [Sweden]	Bivariate and multivariable associations with two outcomes: (1) DMFS increment and (2) DeMFS increment -enamel caries on proximal surfaces included in index. Poisson regression with over-dispersion used to analyze incidence rate.	Källestal C, Fjelddahl A. A four-year cohort study of caries and its risk factors in adolescents with high and low risk at baseline. Swed Dent J 2007;31:11–25.
Questionnaires administered at exams at 12 yrs, 14 yrs, and 16 yrs			Evaluated for total population and "high risk."	
			High risk identified as	
Note:			-having >1 decayed proximal surface, enamel or dentine	
Baseline total population % with DMFS=0: 47% Baseline high risk % with DMFS=0: 28%			caries, filled proximal surface or missing tooth because of caries, or	
Baseline DMFS, total population, 12 yrs old (mean)=1.67 Baseline DMFS, high risk, 12 yrs old (mean)=2.87			-dentist found patient had high risk due to mental/physical disability or chronic disease, or -CFU>10(5) - lactobacillus test	
Baseline DeMFS, total population, 12 years old (mean)=2.40 Baseline DeMFS, high risk, 12 yrs old (mean)=4.67 DMFS. total population. 16 yrs old (mean)=3.69			Children randomly assigned to one of our preventive programs: (1) tooth-brushing, (2) fluoride lozenges prescription, (3) fluoride varnish, (4) individual program - counseling dental hygiene and nutrition; professional cleaning and FV.	
DMFS, high risk, 16 yrs old (mean)=5.95				

Data Element	Results (OR, RD, RR, Sn, Sp)	Population	Relationship Examined	Study
		Note: n represents sample size at		-
		final follow-up		
Sweet beverages (1/day, 2/day, 3/day, 4+day in questionnaire; unclear how defined in model)	Logistic Regression NS, Multivariate, all factors Not included, Multivariate, stepwise NS, Multivariate, most robust based on balancing technique	5-6 years at baseline, followed for 3 years (n=500) [Gifu Prefecture, Japan]	Outcome: new incident dental caries of the permanent teeth; 3 approaches: (1) conventional modeling, (2) neural network, C5.0 - tool for discovering patterns in databases and used to make predictions.	Tamaki Y, Nomura Y, Katsumura S, Okada A, Yamada H, Tsuge S, et al. Construction of a dental caries prediction model by data mining. J Oral Sci 2009;51:61–8.
Note: Baseline: DF=0.054	Note: Overall study finding: decision analysis produced better prediction models than logistic regression or neural network approaches. Significant predictors in this approach were MS levels, LB, salivary pH, gender, and sweet beverages.		Logistic regression analyses were conducted for a full model with all variables as well as using stepwise selection. Neural network model had 12 input layers, 3 hidden layers, and 1 output layer. C5.0 models work by sequenced sample splitting based on fields providing the maximum information gained. Balancing technique applied. Total of 10 balanced sample sets applied to the models. Model selection based on highest mean of sum of SN and SP.	
Level 3 - Bottle feeding (yes vs. no) Note: ECC prevalence at baseline (8 months) = 0; 14 months = 0; 20 months =1.6%; 26 months = 11.1%; 32 months=28.4%.	1.35 (IDR, p=0.098) Within level multivariable analysis *Although p<0.05, retained all variables p<0.25 in stepwise regression	Children 8 months of age with six month follow-ups through 32 months of age (2- year follow up) (n=255 at recruitment; 155 at last follow-up) [Guangzhou, China]	Generalized estimating equations used to assess relationship with outcome: incidence density of a tooth surface developing caries, which is the number of new caries-affected surfaces per surface time at risk. Incidence density ratio = incidence density among those exposed and not exposed to independent variable. Sequential stepwise GEE using 5-level model (1=socioeconomic/demographic vars; 2=developmental characteristics; 3=nutritional upbringing including feeding/nutrition; 4=oral health behaviors; 5= S. mutans)	Zhou Y, Yang JY, Lo EC, Lin HC. The contribution of life course determinants to early childhood caries: a 2-year cohort study. Carles Res 2012;46:87–94.
Regularity of between meal snacks (irregular versus regular) Note: Baseline caries experience among 3 year olds was 41% with mean dmft of 1.70.	NS	646 mother-child pairs; children aged 1.5 and 3 years during examinations conducted between 1992 to 2005. [Ishii town, Tokushima Prefecture, Japan]	Multiple logistic regression of factors associated with outcome: presence of dental caries at age 3 years. Caries was based on WHO methodology; recorded as present when lesion in pit/fissure, or on a smooth tooth surface, has detectably softened floor, undermined enamel, or softened wall; dmft recorded.	Niji R, Arita K, Abe Y, Lucas ME, Nishino M, Mitome M. Maternal age at birth and other risk factors in early childhood caries. Pediatr Dent 2010;32:493–8.
Frequency of between-meal snacks Note: Baseline caries experience among 3 year olds was 41% with mean dmft of 1.70.	2/day (versus 0-1) NS 3/day (versus 0-1) NS >=4/day (versus 0-1) 2.53 (OR, p=0.03)	646 mother-child pairs; children aged 1.5 and 3 years during examinations conducted between 1992 to 2005. [Ishii town, Tokushima Prefecture, Japan]	Multiple logistic regression of factors associated with outcome: presence of dental caries at age 3 years. Caries was based on WHO methodology; recorded as present when lesion in pit/fissure, or on a smooth tooth surface, has detectably softened floor, undermined enamel, or softened wall; dmft recorded.	Niji R, Arita K, Abe Y, Lucas ME, Nishino M, Mitome M. Matemal age at birth and other risk factors in early childhood caries. Pediatr Dent 2010;32:493–8.
Meals >7/day Note: Clinical examinations conducted at 2.5 and 3.5 years of age. At 2.5 years: 11% had initial or manifest caries; 7% had one or more manifest lesions. At 3.5 years: 37% initial/manifest; 29% manifest.	1.8 (OR, p<0.05)	Children 1 year at baseline with follow up at 2.5 and 3.5 years of age (n=692) [Stockholm, Sweden]	Univariate and logistic multivariate regression for association with outcomes: initial/manifest caries at 2.5 years of age and manifest caries at 3.5 years of age (versus not). Initial caries - loss of translucency and slight roughness on probing (chalky appearance); Manifest - minimal level venfied as a cavity detectable by probing; and catch of probe under slight pressure for fissures.	Grindefjord M, Dahllöf G, Nilsson B, Modéer T. Stepwise prediction of dental caries in children up to 3.5 years of age. Caries Res 1996;30:256–66.

Data Element	Results (OR, RD, RR, Sn, Sp)	Population	Relationship Examined	Study
		Note: <i>n</i> represents sample size at		
		final follow-up		
Meals >7/day	NS	Children 2.5 years at baseline with 1-	Univariate analysis of each variable comparing children (A)	Grindefiord M. Dahllöf G. Modéer T. Caries
		year follow-up (n=692) [Stockholm,	caries free at baseline and follow-up, (B) caries free at	development in children from 2.5 to 3.5 years
Comparing three groups of children: (A) caries free at baseline		Sweden]	baseline with caries at follow-up, (C) caries at baseline and	of age: a longitudinal study. Caries Res
and follow-up, (B) caries free at baseline with caries at follow-			follow-up - (A) and (B) compared; (B) and (C) compared.	1995;29:449-54.
up, (C) caries at baseline and follow-up. Two comparisons				
among the three groups: (A) and (B) compared; (B) and (C)				
compared.				
Note: Clinical examinations conducted				
at 2.5 and 3.5 years of age.				
At 2.5 years (baseline for this study): 11% had initial or manifest				
caries.				
At 3.5 years: 37% initial/manifest.				
Child snacks between meals (never, 1x/day, 2x/day, >2x /day)	Bivariate association with Caries Progression (significant or NS using logistic regression -	5-13 years of age with 2-year follow-up	Logistic regression for progression outcomes (see below) at	Fontana M, Santiago E, Eckert GJ, Ferreira-
	specific values not reported)	(n=395) [Aguas Buenas, Puerto Rico]	12/24 months; for each predictor individually; multiple	Zandona AG. Risk factors of caries
	New ICDAS>=1 at 24 months: NS		regression developed using backward elimination retaining	progression in a Hispanic school-aged
Note: Baseline mean age was 9.7 years	New ICDAS>=3 at 24 months: NS		predictors p<0.05 with AUC/ROC calculated for final models	population. J Dent Res 2011;90:1189–96.
Baseline mean ICDAS>=1: 15.7			at model level; Poisson regression for number of lesions with	
Baseline mean ICDAS>=3: 8.2	Multivariate Caries Risk Models		progression	
12 month mean ICDAC-1: 17.0	NS - Not included in any final models		Two Outcomes	
12-monutimean (CDAS>=1, 17.9			1 Any prograssion (ICDAS>=1): at least one new losion	
-89% of children			ICDASs=1, and new filling, and for progression of losion from	
61% of childron			scores of 1.2 to 2 to higher or from 2.4 to 5 to higher between	
-or% of children			the two evans	
24-month mean ICDAS>=1: 16.8			 Progression toward cavitation (ICDAS>=3): at least one 	
-91% of children			new lesion ICDAS>=3, one new filling, and/or progression of	
242-month mean ICDAS>=3: 8.4			lesion from score of 1-2 to 3 or higher or from 3-4 to 5 or	
-68% of children			higher between the two exams.	
			Models run for outcomes at 12 and 24 months;	
			Models run without any baseline ICDAS; models run adding	
			baseline ICDAS last; models run starting with baseline ICDAS	
			score	
Snacking frequency (>2 times per day between meals versus 2	1.24 (OR, p=0.006) Baseline	7 years old at baseline (n=3,303) with at	1. Cross-sectional multiple logistic regression with outcome:	Vanobbergen J, Martens L, Lesaffre E,
times or less)		least one follow-up by age 10 years	dmfs (caries v. no caries) in permanent first molars	Bogaerts K,
	NS Follow-Up	(n=3,002) [Flanders, Belgium]	(baseline)	Declerck D. The value of a baseline caries
			Stepwise multiple logistic regression with outcome: net	risk assessment model in the primary
			caries increment on permanent first molars (0/1 additional	dentition for the prediction of caries
			surface affected v. 2 or more additional surfaces affected)	incidence in the permanent dentition. Caries
			calculated by subtracting baseline DMFS6 score from last	Res 2001;35:442–50.
			available DMFS6 score [follow-up]	
Dry mouth (due to medication, radiation, chemo	tnerapy, arug use)			
Orthodontic or prosthodontic appliances.				

Data Element	Results (OR. RD. RR. Sn. Sp)	Population	Relationship Examined	Study
		Note: n represents sample size at		,
		final follow-up		
Pacant carias experience in parents or siblings				
Caregiver baseline dmfs (A categories: cat 1-0-27, ref: cat2-28-	1 3 (IRR n=0.03) cat 3 new d16mfs	Children 0-5 years at baseline followed	Stepwise backward multiple regression zero-inflated pegative	Ismail AL Sohn W/ Lim S Willem IM
40: cat3=41-59: cat 4=60-182)	1.4 (IRR, p=0.03) cat 4	for 2 years (n=788) [low-income African-	binomial models with outcomes: caries increment measured	Predictors of dental caries progression in
		American children in Detroit, Michigan]	as (1) new d16mfs and (2) new d36mfs.	primary teeth. J Dent Res 2009;88:
	Note: cat 2 NS			270–5.
Caregiver has current caries (Self report)	Bivariate association with Caries Progression (significant or NS using logistic regression -	5-13 years of age with 2-year follow-up	Logistic regression for progression outcomes (see below) at	Fontana M, Santiago E, Eckert GJ, Ferreira-
	specific values not reported)	(n=395) [Aguas Buenas, Puerto Rico]	12/24 months; for each predictor individually; multiple	Zandona AG. Risk factors of caries
	New ICDAS>=1 at 24 months: Significant		regression developed using backward elimination retaining	progression in a Hispanic school-aged
Note: Baseline mean age was 9.7 years	New ICDAS>=3 at 24 months: Significant		predictors p<0.05 with AUC/ROC calculated for final models	population. J Dent Res 2011;90:1189-96.
Baseline mean ICDAS>=1: 15.7	Multivariate Caries Rick Medials		at model level; Poisson regression for number of lesions with	
Baseline mean ICDAS=3. 8.2	Note: Total of 12 Multivariate Caries Risk Models: 2 outcomes 2 time periods 3 ways of		progression	
12-month mean ICDAS>=1: 17.9	handling baseline dmfs/DMFS (not included, added last, added first)		Two Outcomes:	
-89% of children			 Any progression (ICDAS>=1): at least one new lesion 	
12-month mean ICDAS>=3: 8.4	-Significant in 3 of 12 models (all 12-month follow up models)		ICDAS>=1, one new filling, and/or progression of lesion from	
-61% of children			scores of 1-2 to 3 to higher or from 3-4 to 5 to higher between	
			the two exams.	
24-month mean ICDAS>=1: 16.8	Reporting results for best model for "any progression" and "progression to cavitation"		Progression toward cavitation (ICDAS>=3): at least one	
-91% of children	 dmfs/DMFS excluded, 24-month follow-up, ICDAS>=1 (model SN=.82, SP=.59, AUC=0.75) 		new lesion ICDAS>=3, one new filling, and/or progression of	
242-month mean ICDAS>=3: 8.4	2 (2) (00, n=0.01(0))		lesion from score of 1-2 to 3 or higher or from 3-4 to 5 or	
-68% of children	2.62 (OK, p=0.0160)		nigher between the two exams.	
	2. dmfs/DMFS added last, 12 month follow-up, ICDAS>=3 (model SN=.81, SP=.58, AUC=0.77)		Models run for outcomes at 12 and 24 months:	
			Models run without any baseline ICDAS; models run adding	
	NS (Not included in final model)		baseline ICDAS last; models run starting with baseline ICDAS	
			score	
	2 dmfr/DAAES added first 12 month follow up ICDASS=2 (model SAI= 91 SD= E7 ALIC=0.70)			
Special healthcare needs				
No "health problems"		Children aged 3-6 years with one-year	Multiple stepwise logistic regression for association with	Gao XL, Hsu CY, Xu Y, Hwarng HB, Loh T, Koh
	2.87 (OR, p<0.05) Prediction model w/o biological factors	follow-up (n=1,576). [Singapore]	outcome: one-year caries increment measured as change in	D. Building caries risk assessment models for
Note: At baseline, 40.3% of children were affected by caries	(change dmft>0)		dmft. Data from 50% children used for model construction;	children. J Dent Res 2010;89:637–43.
(mean dmft was 1.57). In 1 year, 43.7% of children had dmft			remainder for model validation. Prediction (all potential	
increment. Mean increase of dmft in 1 year was 0.93.	2.67 (OR, p<0.05) Prediction model w/ biological factors		factors) and risk models (subset of modifiable factors) with	
	(change dmft>0)		and without biological tests examined. Also, community	
	NS Bisk model w/o biological factors		screening model for identity high risk using a questionnaire	1
	(change dmft>0)		dmft>2 for population studied).	
	(
	NS Risk model w/biological factors			
	(change dmft>0)			
	NS Community high risk model; questionnaire			
	(baseline dmft>0)			
Low SES				
	0.58 (IPP, p=0.02) Now pop cavitated carios	Children tracked from hirth through 12	Multivariable model (GLMM based on perative binemial	Chankanka et al. Longitudinal Associations
night ses (vs. low ses)	0.58 (IRR, p=0.02) New holi-cavitated carles	vears old (n=156) [lowa]	distribution) of association with: (1) new non-cavitated caries	hetween Children's Dental Caries and Risk
Note: % with new non-cavitated caries at first exam. primary	NS New cavitated caries		and (2) new cavitated caries (repeated measures analysis	Factors. J Public Health Dent 2011:71:289-
dentition: 21.15%; % with new cavitated caries at first exam,			with measurements at 3-5 y, 6-8 y, and 11-13 y)	300.
primary dentition: 26.28%				
Household income (<\$10K or >= \$10K)	NS	Children 0-5 years at baseline followed	Stepwise backward multiple regression, zero-inflated negative	Ismail Al, Sohn W, Lim S, Willem JM.
		for 2 years (n=788) [low-income African-	binomial models with outcomes: caries increment measured	Predictors of dental caries progression in
		American children in Detroit, Michigan]	as (1) new d16mfs and (2) new d36mfs.	primary teeth. J Dent Res 2009;88:
L				270-5.

Data Element	Results (OR, RD, RR, Sn, Sp)	Population	Relationship Examined	Study
		Note: n represents sample size at		
		final follow-up		
Level 1 - Family monthly income >=\$450 US (vs less)	2.40 (IDR, p=0.010) Within level multivariable analysis	Children 8 months of age with six month	Generalized estimating equations used to assess relationship	Zhou Y. Yang JY. Lo EC. Lin HC. The
		follow-ups through 32 months of age (2-	with outcome: incidence density of a tooth surface developing	contribution of life course determinants to
		year follow up) (n=255 at recruitment;	caries, which is the number of new caries-affected surfaces	early childhood caries: a 2-year cohort study.
	3.05 (IDR,p=0.003) Final model with all five levels, using sequential stepwise GEE	155 at last follow-up) [Guangzhou,	per surface time at risk.	Caries Res 2012;46:87-94.
Note: ECC prevalence at baseline (8 months) = 0; 14 months =		China]		
0; 20 months =1.6%; 26 months = 11.1%; 32 months=28.4%.			Incidence density ratio = incidence density among those	
			exposed and not exposed to independent variable.	
			Sequential stanuice CEE using E lovel model	
			/1=sosioosopomis/demographis yars: 2=developmental	
			characteristics: 3=nutritional upbringing including	
			feeding/nutrition: 4=oral health behaviors: 5= S. mutans)	
Maternal social wolfare allowance , vos (vs. no)	1.71 (OP, pc0.001)	12 years of ago followed 6 years	Pivariate and multivariable logistic regression with outcome:	Iulibn A. Ekborn A. Modéor T. Matemal
Maternal social wenare anowance - yes (vs no)	1.71 (OK, p<0.001) Bivaliate	(n=15 538) [Stockholm Sweden]	approximal caries increment (DMESa) between 13 and 19	overweight and smoking: prenatal risk
Note:		(ii-13,536) [Stockholm, Sweden]	vears of age.	factors for caries development in offspring
Baseline DMFT at 13 yrs (mean)=1.28	Note: Variable included in multivariable regression as control; OR and significance in these		,	during the teenage period. Eur J Epidemiol
Baseline DMFSA at 13 yrs (mean)=0.31	models were not reported.			2009;24: 753-62.
DMFT at 19 yrs (mean): 3.39				
DMFSa at 19 yrs (mean): 1.60				
	New of these Considering had a similar statement of the Considering statement in	C 10 years ald at here live followed for 5		Managerian Albi Tarana Matulara C
caregiver education (<n.s., n.s.,="">n.s.)</n.s.,>	None of these 6 variables had a significant association with 5-year increment in hivariate/multivariate models	b-10 years old at baseline followed for 5	(1) 5-year increment of carious teeth and (2) 5-year increment	Soncini IA Trachtenberg El Prospective
Caregiver employment status	bivanate/martivanate models.	Farmingham, ME1	of carious surfaces. Carious/filled surfaces measured from	study of 5-year caries incre-ment among
			date of baseline visit through date of final study dental visit.	children receiving comprehensive dental care
Household income (<\$20,000; \$20,001-\$40,000;>=\$40,000)		Note: Sample were high-risk children	Caries in both primary and permanent dentition were summed	in the New England children's amalgam trial.
		enrolled in the New England Children's	to obtain cumulative incident disease burden (net caries	Community Dent Oral Epidemiol
Welfare use		Amalgam Trial - additional inclusion	increment).	009;37:9–18.
		criteria were no prior amalgam	Eastern and side durith and a language state land of an 0.45	
Medicald/Medicare use		decayed posterior occlural surfaces. All	Factors associated with carles increment at a level of p>0.15	
Meeting FPL		participants received restorations of	model included variables significant at p<0.05 or changed	
		baseline caries and sealants and	coefficients of other variables more than 10%. Multivariate	
Note:		comprehensive semiannual dental care.	analyses conducted using negative binomial model.	
Baseline carious surfaces (mean): 9.4				
At 5-year following, net increment of carious surfaces (mean):				
6.9				
WIC participation (ves/no)	NS	Children 0-5 years at baseline followed	Stepwise backward multiple regression, zero-inflated negative	Ismail Al. Sohn W. Lim S. Willem JM.
		for 2 years (n=788) [low-income African-	binomial models with outcomes: caries increment measured	Predictors of dental caries progression in
		American children in Detroit, Michigan]	as (1) new d16mfs and (2) new d36mfs.	primary teeth. J Dent Res 2009;88:
				270–5.
Head Start participation (yes versus no)	NS new d16mfs	Children 0-5 years at baseline followed	Stepwise backward multiple regression, zero-inflated negative	Ismail AI, Sohn W, Lim S, Willem JM.
	0.6 (IPD == 0.02)	for 2 years (n=788) [low-income African-	binomial models with outcomes: caries increment measured	Predictors of dental caries progression in
	0.0 (mm, p=0.02) new usonins	American children in Deuton, Michiganj	as (1) new 0101115 dilu (2) new 0501115.	270–5.
Full time employment (yes/no)	NS	Children 0-5 years at baseline followed	Stepwise backward multiple regression, zero-inflated negative	Ismail Al, Sohn W, Lim S, Willem JM.
		for 2 years (n=788) [low-income African-	binomial models with outcomes: caries increment measured	Predictors of dental caries progression in
		American children in Detroit, Michigan]	as (1) new d16mfs and (2) new d36mfs.	primary teeth. J Dent Res 2009;88:
				270–5.

Data Element	Results (OR, RD, RR, Sn, Sp)	Population	Relationship Examined	Study
		Note: n represents sample size at		
		final follow-up		
Parent education <13 years (versus >=13 years)	2.9 (OR, p<0.001), 0.69 (SN), 0.57 (SP) Baseline	Kindergarten children (mean age 5 y 8m)	Bivariate association and multivariate logistic regression for	Demers M, Brodeur JM, Mouton C, Simard PL,
		followed up after one year (n=302)	outcome: at least one new carious surface in primary teeth at	Trahan L, Veilleux G. A multivariate model to
	Significant (specific values not reported) Multivariate	[Montreal, Canada]	one-year follow-up	predict caries increment in Montreal children
				aged 5 years. Community Dent Health
Education, household head, # of years	NS	Two cohorts (Grade 1 and Grade 5) at	Backward stepwise logistic regression for outcome: high risk	Disney JA, Graves RC, Stamm JW, Bohannan
		two sites (Aiken, SC and Portland, ME)	based on 3-year DMFS increment (final DMFS-baseline DMFS)	HM, Abernathy JR, Zack DD. The University of
Note: Baseline caries experience:	Note: Comparison to "any risk" in Beck et al. 1992 where "any risk" is a DMFS increment of 1 or	with 3-year follow-up (n=4158)	where high risk definition varied by cohort	North Carolina Caries Risk Assessment study:
Mean dmfs, Grade 1, Aiken: 9.3, Portland: 2.9	more (Beck et al. results below):			further developments in caries risk
Mean DMFS Grade 1, Aiken: 0.3, Portland: 0.2				1992:20:
Mean DMFS Grade 5, Aiken: 3.0, Portland: 1.7				64–75.
Mother's education <=9 years	3.4 (OR, p<0.001) Univariate Group B v. Group A	Children 2.5 years at baseline with 1-	Univariate analysis of each variable comparing children (A)	Grindefjord M, Dahllöf G, Modéer T. Caries
		year follow-up (n=692) [Stockholm,	caries free at baseline and follow-up, (B) caries free at	development in children from 2.5 to 3.5 years
Comparing three groups of children: (A) caries free at baseline	NS Group C v. Group B	Sweden]	baseline with caries at follow-up, (C) caries at baseline and	of age: a longitudinal study. Caries Res
up. (C) caries at baseline and follow-up. Two comparisons			ionow-up - (A) and (B) compared, (B) and (C) compared.	1555,25.445-54.
among the three groups: (A) and (B) compared; (B) and (C)				
compared.				
Note: Clinical examinations conducted				
at 2.5 and 3.5 years of age.				
At 2.5 years (baseline for this study): 11% had initial or manifest				
At 3.5 years: 37% initial/manifest.				
Mother's education <=9 years	3.6 (OR, p<0.001) Univariate (manifest caries at 3.5 years)	Children 1 year at baseline with follow	Univariate and logistic multivariate regression for association	Grindefjord M, Dahllöf G, Nilsson B, Modéer
Note: Clinical examinations conducted at 2.5 and 3.5 years of	NS Multivariate (initial/manifest at 2.5 v)	(Stockholm, Sweden)	manifest caries at 3.5 years of age (versus not).	children up to 3.5 years of age. Caries Res
age.				1996;30:256–66.
At 2.5 years: 11% had initial or manifest caries; 7% had one or	2.58 (OR, p=0.002) Multivariate (manifest at 3.5 y)		Initial caries - loss of translucency and slight roughness on	
more manifest lesions.	[standardized beta coefficient: 0.947]		probing (chalky appearance); Manifest - minimal level verified	
AC3.5 years. 57 % mittar/mannest, 25% mannest.	Note: Logistic regression ORs are standardized for each factor.		slight pressure for fissures.	
Parent education (<h.s. or="">=h.s.)</h.s.>	NS	Children 0-5 years at baseline followed	Stepwise backward multiple regression, zero-inflated negative	Ismail Al, Sohn W, Lim S, Willem JM.
		for 2 years (n=788) [low-income African-	binomial models with outcomes: caries increment measured	Predictors of dental caries progression in
		American children in Detroit, Michiganj	as (1) new diffinits and (2) new diffinits.	270–5.
Mother educational level <=9 years (vs. >9 years)	1.39 (OR, p<0.001) Bivariate	13 years of age followed 6 years	Bivariate and multivariable logistic regression with outcome:	Julihn A, Ekbom A, Modéer T. Maternal
Father educational level <= 9 years (vs. > 9 years)		(n=15,538) [Stockholm, Sweden]	approximal caries increment (DIVIFSa) between 13 and 19	factors for caries development in offspring
+B165	1.13 (OR, p=0.005)		/	during the teenage period. Eur J Epidemiol
Note:				2009;24: 753-62.
Baseline DMFT at 13 yrs (mean)=1.28	Note: Variables were included in multivariable regression as controls; OR and significance in			
Dasenne DIVIESA at 13 yrs (mean)=0.31	uiese mouels were not reported.			
DMFT at 19 yrs (mean): 3.39				
DMFSa at 19 yrs (mean): 1.60				

Data Element	Results (OR, RD	, RR, Sn, Sp)	Population	Relationship Examined	Study
			Note: n represents sample size at		
			final follow-up		
Level 1 - Mother's schooling at birth >=12 years (vs less)	0.28 (IDR, p=0.003)	Within level multivariable analysis	Children 8 months of age with six month follow-ups through 32 months of age (2- year follow up) (n=255 at recruitment;	Generalized estimating equations used to assess relationship with outcome: incidence density of a tooth surface developing caries, which is the number of new caries-affected surfaces	Zhou Y, Yang JY, Lo EC, Lin HC. The contribution of life course determinants to early childhood caries: a 2–year cohort study.
Note: ECC prevalence at baseline (8 months) = 0; 14 months =	0.35 (IDR,p=0.017)	Final model with all five levels, using sequential stepwise GEE	155 at last follow-up) [Guangzhou, China]	per surface time at risk.	Caries Res 2012;46:87-94.
0, 20 monuis =1.6%, 26 monuis = 11.1%, 52 monuis=28.4%.				exposed and not exposed to independent variable.	
				Sequential stepwise GEE using 5-level model (1=socioeconomic/demographic vars; 2=developmental characteristics; 3=nutritional upbringing including	
				reeding/nutrition; 4=oral nealth benaviors; 5= 5. mutans)	
Father's education level	0.65 (OR pc0.05)	Prediction model w/a biological factor:	Children aged 3-6 years with one-year	Multiple stepwise logistic regression for association with	Gao XL, Hsu CY, Xu Y, Hwarng HB, Loh T, Koh
(categories - none, primary, secondary)	0.85 (0κ, μ<0.05)	(change dmft>0)	Tonow-up (n=1,576). [Singapore]	dmft. Data from 50% children used for model construction; remainder for model validation. Prediction (all potential	children. J Dent Res 2010;89:637–43.
Note: At baseline, 40.3% of children were affected by caries (mean dmft was 1.57). In 1 year, 43.7% of children had dmft increment. Mean increase of dmft in 1 year was 0.93	0.61 (OR, p<0.05)	Prediction model w/ biological factors (change dmft>0)		factors) and risk models (subset of modifiable factors) with and without biological tests examined. Also, community screening model for identify "high rick" using a questionnaire	
inclement, wear necess of anitern 1 year was 0.55.	Not included	Risk model w/o biological factors (change dmft>0)		high risk = 25% of children with high caries burden (baseline dmft>2 for population studied). At baseline, 40.3% of children	
	Not included	Risk model w/biological factors (change dmft>0)		were affected by caries (mean dmft was 1.57). In 1 year, 43.7% of children had dmft increment. Mean increase of dmft in 1 year was 0.93.	
	NS	Community high risk model; questionnaire			
Mother's education (>=8 yrs vs. < 8 yrs)	Initial Bivariate Tes DMFT>=1 at 12 yrs, meant DMFT at 12 yr	ts p=0.03 (chi-square/Fischer exact test) Bivariate yrs, p=0.05 (Mann-Whitney u-test) Bivariate	Study nested within a population based cohort with dental exams and interviews performed at 6 and 12 years of age	Bivariate and multivariable associations with outcome: DMFT at 12 years old. Multivariate analyses were conducted using Poisson regression to generate relative risk ratio and logistic regression (backward topwire) to predict double and social to the	Peres MA, Barros AJ, Peres KG, Araujo CL, Menezes AM. Life course dental caries determinants and predictors in children aged 12 warrs - population based birth schoot
	Poisson Regression NS Univariate and	<u>is</u> d Multivariate (p=0.07)		12 years.	Community Dent Oral Epidemiol 2009;37:123–33.
Note: The following variables did not have statistically significant association with caries at 12 yrs in initial bivariate tests:				Variables grouped into hierarchical model with 6 levels: (1) socioeconomic/demographic, (2) nutritional/development characteristics (3) OH behaviors and dental service use at	
•Father's education (>=8 yrs vs. < 8 yrs) •Social class (employer/professional; skilled worker; unskilled worker)				age 6, (4) primary dental caries at 6 yrs, (5) family economic level at 12 yrs, (6) OH related behaviors and dental service use at 12 yrs.	
•Family income (quartiles) •Family economic status at 12 yrs (A+B, C, D+E)				At each level, variables excluded if p>0.25. Final model	
Note: Baseline caries: 63%				variables retained it p<=0.05.	
High social status/parent education - both parents attained	2.6 (OR, p<0.05)	Bivariate	Children 3 years of age followed up at	Bivariate and multiple logistic regression of factors	Skeie MS, Espelid I, Riordan PJ, Klock KS.
university level education (versus not)	NS	Multivariate	age 5 years (n=304) [Oslo, Norway]	associated with outcome: positive severe caries increment (change in d3-5mfs).	Caries increment in children aged 3-5 years in relation to parents' dental attitudes: Oslo,
Note: Baseline caries prevalence among 3 year olds was 20.1% d1-5 mfs and 6.6% d3-5 mfs.				5 grade caries diagnostic system: grades 1-2=enamel lesions; 3-5 dentine lesions.	Epidemiol 2008;36:441–50.
Caries prevalence at 5 years was 48.0% d15mfs and 19.1% d3- Smfs.				Caries increment=change d1-5mfs Severe caries increment=change d3-5mfs Molar-approximal caries excluded from caries increment	
				calculations.	

Data Element	Results (OR, RD, RR, Sn, Sp)	Population	Relationship Examined	Study
		Note: <i>n</i> represents sample size at		
		final follow-up		
Caregiver education (high school nost-high school college	Rivariate association with Carles Progression (significant or NS using logistic regression -	5-13 years of age with 2-year follow-up	Logistic regression for progression outcomes (see below) at	Fontana M. Santiago F. Eckert GI. Ferreira-
degree)	specific values not reported)	(n=395) [Aguas Buenas, Puerto Rico]	12/24 months: for each predictor individually: multiple	Zandona AG. Risk factors of caries
	New ICDAS>=1 at 24 months: NS		regression developed using backward elimination retaining	progression in a Hispanic school-aged
Note: Baseline mean age was 9.7 years	New ICDAS>=3 at 24 months: NS		predictors p<0.05 with AUC/ROC calculated for final models	population. J Dent Res 2011;90:1189-96.
Baseline mean ICDAS>=1: 15.7			at model level; Poisson regression for number of lesions with	
Baseline mean ICDAS>=3: 8.2	Multivariate Caries Risk Models		progression	
	NS - Not included in any of the multivariate models.			
12-month mean ICDAS>=1: 17.9			Two Outcomes:	
-89% of children			1. Any progression (ICDAS>=1): at least one new lesion	
12-month mean ICDAS>=3: 8.4			ICDAS>=1, one new filling, and/or progression of lesion from	
			the two exams	
24-month mean ICDAS>=1: 16.8			 Progression toward cavitation (ICDAS>=3): at least one 	
-91% of children			new lesion ICDAS>=3, one new filling, and/or progression of	
242-month mean ICDAS>=3: 8.4			lesion from score of 1-2 to 3 or higher or from 3-4 to 5 or	
-68% of children			higher between the two exams.	
			Models run for outcomes at 12 and 24 months;	
			Models run without any baseline ICDAS; models run adding	
			baseline ICDAS last; models run starting with baseline ICDAS	
			score	
Lower Socioeconomic Level (classified using parent occupation	1.05 (RR, p<0.05) Univariate, increment DMFS, total study group	12 years old at baseline followed for 4	Bivariate and multivariable associations with two outcomes:	Källestal C, Fjelddahl A. A four-year cohort
reported by adolescent): workers vs. civil servant	1.04 (RR, p<0.05) Multivariable, increment DMFS, total study group	years (n=3,373) [Sweden]	(1) DMFS increment and (2) DeMFS increment -enamel caries	study of caries and its risk factors in
			on proximal surfaces included in index. Poisson regression	adolescents with high and low risk at
			with over-dispersion used to analyze incidence rate.	baseline. Swed Dent J 2007;31:11-25.
	1.05 (RR, p<0.05) Univariate, increment DeMFS, total study group			
Note:	1.06 (RR, p<0.05) Multivariable, increment DeMFS, total study group		Evaluated for total population and "high risk."	
Baseline total population % with DMFS=0: 47%			Ligh rick identified as	
Baseline high risk % with DMFS=0. 28%	1.08 (RB, pc0.05) Univariate increment DMES high risk group		-having >1 decayed provimal surface, enamel or dentine	
Baseline DMFS, total population, 12 yrs old (mean)=1.67	1.06 (RR, p<0.05) Multivariable, increment DMFS, high risk group		caries, filled proximal surface or missing tooth because of	
Baseline DMFS, high risk, 12 yrs old (mean)=2.87			caries, or	
	1.07 (RR, p<0.05) Univariate, increment DeMFS, high risk group		-dentist found patient had high risk due to mental/physical	
	1.06 (RR, p<0.05) Multivariable, increment DeMFS, high risk group		disability or chronic disease, or	
Baseline DeMFS, total population, 12 years old (mean)=2.40			-CFU>10(5) - lactobacillus test	
Baseline DeMFS, high risk, 12 yrs old (mean)=4.67				
			Children randomly assigned to one of our preventive	
DMFS, total population, 16 yrs old (mean)=3.69			programs: (1) tooth-brushing, (2) fluoride lozenges	
DIVIES, high risk, 16 yrs old (mean)=5.95			prescription, (3) fluoride varnish, (4) Individual program -	
DeMES total population 16 years old (mean)=6.42			and EV	
DeMFS, high risk, 16 vrs old (mean)=10.03				
Social class	NS	Children 2.5 years at baseline with 1-	Univariate analysis of each variable comparing children (A)	Grindefjord M, Dahllöf G, Modéer T. Caries
		year follow-up (n=692) [Stockholm,	caries free at baseline and follow-up, (B) caries free at	development in children from 2.5 to 3.5 years
		Swedenj	follow-up - (A) and (B) compared: (B) and (C) compared	1995-29-449-54
			······································	,
Social class (based on father occupation, unemployed/workers	1.8 (OB. p<0.01) Univariate (manifest caries at 3.5 years)	Children 1 year at baseline with follow	Univariate and logistic multivariate regression for association	Grindefiord M. Dahllöf G. Nilsson B. Modéer
social class3)		up at 2.5 and 3.5 years of age (n=692)	with outcomes: initial/manifest caries at 2.5 years of age and	T. Stepwise prediction of dental caries in
,	NS Multivariate (initial/manifest at 2.5 y)	[Stockholm, Sweden]	manifest caries at 3.5 years of age (versus not).	children up to 3.5 years of age. Caries Res
Note: Clinical examinations conducted at 2.5 and 3.5 years of				1996;30:256-66.
age.	NS Multivariate (manifest at 3.5 y)		Initial caries - loss of translucency and slight roughness on	
At 2.5 years: 11% had initial or manifest caries; 7% had one or			probing (chalky appearance); Manifest - minimal level verified	
more manifest lesions.			as a cavity detectable by probing; and catch of probe under	
At 3.5 years: 37% initial/manifest; 29% manifest.			slight pressure for fissures.	
1				
Neighborhood disadvantage (1=most disadvantaged: 4 = least	0.7 (IRR. p=0.03) category 3 new d16mfs	Children 0-5 years at baseline followed	Stepwise backward multiple regression, zero-inflated negative	Ismail Al, Sohn W, Lim S, Willem IM.
disadvantaged)		for 2 years (n=788) [low-income African-	binomial models with outcomes: caries increment measured	Predictors of dental caries progression in
· · /	Note: Categories 2, 4 NS for new d16mfs. NS overall for new d36mfs.	American children in Detroit, Michigan]	as (1) new d16mfs and (2) new d36mfs.	primary teeth. J Dent Res 2009;88:
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Appendix 3: Summary of Additonal Studies Identified by Panel members Factors

Summary of Study Results by Data Element: DISEASE INDICATORS

Data Element	Results (OR, RD, RR, Sn, Sp)	Population Note: <i>n</i> represents sample size at final follow-up	Relationship Examined	Study
Presence of any non-cavitated active enamel	lesion(s) (aka white spots, non-cavitated enamel defect, initial superficial, ADA Co	CS initial)		
Approximal enamel lesions on xrays	8.21 (OR, p<0.001) *Note: In decision analysis: Domejean et al. 2015 found this to be one of four main factors used in decision making by dental students using CAMBRA with patients	6 and older; primarily adults (n=12,954) [UCSF predoctoral dental clinic patients]	Bivariate association with outcome: Visible cavitation or radiographic penetration of the dentin at CRA baseline	Domejean, White & Featherstone. CAMBRA Caries Risk Assessment — A Six-Year Retrospective Study. CDA Journal. 2011;38(10): 709-715.
White spots	2.77 (OR, p<0.001) *Note: In decision analysis: Domejean et al. 2015 found this to be one of four main factors used in decision making by dental students using CAMBRA with patients	6 and older; primarily adults (n=12,954) [UCSF predoctoral dental clinic patients]	Bivariate association with outcome: Visible cavitation or radiographic penetration of the dentin at CRA baseline	Domejean, White & Featherstone. CAMBRA Caries Risk Assessment — A Six-Year Retrospective Study. CDA Journal. 2011;38(10): 709-715.
Evident tooth decay or white spots Note: Baseline: 63% with evident decay or restorations	55.1 (RD, p<0.05) Follow Up	6-72 months at baseline (n=1,315) [UCSF predoctoral dental clinic patients]	Bivariate association with (1) evident decay or white spot at baseline and (2) evident decay at follow-up (longitudinal unadjusted associations); follow-up time ranged 4-36 months	Chaffee, Featherstone, Gansky, Cheng, and Zhan. Caries Risk Assessment Item Importance: risk Designation and Caries Status in Children under Age 6. JDR Clinical & Translational Research. 2016;(1)2:131-142.
Presence of any cavitated lesion(s) (aka ADA	CCS moderate, ADA CCS Advanced, obvious caries)			
Any cavitated lesion in last 3 years for new pa	tient or since last caries risk assessment for existing patients			
Restorations (within 3 years)	1.46 (OR, <i>p</i> <0.001) *Note: In decision analysis: Domejean et al. 2015 found this to be one of four main factors used in decision making by dental students using CAMBRA with patients	6 and older; primarily adults (n=12,954) [UCSF predoctoral dental clinic patients]	Bivariate association with outcome: Visible cavitation or radiographic penetration of the dentin at CRA baseline	Domejean, White & Featherstone. CAMBRA Caries Risk Assessment — A Six-Year Retrospective Study. CDA Journal. 2011;38(10): 709-715.
Recently placed restorations (within 2 years) Note: Baseline: 63% with evident decay or restorations	15.5 (RD, p<0.05) Baseline 12.1 (RD, p<0.05) Follow-Up	6-72 months at baseline (n=1,315) [UCSF predoctoral dental clinic patients]	Bivariate association with (1) evident decay or white spot at baseline and (2) evident decay at follow-up (longitudinal unadjusted associations); follow-up time ranged 4-36 months	Chaffee, Featherstone, Gansky, Cheng, and Zhan. Caries Risk Assessment Item Importance: risk Designation and Caries Status in Children under Age 6. JDR Clinical & Translational Research. 2016;(1)2:131-142.

Summary of Study Results by Data Element: PROTECTIVE FACTORS

Data Element	Results (OR, RD, RR, Sn, Sp)	Population Note: <i>n</i> represents sample size at final follow-up	Relationship Examined	Study
Brushes twice a day with fluoridated toothpaste				

Fluoride toothpaste (at least daily)	0.81 (OR, p=0.003)	6 and older; primarily adults (n=12,954) [UCSF predoctoral dental clinic patients]	Bivariate association with outcome: Visible cavitation or radiographic penetration of the dentin at CRA baseline	Domejean, White & Featherstone. CAMBRA Caries Risk Assessment — A Six-Year Retrospective Study. CDA Journal. 2011;38(10): 709-715.
Fluoride toothpaste (at least daily)	5.3 (RD, p<0.05) Baseline	6-72 months at baseline (n=1.315) [UCSF predoctoral	Bivariate association with (1) evident decay or white spot at baseline and (2) evident	Chaffee, Featherstone, Gansky, Cheng, and Zhan, Caries Risk
Note: Baseline: 63% with evident decay or restorations	NS Follow-Up	dental clinic patients]	decay at follow-up (longitudinal unadjusted associations); follow-up time ranged 4-36 months	Assessment Item Importance: risk Designation and Caries Status in Children under Age 6. JDR Clinical & Translational Research. 2016;(1)2:131-142.
Drinks fluoridated water				
Community water fluoridation	0.85 (OR, p=0.011)	6 and older; primarily adults (n=12,954) [UCSF predoctoral dental clinic patients]	Bivariate association with outcome: Visible cavitation or radiographic penetration of the dentin at CRA baseline	Domejean, White & Featherstone. CAMBRA Caries Risk Assessment — A Six-Year Retrospective Study. CDA Journal. 2011;38(10): 709-715.
Community water fluoridation	8.0 (RD, p<0.05) Baseline	6-72 months at baseline	Bivariate association with (1) evident decay	Chaffee, Featherstone, Gansky, Chang, and Zhan, Carles Risk
Note: Baseline: 63% with evident decay or restorations	NS Follow-Up	dental clinic patients]	decay at follow-up (longitudinal unadjusted associations); follow-up time ranged 4-36 months	Assessment Item Importance: risk Designation and Caries Status in Children under Age 6. JDR Clinical & Translational Research. 2016;(1)2:131-142.
Drinks fluoridated water	NS Baseline	6-72 months at baseline (n=1.315) [UCSF predoctoral	Bivariate association with (1) evident decay or white spot at baseline and (2) evident	Chaffee, Featherstone, Gansky, Cheng, and Zhan, Caries Risk
Note: Baseline: 63% with evident decay or restorations	NS Follow-Up	dental clinic patients]	decay at follow-up (longitudinal unadjusted associations)	Assessment Item Importance: risk Designation and Caries Status in Children under Age 6. JDR Clinical & Translational Research. 2016;(1)2:131-142.
Prescription home-use products (e.g. high concent	tration fluoride toothpastes)		·	
In-office applied fluoride products (e.g. fluoride val	rnish)			
FV in past 6 months	NS Baseline	6-72 months at baseline (n=1,315) [UCSF predoctoral	Bivariate association with (1) evident decay or white spot at baseline and (2) evident	Chaffee, Featherstone, Gansky, Cheng, and Zhan. Caries Risk
Note: Baseline: 63% with evident decay or restorations	NS Follow-Up	dental clinic patients]	decay at follow-up (longitudinal unadjusted associations); follow-up time ranged 4-36 months	Assessment Item Importance: risk Designation and Caries Status in Children under Age 6. JDR Clinical & Translational Research. 2016;(1)2:131-142.
Over the counter fluoride products (e.g. mouth rins	ses)			
Fluoride mouthwash daily	0.80 (OR, p<0.001)	6 and older; primarily adults (n=12,954) [UCSF predoctoral dental clinic patients]	Bivariate association with outcome: Visible cavitation or radiographic penetration of the dentin at CRA baseline	Domejean, White & Featherstone. CAMBRA Caries Risk Assessment — A Six-Year Retrospective Study. CDA Journal. 2011;38(10): 709-715.

Summary of Study Results by Data Element: RISK FACTORS

Data Element	Results (OR, RD, RR, Sn, Sp)	Population Note: <i>n</i> represents sample size at final follow-up	Relationship Examined	Study	
Deep pits and fissures					

Deep pits and fissures	1.80 (OR, p<0.001)	6 and older; primarily adults (n=12,954) [UCSF predoctoral dental clinic patients]	Bivariate association with outcome: Visible cavitation or radiographic penetration of the dentin at CRA baseline	Domejean, White & Featherstone. CAMBRA Caries Risk Assessment — A Six-Year Retrospective Study. CDA Journal. 2011;38(10): 709-715.	
Visible plaque on teeth					
Visible heavy plaque on teeth	2.55 (OR, p<0.001) *Note: In decision analysis: Domejean et al. 2015 found this to be one of four main factors used in decision making by dental students using CAMBRA with patients.	6 and older; primarily adults (n=12,954) [UCSF predoctoral dental clinic patients]	Bivariate association with outcome: Visible cavitation or radiographic penetration of the dentin at CRA baseline	Domejean, White & Featherstone. CAMBRA Caries Risk Assessment — A Six-Year Retrospective Study. CDA Journal. 2011;38(10): 709-715.	
Heavy dental plaque Note: Baseline: 63% with evident decay or restorations	32.5 (RD, p<0.05) Baseline 17.6 (RD, p<0.05) Follow-Up	6-72 months at baseline (n=1,315) [UCSF predoctoral dental clinic patients]	Bivariate association with (1) evident decay or white spot at baseline and (2) evident decay at follow-up (longitudinal unadjusted associations); follow-up time ranged 4-36 months	Chaffee, Featherstone, Gansky, Cheng, and Zhan. Caries Risk Assessment Item Importance: risk Designation and Caries Status in Children under Age 6. JDR Clinical & Translational Research. 2016;(1)2:131-142.	
Difficulty with home care due to physical or he	havieral recence				
Difficulty with home care due to physical of be					
Frequent sugar consumption (e.g. sugary drin)	ks. snacks rich in fermentable carbohvdrates)			1	
Bottle for nonmilk/nonwater	11.8 (RD. P<0.05) Baseline	6-72 months at baseline	Bivariate association with (1) evident decay or	Chaffee, Featherstone, Gansky,	
Note: Baseline: 63% with evident decay or restorations	NS Follow-Up	(n=1,315) [UCSF predoctoral dental clinic patients]	white spot at baseline and (2) evident decay at follow-up (longitudinal unadjusted associations); follow-up time ranged 4-36 months	Cheng, and Zhan. Caries Risk Assessment Item Importance: risk Designation and Caries Status in Children under Age 6. JDR Clinical & Translational Research. 2016;(1)2:131-142.	
Bottle use in bed Note: Baseline: 63% with evident decay or restorations	8.2 (RD, P<0.05) Baseline NS Follow-Up	6-72 months at baseline (n=1,315) [UCSF predoctoral dental clinic patients]	Bivariate association with (1) evident decay or white spot at baseline and (2) evident decay at follow-up (longitudinal unadjusted associations); follow-up time ranged 4-36 months	Chaffee, Featherstone, Gansky, Cheng, and Zhan. Caries Risk Assessment Item Importance: risk Designation and Caries Status in Children under Age 6. JDR Clinical & Translational Research. 2016;(1)2:131-142.	
Bottle use continuously Note: Baseline: 63% with evident decay or restorations	7.5 (RD; p<0.05) Baseline NS Follow-Up	6-72 months at baseline (n=1,315) [UCSF predoctoral dental clinic patients]	Bivariate association with (1) evident decay or white spot at baseline and (2) evident decay at follow-up (longitudinal unadjusted associations)	Chaffee, Featherstone, Gansky, Cheng, and Zhan. Caries Risk Assessment Item Importance: risk Designation and Caries Status in Children under Age 6. JDR Clinical & Translational Research. 2016;(1)2:131-142.	
Frequent snack (>3 times daily between meals)	1.77 (OR, p<0.001)	6 and older; primarily adults (n=12,954) [UCSF predoctoral dental clinic patients]	Bivariate association with outcome: Visible cavitation or radiographic penetration of the dentin at CRA baseline	Domejean, White & Featherstone. CAMBRA Caries Risk Assessment — A Six-Year Retrospective Study. CDA Journal. 2011;38(10): 709-715.	
Frequent snacking Note: Baseline: 63% with evident decay or restorations	29.8 (RD, P<0.05) Baseline 15.8 (RD, P<0.05) Follow-Up	6-72 months at baseline (n=1,315) [UCSF predoctoral dental clinic patients]	Bivariate association with (1) evident decay or white spot at baseline and (2) evident decay at follow-up (longitudinal unadjusted associations); follow-up time ranged 4-36 months	Chaffee, Featherstone, Gansky, Cheng, and Zhan. Caries Risk Assessment Item Importance: risk Designation and Caries Status in Children under Age 6. JDR Clinical & Translational Research. 2016;(1)2:131-142.	
Dry mouth (due to medication, radiation, chemotherapy, drug use)					

Recreational drug use	1.95 (OR, p<0.001)	6 and older; primarily adults (n=12,954) [UCSF predoctoral dental clinic patients]	Bivariate association with outcome: Visible cavitation or radiographic penetration of the dentin at CRA baseline	Domejean, White & Featherstone. CAMBRA Caries Risk Assessment — A Six-Year Retrospective Study. CDA Journal. 2011;38(10): 709-715.
Salivary-reducing medications Note: Baseline: 63% with evident decay or restorations	10.9 (RD; p<0.05) Baseline 16.6 (RD; p<0.05) Follow-Up	6-72 months at baseline (n=1,315) [UCSF predoctoral dental clinic patients]	Bivariate association with (1) evident decay or white spot at baseline and (2) evident decay at follow-up (longitudinal unadjusted associations); follow-up time ranged 4-36 months	Chaffee, Featherstone, Gansky, Cheng, and Zhan. Caries Risk Assessment Item Importance: risk Designation and Caries Status in Children under Age 6. JDR Clinical & Translational Research. 2016;(1)2:131-142.
Orthodontic or prosthodontic appliances.				1
Recent caries experience in parents or siblings				
Caregiver or sibling tooth decay	13.3 (RD; p<0.05) Baseline	6-72 months at baseline (n=1,315) [UCSF predoctoral	Bivariate association with (1) evident decay or white spot at baseline and (2) evident decay at	Chaffee, Featherstone, Gansky, Cheng, and Zhan. Caries Risk
Note: Baseline: 63% with evident decay or restorations	10.1 (RD; p<0.05) Follow-Up	dental clinic patients]	follow-up (longitudinal unadjusted associations); follow-up time ranged 4-36 months	Assessment Item Importance: risk Designation and Caries Status in Children under Age 6. JDR Clinical & Translational Research. 2016;(1)2:131-142.
Special healthcare needs				
Special care needs Note: Baseline: 63% with evident decay or restorations	7.1 (RD; p<0.05) Baseline NS Follow-Up	6-72 months at baseline (n=1,315) [UCSF predoctoral dental clinic patients]	Bivariate association with (1) evident decay or white spot at baseline and (2) evident decay at follow-up (longitudinal unadjusted associations); follow-up time ranged 4-36 months	Chaffee, Featherstone, Gansky, Cheng, and Zhan. Caries Risk Assessment Item Importance: risk Designation and Caries Status in Children under Age 6. JDR Clinical & Translational Research. 2016;(1)2:131-142.
				<u> </u>
Low SES				
Low SES Note: Baseline: 63% with evident decay or restorations	15.5 (RD; p<0.05) Baseline 10.4 (RD; p<0.05) Follow-Up	6-72 months at baseline (n=1,315) [UCSF predoctoral dental clinic patients]	Bivariate association with (1) evident decay or white spot at baseline and (2) evident decay at follow-up (longitudinal unadjusted associations); follow-up time ranged 4-36 months	Chaffee, Featherstone, Gansky, Cheng, and Zhan. Caries Risk Assessment Item Importance: risk Designation and Caries Status in Children under Age 6. JDR Clinical & Translational Research. 2016;(1)2:131-142.

Included Studies

Chaffee, Featherstone, Gansky, Cheng, and Zhan. Caries Risk Assessment Item Importance: Risk Designation and Caries Status in Children under Age 6. JDR Clinical & Translational Research. 2016;(1)2:131-142.

Domejean, White & Featherstone. CAMBRA Caries Risk Assessment — A Six-Year Retrospective Study. CDA Journal. 2011;38(10): 709-715.

Domejean, et al. How Do Dental Students Determine Patients' Caries Risk Level using the Caries Management by Risk Assessment (CAMBRA) System? J Dent Educ. 2015;79(3):278-285.

Appendix 4: Identifying Data Elements/Factors for a CRA Tool – Summary of Expert Panel Discussions and Determinations

Data elements from all major CRA tools currently in use were included to form a comprehensive list. The list was divided into three categories of data elements:

- Disease Indicators
- Protective Factors
- Risk Factors

Disease Indicators

	Data Element in Delphi I	Discussions following Delphi surveys	CRA Tool Factors
1	White Spot Lesions		
2	Non-cavitated enamel defect		
3	ADA CCS initial lesion(s)	Disease is already present even if the	
4	Active pit and fissure caries	lesion is at a non-cavitated stage. Important to distinguish between "active" and "inactive" lesions: The ADA CCS	
5	Past pit and fissure caries	paper has a clear guide that can	Active initial lesion(s) (i.e.,
6	New or active non- cavitated occlusal or smooth surface enamel lesions	"activity". "Smooth surface" vs. "occlusal pit and fissures" are often are considered different types of disease. But diagnostic coding at tooth-level will capture this.	enamel lesions, white spots)
7	New or active non- cavitated approximal enamel lesions	Activity and extent are more important.	
8	Interproximal demineralization		
9	One or more interproximal lesions(s)		Active moderate
10	ADA CCS moderate or advanced lesions		or advanced lesion(s)
11	Obvious caries		

12	Cavitated smooth surface carious lesion		
13	One new smooth surface restoration due to caries within the past year		
14	Restorations or cavitated lesions	Difficult to say why a restoration was delivered. "Past experience of caries" is	
15	Interproximal restorations	Having a time-box of 3 years is restrictive	
16	Direct Restorations	and doesn't allow the patient to be re-	Moderate or advanced
17	Indirect restorations	once at high risk patient remains for 3	lesion(s) in the
18	Missing teeth due to caries	Also having a time-box may not take into account severe disease just beyond that	since last assessment
20	dmft/DMFT	time box. But not having a time-box doesn't allow a patient to be re-	
21	Caries experience (high DMFT/dmft, interproximal restorations, root caries, direct or indirect restorations, fillings, crowns and bridges)	categorized ever. A three year time box for children under age 6 is inappropriate.	
19	Root Caries	Not relevant for children	Do not include

Protective Factors

Note: Most of these "protective" factors can also be viewed as "risk factors" – i.e., lack of protective factors indicates greater risk for disease or presence of disease. Clinicians preferred them to be worded positively: i.e., use "Brushes with fluoridated toothpaste – Yes/No" rather than "Does not brush with fluoridated toothpaste – Yes/No".

	Data Element in Delphi I	Discussions following Delphi surveys	CRA Tool Factors
1	Brushes twice a day	More evidence for effect of the fluoridated	Brushes twice a day with
2	Uses fluoride toothpaste	toothpaste rather than the brushing itself.	toothpaste containing fluoride
3	Drinks fluoridated water	Difficult to say how much a person drinks and thus exactly what the contribution will be to the persons' risk/protection. Also there is a "halo" effect in which people that live in non-fluoridated communities consume	Predominantly drinks fluoridated water/beverages made from fluoridated water

		beverages that may have been produced in fluoridated communities	
4	Other home-use fluoride products	These are interventions that follow assessment of risk. So if these are present as "protective factors" that just means someone has assessed risk and deemed these interventions as being necessary.	Uses at-home prescription fluoride products
5	Fluoride mouth rinse		Uses over the counter mouth rinse that says "fluoride- containing" (consider for older children)
6	High-concentration fluoride toothpaste	risk. Keep these elements separate. They may all have an equivalent contribution to	
7	Fluoride varnish	the risk, but from a clinician perspective this is all good information to have for care planning. Rinse evidence: https://www.ncbi.nlm.nih.gov/pubmed/274 72005	Receives professionally applied fluoride
8	Antiseptic or antimicrobial mouthwashes	Insufficient evidence that the intervention lower risk. Intervention following risk assessment but because a person was prescribed doesn't tell us why it was prescribed.	Do not include.
9	Xylitol use		
10	Xylitol gum	lower risk	Do not include
11	Xylitol lozenges		
12	Calcium phosphate pastes	Insufficient evidence that the intervention lower risk	Do not include
13	Salivary flow	 Not relevant for children Strong evidence that when the flow rate is lower there is higher association with caries risk (Leone et al., J Dent Ed, 2001;65:1054- 1062). Time to saturate a cotton roll used in previous research. Many considerations 	Do not include as a separate factor; consider with "dry mouth" as a risk factor (see below)

	exist: Is there a chairside tool that is accurate? Stimulated or not? Mucous or serous or both and in what combo? Is It flow or consistency or constituency? We know, for example, that calcium rich saliva has an anti-caries effect, but what is "enough"? In	
	young children, this may be a fairly subjective metric, due to their inability to reliably spit into a tube.	
	- The factor that is important is "Dry Mouth" by clinical appearance or measured. Clinical observation and judgement of dry mouth is often all that is required, if the patient's mouth is wet, it is wet and if it is dry, it is dry. There is a lot of debate about stimulated and unstimulated saliva measurement. For those who measure stimulated saliva, less than 1mm/min over 3 minutes, indicates dry mouth. In practical terms, some clinicians only measure saliva when it is not clear if the patient is wet or dry. The presence of dry mouth, elevates risk one level, i.e. from low to moderate, moderate to high and high to extreme.	
	- But clinically difficult to use and interpret.	

Risk Factors (Person-centered parameters)

	Data Element in Delphi I	Discussions following Delphi surveys	CRA Tool Factors
1	Deep pits and fissures	Operational definition? Will multiple clinicians view this and come to the same conclusion? Clinicians feel "yes" May be important for younger kids. Just like we had "fluoride" as a protective factor, should we not have "sealants" as a protective factor?	Susceptible deep, un-coalesced, and unsealed pits and fissures
2	Visible plaque on teeth	Children usually have an opportunity to brush before their dental visit. When a child comes in with visible plaque even with this opportunity then we need to consider this as a risk factor. Clinicians feel this can be operationalized. Evidence supports <u>http://onlinelibrary.wiley.com/doi/10.1111/j.</u> <u>1600-0528.1994.tb02049.x/full</u>	Visible plaque

3	Difficulty with home care due to physical restrictions	Combine into one. Consider whether this can be associated with "brush twice a day with F toothpaste" because if they physically can't then that item may be impacted. However some may be able to "brush" but not do that properly.	Physical or behavioral health
4	Difficulty with home care due to psychological restrictions		issues that impede home care
5	Diet rich in carbohydrates		Consumers more than 3 sugary
6	Frequent sugary snacks		snacks between
7	Frequent sugary drinks	Diet rich in complex carbohydrates is ok. It's the sugar that's the problem	meals each day (If infant, is the child put to bed with a bottle containing beverage with sugar)
8	Dry mouth		
9	Medication induced dry mouth	- Can be combined since the reason for dry	Clinically little saliva or medical condition or
10	Radiation induced dry mouth	itself from a CRA perspective	medication that causes dry mouth
11	Recreational drug use		
12	Exposed roots	- NA in children	Do not include
13	Orthodontic or prosthodontics appliances	- Include	Orthodontic or prosthodontic appliances that impede oral hygiene
14	Parent or caregiver has active caries	- Activity can't be recorded without an	Parents or siblings have cavitated lesion(s) in the last
15	Siblings have active caries	exam	year (consider for children under age 14)
16	General health conditions	Too many permutations/combinations. Element should include emerging	Physical or
17	Major health changes	healthcare conditions.	benavioral health

18	Special healthcare needs		issues that impede home care
19	Eating disorders		
20	Chemo/radiation therapy		
23	Saliva pH	Adds cost. Limited evidence. Difficult measuring chair-side. It contributes to risk but it varies throughout the day, so isn't reliable as a one-time measure.	Do not include

Risk Factors (Population Parameters)

	Data Element in Delphi I	Discussions following Delphi surveys	CRA Tool Factors
21	Parent or caregiver has low socioeconomic status	Inclusion considerations: - SES is a population parameter. Low SES and Medicaid status are being used as a proxy for poverty which is a proxy for various exposures and behaviors which would then affect caries risk as a risk factor. This is not straightforward as say someone with physical limitations affecting their ability to brush.	
22	Medicaid enrollment	 Predictive ability of any risk factor is assessed in populations and applied to individuals. Significant evidence for strong correlation between SES and caries incidence. However, Chaffee, et. al. reports in a group of children under 6 (n=1,289), those with low SES 57.6% (n=859) had decay and 47.2% (n=430) did not, a risk difference of only 10.4%. 	Do not include as data element. But include guidance about how to factor SES into the CRA process.
		- Most people doing caries risk place the variable as either a disease indicator, risk factor or protective factor. Disease indicators elevate risk all on their own. Risk factors, generally take more than one to elevate risk. Protective factors decrease risk. SES can be a risk factor that when	

combined with other risk factors raises the risk level. - Insufficient evidence to determine whether SES is a risk factor outside of the other disease indicators/risk factors that we were looking at, or whether it more so correlated in that those with low SES tend to have other caries risk factors?	
Definition considerations "Medicaid" and "Government programs" are not good definitions. Use family level measures (income and parental education are two of the easiest to determine). In many settings income/parent education are not collected and it makes some people uncomfortable to ask these question	

Additional Data Elements Not Included in Delphi 1

	Additional Factors not included in Delphi I	Discussions following Delphi surveys	CRA Tool Factors
1	Mutans Streptococci	Adds cost that is not present in a "look and ask" CRA. Mixed evidence interpretation. Recent research suggests numbers may decline but virulence rises after treatment. Strains of S mutans would make this a more complicated test and (maybe) affect its utility as a point-or-service test. There are both pathologic and non-pathogenic species in the biofilm and that their ratio is important in predicting future caries. Assessing bacterial species or even assessing the degree of challenge from a particular patient's biofilm is not likely to be chair-side easy. Newer chairside methods are in development.	
2	Bacterial Challenge		DO NOT INCIUAE
3	Recall compliance	May assist in determining course/intensity of treatment but not predictive of future disease occurrence	Do not include
4	Locus of control	Extent to which parents have control over their child's behavior e.g. getting them to brush. Some research available but not overwhelming support	Do not include