Supplementary materials

Legend to figure

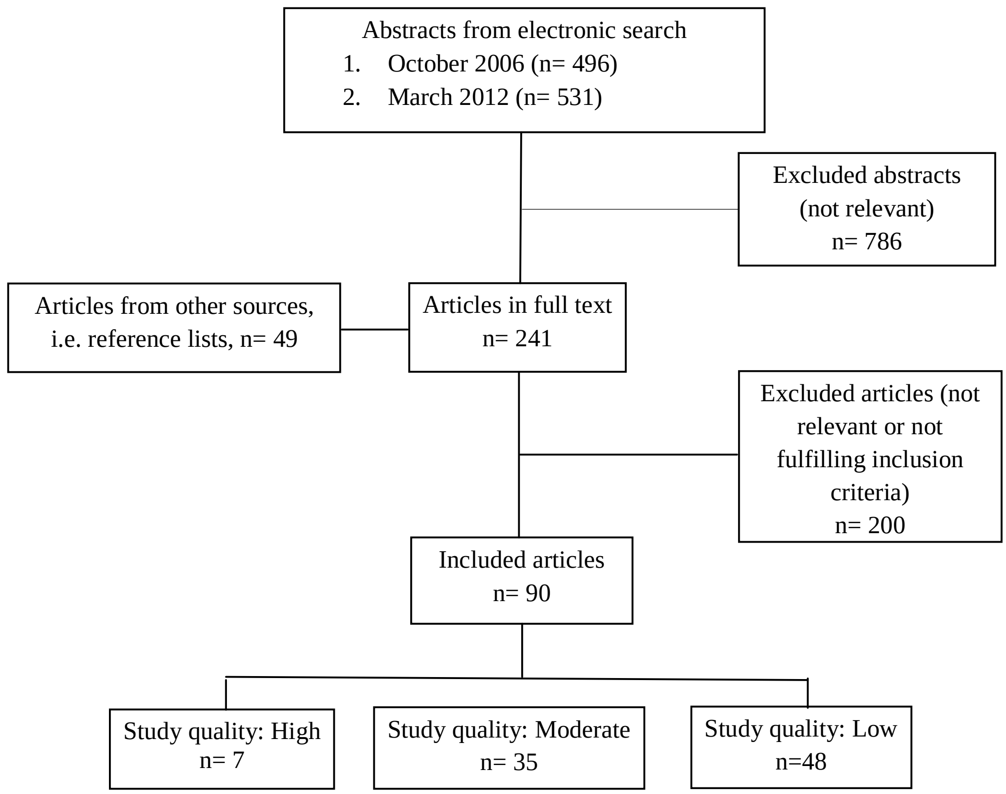

Figure 1. Flow chart showing search strategy, numbers of included and excluded articles and study quality of included articles.

Legend to Table

Table I. Search strategies for PubMed-MEDLINE and Cochrane-CENTRAL databases.

1966–2006 (October)
Dental Caries (Major Topic) AND Risk OR Risk/TI*OR Prognosis OR Prediction/TW OR Predicting/TW OR Forecasting OR Socioeconomic Factors OR Saliva/secretion OR Saliva/microbiology OR Hydrogen Ion Concentration OR Dental Caries Susceptibility (Major Topic) AND Prospective /TW OR Cohort/W OR Longitudinal/TW OR Sensitivity and Specificity OR Sensitivity/TW OR Specificity/TW OR Follow up/TW OR Followup/TW OR Comparative Study OR Compared/TW* OR Comparison/TW*OR Evaluate/TW* OR Evaluated/TW* OR Evaluation/TW* OR Odds-ratio/TW*OR Odds-ratios/TW NOT Cariostatic Agents NOT Dental Caries/therapy (Major Topic) NOT Dental Caries/prevention and control (Major Topic) NOT therapeutic use NOT Case Reports/PT NOT Comment/PT Not Editorial/PT NOT Letter/PT AND Humans AND Danish/LA OR English/LA OR German/LA OR Norwegian/LA OR Swedish/LA
* New search terms (Febr 2012).

Updated PubMed (Febr 2012)
Limits Activated: English, German, Danish, Norwegian, Swedish, Publication Date from 2006/10/01

("dental caries"[MeSH Major Topic] OR dental caries[Title/Abstract) AND ("risk"[Mesh] OR "prognosis"[Mesh] OR "forecasting"[MeSH Terms]OR "dental caries susceptibility"[MeSH Major Topic] OR "risk"[Title] OR prognosis[Title/Abstract] OR predict*[Title/Abstract] OR susceptibility[Title/Abstract]) AND("Cohort Studies"[Mesh] OR prospective[Title/Abstract] OR cohort[Title/Abstract] OR longitudinal[Title/Abstract] OR follow-up[Title/Abstract] OR followup[Title/Abstract] OR "comparative study"[MeSH Terms] OR [compared[Title/Abstract] OR "comparison"[Title/Abstract] OR "evaluate"[Title/Abstract] OR "evaluated"[Title/Abstract] OR evaluation[Title/Abstract) NOT ("case reports"[Publication Type] OR "comment"[Publication Type] OR "editorial"[Publication Type] OR "letter"[Publication Type]) AND ("danish"[Language] OR "english"[Language] OR "german"[Language] OR "norwegian"[Language] OR "swedish"[Language]).

Table II. Predetermined inclusion criteria.

Design

- Prospective longitudinal cohort, randomized clinical trial
- Studies using the same sample but a different prediction model are accepted
- Studies using only one etiological factor or previous caries experience as a predictor are accepted

Sample

- Inclusion criteria defined, the selection of the sample declared
- Population defined, $N \geq 70$; representativeness understandable (no obvious risk of selection bias)
- Clinical and demographic characteristics described
- Heterogeneous cohorts included if they were stratified in the analysis
- All individuals initially thought to be involved should be included

Method

- Diagnostic criteria described
- One investigator accepted if the investigator completed both baseline and follow-up examinations
- Defined prediction variables
- Defined validation variables

Follow-up time

- At least 2 years for permanent teeth, at least 1 year for primary teeth

Results and analysis

- Outcome is caries increment or caries incidence (dentin and/or enamel) reported on tooth or tooth surface level.
- Outcome measures are sensitivity and specificity, relative risk, odds ratio, hazard ratio, caries rate ratio (incidence density ratio) or area under the ROC curve (AUC)
- Studies on post-eruptive age as a risk factor for dental caries were included if caries rate (incidence density) or some other kind of survival analysis is performed or possible to calculate from reported data.

Table III. Criteria for high, moderate and poor study quality, mainly according to Altman [103] and Hudak et al. [104].

High: small risk of bias	• Prospective longitudinal study examining the accuracy of methods used to assess future caries risk, consecutively recruited individuals • Clearly defined population, both in terms of socio-demographic and socio-economic status, caries prevalence at start and increment/incidence at end • Number of individuals $\geq$ 100 • Diagnostic criteria specified, diagnostic reproducibility reported • Who made the risk assessment stated • Blinding reported, e.g. at the end of study the investigator is blinded to which risk group the individual belonged to • At least two relevant predictor variables included, described and understandable; at least one etiological predictor included • Outcome variables defined • Drop-out $\leq$30 percent • No obvious risk of bias due to treatment during follow-up • Adjustment for other known risk factors than those studied • Accuracy reported as sensitivity and specificity or can be calculated from reported data. Numerical summaries of the predictive power models or single variables reported.
Moderate: moderate risk of bias	Shortcomings regarding the above, but: • Prospective longitudinal study examining the accuracy of methods used to assess future caries risk, consecutively recruited individuals • Clearly defined population, both in terms of socio-demographic and socio-economic status, caries prevalence at start and increment/incidence at end • Diagnostic criteria specified, diagnostic reproducibility or calibration described • At least one relevant predictor variable, described and understandable • Outcome variables defined • No obvious risk of bias due to treatment during follow-up • Drop-out $\leq$30 percent. For studies with follow-up time exceeding three years, a larger loss was accepted if a drop-out analysis was made and taken into account when interpreting the results • Accuracy reported as sensitivity and specificity or only as relative risk, odds ratio or the ROC
Poor: high risk of bias	• Shortcomings in several aspects; criteria for moderate study quality not fulfilled.

Table IVa. Caries prediction in pre-school children. Studies of high or moderate quality.

Author, reference, year, country	Sample, n, age start (yrs)	Caries prevalence at start/increment	Obs. time	Drop-out	Diagnostic criteria	Examiner, n Diagnostic reliability	Predictor variables	Validating criteria	Proportion at high risk	Results*	Study quality
Demers [8] 1992 Canada	n= 428 Age= 5 Primary	Increment: 47% ≥1 new dfs	1 yr	29 %	WHO No BW	n=1 Yes	Age, gender, baseline caries prevalence, plaque, mutans streptococci (MS), lactobacilli (LB), oral hygiene habits, fluoride supplement, saliva buffer capacity, parents´ education family (child living with both parents)	>1 new dfs	50%	Best model: caries exp + LB: Se= 0.82; Sp= 0.77 Baseline caries: Se= 0.78; Sp= 0.77 MS: Se= 0.28; Sp= 0.92 LB: Se= 0.17; Sp= 0.99 Fluoride supplements: Se= 0.55; Sp= 0.63 Parents´ education: Se=0.69; Sp= 0.57. Salivary buffer: NS Highest OR: LB= 32; Baseline caries=12.	High
Gao [11] 2010 Singapore	n=1782 Age= 3-6	40 % had caries. Mean dmft= 1.57	1 yr	12 %	WHO (1997) No BW	n=1 Yes	Demographic, socio-economic, behavioral, clinical, biological variables in different combinations: Full model: all variables included. Screening: all variables except biological Community screening: clinical and biological variables excluded (questionnaire only). Cariogram	dmft increment >0	25 %	Full model: Se=0.83; Sp = 0.92 Screening: Se= 0.81; Sp= 0.62 (similar results in community screening) Cariogram: Se= 0.71; Sp= 0.66	Moderate
Grindefjord [9] 1995 Sweden	n= 786 Age= 1 Primary 56% with immigrant background	Caries-free Increment: 29% ≥1 new dfs	2.5 yrs	28 %	Koch 1967 modified	n=2 Yes	Age, gender, MS from tongue, diet, fluoride use, tooth brushing frequency, toothpaste, breast-feeding, chronic illness, medication, education of mother, immigrant background, demography, socioeconomy	≥1 new dfs	Not reported	Best model: immigrant background, mothers education ≤9 yrs, beverages ≥2/day, MS, candy≥1/week: Se= 0.87; Sp=0. 83 Best single predictor: immigrant background: Se= 0.77; Sp=0.59 MS: Se= 0.13; Sp= 0.97 Candies >1/week: Se= 0.72; Sp= 0.45 Tooth brushing ≤1/day: Se= 0.59, Sp= 0.63	High
Grindefjord [12] 1996 Sweden	n= 692 Age= 1 and 2.5 Primary 56% with immigrant background	Age 2.5: 7% dentin, 11% initial caries	1.5 yrs: 1-2.5 1 yr: 2.5-3.5	37 %	Koch 1967 modified	n=2 Yes	Added variables to previous study [9]: Salivary buffer, LB from tongue, gingivitis, caries prevalence at age 2.5, occlusion, cooperation at exam	0 vs. ≥1 initial and/or manifest lesion	Not reported	Highest OR: 1-2.5 (2.5-3.5) (Initial caries = 8.8 Manifest caries= 13.5) MS= 3.2 (3.7) Candy >1/week= 2.3 (1.6) Immigrant background= 2.3 (2.6) Salivary buffer= NS	Moderate Same material as Grindefjord [9]
Holgerson [13] 2009 Sweden	n=103 Age= 2 2 groups: experimental (xylitol) (n=48)	94 % caries-free	5 yrs	18 %	Modified WHO (1987) BW	n=1 Not reported	Cariogram (7 variables)	new dmfs/DMFS >0	Not reported	Se and Sp calculated form Cariogram: Control group: Se= 0.46 (31;62); Sp= 0.88 (71;104) Experimental group: Se = 0.61 (39;84); Sp =0. 47 (29:65)	Moderate

	control (n=55)										
Ismail [14] 2009 USA	n=788 Age= 0-5 mean=2.6	not reported	2 yrs	23 %	ICDAS (Ismail 2007) No BW	n= 4 Yes	Demographic, social environment factors, caregiver´s education, well-being, habits, beliefs. Child´s age, gender, baseline caries prevalence, consumption of carbonated sugared drinks, tooth brushing frequency, dental visits.	new d_{1-6} mfs new d_{3-6} mfs	All at risk	Statistically significant incidence rate ratios of new d_{1-6} mfs (RR): Advantaged neighbourhood: 0.7 (0.6;0.9) Parent´s fatalistic belief: 1.3 (1.1;1.6) Child´s young age: 0.8 (0.7;0.9) Dental treatment visit (0 vs. ≥1): 1.7 (1.4;2.0). Baseline caries ≥7: 2.3 (1.6;3.2).	Moderate
Karjalainen [15] 2001 Finland	n= 135 Age =3	92% caries-free Increment: 0.8 dmft	3 yrs	9 %	WHO No BW	n=1 Yes	Mother´s education, sweet intake, tooth brushing frequency, visible plaque, general health	dmft > 0 (including enamel lesions)	7–29%	Combined: Se= 0.72; Sp= 0.47 Sweet intake: Se= 0.61;Sp= 0.54 RR: Combined = 1.7 (NS)	Moderate
MacRitchie [16] 2012 UK	n=697- 784 Age= 1	0.4 % had dmfs≥1	3 yrs	11 %	Fyffe (1997) No BW Fibre optics	n=1 Yes	Dundee Caries Risk Assessment model (DCRAM): Chi-squared automated interaction detector analysis (CHAID). Originally 56 predictors: type of housing, child´s health visitor´s opinion, parental smoking, food or drink at night, use of feeder cup, vitamins.	1. Any risk: $d_1$mft >0, $d_3$mft >0. 2. High risk: $d_1$mft ≥3, $d_3$mft ≥3	Not reported	DCRAM model: $d_1$mft>0: Se= 0.67; Sp= 0.57 $d_3$mft>0: Se= 0. 53; Sp= 0.77 $d_1$mft≥3: Se= 0.69 Sp= 0.60 $d_3$mft≥3: Se= 0.65; Sp= 0.69.	Moderate
Morou- Bermudez [17] 2011 USA	n=80 Age= 3-6 (n=80) 6-9 (n=52)	Mean (median) dmfs+DMFS = 7.56 (2).	2-3 yrs	Annual attrition rate =13 %	Cortes (2003) including FOTI	n=1 Yes	Urease activity in saliva and plaque, baseline caries prevalence, MS in saliva	Incidence rate: ≥1 new caries lesion	45 % (dmfs+ DMFS>2)	Hazard ratio (HR): Increasing saliva urease: HR= 4.98 (1.33;18.69) Decreasing saliva urease: HR= 0.20 (0.11;0.76) Baseline caries dmfs+DMFS>2: HR= 3.01 (1.50;6.08) MS >10^6 CFU: HR= 4.09 (1.58;10.58)	Moderate
Motohashi [18] 2006 Japan	n=98 Age= 5 2 cohorts: n=53, n=45	dmft>1:68-78 %	5.5 yrs	Not reported	own criteria No BW	n=5 Not reported	Baseline caries prevalence (dmft)	DMFT increment	not reported	RR, new DMFT>0: Cut-off dmft≥2: RR= 2.6-2.7 Cut-off: dmft ≥4: Se=74 %; Sp=72%. Cut-off: dmft ≥5: Se=52%; Sp=92 %.	Moderate
Niji [19] 2010 Japan	n=646 Age= 1.5	Baseline: not reported Increment: mean dmft:=1.7	1.5 yrs	0%	WHO No BW	n=3 Yes	Questionnaire, 10 items, Caries activity test	dmft>0	5-17%	Sign OR: Mothers age at childbirth= 3.0 High caries activity score= 2.1 Frequent snacking= 2.5	Moderate
Pienihäkkinen [10] 2002 Finland	n= 226 Age= 2	dmfs >0: 3% Increment: 20% ≥1 new dmfs	3 yrs	19 %	Own criteria: No BW (fibre optics)	n=5 Yes	Incipient lesions, MS in plaque Low risk: caries-free + MS= 0 Intermediate risk: caries-free+ MS+ High risk: caries+ MS+	≥ 1 new dmfs	9 %	Best model: low vs. intermediate +. high risk: Se= 0.72; Sp= 0.77 low + intermediate vs. high risk: Se= 0.38; Sp= 0.98	High
Pienihäkkinen [20] 2004 Finland	n= 226 Age= 2	dmfs >0: 3% Increment: 20% ≥1 new dmfs	3 yrs	19 %	Own criteria No BW (fiber optics)	n= 5 Yes	Visible plaque, gingival bleeding, incipient lesions, MS in plaque, fluoride use, candies	≥ 1 new dmfs	9- 35%	Best model: Az = 0.81 MS: Se= 0.69; Sp= 0.78 d_{1-3}mfs : Se= 0.29; Sp= 0.97 Candies >1/week: Se= 0.84;Sp= 0.55 Visible plaque: Se= 0.26; Sp= 0.88	Moderate

										Fluoride use: NS	
Skeie [22] 2006 Norway	n= 186 Age= 5 Permanent teeth	48% caries-free Increment: Mean DMFS: 3.5 (including enamel lesions)	5 yrs	14 %	Espelid 1990 BW	n=5 Yes	Baseline caries prevalence in 2nd primary molars (including enamel lesions)	≥1 DFS on mesial surface of 1st perm. molar or incisors	40%	Best model: Se= 0.76; Sp= 0.72 ROC= 0.75–0.76	Moderate
Skeie [23] 2008 Norway	n=354 Age: 3	Baseline: dmfs>0=7% Increment: dmfs>0=19%	2 yr	14 %	Amarante, 1998 BW (on individual. need)	n=7 Not reported	Questionnaire, 82-127 items, i.e. demographic factors, attitudes to diet, oral hygiene and habits related to diet and tooth-brushing	"Severe caries increment"= d3-5mfs>0	Not reported	Highest OR: Immigrant status=3.4 Attitude to diet=2.4 Baseline caries=2.2	Moderate
Wendt [21] 1996 Sweden	n= 289 Age= 1	Caries-free Increment: 29% ≥1 dmfs	2 yrs	11 %	Modified Koch 1967 BW	n=1 Not reported	MS in saliva, visible plaque, dietary habits, oral hygiene habits	≥1 new caries lesion	Not reported	Highest OR for being caries-free at age 3: No visible plaque=3.6 No sugar containing liquid at night= 23.7	Moderate
Zhou [24] 2012 China	n=225 Age = 8 months	Baseline: 0% Increment: 11% Mean dmfs= 0.2	2 yr	31 %	WHO No BW	n=1 Yes	Life course determinants, i.e. socio-demography, socio-economy, MS, enamel defects, visible plaque, dietary habits	Caries incidence (dmfs)	Not reported	Incidence density ratio: Low-educated mothers= 0.4 Higher monthly income= 3.1 Enamel hypoplasia= 4.9 Visible plaque= 9.1; Presence of MS= 7.6	Moderate

* Se= sensitivity; Sp= specificity; RR= relative risk; OR= odds ratio; HR= hazard ratio.

Table IV b. Caries prediction in schoolchildren and adolescents. Studies of high or moderate quality.

Author reference year, country	**Sample, n Age start (yrs)**	**Caries prevalence at start/increment**	**Obs. time**	**Drop-out**	**Diagnostic criteria**	**Examiner, n Diagnostic reliability**	**Predictor variables**	**Validating criteria**	**Proportion at high risk**	**Results***	**Study quality**
Alm [100] 2008 Sweden	n= 539 Ages= 1 and 3	Age 1: 0.5 % had approximal dfs >0 Age 3: 9 % had approximal dfs >0	14 yrs	20 %	Koch (1967) BW	n= not stated Yes	Parent-and child-related factors: Mother´s self-estimation of her oral health care, father´s self-estimation of the social situation. Child: gender, use of fluoride toothpaste (age 3), presence of plaque (age 1).	Radiographically observed approximal caries (enamel and/or dentin): DFSa>0 or DFSa≥4 or DFSa≥8	Not reported	Parent-related factors: 1. Mother: less good/poor self-estimation of her oral health care: OR= DFSa>0=1.6 (1.1;2.5); DFSa≥4=2.3 (1.3;3.9); DFSa≥8=2.9 (1.2;7.3) 2. Father: low satisfaction with the social situation: OR= DFSa≥4= 2.1(1.2;3.7) Child-related factors: 3. Gender, female: OR= DFSa≥4=1.6 (1.1;2.5), presence of plaque on maxillary incisors at age1: OR= DFSa≥4=4.3 (1.1;17.5), insufficient use of fluoride toothpaste at age 3: OR=DFSa≥8= 7.6 (2.2;26.0).	Moderate
Baca [51] 2010 Spain	n= 95 Age= 6-7	Mean dft=2.2 Mean DFT=1.1	2 yrs	15 %	WHO (1988) No BW	n= 1 Yes	Baseline caries prevalence, salivary levels of MS (Dentocult SM strip), LB (Dentocult LB), the original Alban test, and six modified Alban tests with different sugars and polyalcohols.	>0 dft and/or >0 DFT	Not reported	MS: no statistically significant association with caries risk. AUC: dft = 0.67 (0.55;0.80). Various Alban tests= 0.69- 0.74 LB= 0.64 (0.51;0.77)	Moderate
Beck [99] 1992 USA	n=2 185 Age= 6 n=1932 Age=10 Permanent	mean DMFS: Age 6=0.2-0.3 Age 10=1.7-3.0 Mean DMFS increment: Age 6= 0.8-1.9 Age 10= 1.5-3.1	3 yrs	19–22 %	Radike 1968 No BW (fibre optics)	n= 4 Yes	Included significant predictors: 1. any risk predictor model 2. high risk predictor model 3. any risk etiologic model Socio-demographic, fluoride use, LB, gut feeling, baseline DMFS	1. any risk: ≥1 new DMFS 2. high risk: 2-5 new DMFS	Not reported	Any risk prediction model: Aiken (high risk area): Se= 0.80–0.84; Sp= 0.54-0.61 Portland (low risk area): Se= 0.66-0.76; Sp= 0.71-0.78	High Same material as Disney [47]
Burt [52] 1994 USA	n=499 Age=10–15 Permanent	Mean DMFS: boys/girls Age 10=0.4/2.4 Age 13=4.1/5.5 Age 15=4.9/6.0 Increment: Mean new DMFS=2.7/3.1	3 yrs	33 %	NIDR 1989 No BW	n=2 Yes	Total sugar intake, % sugar of total energy intake, between meal sugar consumption (% of total energy intake) age, gender	DMFS ≥1	25 %	Caries incidence poorly related to sugar intake Highest quartile: RR for between meal sugar: Any DMFS= 1.2 (NS) occlusal DMFS= 1.1 (NS) proximal DMFS= 1.7	Moderate
Chankanka [53] 2011 USA	n=156 Ages= 5, 9 and 13	Mean numbers: age 5: non-cavitated= 0.56	8 yrs	not reported	Modified Pitts (1997) No BW	n= not reported Yes	Socioeconomic status (SES), tooth brushing frequency, exposure to 100 % juice frequency, dentition (primary, mixed,	New non-cavitated and new	Not reported (majority low to	New non-cavitated caries (primary, mixed and permanent dentition): HR for high vs. low: SES: -0.55	Moderate .

		cavitated= 1.3 age 9: non-cavitated=0.99 cavitated= 2.97					permanent).	cavitated caries lesions.	medium high risk).	Tooth brushing frequency:-0.40 100 % juice exposure:-0.69 Dentition (permanent vs. primary: 0.37. Similar results for new cavitated lesions	
Disney [47] 1992 USA	n=2 185 Age= 6 n=1932 Age=10 Permanent	mean DMFS: Age 6= 0.2-0.3 Age 10=1.7-3.0 Mean DMFS increment: Age 6=0.8-1.9 Age 10=1.5-3.1	3 yrs	19–22 %	Radike 1968 No BW (fibre optics)	n= 4 Yes	Baseline dmfs, DMFS, subjectively predicted caries (“gut feeling”), sound permanent surfaces, white spot lesions, sealants, fissure morphology, MS, LB in saliva, plaque score, between meal snacks, oral hygiene, fluoride mouth rinse, fluoride tablets, fluorosis, age, race, gender, general health, dental visits last year, education of household	New DMFS: Grade 1: ≥2 Grade 5: ≥3	25 %	Best model for combined fissure morphology, subjectively predicted caries (gut feeling) and DMFS: Grade 1: Se= 0.59; Sp= 0.84 Grade 5: Se= 0.62; Sp= 0.83	High
Fontana [54] 2011 USA	n=395 Age= 5-13	Mean dmfs/DMFS ≥1=15.7 % Mean dmfs/DMFS ≥3= 8.2	2 yrs	3 %	ICDAS at d1-d3 level (Ismail 2007) No BW	n= 2 Yes.	Baseline caries prevalence (ICDAS <3), demographics/access to care, medical and dental history, dental and dietary habits and protective factors.	Any progression (caries if ICDAS ≥1) or ICDAS ≥3	Not reported	Best models: Any progression: Se= 0.75; Sp= 0.61; AUC=0.77 Progression to cavitation: Se= 0.73; Sp= 0.62; AUC= 0.70.	Moderate
Hietasalo [55] 2008 Finland	n=497 Age= 11-12	Only children with ≥ 1 active caries lesion. DMFS at start= 2.1-2.3.	3.4 yrs	not reported	Nyvad (1999) BW	n= 1 Yes (no radiographic reliability test)	Gender, tooth brushing habits, use of xylitol products, snacking on treats, drinking soft drinks, eating candy.	≥1 new DMFS	All at risk	Statistically significant OR:s: Brushing with fluoride toothpaste twice/day vs. < once/day: 0.31 (0.11;0.87) Eating candy ≥5 times/day: 2.7 (1.3;5.7).	Moderate
Julihn [56] 2009 Sweden	n=15 538 Age= 13	Mean DMFSappr=0.31	6 yrs	14 %	not reported BW	not relevant (register study)	Prenatal (maternal smoking/ overweight), perinatal, socio-demography (i.e. parents ‘income, year of schooling)	DMFSappr increment >0	Not reported	OR: DMFSappr >0: Maternal smoking:1.33 (1.22;1.44) Maternal overweight (BMI>25): 1.21 (1.07;1.37).	Moderate?
Kassawara [57] 2010 Brazil	Total n=765 Age= 7-8 (n= 423) 9-10 (n= 342)	7-8 yrs: 42 % had dmft and/or DMFT >0. 9-10 yrs: 35 % had dmft and/or DMFT >0.	2 yrs	22 %	WHO (1997), Nyvad 1999), Fyffe (2000) No BW	n=1 Yes	Baseline initial active lesions, dmft, DMFT	DMFT increment >0.	35-42 %	OR for DMFT 1. initial lesions at baseline: 7-8 yrs: 1.2 (0.70;2.06) 9-10 yrs: 1.8 (1.00;3.23) 2. DMFT and/or dmft at baseline: 7-8 yrs: 9.87(4.26;22.78) 9-10 yrs: 2.96 (1.51;5.78)	Moderate
Källestål [58] 2007 Sweden	n=2 848 Age= 12s	Mean: DMFS=1.67 DMFSappr= 0.30	4 yrs	16 %	Own criteria BW	n =several Yes	Gender, ethnicity, socio-economy, fluoride in drinking water, previous preventive programs, self-administered fluoride, sealants, candy and soft drinks, tooth brushing habits.	DMFS+ initial caries DMFSappr increment	39 %	Rate ratio increment: Lower socioeconomy =1.04 (1.02;1.07) Ethnic background (Eastern Europe)=1.25 (1.12;1.40) Tooth brushing <twice daily =1.08 (1.02;1.14).	Moderate
Masereijan	n=429	Mean	5 yrs	16 %	Pitts (2001)	n= 4	Age, gender, socio-demographic, socio-	DMFS	All high risk	Rate ratios (RR), DMFS:	Moderate

[59] 2009 USA	3 cohorts: Age: 6-7 (n=237), 8-9 (n=158), 10-11 (n=34) yrs	dmfs+DMFS=9.4			BW not reported	Yes	economic factors, oral health behaviour factors, baseline caries prevalence	increment		Age, continuous yrs =1.09 (1.03;1.17) Baseline carious surfaces, continuous n= 1.03 (1.02;1.04) Tooth brushing <1/day= 1.5 (1.0;2.1)	
Peres [60] 2009 Brazil	n=359 Age= 6 Permanent	Baseline: 64% DMFT>0 Increment: Mean DMFT=1.2	6 yrs	6 %	WHO No BW	n=3 Yes	Socioeconomic and demographic variables at birth, nutritional characteristics, baseline caries prevalence, oral health behaviour, dental service use	DMFS>0	45-70%	Highest RR: 4-19 decayed teeth= 2.7 Se= 0.60, Sp= 0.60 Gingival bleeding=1.5	Moderate
Russell [48] 1991 Scotland	n=372 Mean age=12.6 Permanent	Baseline DMFS=10 Increment: new DMFS=4.9	2 yrs	23 %	Bennie 1978 BW	n= 2 Yes	Baseline DMFS, plaque score, MS, LB, Candida, Veilonella in saliva, Snyder colorimetric test (acid production of oral bacteria), salivary buffer (SB), salivary flow rate (SR)	>14 DMFS >2 DS $\geq 10^6$ MS $\geq 10^5$ LB $\geq 10^2$ candida	25-42%	Best model: combined DMFS, LB and Veilonella: Se= 0.71; Sp= 0.74 Single best predictor: DS (proportion high risk =38 %): Se= 0.54; Sp= 0.72	High
Sanche-Perez [61] 2009 Mexico	n=110 Age= 6 Permanent	Baseline: Mean dmfs+DMFS: 5.6 Increment: 59%	4 yrs	14 %	WHO No BW	n= 1 Yes	Morphology, baseline caries prevalence salivary flow rate, MS, LB, Snyder test	DMFS>0	33 %	Best model: Se= 0.79, Sp= 0.80 OR: Fissure morph =19 Caries Experience= 13; Snyder test= 6 MS and LB did not contribute to the model. Salivary flow rate: NS	Moderate
Stenlund [62] 2002 Sweden	n=432 Age=12-13 Permanent	DMFSprox= 0.6	9 yrs	19 %	Own radiographic criteria (BW)	n= 2 Yes	Baseline proximal DMFS	>0 new enamel/dentin proximal lesion	Not reported	The more approximal lesions at baseline, the higher the risk. RR: ≥3 lesions= 3.6; >8 lesions= 4.9	Moderate
Tamaki [63] 2009 Japan	n=560 Age= 5-6 Permanent	Baseline (mean): DFT= 0.1 Increment: DFT= 0.3	2.5 yrs	9 %	WHO No BW	Nor reported Not reported	MS, LB, salivary pH, fluoride usage, sweet snacks,	DFT>0	Not reported	Best model: Se= 0.73, Sp= 0.77	Moderate
Vanobbergen [49] 2001 The Netherlands	n=3002 Age= 7 Permanent molars	Not stated Increment: 68% DMFS=0 68%	3 yrs	19 %	WHO No BW	n=16 Yes	Baseline dmfs, plaque, dietary habits, start tooth brushing, tooth brushing frequency, sociodemographic factors	>2 new DMFS in permanent 1st molars	10-50 %	Best model: almost all predictive power from baseline dmfs: for 30 % high risk proportion: Se= 0.59; Sp= 0.73 ROC (Az) for model, (baseline dmfs): 0.72 (0.69). Misuse of sugar: NS	High
Vallejos-Sanchez [64] 2006 Mexico	n=580 Age= 6-9 Permanent	14% DMFT>0 Increment: 35% DMFT>0 Mean DMFT: 0.52	2 yrs	22 %	WHO No BW	n=2 Not reported	Baseline caries prevalence, age, sex	DMFT>0	21 %	Highest RR: DMFT>0 perm molars= 2.8	Moderate

* Se= sensitivity; Sp= specificity; RR= relative risk; OR= odds ratio; HR= hazard ratio.

Table IVc. Posteruptive age as predictor of caries incidence in schoolchildren and adolescents. Studies of high or moderate quality.

Author reference year, country	Sample, n age start (yrs)	Teeth/surfaces , caries prevalence at start	Obs. time	Drop-out, explained	Diagnostic criteria	Examiner, n reliability	Post-eruptive follow-up time	Validating criteria	Statistical method	Results	Study quality/comments
Abernathy [92] 1986 USA	N= 4365 7-8 and 12	Occlusal surfaces of 1st and 2nd molars Mean DMFS: Grade 1 and 2: 0.9 Grade 5:3.2	4 yrs	42 % yes	Radike (1968) No BW	n=16 Yes	1-4 yrs	D or F (decayed or filled surface)	Life table	Annual DMF rates 1-5 = post-eruption period 1st molars: 2nd molars: 1. 0.16 0.12 2. 0.13 0.18 3. 0.11 0.18 4. 0.09 0.12 5. 0.06 0.08	Moderate High attrition rate Possible bias due to uncontrolled filling rates.
Bœlum [93] 2003 Denmark	N=845 12-14	All surfaces except permanent 1st molars Mean DMFS=6.4	3 yrs	5 %	WHO (1997), Nyvad (1996) BW not reported	n=1 Yes	≤1 yr 2-3 yrs and >3yrs	Sound to caries, sound to cavitated	Caries rate, hazard ratio (HR)	Sound to caries (HR). Erupted for: ≥3 yrs = 1 2-3 yrs = 0.90 1-2 yrs= 1.06 <1yr:1.9 Sound to cavity (HR): ≥3 yrs = 1 2-3 yrs = 0.82 1-2 yrs= 0.93 <1yr:1.9	High
Carlos [95] 1965 USA	N= 5068 4-18	All permanent teeth	6 yrs	25 Yes	Not reported No BW	Not reported	1-6 yrs	Sound to dentine/cavity	Life table	Caries incidence highest during the first 3-4 yrs after tooth eruption. Most pronounced for 1st and 2nd molars.	Moderate Heterogeneous sample. Population not exposed to fluoride toothpaste.
Mejàre [94] 2004 Sweden	N=534 12-13 yrs	Occlusal and approximal surfaces Mean DMFS= 3.2 Mean DFS appr= 0.6	15 yrs	31 Yes	Own radiographic criteria (BW)	n=2 Yes	Age groups: 12-15, 16-19 and 20-27	Sound to enamel, enamel to dentine, in dentine and sound to dentine	Caries rate Survival analysis	Sound to dentin, all surfaces: 12-15: 2.0 16-19:0.9 20-27:0.7 Occlusal surfaces 1st molars: 12-15: 4.4 16-19: 2.3 20-27: 1.5 Occlusal surfaces 2nd molars: 12-15: 6.7	High

										16-19: 3.0 20-27: 2.7	
Månsson [96] 1977 Sweden	169 5-6 yrs	Occlusal surfaces of permanent 1st molars	27 months	33 Yes	Möller 1966 No BW	Not reported	3,6,9,12,15,18,21 and 27 months after tooth eruption	Sound to dentine/cavity	Life table (made from reported original data)	Probability of being caries-free et end of period(months): 3:0.92, 12:0.57, 18:0.45, 27:0.41. 41 % of the molars (25 % of the children) were caries-free at the end	Moderate
Shwartz [97] 1984 Sweden, USA	N=758 6-7, 13-14, 17-18	Approximal surfaces	4 yrs	Not reported	Own radiographic criteria (BW)	Unclear Not reported	7-11, 12-16, 17-22	Sound to outer enamel, outer enamel to inner enamel	Survival analysis	Mean survival time (yrs) through enamel, age (yrs). Swedish group: Age at end: Survival time 10-11 4 17-18 7 21-22 8	Moderate

Table IV d. Systematic reviews of caries prediction. Quality rating according to AMSTAR [6].

Author, reference year, country	Main question	Search strategy	Inklusion/ exclusion criteria	Quality assessment of individual studies	Type of included studies	Conclusions	Study quality
Burt [5] 2001 USA	Do individuals with high level of sugar intake experience greater caries severity relative to those with a lower level of intake?	2 databases Search terms described Independent readings not reported	Yes	Yes	Cross-sectional and cohort studies	Sugar consumption is likely to be a more powerful indicator for risk of caries infection in persons who do not have regular exposure to fluoride.	Moderate
Maupomé [4] 2010 USA	Is there an association between asthma and caries?	1 database Search terms described Independent readings not reported	Yes	Not described.	Prospective, case-control, case series, retrospective	No strong evidence that a causal link exists between asthma and dental caries.	Moderate

Appendix

List of excluded studies and the main reason of exclusion.

First author, publication year [ref no]	Main reason for exclusion
Aaltonen AS 2000 [1]	not prediction
Aaltonen AS 1994 [2]	only correlation
Alaki SM 2008 [3]	outcome measure not relevant
Alaluusua S 1993 [4]	small sample (n=39)
Alanen P 1994 [5]	too short follow-up time
Anderson M 2002 [6]	narrative review
Arantes R 2009 [7]	small sample (n=60)
Ashley FP 1981[8]	not prediction
al-Shalan TA 1997 [9]	retrospective data
Axrak B 2010 [10]	small sample
Bader JD 2004 [11]	review on prevention
Bader JD 1986 [12]	short follow-up (18 months)
Bader JD 2005 [13]	predicting restorative treatment only
Bader 2008 [14]	retrospective, modelling
Bawden JW 1980 [15]	effect of program
Benn DK 1997 [16]	not answering the question
Bergman B 1986 [17]	cross-sectional study
Berkey DB 1991[18]	narrative review
Bille J 1980 [19]	modelling data
Birkeland JM 1976 [20]	only associations
Bjerkeborn K 1987 [21]	cross-sectional study
Botha FS 2001[22]	cross-sectional
Bratthall D 1997 [23]	narrative article
Burt BA 1983 [24]	longitudinal but only associations

Burt BA 1988 [25]	longitudinal but only relationships
Burt BA 1990 [26]	caries not outcome
Burt BA 1993 [27]	narrative review
Burt BA 2005 [28]	review of concepts of risk
Carvalho J 1989 [29]	cross-sectional study
Campus G 1997 [30]	cross-sectional study
Campus G 2000 [31]	cross-sectional study
Campus G 2001[32]	cross-sectional study
Campus 2009 [33]	cross-sectional study
Carvalho JC 1989 [29]	cross-sectional study
Caufield PW 1993 [34]	not prediction
Chase I 2004 [35]	correlations only
Cleaton-Jones P 1991 [36]	cross- sectional study
Cogulu 2007 [37]	outcome correlations only
Coogan M 2008 [38]	small sample (n=20)
Cook SR 1984 [39]	not age-related analysis
Cornejo 2007 LS [40]	in Spanish
Crossner CG 1981[41]	too short follow-up (15 months)
Demers M 1990 [42]	narrative review
Denny PC 2007 [43]	outcome correlation only
Ditmeyer M 2011 [44]	retrospective
Domejean OS 2006 [45]	retrospective
Disney J 1992 [46]	not prediction
Dodds M 1995 [47]	narrative review
Douglass CW 1998 [48]	methodology
Downer MC 1978 [49]	correlations only
Downer MC 1989 [50]	narrative review
Drake CW 1994 [51]	too short follow-up (18months)

Dummer PMH 1990 [52]	covariance analysis, not prediction
Ekstrand K 1998 [53]	only associations
Erickson PR 1999 [54]	in vitro study
Ewoldsen N 2010 [55]	narrative review
Freeman R 2009 [56]	irrelevant question
Frencken JE 1992 [57]	not prediction
Federation Dentaire Internationale 1988 [58]	narrative review
Fure S 1990 [59]	prevalence data
Fyffe HE 2000 [60]	not prediction
Granath L 1978 [61]	correlations only
Granath L 1978 [62]	modelling data
Graves RC 1991[63]	not prediction
Graves CE 2004 [64]	not prediction
Grindefjord M 1995 [65]	cross-sectional analysis
Grytten J 1988 [66]	only associations calculated
Gruythuysen RJ 1992 [67]	not age-related analysis
Habibian M 2001 [68]	caries not outcome measure
Hannigan A 2000 [69]	methodological study
Hart TC 2011 [70]	cross-sectional study
Helfenstein U 1991 [71]	statistical modelling of data
Heller KE 2000 [72]	outcome measure = treatment
Helm S 1990 [73]	correlations only
Hill IN 1967 [74]	not applicable (before F-toothpaste was introduced)
Hintze H 1997 [75]	retrospective, serious systematic bias likely
Holbrook WP 1995 [76]	bivariate associations only
Holst AL 1997 [77]	diagnostic criteria not described
Hong 2009 [78]	short follow-up

Honkala E 1984 [79]	cross-sectional study
van Houte J 1993 [80]	narrative review
Hunter PB 1988 [81]	narrative review
Hänsel Petersson G 2004 [82]	not prediction
Hujoel PP 1999 [83]	not prediction
Hujoel PP 1995 [84]	not prediction
Imfeld TN 1995 [85]	not answering the question
Isokangas P 1993 [86]	pilot study, heterogenous sample
Ito A 2011 [87]	retrospective study
Jaafar N 1988 [88]	correlations only
Jamieson L 2010 [89]	irrelevant outcome
Jarjoura K 2006 [90]	irrelevant question
Kawabata K 1997 [91]	model applied backwards
Kelly 1997 [92]	irrelevant question
Kidd E 1998 [93]	not answering the question
Kingman A 1988 [94]	too short follow-up time (17 months)
Kirchner TH 1991 [95]	not prediction
Kishi 2009 [96]	small sample (n=54)
Klein H 1981 [97]	correlation analysis only
Klock B 1979 [98]	correlation analysis only
Klock B 1989 [99]	too short follow-up (12 months)
Kolemainen L 1985 [100]	too short follow-up (12 months)
Korhonen M 2003 [101]	retrospective study
Krasse B 1988 [102]	narrative review
Kristoffersson K1985 [103]	too small sample (n=28)
Kronmiller J 1988 [104]	prevalence data
Krustrup U 2008 [105]	not prospective
Källestål C 2000 [106]	not prediction

Köhler B 1988 [107]	associations only
König KG 1963 [108]	in vitro study
Lai PY 1997 [109]	too small sample (25*2)
Lawrence HP 1997 [110]	not prediction; 1year follow-up only
Leverett DH 1993a [111]	too short follow-up (6 months)
Leverett DH 1993b [112]	cross-sectional study
Li SH 1993 [113]	cross-sectional study
Litt MD 1995 [114]	correlation analysis only
Locker D 1998 [115]	not prediction
Lovrov S 2007[116]	small sample (N053)
Lu KU 1966[117]	not answering the question
Luan WM 1989 [118]	cross-sectional study
Lundberg P 2007 [119]	irrelevant question
Löfstedt-Stålhane I 1961 [120]	inadequate analysis
MacEntee MI 1994 [121]	narrative review
MacKneown JM 2003 [122]	associations only
Mancl LA 2004[123]	methodology
Margolis MQ 1994 [124]	prevalence data
Mariri BP 2003 [125]	case-control study
Marhtaler TM 1990 [126]	cross-sectional study
Matejka J 1989 [127]	associations only
Mattila ML 2001 [128]	irrelevant question
Meldrum AM [129]	only associations described
Mejàre I 2000 [130]	surface risk assessment
Messer LB 2000 [131]	narrative review
Moss ME 1995 [132]	narrative review
Moss ME 2007 [133]	irrelevant question
Neilson A 1991 [134]	relationship only

Newbrun E 1984 [135]	backward prediction
Nordblad A 1985 [136]	not prediction
Nuttal NM 2002 [137]	outcome measure only ROC
Nuttal NM 1997 [138]	caries not outcome measure
O´Hickey S 1983 [139]	not prediction
Ollila et al., 2008 [140]	no eligible endpoint
O´Sullivan DM 1996 [141]	correlation only
Palin-Palokas T 1984 [142]	descriptive, not prediction
Paunio P 1993 [143]	not prediction
Parisotto T 2010 [144]	review paper
Parisotto T 2011 [145]	too small sample (n=40)
Patz J 1971 [146]	cross-sectional study
Peretz BP 2003 [147]	correlations only, retrospective
Persson LÅ 1984 [148]	correlations only
Persson LÅ 1985 [149]	correlations only
Petti S 1999 [150]	cross-sectional study
Pienihäkkinen K 2005 [151]	only correlations
Pitts NP 1998 [152]	narrative review
Poppe B 1990 [153]	not age-related analysis
Potoczek S 1969 [154]	not prediction
Poulsen V 1987 [155]	retrospective, selected sample
Poulsen S 1980 [156]	retrospective, heterogenous sample
Poulton R 1997 [157]	no caries prediction study (dental fear)
Powell 1998 [158]	narrative review
Raitio M 1996 [159]	too short follow-up (1month)
Raitio M 1996a [160]	too short follow-up (11 months)
Reis IM 1998 [161]	cross-sectional study
Reisine S 1994 [162]	large attrition (about 60%)

Retnakumari N 1999 [163]	cross-sectional study
Rise J 1979 [164]	prediction of filled surfaces only
Rodrigues CS 2000 [165]	not prediction
Roeters FJM 1994 [166]	not prediction (not prospective)
Rugarabamu PG 2002 [167]	not age-related analysis
Rugg Gunn AJ 1984 [168]	correlations with respect to confounders
Rugg Gunn AJ 1987 [169]	starch vs sugar; correlation only
Rundegren J 1978 [170]	small sample (n=18)
Russel JI 1990 [171]	same sample as Russel 1991
Rymar J 1981 [172]	pilot study
Saemundsson SR 1997 [173]	cross-sectional study
Sanchez-Garcia S 2011[174]	elderly patients
Saraiva M 2007 [175]	not prediction
Sayegh A 1997 [176]	cross-sectional study
Scheie 1986 [177]	narrative review
Schröder U 1983[178]	cross-sectional study
Schröder U 1987 [179]	cross-sectional study
Schwartz E 1998 [180]	not caries prediction
Seki M 2003 [181]	too short follow-up time (6 months)
Senpuku H 2010 [182]	elderly patients
Sigurdjons 1995 [183]	heterogenous sample
Slade GD 1994 [184]	descriptive study
Sohn W 2006 [185]	cross-sectional study
Steiner M 1991 [186]	prevalence data
Steiner M 1992 [187]	modelling of data
Stephenson J 2010 [188]	irrelevant outcome
Suni J 1998 [189]	diagnostic criteria not described
Sutcliffe P 1972 [190]	not age-related analysis

Szpunar SM 1995 [191]	same material as Burt & Szpunar 1994
Thibodeau EA 1999 [192]	only correlations
Tianviwat S 2008 [193]	not prediction
Tinanoff N 1995 [194]	narrative review
Twetman S 1990 [195]	not prediction
Twetman S 1991 [196]	cross-sectional study
Twetman S 1999 [197]	not answering the question
Vadiakas G 2008 [198]	narrative review
Vanderas AP 2003 [199]	narrative review
Vanderas AP 2004 [200]	tooth surface risk assessment
Vanderas 2003 [201]	not age-related analysis
van Palenstein WH [202]	WH 2001a method applied to old data
van Palenstein WH [203]	WH 2001b method applied to old data
Vanobbergen J 2001 [204]	cross-sectional study
Vecchio TJ 1966 [205]	methodology
Vehkalahti M 1996 [206]	selected small sample (n=66), retrospective study
Wendt LK 1995 [207]	correlations only (caries exp. and diet)
Wendt LK 1999 [208]	correlations only (caries exp. and immigrant status)
Verrips GH 1993 [209]	correlations only
Virtanen J 1997 [210]	caries not the outcome, retrospective study
Wogelius P 2004 [211]	important confounders not included (only asthma)
Wong MC 1997 [212]	not age-related analysis
Woodward GL 1996 [213]	not age-related analysis
Zadik D 1976 [214]	associations only
Zhang Q 2006 [215]	correlations only
Zhang Q 2007 [216]	correlations only

Zimmer BW 2004 [217]	small sample (n=40)
Yorty JS 2011[218]	not prediction

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