

**At What age should a child's first dental visit be?**

**An Evidence-Based Report**

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## **ABSTRACT**

Early childhood caries (ECC) is a major health concern as it affects a child's dental health as well as overall well-being. The current guidelines, which recommend a child to be seen by a dentist before 12 months of age, are based on expert opinion and not on high-quality clinical evidence. The purpose of this paper was to determine, based on scientific evidence, the most appropriate age for an infant to have the first dental visit in order to prevent ECC.

A comprehensive literature search was conducted using electronic databases including Ovid Medline and PubMed. Initial search yielded 1023 studies, further reviewed at title, abstract and critical appraisal stages. Strict inclusion and exclusion criteria were incorporated in order to keep the report systematic and relevant. Using appropriate checklists, 5 studies were selected at the critical appraisal stage to construct an evidence table. Of the 5 relevant studies, randomized controlled trial studies were assigned the highest design strength and level of evidence, while cross-sectional studies yielded lower scores in design strength and level of evidence.

The relevant studies demonstrated that prenatal dental visits and treatment of mothers for mutans streptococci would significantly reduce bacterial load in infants, however, limited evidence exists as to whether this translates into lower rates of caries. Hence, this systemic review suggests the need for further research to establish the direct correlation between prenatal visit and incidence of ECC.

## **INTRODUCTION**

The dramatic decline in dental caries among children in many industrialized countries has been demonstrated since the early 1980s. However, there is mounting evidence that this decline has stopped and dental caries is still the most common chronic infectious disease in

children under 6 years of age<sup>1,2</sup>. Specifically, early childhood caries (ECC) is a particularly virulent form of caries, “beginning soon after dental eruption, developing on smooth surfaces, progressing rapidly, and having a lasting detrimental impact on the dentition”<sup>3,4</sup>. It is believed to represent a major health problem and if left untreated can develop into major oral infections with destruction of soft and hard tissues in children at high risk. ECC can also have a lasting detrimental impact on the dentition as it poses increased probability of caries in both primary and permanent dentition<sup>5</sup>.

Since caries is a transmissible infectious disease, understanding how the cariogenic microbes are acquired is crucial in implementing new preventive strategies. Early acquisition of *mutans streptococci* (MS) is a key event in the development of ECC and recent evidence demonstrates that they can be acquired via vertical and horizontal transmission from human reservoirs<sup>6</sup>. Horizontal transmission of MS, between members of a family or group such as daycare, can often occur from saliva sharing activities. Vertical transmission, the transmission of microbes from intimate caregiver to child, appears to be the predominant means of primary colonization of MS as the major reservoir from which infants acquire the cariogenic bacteria is the mother’s saliva<sup>7,8,9</sup>. Hence, controlling maternal cariogenic factors during prenatal period may prevent or delay infant inoculation and thus reduce the incidence of ECC in the child.

The traditional approach to treating dental caries consisted of surgical treatment of the effects of the disease then initiating a preventive program. However, this has not been successful in preventing ECC; current recommendations by the American Association of Pediatric Dentistry (AAPD), the American Dental Association (ADA) and the Canadian Dental Association (CDA) urge the first visit to dentist to be within 6 months of eruption of the first tooth and no later than 12 months of age<sup>3,10,11,12,13</sup>. However, even with the advent of the revised recommendations,

treatment of ECC has had minimal success within the last 10 years, which suggests that a more comprehensive approach towards prevention is needed. Further improvements in the prevention of dental caries may be made possible through intervention strategies that address the infectious nature of this disease. Since caries is an infectious disease and the major infectious medium, MS, is known to be mainly vertically transmitted from mothers to infants, it is conceivable that a specific preventive intervention targeting the mothers during pregnancy even before the child is born may possibly be the most effective and beneficial strategy in preventing ECC.

The aim of this systematic review was to determine the most appropriate timing of implementing preventive interventions administered by a dentist to a group at risk of ECC. A comprehensive review of literature was conducted to evaluate the best age for a child's first dental visit as based on its effects on the development of ECC. This review, thus, will examine the impact of the timing of the preventive preventions on 1) the vertical transmission of MS and 2) the mean decayed, missing and filled primary tooth surface (dmfs) scores of the infants to children under age 4. Our hypothesis is that the children borne from mothers who have received prenatal instructions will exhibit lower ECC incidence than those who received first dental examination post birth before the age of 1 year.

## **METHODS**

From our review of the current practice guidelines of the major North American dental associations (AAPD, ADA, and CDA), we found that the child's first dental visit should occur within 6 months of eruption of the first tooth and no later than 12 months of age<sup>3,10,11,12</sup>. While these recommendations were consistent with one another, they were based on expert opinions rather than high quality clinical evidence. Nonetheless, it was brought to our attention that the

AAPD's guideline also stated that the ideal time to intervene would be in the prenatal period because reducing maternal MS levels early, even before delivering the baby, would delay the transmission of MS to their newborns<sup>3,10</sup>. Since this suggestion was based on biological data rather than the expert opinion, we decided to search for the clinical evidence supporting it. Hence, a systemic review of literature was conducted to search, identify, and critically appraise relevant studies.

### **Search Strategy**

The following databases were used to identify the papers from their inception to February 2009: Ovid Medline and PubMed. The keywords were selected after consideration of the following **PICO** parameters:

- **Population:** Children under age 4
- **Intervention:** Preventive dental care to pregnant mothers and mothers with newborns
- **Control:** Children under age 4 whose mothers did not receive preventive dental care
- **Outcome:** Streptococcus mutans infection and/or dental caries in primary dentition

Different combinations of the following keywords were used to retrieve relevant articles on PubMed: child\$, infant\$, pregnan\$, mothers, preventive dental care, Streptococcus Mutans, and dental caries. A systematic search was then conducted using the Ovid Medline. Medical Subject Headings (MeSH) were used to expand on the vocabulary to conduct a more comprehensive search. Our initial search used the combination of the following MeSH terms: child OR infant OR child, preschool AND streptococcus mutans.

The filters applied to the search results include: studies involving humans only and papers published in English. We limited our searches to articles that were available through the University of Toronto Libraries in hardcopy or e-journal format. We also hand searched the references of the retrieved papers to broaden the search.

### **Selection Criteria**

We selected studies that evaluated the clinical intervention of preventive dental care to pregnant women or women with young infants, as well as related descriptive studies that supported such intervention. Here, preventive dental care was defined as any clinical intervention that reduces MS colonization in mothers' oral cavity, such as daily use of chlorhexidine mouthrinse or oral hygiene instructions. Papers were excluded if they did not meet our PICO parameters or if their scope of study was too narrow, for example, the population of interest limited only to pregnant women of low socioeconomic status with active carious lesions<sup>14</sup>. Articles were rejected at 3 stages: title stage, abstract stage, and at critical appraisal (full copy) stage.

### **Evaluation of Studies**

Data from selected studies were extracted using standardized checklists. Any differences in opinion were resolved by discussion. Information was extracted on study design; study population; type of intervention and control; outcome measures; results; and study quality. Each study was critically appraised using a checklist that was appropriate for the design of the study. Thus, 2 different checklists were used to assess clinical interventional studies (see Table 1) and descriptive or longitudinal studies (see Table 2). Meeting each criterion was given 1 point and

the highest possible scores were 16 and 12, respectively. Only those studies that scored above 12/16 and 9/12 were ultimately used to produce an evidence table. Each study that was used for the review was assigned a CTFPHE quality of the evidence (I to III) and the classification of the final recommendations (A to E, I).

## RESULTS

A total of 1023 articles were retrieved using the key words: *child OR infant OR child, preschool AND streptococcus mutans* (see Figure 1 for a flow chart). The search was narrowed down to 920 articles by eliminating non-human and non-English articles. We then systematically eliminated 874 articles at the title stage and 37 articles at the abstract stage. Nine full copy articles were retrieved and 3 hand-searched articles were added. From these 12 articles, we rejected 7 articles at the critical appraisal stage (see Table 3), leaving 5 final articles to construct our evidence table (see Table 4).

Of the 5 relevant studies, the strongest evidence came from the 3 randomized controlled trial (RCT) studies<sup>15,16,17</sup>, while the remaining 2 studies<sup>18,19</sup> used weaker study designs (see Table 4). Nonetheless, the overall findings were consistent with the idea that the preventive therapy given to mothers delays the transmission of MS to infants, thereby preventing caries in primary dentition. The highest quality of evidence (i.e. I) given was given to the RCT study by Brambilla et al.<sup>15</sup> while the other 2 RCT studies<sup>16,17</sup> and 2 non-RCT studies<sup>18,19</sup> were given II-1 and II-2, respectively. The level of recommendation was B in all these studies.

The cross-sectional study by Berkowitz et al.<sup>19</sup> found that that the infants (aged 8-18 months) were 9 times more likely to have their primary incisor teeth infected with MS when their mother's saliva contained a high level of MS ( $10^5$  CFU [colony-forming-units]/ml) as opposed to

a lower level ( $10^3$  CFU/ml). This finding identified the mothers' saliva as the main source of MS infection in children. In the light of this result, Köhler et al.<sup>18</sup> demonstrated the close association between the colonization of MS in children's mouth and dental caries. Their prospective cohort study showed that 4-year-old children who had detectable MS at age 2 had significantly higher caries prevalence (89%, with a mean dfs of 5.0) than children who were later colonized or not colonized (25% with a mean dfs of 0.3). Together, these studies, as with other similar studies that were examined during our literature search, provided the rationale for reducing the mothers' salivary MS level to prevent caries in their children.

Such intervention was the common theme of the 3 clinical trial studies that we examined closely<sup>15,16,17</sup>. These studies were conducted in Italy<sup>15</sup> and Sweden<sup>16,17</sup>. The timing of intervention of the Brambilla study<sup>15</sup> was when the mothers were pregnant, therefore prenatal in nature, whereas the Köhler studies<sup>16,17</sup> examined mothers with 3-8 months old infants. The actual nature of intervention was comparable in all studies. The preventive methods included dietary counseling, scaling, oral hygiene instructions (OHI), and daily use of chlorhexidine mouthrinse, which decrease total bacterial load in the oral cavity. As expected, Brambilla et al.<sup>15</sup> showed the treatment significantly reduced MS levels in mothers and hence delayed the infection in their children for about 4 months. Similarly, Köhler et al. drew the same conclusion that the MS infection in children was preventable by treating their mothers<sup>16</sup>. Moreover, their later study showed that there was a significant reduction in caries in the test children (16% vs. 43% in control)<sup>17</sup>.

## DISCUSSION

Current guidelines<sup>3,10,11,12</sup> on early childhood caries recommend the establishment of a dental home no later than 12 months of age, citing either expert opinion or studies reared towards determining cost-effectiveness of early dental visits<sup>3</sup>. It is palpable, however, that neither provides a realistic evidence-based approach toward determining the best age for the child's first dental visit contingent upon prevention of disease progression or initial colonization. The need for further research, notably prospective cohort studies aimed at establishing an impact on caries prevalence in later life based on varying initial dental visit times (e.g. prenatal, 6 months of age, one year of age, etc), is vital to the institution of guidelines backed by strong scientific research. Although not convincing as of yet, the implementation of prenatal intervention has been touted as an ideal situation by the AAPD, with some relevant research presented to support the claim.

In the Brambilla et al. study<sup>15</sup>, the fluoride and chlorhexidine regimen significantly reduced maternal MS levels, in turn producing a decrease in incidence of streptococcal acquisition in the children of mothers from the control group. In addition, the mean age of colonization was delayed in children of mothers from the experimental group. These findings, in accordance with two previous studies by Kohler et al.<sup>16,17</sup>, demonstrated that a reduction in the maternal level of MS in highly infected women could inhibit and/or delay the establishment of these microbes in their infants. Moreover, the Kohler et al. study<sup>17</sup> also demonstrated that a significantly lower percentage of children who did not have detectable levels of *Streptococcus mutans* developed caries.

Perhaps of greatest significance is the fact that in all the above-mentioned studies, infected infants were also found in those mothers with sub-threshold levels of MS. Several explanations are possible: it is conceivable that, in many cases, the father (or a close

contact/caregiver) may have served as the source of infection. This possibility highlights the importance of a broader prophylactic regimen that would include risk assessment for both parents. Alternatively, differences in dietary habits (specifically sucrose consumption) may account for the disparity, further lending support for inclusion of dietary counseling in any putative preventive program. Provisions should be made in future studies to control for such confounding variables in an attempt to increase the overall power of the studies.

The antiquated approach of providing professional intervention beginning between ages 3 and 5 years of age has been proven to fail at both preventing infection and its effects<sup>20</sup>. It is with this in mind that the AAPD, ADA, and CDA restructured their policy on Early Childhood Caries (ECC) and have recommended that “a child should visit the dentist within six months of the eruption of the first primary tooth and no later than 12 months of age”<sup>3</sup>. This contemporary guideline is aimed at providing examination, risk assessment, and anticipatory guidance to the parents so that disease can be prevented<sup>3,20</sup>. Concomitantly, the policy recognizes that in order to achieve successful prevention of dental disease, “dentists must begin preventive interventions within the first year of life”<sup>3</sup>. In their official policy statement, the AAPD posits that preventive measures must be implemented, both professionally and at-home, to 1) reduce the mother’s MS levels; 2) minimize saliva-sharing activities; 3) implement timely oral hygiene measures; 4) establish a dental home within 6 months of eruption of the first tooth; and 5) avoid caries-promoting feeding behaviours<sup>3</sup>. The recommendation, however, relies upon expert opinion that represents, at best, weak evidence-based support for their claim. In addition, what little scientific data is reported by the organization is usually geared at cost-effectiveness of treatment and generally upheld by the notion that MS species require non-shredding surfaces for adherence (e.g. teeth). It is for these reasons that the authors of this paper recommend further research,

especially the design of appropriate longitudinal studies, to formulate and support a truly evidence-based recommendation.

## **CONCLUSION**

Our call-to-arms is not tantamount to all scientific endeavors but is rather an attempt to emphasize the need for an early treatment regimen rooted in scientific actuality. The realization of such a policy may well come in the form of a prenatal program. Recent studies<sup>21</sup> demonstrating oral colonization of preterm infants is but a beginning: in addition to the evidence outlined above, intrauterine intervention not only fulfills each of the preventive measures stipulated in the current guidelines but additionally takes advantage of the pregnant women's receptiveness to suggestions that may impact her child's health<sup>13</sup>. Nevertheless, prospective studies aimed at following caries development in children - rather than surrogate studies - have yet to be undertaken and an evidence-based approach continues to elude the dental profession as to the subject of when a child's first dental visit should be carried out.

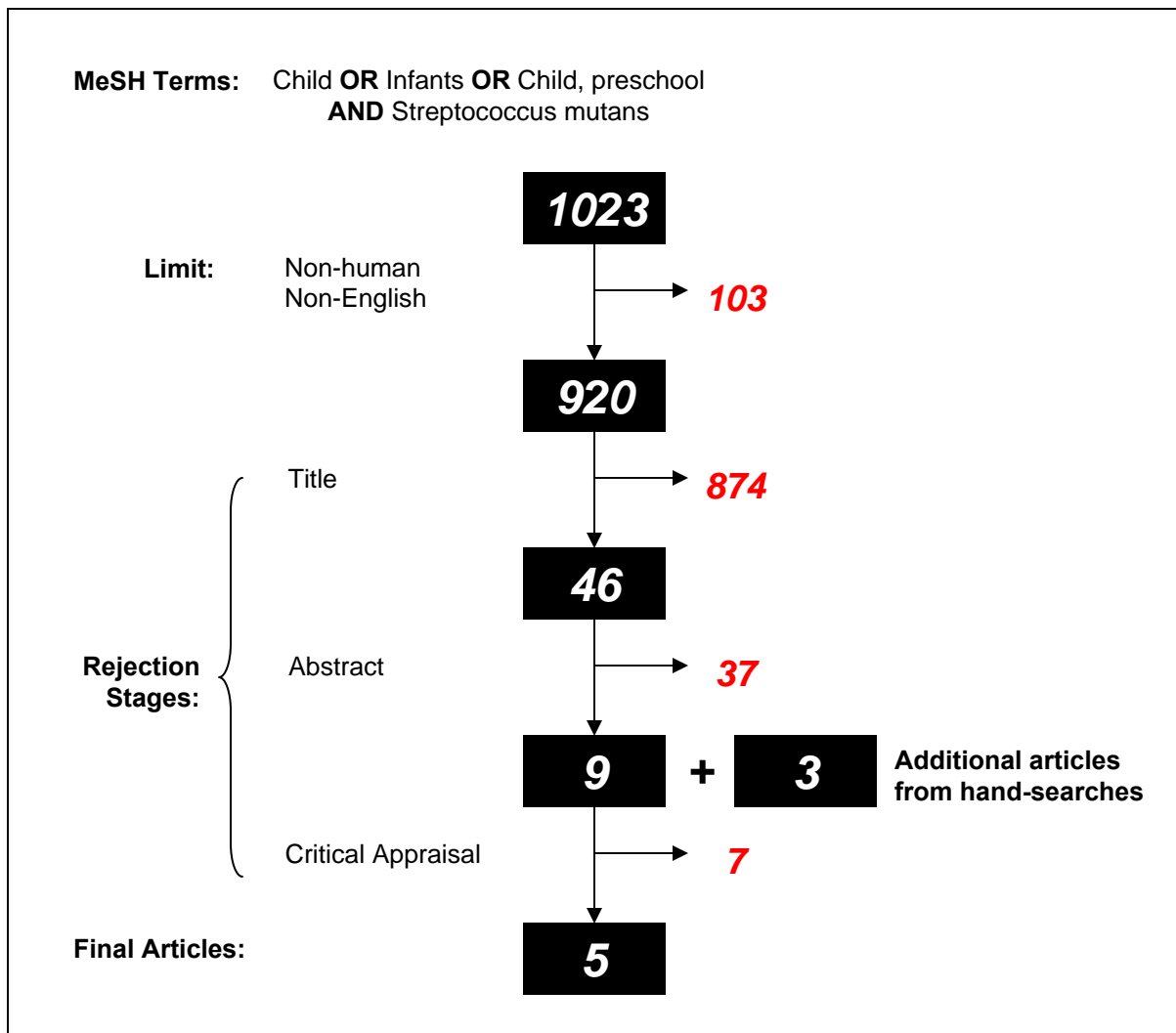
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**Figure 1. Flow Chart of Article Selection Process (using Ovid Medline)**



**Table 1. Checklist to Assess Evidence of Efficacy of Therapy or Prevention\***

Criteria	Score
1. Was the study ethical?	1
2. Was a strong design used to assess efficacy?	1
3. Were outcomes (benefits and harms) validly and reliably measured?	1
4. Were interventions validly and reliably measured?	1
5. Was the treatment effect large enough to be clinically important?	1
6. Was the estimate of the treatment effect beyond chance and relatively precise?	1
7. Was the assignment of patients to treatments randomized?	1
8. Was loss to follow-up less than 20% and balanced between test and controls?	1
9. Were patients analyzed in the groups to which they were randomized?	1
10. Was the study of sufficient duration?	1
11. Were patients, health workers, and study personnel “blind” to treatment?	1
12. Were the groups similar at the start of the trial?	1
13. Aside from the experimental intervention, were the groups treated equally?	1
14. Was care received outside the study identified and controlled for?	1
15. Were all clinically important outcomes considered?	1
16. Are the likely benefits of treatment worth the potential harms and costs?	1
<b>Total Score</b>	<b>16</b>

\*Adapted from: Fletcher, Fletcher and Wagner. Clinical epidemiology – the essentials. 3<sup>rd</sup> ed. 1996, and Sackett et al. Evidence-based medicine: how to practice and teach EBM. 1997

**Table 2. Checklist to Assess Evidence of Prevalence and Incidence (Descriptive or Longitudinal Studies)**

Criteria	Score
1. Was the study ethical?	1
2. Was the study internally valid?	1
3. Was the sampling frame complete, or for longitudinal studies, were all members of the cohort entered at the beginning?	1
4. Did the sampling scheme allow a representative sample?	1
5. Was the response rate 80% or higher, or for longitudinal studies, was loss to follow-up low (less than 20%)?	1
6. Was completion rate on individual items of the assessment instrument high?	1
7. Did the survey use valid measures of disease (case definition) and risks?	1
8. Were the data gathered using the best-accepted techniques (trained examiners)?	1
9. Were the data tested for accuracy and reliability?	1
10. Are the age/sex distributions similar?	1
11. Is there evidence of no systematic differences in prevalence or trends in disease between this group and your patients?	1
12. Is there evidence of no systematic differences in important environmental, behavioural or health care access factors between this group and your patients?	1
<b>Total Score</b>	<b>12</b>

**Table 3. List of Excluded Articles**

<b>Study</b>	<b>Title</b>	<b>Study Design</b>	<b>Reasons for Rejection</b>
Thorild et al. (2004) <sup>22</sup>	Salivary mutans streptococci and dental caries in three-year-old children after maternal exposure to chewing gums containing combinations of xylitol, sorbitol, chlorhexidine, and fluoride	RCT	- Evidence lacked statistical significance - Focused heavily on the chewing gum effects
Türksel Dülgergil et al. (2004) <sup>23</sup>	Prevention of caries in children by preventive and operative dental care for mothers in rural Anatolia, Turkey	RCT	- Studied a rural population with limited dental access - Not representative of overall demographic
Zanata et al. (2003) <sup>14</sup>	Effect of Caries Preventive Measures Directed to Expectant Mothers on Caries Experience in their Children	RCT	- Focused on low socio-economic class pregnant women only - Not representative the general population and outside of our PICO parameters
Gomez and Weber (2001) <sup>24</sup>	Effectiveness of a caries preventive program in pregnant women and new mothers on their offspring	Cross-sectional	- Not a clinical trial but a cross-sectional study, which is a weaker study design to show efficacy of prevention
Gomez et al. (2001) <sup>25</sup>	A prospective study of a caries prevention program in pregnant women and their children five and six years of age.	Cross-sectional	- Same study as the above article by Gomez and Weber (2001) - Children assessed at age 5 and 6, beyond our PICO parameter
Günay et al. (1998) <sup>26</sup>	Effect on caries experience of a long-term preventive program for mothers and children starting during pregnancy	Longitudinal	- Not a clinical trial but a 3 phase prospective study - Significant loss of follow-up (45%) - No controls used in phase I of the study and then used random, unmatched control for phase 2
Köhler and Andréén (1994) <sup>27</sup>	Influence of caries-preventive measures in mothers on cariogenic bacteria and caries experience in their children	RCT	- Children assessed at age 7, well beyond our PICO parameter

**Table 4. Evidence Table**

Study Design	Title	Population (Age and Location)	Test Treatment (Number Studied)	Control treatment (Number Studied) or Sample Size	Outcome	Critical Appraisal Comments	Conclusion, Quality of Evidence, Level of Recommendation
Brambilla et al. (1998) <sup>15</sup>  RCT	Caries prevention during pregnancy: results of a 30-month study	Children under 24 months of age  Italy	<b>31</b>  Pregnant women beginning at the end of the 6 <sup>th</sup> month of pregnancy and continuing until delivery  Dietary counseling, one session of caling, OHI, rinsing daily with fluoride and chlorhexidine mouthrinses.	<b>29</b>  Similar subjects  Dietary counseling, one session of scaling, and OHI	- Children infected with S. Mutans (>1×10 <sup>3</sup> c.f.u./mL): <b>48% (test)</b> <b>83% (control)</b> <b>difference 34.37%</b>  - Mean age (months) at which colonization occurred: <b>22.53 (test)</b> <b>18.20 (control)</b>	Used threshold value of 10 <sup>5</sup> CFU/ml as discussed by Berkowitz et al.; permanent colonization considered to have occurred at levels higher to 10 <sup>3</sup> CFU/ml based on lowest limit of detection for culture method rather than biological basis; restorative treatment not performed in mothers (increasing risk of recurring elevated levels of MS); mothers in either control or experimental group received similar treatment ± mouthrinse treatment	Preventive treatment significantly reduced salivary MS levels in mothers and delayed the colonization of bacteria in their children for about four months  <b>I, B</b>
Köhler et al. (1983) <sup>16</sup>  RCT	Preventive measures in mothers influence the establishment of the bacterium Streptococcus Mutans in their infants	Children at 23 and 36 months of age  Sweden	<b>41</b>  First-time mothers who had a high salivary number of S. Mutans greater than or equal to 10 <sup>6</sup> c.f.u. per ml  Dietary counseling, tooth-cleaning and OHI, fluoride treatment, excavation of large cavities	<b>40</b>  Similar subjects  No intervention	- Children infected with S. Mutans at age of 23 months old: <b>11% (test)</b> <b>45% (control)</b>  - Children infected with S. Mutans at age of 36 months old: <b>19% (test)</b> <b>63% (control)</b>	Used threshold value of 3 X 10 <sup>5</sup> CFU/ml (runs risk of inadvertently transmitting streptococcal infection); chlorhexidine treatment only used when prophylactic treatment failed to reduce MS levels (below threshold) and pregnant mothers did not receive chlorhexidine treatment; infected infants still found whose mothers demonstrated low levels of MS; no control for dietary habits	Transmission of MS to children can be delayed by preventive measures directed against their mothers  <b>II-1, B</b>
Köhler et al. (1984) <sup>17</sup>  RCT	The effect of caries-preventive measures in	Children at Age 3  Sweden	<b>37</b>  First-time mothers who had a high	<b>40</b>  Similar subjects	- Children infected with S. Mutans: <b>41% (test)</b> <b>70% (control)</b>	Reviewed dietary history to control for sucrose-consumption; statistical significance of dietary habits not assessed; unlike MS	Reducing the MS levels in mothers by preventive measures decreased vertical

	mothers on dental caries and the oral presence of the bacteria Streptococcus Mutans and Lactobacilli in their children		salivary number of S. Mutans greater than or equal to 10 <sup>6</sup> c.f.u. per ml  A special preventive programme to reduce the salivary level of S. Mutans	No intervention	- Children with caries: <b>52% (with MS)</b> <b>3% (without MS)</b>	levels, lactobacilli levels not studied longitudinally; no correlation between presence of lactobacilli in children and high salivary levels in mothers; differences in child exposure to water fluoridation present and unaccounted for	transmission of MS to their children and caries incidences  <b>II-1, B</b>
<b>Köhler et al. (1988)</b> <sup>18</sup>  Longitudinal	The earlier the colonization by mutans streptococci, the higher the caries prevalence at 4 years of age	Children at age 4  Sweden	<b>N/A</b>	<b>78</b>	- Mean dfs of children (at various colonization ages): <b>5 (1 – 2 years)</b> <b>2.5 (2 – 3 years)</b> <b>0.9 (3 – 4 years)</b>	Weaker design of study (prospective cohort vs. RCT); causes other than vertical transmission not controlled for (i.e. dietary consumption of sugar/sucrose); all children eventually colonized by age 4 (effect of 4 month delay in colonization not assessed relative to shorter or longer delays)	The earlier colonization of MS led to increased caries in 4 year-old children  <b>II-2, B</b>
<b>Berkowitz et al. (1981)</b> <sup>19</sup>  Cross-sectional	Maternal salivary levels of streptococcus mutans and primary oral infection of infants	Infants aged 8 to 18 months and harbouring only 6 – 8 primary incisor teeth  United States	<b>N/A</b>	<b>156</b>	- Proportion of infant infection (in relation to increasing maternal salivary levels of Streptococcus Mutans): <b>0.06 (ND – 1000 CFU/ml)</b> <b>0.16 (1001 – 10,000 CFU/ml)</b> <b>0.14 (10,001 – 100,000)</b> <b>0.58 (≥ 100,001)</b>	Weaker design of study (cross-sectional vs. RCT); variability of data (i.e. standard deviation) precluded use of Student's t-test; data transformation was necessary (log <sub>10</sub> and non-parametric rank-order Mann-Whitney U test); standardized fluoridated communal water supply	Successful oral transmission of MS in children was related to the magnitude of the inoculum from their mothers  <b>II-2, B</b>