


# Effectiveness of a short web-based film targeting parental oral health knowledge in a well-child care setting

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Young children rely on their parents with respect to oral health routines. However, parental knowledge on this topic is often insufficient. Well-child care may be an excellent route to reach parents because almost all of them attend. To evaluate the effectiveness of an 8.5 min web-based film about oral health, provided by well-child care, a non-blinded quasi-experimental study was performed. Parents attending well-child care clinics in the Netherlands were assigned to an intervention ( $n = 88$ ) or control group ( $n = 41$ ). The control group received care as usual. We measured parental knowledge of oral health with a questionnaire (range of scores 1–12) before and directly after the intervention, and 6 months later, and assessed differences between the intervention and the control group. Parental oral health knowledge improved after watching the film: the intervention group's mean score of 11.1 (SD 1.3) was greater than the mean score of 7.1 (SD 2.0) of the control group (Cohen's  $d = 2.64$ ). Scores remained higher in the intervention group 6 months after watching the film (mean 9.1, SD 1.3) than before (Cohen's  $d = 1.25$ ). A web-based educational film delivered in a well-child care setting can be an effective way to address oral health and to improve parental knowledge.

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## Introduction

Children rely on their parents with respect to oral health routines, and parental knowledge on this is often insufficient, particularly for the parents of young children. These routines are not always adequately performed by parents, especially those of low socioeconomic status (SES) (1–4).

Well-child care may be an excellent route to reach such parents, since most parents in the Netherlands already visit well-child clinics. Well-child care covers preventive pediatric care from birth until 18 or 21 yr, depending on the country where the baby is delivered. At the well-child care clinic, children receive scheduled immunizations, growth and development are monitored, and children and parents receive care to promote the child's health and development. The routine health check-ups and immunizations are an essential part of well-child care visits. Topics such as child behavior, eating, and sleeping are discussed during a well-child visit. However, because there are so many important health issues that have to be discussed, some remain unaddressed during the well-child care visits (5). Caring for children's teeth and dental caries are frequently unaddressed topics in the Netherlands, despite caries being the most common pediatric disease (6,7).

Dental caries have a known etiology that implies routines for prevention since their appearance depends on behavioral factors, such as twice-daily tooth brushing with fluoride toothpaste and low levels of sugar intake (8,9). The consequences of advanced caries (such as pain, discomfort, infection, and tooth loss) can have a major impact on children's general health, growth, and development. Caries affect the ability to chew and eat properly, and they can lead to lost school hours and affect children's quality of life, overall wellness, and self-esteem (1,10). Total costs for dental care for children up to 18 yr old were 443.5 million Euro in 2018 in the Netherlands (11).

In the Netherlands in 2011, 43% of low-SES 5-yr-olds and 30% of high-SES 5-yr-olds had experienced caries (12). The Dutch routine policy is to arrange for a first oral check and advice at a dental practice when a child reaches the age of 2–2.5 yr, but not all parents visit a dentist with their child at that time. Oral health promotion should preferably be initiated at the age of 6 months, when the first tooth erupts. Well-child care clinics are an excellent route for infant oral health promotion, since the clinics are in contact with 99% of Dutch parents and children from birth, including disadvantaged groups, such as those of low socioeconomic status or ethnic minorities (13).

Having adequate and correct knowledge is essential for appropriate health behaviors. Films have been shown to improve parental knowledge about oral health and associated behaviors, and those with web-based approaches are relatively inexpensive. ALSADA *et al.* (14) reported an increase of 32% in knowledge of infant oral health in young mothers and early childhood educators after oral health information was given through a film. ROTHE (15) reported improved oral health knowledge among parents in Nebraska (USA) after watching a PowerPoint and film presentation. BATES & RIEDY (16) reported improvements in knowledge of oral health among pregnant women and new mothers after the women had watched an oral health commercial on a website. However, none of these studies had a control group or explored whether the effects were sustained. The advantages of supplying information in a film are, first, that knowledge is transferred and, second, that the desirable behavior is modelled by actors as role models (16–18).

Evidence-based and structured interventions for oral health promotion in 0–5-yr-olds are not standard in well-child clinics, and the encouragement of adequate oral health knowledge is not part of routine care. Electronic health (e-health) offers new routes for health promotion (19–21). Since 94% of parents in the Netherlands have access to the internet, a web-based intervention could increase the scale and sustainability of implementation (22). Via the internet, parents can access preventive interventions easily at any time via various devices, making implementation relatively inexpensive. A web-based film that demonstrates appropriate oral health behaviors to parents delivered in well-child care could therefore be an effective way of informing parents.

The aims of this study were: (i) to assess whether a web-based film about oral health routines in well-child care improved parental knowledge of oral health; and (ii) to determine whether the film had an effect over the longer term.

## Material and methods

### Study design

This was a non-blinded quasi-experimental study. The intervention group were assessed at three time points: (i) a pre-intervention baseline measurement; (ii) a post-intervention measurement, immediately after watching the film; and (iii) a follow-up measurement 6 months after watching the film. The control group had one measurement, made simultaneously with the post-intervention measurement of the intervention group, at which time they were also offered the opportunity to watch the web-based film. To obtain a group of controls with a similar motivation for watching the film as in the intervention group, the control group included only those who had watched the film. In this way, we could prevent selection bias. We then assessed the effects of the intervention by comparing the differences in oral health knowledge scores between the intervention and the control group at the post-intervention

measurement. We further assessed the increase in oral health knowledge scores of parents in the intervention group by comparing the post-intervention and the follow-up measurements of this group with their baseline measurements.

### Study setting and participants

Included in the study were parents of 0–5-yr-olds living in urban or rural areas in the Netherlands, and parents who attended well-child clinics in municipalities in the provinces of Zeeland, South Holland, and Flevoland (Fig. 1). Parents who were not able to read Dutch, English, Moroccan, or Turkish were excluded. The study took place in routine well-child care settings, with all parents from any given clinic being allocated to either the control or intervention group. Well-child clinics for both groups were selected based on comparability of the regions concerned, in order to minimize the likelihood of selection bias. Since doctors and nurses in well-child clinics serve entire clinics, five clinics were allocated to the intervention group and five clinics were allocated to the control condition. Thus, parents were assigned to the intervention or control group depending on the specific well-child clinic they visited. Doctors and nurses at the well-child care clinics invited parents to participate in the study. These doctors and nurses spoke fluent Dutch and moderate levels of English. Informed consent was obtained from all participants. Data were anonymized to protect the privacy of the responses. The research did not require a full assessment by a medical-ethical committee, based on the Dutch law, but was reviewed and approved by the quality and research ethics board of the Netherlands Organization for Applied Scientific Research (TNO) and was conducted in accordance with the guidelines of the 1964 Helsinki Declaration.

### Intervention

The intervention was the viewing of the 8.5 min web-based information film entitled ‘Healthy teeth for children’. This film was designed by oral health promotion professionals working at the Netherlands Organization for Applied Scientific Research TNO and produced by Elan Productions (Elan Productions, Aadorp, the Netherlands). The film aimed to enhance knowledge and attitudes about oral health-related behavior for parents of children aged 0–5 yr. It included standard oral health recommendations about how to care for children’s teeth until the age of 5 yr (see Table S1). To be comprehensible for parents of all levels of oral health literacy, the script was developed using plain language. The persons in the film were mothers and a female oral health professional, and the narrator was a woman. The film was translated into Moroccan, Turkish, and English, the three most commonly spoken foreign languages in the Netherlands (23).

The film displayed five challenges in dental prevention in children, using five scenarios. In the first scenario, a 5-yr-old boy and his mother were taught by an oral hygienist how to brush his teeth appropriately with fluoride toothpaste. The second scenario was of a 2-yr-old boy and his mother showing how a caregiver should help a toddler brush his teeth twice a day in the home situation. The next scenario was about food intake and showed that drinking from a cup is preferable to drinking from a bottle. Advice

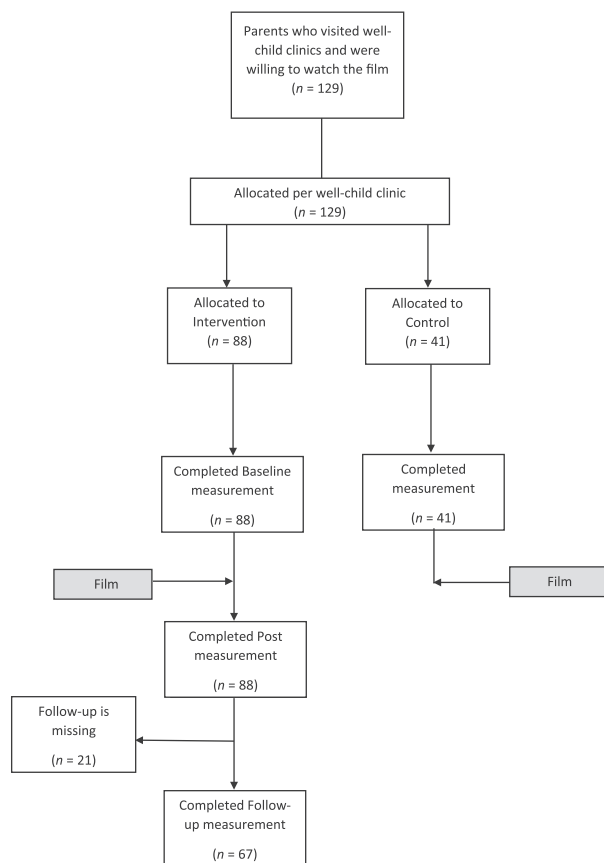


Fig. 1. Flow chart of participants. The control group was restricted to those parents who watched the film after they filled in the questionnaire, to select the parents who were similarly motivated to watch the film as in the intervention group.

was also given about not drinking anything else than water when lying in bed. The fourth scenario showed a baby drinking lemonade from his bottle while shopping with his mother, and emphasized that water should be the preferred drink in this case. The last scenario showed a child having its first dental visit, recommended at the age of 6 months (when the first tooth erupts). At the end, the film provides a short summary in text of all guidelines on keeping children's teeth clean and healthy.

The film was piloted among 48 parents visiting well-child care clinics in the province of Zeeland in The Netherlands. All participants in the pilot study thought the film was clear, and 79% of them thought the film duration to be good; the other 21% thought it was too long. Based on this pilot, the film was shortened.

#### Procedure: instrument

We developed a 12-item questionnaire on parental oral health knowledge (Table 1), and used this questionnaire to assess the effectiveness of the film. The questionnaire was tested among the 48 parents in the pilot study. The Dutch language questionnaire was translated into Turkish and Moroccan, adhering to international agreed guidelines for securing cultural and semantic equivalence, including forward-backward translations (24).

#### Procedure: intervention group

Parents in the intervention group were asked to complete the same questionnaire on three occasions: (i) at the pre-intervention baseline; (ii) at post-intervention immediately after watching the film; and (iii) at a follow-up measurement, 6 months after watching the film. First, they were asked to complete the questionnaire at the well-child clinic before the intervention. They received a card with the link to the film's website and a personal log-in code and were asked to watch the film online at home. Parents could choose in which language they watched the film. Immediately after watching the film online, the participants were asked to complete the post-intervention measurement online. Parents who did not complete the post-intervention measurement were excluded from all analyses. After 6 months, parents in the intervention group were asked to complete the questionnaire again.

#### Procedure: control group

The control group received care as usual (promotion of oral health knowledge is not part of routine care). Parents who were allocated to the control group were asked to complete the same questionnaire at the well-child clinic.

After responding to the questionnaire, parents were offered the opportunity to view the web-based film several weeks after filling the questionnaire. Analyses for the control group were restricted to those who were willing to watch the film at follow-up ( $n = 41$ ).

#### Background variables

The educational level of the mother was recorded and categorized ( $\leq 10$  yr of education was coded as low educational level;  $> 10$  yr of education was coded as a high educational level). This decision was made in accordance with the International Standard Classification for Education 2011 (25). Other background variables were the age of the child with an appointment at the well-child clinic, the ethnicity of the mother, and the total number of children in the household.

#### Outcome measures

The primary outcome was parental oral health knowledge. There were twelve questions addressing levels of knowledge. All the questions had one correct answer, so the total score could range between 1 and 12 (Table 1).

#### Power and sample size

Sample size was determined based on the potential to detect an effect size of 0.5 standard deviation (SD) in mean oral health-related knowledge score (range of scores 1–12) relative to the control group (knowledge score = 8.1, SD = 2.2) at an alpha of 0.05 and with a power of 80%. This led to a required sample size of 63 persons per group.

#### Statistical analyses

We first described the background characteristics of the two groups before assessing the effects of the intervention on dental knowledge by comparing the intervention group's post-intervention measurement and the control group's measurement using independent-sample *t*-tests.

Table 1

*Parental Oral Health Knowledge Questionnaire (every correct answer is 1 point of knowledge score, with a maximum score of 12)*

| Questions   | Answer options   |
|---|--|
| 1. Generally speaking, at what age does a baby get its first tooth  | Open-ended question  |
| 2. At what age is the set of baby teeth generally complete  | Open-ended question  |
| 3. When do you need to start brushing children's teeth When a child . . . .   | Can brush his or her own teeth/Is around 2 yr old/Has a few teeth/<br>Gets his or her first tooth/I don't know |
| 4. How often should the teeth of a child (aged between 2 and 5) be brushed  | Never/Not every day/. . . . . times a day/I don't know   |
| 5. Up to the age of 5, you need to brush a child's teeth with:  | Toothpaste for adults/Toothpaste for toddlers/Only with water/It doesn't make a difference/I don't know        |
| 6. Up until what age do you need to brush your children's teeth even if they are also brushing themselves   | This is not necessary/Is. . . . years old/I don't know   |
| 7. Should a child rinse his or her mouth with water after brushing  | Yes/No/It doesn't make a difference/I don't know   |
| 8. Can milk be harmful to baby teeth  | Yes/No/I don't know  |
| 9. Many children receive 3 meals a day. How many times a day are children allowed to have something else to eat or drink (excluding water or tea without sugar) | Open-ended question  |
| 10. What is better for the baby's teeth: drinking from a bottle or drinking from a cup?   | Feeding bottle/Cup/It doesn't make a difference/I don't know   |
| 11. What can a child still drink before going to bed after brushing his or her teeth?   | Milk/Only water or sugar-free tea/I don't know   |
| 12. At what age should the first dental check-up be? When a child . . . .   | Has toothache/Is. . . . . years old/I don't know   |

Cohen's *d* effect sizes were calculated (25). We then determined the persistence of the effects in the intervention group by comparing the follow-up measurement with the baseline measurement using paired-sample *t*-tests. Statistical analyses were performed using SPSS 22.0 (IBM, Armonk, NY, USA) and a *P* value <0.05 was considered statistically significant.

## Results

### Background characteristics

Eighty-eight parents in the intervention group and 41 parents in the control group enrolled in the study and could be compared (Fig 1). Parents who completed the questionnaire were mainly mothers, which is in line with assumptions that mothers are often the caregivers who visit the well-child clinic with their child. The sample was predominantly Dutch. We found a significant difference between the intervention and control groups for mean number of children in the family (intervention group: 1.8, SD = 0.9 vs. control group: 2.3, SD = 1.5; *P* = 0.048; Table 2). There were also differences between the two groups for ethnicity, with 9% migrant mothers in the intervention group and 0% in the control group.

### Effect of the intervention

Table 3 shows mean levels of parental oral health knowledge scores for baseline, post-intervention, and follow-up measurements in the intervention and control groups. Parental oral health knowledge at post-intervention measurement was higher in the intervention group than in the control group [means 11.1 (SD 1.3) vs. 7.1 (SD 2.0), *P* < 0.001]. In the intervention group,

parents had higher knowledge scores at post-intervention measurement than at baseline [mean 11.1 (SD 1.3) vs. 6.9 (SD 1.7), *P* < 0.001] and the difference between the baseline and post-intervention measurement was large; Cohen's *d* = 2.82. At follow-up, 67 parents in the intervention group completed the questionnaire, reporting higher knowledge scores than at baseline [9.1 (SD 1.3) and 7.2 (SD 1.7)], yielding a Cohen's *d* of 1.25.

Table 4 shows the proportion of correct answers for parental oral health knowledge per item in the intervention group at post-intervention measurement and in the control group.

There were no differences in parental knowledge scores by child age: mean scores for parents of young children and mean scores for parents of older children

Table 2

*Background characteristics of the participating parents of children aged 0–4 yr*

|  | Intervention group<br><i>n</i> = 88<br>% | Control group<br><i>n</i> = 41<br>% | <i>P</i> value |
|--|--|-------------------------------------|----------------|
| Ethnicity of mother                    |  |                                     |                |
| Dutch                                  | 91                                       | 100                                 | 0.06           |
| Non-Dutch                              | 9  | –                                   |                |
| Educational level of mother            |  |                                     |                |
| Low                                    | 54                                       | 51                                  | 0.76           |
| High                                   | 46                                       | 49                                  |                |
| Age child (yr)                         |  |                                     |                |
| 0–1                                    | 69                                       | 66                                  | 0.91           |
| 1–2                                    | 21                                       | 22                                  |                |
| 2–4                                    | 10                                       | 12                                  |                |
| Mean number of children in family (SD) | 1.8 (0.9)                                | 2.3 (1.5)                           | 0.048          |

Table 3

Parental oral health knowledge scores at baseline, post-intervention and follow-up measurement in the intervention group and Cohen's *d* effect sizes

|   | Baseline mean (SD) | Baseline – Post-intervention |                     |                  | Baseline – Follow-up |                     |                  |
|---|--------------------|------------------------------|---------------------|------------------|----------------------|---------------------|------------------|
|   |                    | Post-intervention mean (SD)  | Difference (95% CI) | Cohen's <i>d</i> | Follow-up mean (SD)  | Difference (95% CI) | Cohen's <i>d</i> |
| Intervention ( <i>n</i> = 88)                                     | 6.9 (1.7)          | 11.1 (1.3)                   | 4.2 (3.8–4.6)       | 2.82             | 9.1 (1.3)            | 1.9 (1.5–2.3)       | 1.25             |
| Control ( <i>n</i> = 41)  | n.a.               | 7.1 (2.0)                    | n.a.                |                  | n.a.                 | n.a.                |                  |
| Difference intervention – control (mean, 95% CI) Cohen's <i>D</i> |                    | 4.0 (3.3–4.7)                | 2.64                |                  |                      |                     |                  |

CI, confidence interval; n.a., not applicable.

were not different at baseline, post-intervention, or at the follow-up measurement. Levels of knowledge tended to be higher for better educated parents at all measurements. However, there were no differences between the intervention and the control group by parental education, or for the changes from baseline to post-intervention measurement or to follow-up measurement in the intervention group.

## Discussion

To the best of our knowledge, this is the first study to assess the 6-month effect of a web-based film about oral health routines in well-child care in order to improve parental knowledge about oral health. We found that parental knowledge scores increased immediately after watching the film. This improvement persisted after 6 months, even though parental knowledge scores were lower than they were immediately after watching. The effect sizes for the immediate effect of the film and the 6-months follow-up effect were both large (26). The demonstration of the long-term effect of the film makes the current study unique (14).

The difference in knowledge between the parents who received the intervention and the parents in the control group was consistent with the results of the few prior studies on this topic (14–16). An explanation for the improvement in knowledge could be our use of the concept of modeling in the film. Film modeling can facilitate the transfer of knowledge, reduce anxiety, improve self-care, and have a positive effect on the self-efficacy of parents (16–18,27). Film or video interventions have been shown to be effective in improving health knowledge in other health settings, such as a video intervention about Ebola and a short video for parents about how to help children cope with fearful situations (28,29).

We also found a sustained effect of the intervention on the oral health knowledge in our study. Previous studies with a film for parents on infant oral hygiene evaluated the effectiveness on oral health knowledge for the short term only (12–14). Possible explanations for the long term improvements in knowledge found in the current study might be the use of verbal summaries of recommendations, the use of clear and short messages, the illustration of the consequences of unfavorable

parental oral health behavior, and the combination of verbal and visual repetition of information in the film (30). The film was also pretested among parents and adjusted based on their comments. The improved film may have captured parents' interest in the film and ignited understanding of the information, which subsequently improved their memory.

A strength of our study was its embedding in routine care and its design to compare a new intervention with routine care. Moreover, we included intervention and control groups, both of which were willing to watch the film and, therefore, were likely to have similar levels of motivation. It is known that parents with lower levels of education are more likely to drop out; they might have lower levels of health literacy and be less healthy than parents with higher levels of education (31,32). Thus, to minimize selection bias, we analyzed groups with similar motivation

Table 4

Proportion of correct answers on oral health knowledge items of the questionnaire for the intervention (post-intervention measurement) and the control group measurement

|   | Intervention<br><i>n</i> = 88<br>% correct | Control<br><i>n</i> = 41<br>% correct |
|---|--|---------------------------------------|
| Age at which baby's first tooth erupts                              | 93   | 73                                    |
| Age at which the set of deciduous teeth is generally complete       | 71   | 20                                    |
| Age at which to start brushing children's teeth                     | 100  | 95                                    |
| Advised frequency of toothbrushing per day for children aged 2–5 yr | 94   | 76                                    |
| Type of toothpaste until the age of 5 yr                            | 100  | 96                                    |
| Age until which helping brushing children's teeth is needed         | 93   | 15                                    |
| Rinsing with water after toothbrushing                              | 94   | 51                                    |
| Milk harmful for baby teeth   | 78   | 44                                    |
| Maximum frequency of eating or drinking per day                     | 92   | 10                                    |
| Recommended way of drinking   | 100  | 85                                    |
| Recommended drink before going to bed                               | 100  | 95                                    |
| Recommended age for first dental check-up                           | 99   | 49                                    |

to watch the film. The improved knowledge found in this study can therefore genuinely be assigned to watching the film and not to differences in motivation levels.

Our study also has some limitations. First, parents were not randomly assigned to the control or intervention groups, but were instead assigned depending on the specific well-child clinic they visited. Some well-child clinics were intervention locations, and some were control locations; this might have resulted in selection bias. However, we selected well-child clinics for both groups from comparable regions to minimize that likelihood. The intervention group and control group differed in the proportions of mothers with a migrant background (intervention group 9%, none in control group). Migrant parents have lower levels of dental attendance and less knowledge of oral health than the native population, so mean knowledge scores would have been lower in the intervention group (33). This will presumably have led to an underestimation of the real effect in our study. Finally, the size of the control group was smaller than required by the power analysis, whereby a sample size of 63 participants was originally determined. Since well-child clinics must address many different topics, oral health is seen as being of less importance. In addition, some of the well-child clinics had to deal with a shortage of (and changes in) workforce. These issues might be reasons for the low number of participants. However, since we found substantial effects on knowledge and a large difference in mean parental oral health knowledge scores between the intervention and control groups (Cohen's  $d = 2.64$ ), we may conclude that the effect is real.

The findings show that a web-based film is a promising method to promote knowledge on oral health among parents. The study opens up a promising avenue for addressing oral health in health settings, such as well-child care. Major advantages of this method of oral health promotion are lower costs, a wider reach, and a straightforward implementation in healthcare settings. Dissemination is probably best left to trusted intermediaries, such as well-child care. It is known that educational interventions, like a web-based film alone, have a limited impact on oral health, but nevertheless could be useful for initiating oral health promotion in children. Further research is needed to determine whether the improved oral health knowledge scores can contribute to better oral health outcomes. Accordingly, a web-based film could be used in practice as part of a longer, multicomponent oral health promotion intervention in the well-child care setting. Evaluation of the effectiveness of the film in different settings (such as physician practices, dental practices, or pharmacies) should be undertaken. Further research is needed to address the effects of a web-based film on outcomes other than parental knowledge, such as parental self-efficacy, attitude, intentions, and perceived behavioral control, which are important factors for changing parental behavior for the oral health of their children (34–38).

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*Conflicts of interest* – The authors declare no conflict of interest.

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## Supporting Information

Additional Supporting Information may be found in the online version of this article:

**Table S1.** Advice from the Dutch Dental Advisory board 'Ivoren Kruis'.