Optimizing oral health: Towards a tailored, effective and cost-effective dental care

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Chapter 4

Value for money in preventive care: economic evaluation of two different caries prevention programmes compared with standard care in a randomized controlled trial in the Netherlands

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Introduction

Health care expenditures related to dental care have increased rapidly in recent years. For instance, in the Netherlands, the costs of dentistry increased by 10% between 2007 and 2010 (Poos et al., 2008; Slobbe et al., 2011). In many countries, increasingly high health care expenditures have raised questions about the amounts of money that should be spent on health care, as well as the justifications for these amounts. One prerequisite in the search for optimal allocation of scarce societal and health care resources is economic evaluation of health care interventions. In economic evaluations, the costs of an intervention are compared to the intervention's benefits, and expressed in some meaningful manner. Economic evaluations can be used to determine the relative efficiency of a new intervention compared with one or more alternatives.

Caries is one of the most prevalent diseases among children worldwide: 60-90% of all schoolchildren experience one or more carious lesions in their primary teeth. Caries is present, although unequally distributed, throughout all socioeconomic classes in both developing and developed countries (Bagramian et al., 2009; Petersen, 2003). As a result, a large proportion of the total dentistry budget is spent on treatment of dental caries; in the Netherlands, this share is 60% (Slobbe et al., 2011). In 2007, costs related to caries were 1.8 billion euros. This amount is equal to the costs related to coronary heart disease (Poos et al., 2008). Therefore, prevention of caries may realize considerable savings.

Many caries prevention programmes focus on professionally performed fluoride applications (Marinho et al., 2002). Some programmes focusing on intensified self-care have been developed during the past couple of decades (Carvalho et al., 1992; Ekstrand et al., 2000; Ekstrand and Christiansen, 2005; Hausen et al., 2007). Considering the allocation of scarce (health care) resources, it is important to have insight into both the costs and the effects of different prevention strategies and thus their relative cost-effectiveness. Such insight can help communities make best use of budgets for oral health. At this time, this kind of information is lacking.

This study aims to assess the cost-effectiveness of caries treatment and prevention strategies. This cost-effectiveness study was performed alongside a randomized controlled trial evaluating the effects of two caries prevention strategies compared with regular dental care among 6-year-olds. Based on earlier literature (Carvalho et al., 1992; Ekstrand and Christiansen, 2005; Marinho et al., 2002), this trial included a regular treatment and prevention approach (control group), an increased professional fluoride application approach (IPFA), and a non-operative caries treatment and prevention (NOCTP) approach. A full description of the evaluated strategies as well as the clinical results of this trial is reported in Chapter 2.

Methods

Interventions and participants

From September 2006 to September 2008, all parents of regular patients, aged 6.0 years (± 3 months) of a large dental clinic in 's-Hertogenbosch (a medium-large city in the Netherlands with some 150.000 inhabitants) were asked for consent to include their child in a randomized controlled trial on caries-preventive strategies. An anticipated dropout percentage of 20% was taken into account. A total of 230 children were included in this study and were randomly assigned to each of the following three groups:

1) Control group:
   This group received standard dental care: dental check-ups twice a year, including professional fluoride gel applications (1.23% F-) and preventive pit and fissure sealants after eruption of the permanent molars, on a routine basis. The threshold for placing restorations was set at the dentine threshold (d3/D3-level).

2) Increased professional fluoride application (IPFA) group:
   Like the control group, the IPFA group received standard dental care but the IPFA group had two additional professional fluoride gel applications. Children in this group therefore received a total of four professional fluoride applications per year.

3) Non-operative caries treatment and prevention (NOCTP) group:
   The NOCTP protocol was copied from a study that Ekstrand and Christiansen performed in Nexø, Denmark (2005). Recall intervals were individualized using criteria described by Carvalho et al. (1992): caries activity, oral hygiene, eruption stage of permanent molars, and cooperation of child and parent. At each visit,

areas where plaque removal and fluoride toothpaste needed to be more effectively applied were identified. If, at the next visit, a progression of the caries process was recognized, fluoride varnish was applied locally. If, at the following visit, there was still no stabilisation or caries inhibition, the surface was sealed or restored.

The study was approved by the Medical Ethical Committee of the VU University Amsterdam, the Netherlands. Protocol number NL13709.029.06.

Time horizon

Data on time and resource use, and data on effectiveness were collected for a three-year time period.

Perspective

This study was conducted from both a health care and a societal perspective. Adopting a health care perspective, cost inclusion is limited to all medical costs: i.e. the costs of the treatment and prevention of caries. Adopting a societal perspective, all relevant societal costs are additionally included, such as out-of-pocket expenses (toothbrushes, toothpastes), travel costs to the clinic, travel time and time necessary to accompany the child, regardless of where these costs fall (Drummond et al., 2005).

Costs

Health care resource use and costs

Calculations were performed according to the recommendations in the Dutch manual for costing (Tan et al., 2012; Hakkaart-van Roijen et al., 2011). A bottom-up micro-costing approach was used to calculate medical costs. Instead of using fixed prices for each treatment strategy, cost-prices were determined per individual patient based on the number of minutes the dental professional spent on the patient.

At every visit to the dental clinic, the number of minutes that the dentist and/or the dental preventive nurse and/or dental hygienist spent on each patient was documented.

Since the Dutch manual for costing (Tan et al., 2012; Hakkaart-van Roijen et al., 2011) does not provide reference prices for dental professionals, cost prices in this study were based on the actual expenditures of the dental clinic. These cost prices were based on both gross incomes of the dental professionals and a share of the supplementary costs of the dental clinic (e.g., costs for materials, housing and management).

Gross incomes and all other expenditures of the dental clinic were divided by the number of 'productive hours' (hours spent on patient care) of the dental professionals (dentists, oral hygienists and dental nurses). It was assumed that 88.5% of working hours were spent on patient care and 11.5% on non-patient work, such as training, conference meetings and non-patient administrative work (Kalf et al., 2010). The dental clinic's costs were divided among the various professionals based on their respective gross incomes. The cost price per minute was calculated to be € 2.60 for a dentist, € 0.78 for a dental hygienist and € 0.70 for a dental nurse. To calculate the medical costs, the calculated cost prices per minute were multiplied by the number of minutes that the dental professional spent on the particular patient.

Societal resource use and costs

At every visit to the dental clinic, data was collected on travel time and travel distance. Travel costs were calculated based on a price of € 0.20 per kilometre for both private (e.g., car) and public transportation) (Hakkaart-van Roijen et al., 2011). Time costs of the adult accompanying the child consisted of travel time, time with the dental professional and an estimated mean waiting time of 7 minutes (Nivell/Dutch Consumers' association, 2002). Time costs were valued at € 12.50 per hour (Hakkaart-van Roijen et al., 2011).

To correct for the rise of general levels of prices of goods and services (inflation), prices were converted to 2011 euros.

Effects

Outcomes of the clinical trial were used to establish the effectiveness of the programs. Effectiveness was expressed as the number of prevented DMFS. DMFS scores were determined based on clinical examinations that were carried out by a dentist who was blinded to the treatment groups. Due to medical-ethical objections, no radiographs were taken for the purpose of this study. As a result, caries was only clinically assessed. Caries was scored at D3-level.

Discounting

In order to correct for time preferences, costs and effects occurring in the 2nd and 3rd year were discounted 4% and 1.5%, respectively, as prescribed in the Dutch pharmacoeconomic guidelines (College voor Zorgverzekeringen, 2006). For a background paper on discounting see Brouwer et al. (2005).

Cost-effectiveness

Incremental cost-effectiveness was expressed as the additional costs per prevented DMFS. The incremental cost-effectiveness ratio (ICER) was calculated by dividing the differences in costs between the experimental group and the control group by the differences in effects (Equation). Two ICERs were calculated: IPFA compared with regular care and NOCTP compared with regular care.

Equation

$$\text{ICER} = \frac{\text{Costs}_{\text{experimental group}} - \text{Costs}_{\text{control group}}}{\text{DMFS}_{\text{experimental group}} - \text{DMFS}_{\text{control group}}}$$

Sensitivity and scenario analyses

Univariate sensitivity analysis was conducted to assess the impact of labour costs on the study results. In the base case analyses, the salaries for a dentist, a dental hygienist, and a dental assistant were € 75,000, € 30,000, and € 25,000 per one full-time equivalent (FTE), respectively. Varying the dentists' salaries from € 45,000 to € 100,000, the dental hygienists' salaries from € 25,000 to € 45,000, and the dental assistants' salaries from € 20,000 to € 35,000 resulted in cost prices per minute of € 1.70 and € 3.03 for a dentist, € 0.67 and € 1.08 for a dental hygienist, and € 0.66 and € 0.95 for a dental assistant.

Since dentist salary turned out to be the most influential factor on the price per minute, sensitivity analyses were conducted with several hypothetical salaries, varying from € 45,000 a year per FTE (estimated starting salary of a newly graduated dentist) to € 100.000 a year per FTE (salary based on maximum norm-income of € 105.075 for an experienced dentist with full management responsibilities) (NZA 2011).

Task delegation and task reallocation have become increasingly relevant in both medicine and dentistry (Horrocks et al., 2002; Jerkovic et al., 2010). These changes would reduce the workload for dentists to restorative treatment, endodontic treatment, and provision of fixed and removable prosthetic care, and increase the workload of dental hygienists. For the cost-price calculations, an assumption was made that the workload for dental hygienists in the clinic would have increased from 4.0 to 5.3 FTE and dentists' workload would have decreased from 5.3 to 4.0 FTE. Therefore, the dental clinic's costs and the allocation of these costs to the dental professionals would change, resulting in a cost price per minute increase from € 0.78 to € 0.81 for a dental hygienist and a cost-price per minute increase from € 2.60 to € 2.69 for a dentist.

Missing data

Children who dropped out of the study but remained patients of the clinic continued to receive regular care (n = 51). These subjects' study data were excluded from all data analyses.

Statistical analysis

Nonparametric bootstrapping (Campbell and Torgerson, 1999) was used to address the uncertainty associated with the fact that the data that were collected for the measures of incremental costs and effects were based on a sample of the population. To construct confidence intervals around the differences in mean costs and effects between the caries prevention strategies, 10,000 random samples were drawn from the data. The difference in costs and effects of these 10,000 samples were displayed in cost-effectiveness planes in scatterplots where each point in the cloud represents the outcomes of one of the randomly drawn samples. Moreover, the bootstrap results were presented in cost-effectiveness acceptability curves. The curves indicate the probability (placed on the y-axis) of the IPFA or the NOCTP strategy being cost-effective at different willingness-to-pay values (placed on the x-axis) for one prevented DMFS.

SPSS Statistical Software Package 20.0, Stata SE 12.1 and MS Excel 2010 were used to conduct the statistical analyses.

Results

Patients

A total of 179 children completed the three-year trial: 63 in the regular dental care programme, 62 in the IPFA programme and 54 in the NOCTP programme. Dropout rates were highest in the NOCTP group (32% *vs.* 22% in the IPFA group and 17% in the control group), resulting in a mean dropout rate of 22%. In the NOCTP group, the main reason for ending participation was the burden of travel; in the IPFA-group and control-group, the main reason was the inconvenience for the child. The baseline dmfs/DMFS of children dropping out of the study did not significantly differ from baseline dmfs/DMFS scores of children who did not drop out.

Costs

Resource use

Table 1 shows the direct medical and non-medical cost-related variables. In the first year, the contact time for children in the NOCTP group was twice that of children in the control group. By the third year of the trial, the difference in contact time between these two groups had disappeared. Similarly, in the first year, travel time was higher in the NOCTP group than in the control group, but in the third year, travel time levelled out. Contact time and accompanying time in the IPFA group was 50% higher than in the control group. Also, the mean number of visits and distance travelled (in kilometres) were higher in the IPFA group (45% and 60%) than in the regular care group.

In Table 2, both discounted and undiscounted cost outcomes are presented from a health care perspective and a societal perspective for the total period of 3 years. Mean total health care costs were € 106 for the control group, € 201 for the IPFA group and € 140 for the NOCTP group. The total societal costs (required parental investments, in terms of accompanying time, travel time and travel costs) were € 47, € 78 and € 48, respectively.

Effectiveness

The discounted and undiscounted caries increment scores of the three groups are presented in Table 3. Compared with the control group, the IPFA strategy had on average reduced the DMFS score by 0.13 ($t = -0.76$, $p = .44$) and the NOCTP strategy had reduced the DMFS score by 0.32 on average ($t = -2.17$, $p = .033$) three years after the start of the trial.

Incremental cost-effectiveness

From a health care perspective, the ICER of the IPFA group compared with regular care was € 733 per additional prevented DMFS, and from the societal perspective, the value was € 977 (Table 4). The ICERs of the NOCTP group compared with regular care were € 108 from the health care perspective and € 111 from the societal perspective.

Sensitivity and scenario analysis

In a scenario where a dental hygienist would have performed all of the preventive visits in both groups (assuming equal effectiveness between dentist and dental hygienist), the ICER would have been € 532 per prevented DMFS in for the IPFA programme and € 41 for the NOCTP programme (both from a societal perspective) (Table 5). Varying the salary of the dentist would result in larger differences in ICER values: between € 87 and

€ 274 per extra prevented DMFS in the NOCTP and between € 715 and € 1402 per extra prevented DMFS in the IPFA group.

Uncertainty

The results of bootstrapping (10,000 bootstraps) are presented separately for both experimental groups and for both the health care perspective and the societal perspective in Figure 1. For the NOCTP group, approximately 95% of the bootstrapped replications are on the east side of the cost-effectiveness plane, indicating an increase in prevented DMFS compared to that of the regular care group; for the IPFA group, this was approximately 70%. About half of the bootstrap replicates for the NOCTP group are above and about half are below the horizontal axis; this indicates that costs for the NOCTP group could either be lower or higher than the costs for the regular dental care. For the IPFA strategy, all bootstraps indicate an increase in costs compared to regular care.

The cost-effectiveness acceptability curves are presented in Figure 2. These curves indicate the probability of the IPFA approach or the NOCTP strategy being cost-effective at different willingness-to-pay values for a prevented DMFS. As Figure 2 shows, considering a societal willingness-to-pay of € 100 in 3 years for an additional prevented DMFS, the probability of the NOCTP strategy being cost-effective is approximately 95% and the probability of the IPFA strategy being cost-effective is approximately 2%.

Discussion

In this study, the non-operative caries treatment and prevention strategy, based on intensified and individualized self-care, was more effective but more costly than regular caries prevention comprising two dental preventive visits a year, professional fluoride application and preventive sealing of newly erupted permanent molars. The additional health care cost to prevent one DMFS was € 108. If the societal perspective was adopted (taking into account parental accompanying time and travel costs) the additional cost was € 111. An alternative approach comprising the control strategy with additional professional fluoride applications (IPFA) was slightly (but insignificantly) more effective than regular care and resulted in ICERs of € 733 (health care perspective) and € 977 (societal perspective) per prevented DMFS.

In NOCTP group, the largest investments were made in the first year of the trial (€ 64 in the first year, € 47 in the second year and € 35 in the third year) resembling the trend that was found in an economic evaluation of an individually designed patient-centred regimen for caries control performed in Finland (Hietsalo et al., 2009). In both current study and Hietsalo et al.'s study (2009), the costs of the experimental group dropped below the costs of regular care in the third year. In Hietsalo et al.'s study (2009), the ICER was € 34 per prevented DMFS from a health care perspective, which is considerably lower than our findings. This difference may be explained by the differences in cost-prices and the fact that a major part of the regimen was conducted solely by dental hygienists. The results of the Finnish study closely resemble the ICERS of the scenario analysis in the current study; assuming prevention would be executed by dental hygienists, ICERs of the same magnitude were found (€ 37-€ 41).

This study had some limitations. For example, all calculations were based on the results of a relatively modest research population (n = 179). The dropout rate of 22% is comparable to those of other clinical trials in dentistry (Machiulskiene et al., 2002; Carvalho et al., 2010). Dropouts were not equally distributed among the treatment regimens. This may raise the question of whether the subjects who remained in the study were a selective group; the most engaged parents may have been more likely to follow through with the regimen. Since the initial mean dmfs-scores of these dropout children did not significantly differ at baseline, one can expect that this would not affect external validity (Vermaire et al., 2011). Note that reasons for withdrawal differed between groups: In the NOCTP group, the main reason was the burden of travelling, while in the IPFA group, the most reported reason was a perceived inconvenience for the child (e.g., tray with fluoride gel). This may indicate that the IPFA and the NOCTP programme are more burdensome than regular care. Compliance may be increased if parents and children are informed of all disadvantages and benefits in advance.

A second limitation of this study was that it only included data obtained in one (large) dental clinic. Nevertheless, the clinic can be considered to deliver dental care in a way that is comparable to that of many other practices in regular populations in the Netherlands. Further, there is no reason to believe that the NOCTP regimen cannot be introduced in other practices. Still, generalizability is dependent on the dental professional's attitude towards preventive dentistry.

A third limitation of this study was the rather short time period of the follow-up. In the study's three-year time period, the NOCTP strategy was more expensive than regular care. However, the NOCTP strategy may turn out to be cost-saving when it is applied over a longer period of time. After all, starting a restorative cycle is assumed to result in further investments during life.

Whether the findings of this study, based on a three-year time period imply that the NOCTP strategy can be considered cost-effective compared to regular care crucially depends on the societal willingness to pay for one extra prevented DMFS. If this exceeds about € 100, the probability of NOCTP being expected to be cost-effective exceeds 90% (Figure 2). To date, knowledge regarding the willingness to pay for dental care and oral health outcomes is limited. However, a recent study on willingness to invest among parents of 6-year-old children in the Netherlands reported an average total willingness to pay of € 31 per month to keep their children's teeth healthy until the age of 18 (Vermaire et al., 2012). Obviously, it is not completely clear how this translates into the value of one avoided DMFS. A time trade-off exercise may make these values tangible (Dolan et al., 1996). However, given that all three programs cost less than € 10 per month and the NOCTP strategy significantly reduces the DMFS score (thus giving the highest probability of improved oral health, at least up to the age of 9), the NOCTP strategy does appear to have the potential to be cost-effective.

In this study, dentists performed the intervention of the NOCTP group. However, it may also be suitable for this intervention to be partly performed by dental hygienists. So, we investigated what the impact on cost-outcomes would be if all preventive visits were to be performed by a dental hygienist, instead of the dentist, to make the results of this study comparable with earlier studies. The results of the scenario analysis imply that from a cost perspective, it may be favourable to have all preventive visits performed by a dental hygienist. However, we assumed that the effectiveness of the program would be equal to that of a case where a dentist performed the same work; whether this is true is uncertain. Many factors may influence efficacy and effectiveness of preventive efforts of dentists and dental hygienists, positively and negatively (Ohrn et al., 1996; Ohrn et al., 2008; Berndsen et al., 1993; Petersson and Brathall, 2000). However, prevention (both in periodontology and cariology) can be seen as a core business of the dental hygienist. It is not unlikely that a trend in differentiation within dental hygiene will develop. Several trials investigating caries prevention strategies were ones where interventions were performed partially or completely by oral hygienists and with good results (Hietsalo et al., 2009).

The NOCTP strategy indicated an increase in costs for the parents of (€ 47.81); the extra medical costs are covered by health insurance and therefore not directly paid for by the parent. Although the parental investment did not differ significantly in this study after the three years, there were notable differences in the first year. This may hamper follow-through on the NOCTP regime and hence broader implementation of the NOCTP strategy. This is highlighted by the fact that a proportion of the parents indicated the burden of travelling/sacrificing spare time as a reason to quit participation. Therefore, if one wishes to implement the NOCTP strategy, it will be important to comprehensively introduce the protocol to parents and to emphasize that the increased demand on parents will, in most cases, be temporary. In the IPFA group, the main dropout reason was perceived inconvenience for the child of the application of fluoride gel in trays. Application of fluoride by means of varnish may have resulted in different dropout levels.

To date, little scientific attention has been paid to the cost-effectiveness of dental care, and economic evaluations in preventive dentistry are rare. We encourage further research in this area. It would be interesting to further investigate the effectiveness and cost-effectiveness of non-operative caries treatment and prevention in other dental clinics. It would also be worthwhile to examine the effects of having all preventive visits performed by dental hygienist. Further studies in dental care, including ones that use quality adjusted life years (QALYs) as a generic health outcome measure, would increase the comparability of the cost-effectiveness of dental care with other types of care. Moreover, more research on the willingness to pay for dental care (outcomes) is needed to enhance interpretations of cost-effectiveness outcomes in dental care.

Conclusion

The non-operative caries treatment and prevention (NOCTP) regime was more effective and more costly than regular dental care. However, the benefits are likely to outweigh the additional costs, implying that this is a cost-effective strategy. Increasing the number of professional fluoride applications did not result in a statistically significant caries reduction but it did at higher cost. If the results of this study are confirmed in future research, broadly implementing non-operative caries treatment and prevention should be considered.

Table 1: Direct medical and non-medical costs-related variables

	Year 1		Year 2		Year 3		Total	
Mean contact time dentist in minutes (sd)								
NOCTP	14.40	(± 5.18)	11.07	(± 3.47)	8.85	(± 2.83)	34.32	(± 9.95)
IPFA	13.61	(± 4.57)	12.74	(± 4.15)	12.22	(± 4.78)	38.57	(± 12.91)
Control	8.70	(± 2.87)	9.71	(± 4.58)	9.00	(± 3.41)	27.41	(± 8.70)
Total	12.09	(± 4.95)	11.16	(± 4.30)	10.07	(± 4.09)	33.32	(± 11.71)
Mean additional contact time dental auxiliaries in minutes (sd)								
NOCTP	4.12	(± 1.85)	4.42	(± 1.97)	3.50	(± 1.65)	12.04	(± 2.81)
IPFA	13.82	(± 1.18)	13.06	(± 1.81)	12.41	(± 2.66)	39.64	(± 4.55)
Control	7.20	(± 2.11)	7.79	(± 2.39)	7.37	(± 2.00)	22.11	(± 4.05)
Total	9.84	(± 4.09)	9.72	(± 3.77)	9.61	(± 3.59)	26.46	(± 13.06)
Mean number of visits to dental clinic (sd)								
NOCTP	3.27	(± 0.87)	2.47	(± 0.54)	1.98	(± 0.42)	7.45	(± 1.44)
IPFA	3.94	(± 0.31)	3.71	(± 0.49)	3.55	(± 0.76)	11.26	(± 1.33)
Control	2.00	(± 0.53)	2.22	(± 0.57)	2.09	(± 0.56)	6.28	(± 1.02)
Total	3.05	(± 1.00)	2.81	(± 0.85)	2.56	(± 0.94)	8.35	(± 2.51)
Mean total travel distance to clinic in KMs (sd)								
NOCTP	21.1	(± 15.16)	16.4	(± 11.90)	12.9	(± 9.51)	50.4	(± 35.53)
IPFA	31.7	(± 36.69)	30.6	(± 36.98)	30.2	(± 37.34)	92.5	(± 110.93)
Control	18.2	(± 21.00)	21.1	(± 26.10)	18.1	(± 19.86)	57.4	(± 65.66)
Total	23.8	(± 26.91)	23.1	(± 28.10)	20.8	(± 26.47)	67.6	(± 80.58)
Mean total accompanying time in minutes (sd) Including travel time, contact time in clinic and waiting time (estimated at 7 minutes / visit)								
NOCTP	90.65	(± 37.98)	69.48	(± 27.63)	55.19	(± 20.67)	215.32	(± 77.97)
IPFA	109.68	(± 25.76)	103.54	(± 27.48)	99.09	(± 32.05)	312.32	(± 81.61)
Control	60.20	(± 24.27)	65.03	(± 26.15)	61.47	(± 22.68)	186.70	(± 64.87)
Total	86.74	(± 36.23)	78.89	(± 31.90)	71.25	(± 31.82)	236.88	(± 91.76)

NOCTP: Non Operative Caries Treatment and Prevention;
IPFA: Increased Professional Fluoride Application

Table 2: Discounted and not-discounted costs in year of participation and research group

Costs are converted to 2011 euros

	Year 1		Year 2		Year 3		Total		
							Discount rate Year 2 & Year 3		
Mean costs in € (95% CI of mean)							0%		4%
Health care costs									
NOCTP	61.64	(55.47-67.82)	47.46	(43.13-51.78)	35.89	(32.69-39.10)	144.99	(132.89-157.08)	140.46
IPFA	74.66	(69.72-79.60)	68.92	(64.40-73.43)	64.49	(59.12-69.87)	208.07	(194.04-222.10)	200.55
Control	35.64	(32.59-39.17)	39.93	(34.59-45.28)	35.32	(11.38-39.25)	110.89	(99.89-121.90)	106.69
Societal Costs									
Accompanying costs									
NOCTP	16.79	(14.05-18.18)	12.96	(11.13-14.12)	9.66	(8.54-10.60)	39.41	(34.09-42.54)	37.10
IPFA	22.10	(18.99-22.20)	20.60	(18.99-22.20)	19.42	(17.64-21.20)	62.12	(57.34-66.90)	59.86
Control	12.23	(10.58-13.34)	13.30	(11.46-14.40)	11.76	(10.55-13.03)	37.29	(33.01-40.36)	35.29
Travel costs									
NOCTP	4.60	(3.68-5.53)	3.53	(2.81-4.24)	2.70	(2.14-3.26)	10.84	(8.70-12.96)	10.49
IPFA	6.93	(4.89-8.96)	6.58	(4.56-8.60)	6.33	(4.34-8.32)	19.84	(13.80-25.88)	19.14
Control	3.97	(2.81-5.12)	4.55	(3.13-5.86)	3.79	(2.75-4.84)	12.31	(8.76-15.86)	11.85
Total Societal costs									
NOCTP	21.39	(18.07-23.63)	16.49	(14.20-18.23)	12.36	(10.85-13.72)	50.24	(43.54-55.17)	47.81
IPFA	29.03	(26.09-31.97)	27.18	(24.16-30.20)	25.75	(22.57-28.93)	81.96	(72.95-90.98)	78.97
Control	16.20	(13.68-18.35)	17.85	(14.88-20.28)	15.55	(13.59-17.65)	49.60	(42.57-55.85)	47.35
Total Costs									
NOCTP	83.03	(75.24-90.82)	63.95	(58.39-69.51)	48.25	(44.32-52.18)	195.23	(180.21-210.26)	189.13
IPFA	103.69	(97.70-109.68)	96.09	(90.15-102.04)	90.25	(82.95-97.55)	290.03	(271-76-308.30)	279.53
Control	51.84	(46.75-56.93)	57.78	(50.76-64.79)	50.87	(45.73-56.02)	160.49	(155.74-195.23)	154.43

NOCTP: Non Operative Caries Treatment and Prevention;
IPFA: Increased Professional Fluoride Application

Table 3: Discounted and not-discounted effect calculations compared with control group

Effects compared to Control Additional DMFS prevention after 3 years		**Effect**	
	Discount rate	**0%**	**1.5%**
Caries increment (ΔDMFS) (± sd)			
Control	0.47 (± 1.039)		
CI 95%	(0.209-0.728)		
NOCTP	0.15 (± 0.496)	0.32	0.31
CI 95%	(0.014-0.288)		
IPFA	0.34 (± 0.867)	0.13	0.13
CI 95%	(0.119-0.559)		

NOCTP: Non Operative Caries Treatment and Prevention;
IPFA: Increased Professional Fluoride Application

Table 4: Discounted and not-discounted ICER calculations for health care perspective and societal perspective

		Health Care Perspective			**Societal Perspective**	
		Discounting			**Discounting**	
		0%	**4% costs**		**0%**	**4% costs**
			1.5% effects			**1.5% effects**
NOCTP	**Δ costs**	34.10	33.77	Δ costs	34.74	34.70
	Δ effects	0.318	0.313	Δ effects	0.318	0.313
	ICER	**107**	**108**	**ICER**	**109**	**111**
IPFA	**Δ costs**	97.18	93.86	Δ costs	129.54	125.10
	Δ effects	0.130	0.128	Δ effects	0.130	0.128
	ICER	**748**	**733**	**ICER**	**996**	**977**

NOCTP: Non Operative Caries Treatment and Prevention;
IPFA: Increased Professional Fluoride Application;
ICER: Incremental Cost Effectiveness Ratio

Table 5: ICERs after sensitivity and scenario analyses

Intervention	Perspective	Salary dentist € 45.000	Salary dentist € 100.000	Intervention performed by dental hygienist
	Health care			
NOCTP		€ 71	€ 141	€ 37
IPFA		€ 469	€ 852	€ 211
	Societal			
NOCTP		€ 87	€ 274	€ 41
IPFA		€ 715	€ 1402	€ 532

ICER: Incremental Cost Effectiveness Ratio; NOCTP: Non Operative Caries Treatment and Prevention;
IPFA: Increased Professional Fluoride Application

Figure 1: Cost Effectiveness Plane

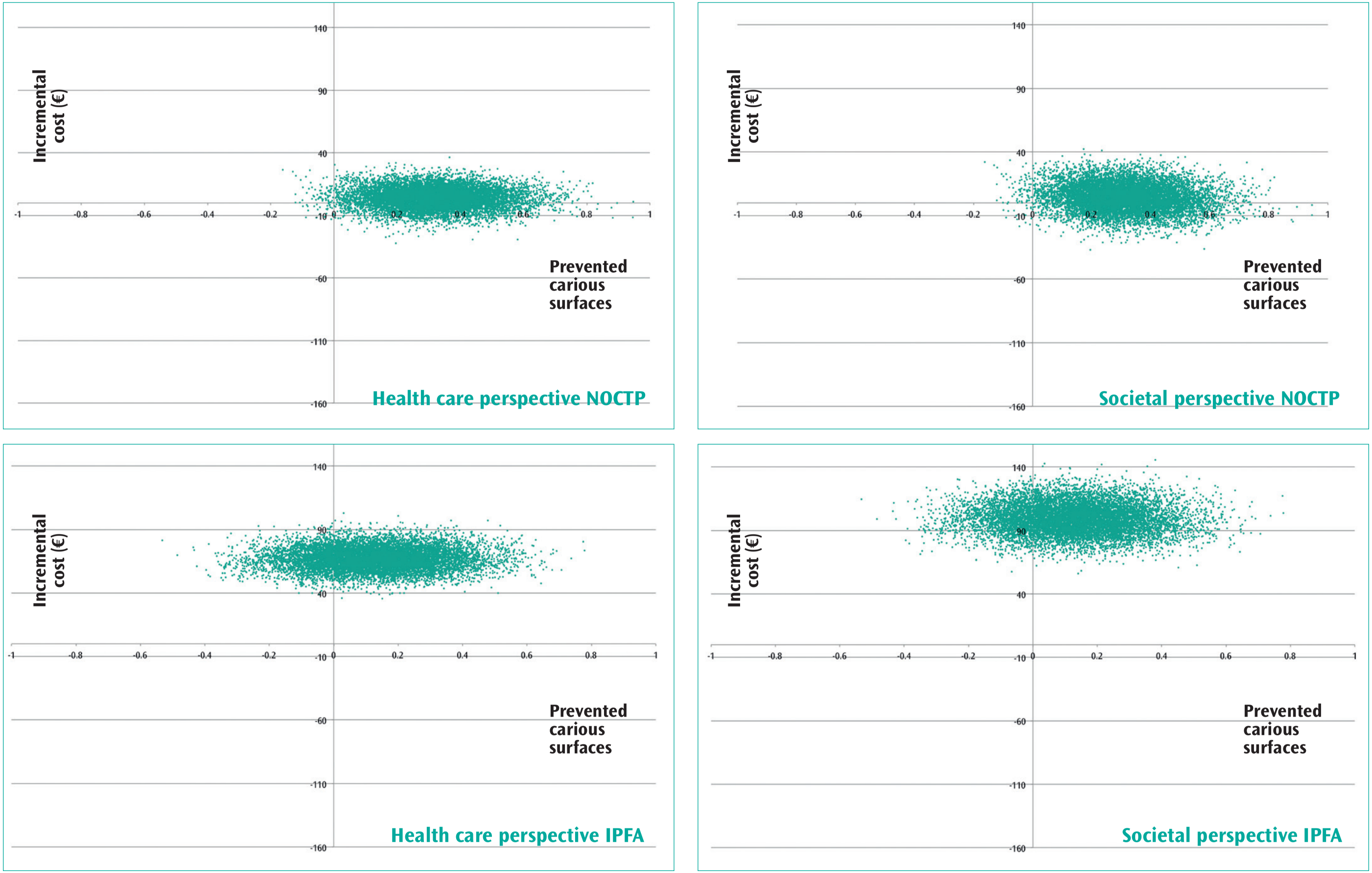

Figure 2: Acceptability curve: probability of number of bootstraps being cost-effective at different willingness to pay values (in €)