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

Vermaire, J.H.

Publication date
2013

Chapter 3

Non-participation in a randomized controlled trial: the effect on clinical and non-clinical variables

Non-participation in a randomized controlled trial: the effect on clinical and non-clinical variables

Introduction

Non-participation-studies reporting both clinical and non-clinical variables are scarce. A recent publication showed that non-participants of a study on a caries prevention program had lower scores of fluorosis and higher caries-levels in their permanent dentition than participants, but not in the primary dentition (Splieth et al. 2005). The authors suggested that these findings may be caused by a lower compliance of non-participating children with preventive measures and that they may be in greater need of caries prevention measures than responders of such a study do. Furthermore, the authors concluded that when the investigated preventive interventions were transferred to a broader group of children it is very likely that their efficiency will be significantly reduced as compared to the experimental results because the proportion of non-compliant people in the total group would be significantly greater than in the experimental group. Davies et al. (2007) concluded that as a result of non-participation only few benefits of a health intervention found in a deprived study population would be discernible at a population level. In their study, the non-participant children had higher dmft levels than the participating children. So non-participation bias may seriously affect the value of clinical trials and it generally is assumed that non-participation bias favors the benefits of preventive interventions. Non-participation may alter the external validity of a study. Strategies used for adjustment of non-participation bias may result in some degree of bias reduction (López et al. 2008). The simplest way is to use the method of inverse probability weights (Grimes and Schulz, 2002; Greenland, 2008). In this method, the participants are weighted by the inverse of the probability of participation. The probability of participation is based on the distributions of variables in eligible and, respectively participating and non-participating children.

The aim of this study is to identify and quantify clinical and non-clinical differences between eligible, participating and non-participating children of a randomized controlled trial (RCT) on caries-preventive strategies in young children and to establish whether the non-participants will have a considerable impact on the external validity of this RCT. A considerable amount of parents chose not to let their child participate in this trial. They were, however, willing to subject their child to the clinical baseline-

measurement and fill out the accompanying questionnaire themselves. This gave the opportunity to assess to what extent eligible, participating and non-participating children differ on both clinical and non-clinical variables.

Material and Methods

From October 2006 till October 2008 parents of all children, aged 6.0 years ± 3 months, (n = 346) in three dental clinics in three of the larger cities in the Netherlands ('s-Hertogenbosch, The Hague and Utrecht) were approached to allow their child to participate in a randomized controlled trial on the effectiveness of strategies to prevent caries. Of this group 286 (83%) parents consented to participate and approved to (i) let their child be randomly assigned to an experimental or control group, (ii) let the oral health status of their child be recorded during a period of six years by means of clinical check-ups, (iii) let the clinical records and bitewing radiographs, taken by their dentist to be used for this study and (iv), fill out three times a set of questionnaires scoring demographic and socio-economic data, knowledge on dental issues and attitudinal and motivational related questions during the length of the trial.

60 parents (17%) preferred not to let their child participate in this RCT. Reasons for this refusal were asked and recorded and parents were asked whether they would consent if participation would be limited to just one visit. Of these parents, 56 consented to participate on that condition. The remaining 4 persisted in their refusal and were not included.

Clinical

Of the participants (n = 286) and non-participants (n = 56) oral hygiene was scored applying the simplified Oral Hygiene Index (OHI-s); (Greene and Vermillion, 1964). Scores of this index vary from 0 (surface not covered with plaque) to 3 (incisal / occlusal 1/3 of the surface covered with plaque). No disclosing agent was used but the surfaces were gently explored using a blunt probe to detect dental plaque. Dental health was assessed using dmfs/DMFS-scores in respectively the primary and permanent dentition. Caries was scored at the dentine-threshold (d3), after drying with compressed air, using mirror, light and a blunt probe by a calibrated, experienced dentists. 35 of 342 children (10.2%) were re-examined by a second examiner. Inter-examiner agreement was high ($\kappa = 0.93$) for caries and satisfactory for plaque ($\kappa = 0.67$).

Questionnaire

Parents were asked to complete a questionnaire, scoring (i) ethnic background, (ii) education-level of both parents / care-givers, (iii) dietary and oral health habits of themselves and their children, (iv) knowledge on several dental health topics (oral hygiene, caries, fluoride, snacking, and prevention), (v) health insurance-matters and (vi) willingness to invest. Maternal education-level was used as a proxy for SES (Desai and Alva, 1998). Willingness to invest was assessed by asking parents to indicate the maximum price they were willing to spend to keep there child's teeth healthy in terms of (a) money (€ / month), (b) time (minutes brushing / day) and (c) effort (times visiting dental office / year). The rationale behind these questions is the presumed relation between these factors and caries experience (Ayo-Yusuf et al. 2009; Sbraraini et al. 2008).

Statistics

Differences in distribution of sample characteristics of both parents and children between participants and non-participants were tested with the Chi-square test.
To quantify changes in the distribution of variables between eligible and participating or non-participating children the determinant-specific participation probability was calculated. The determinant-specific participation probability is the ratio of the participation probability in the participating or non-participating children divided by the participation probability in the eligible children. This method has been applied before by López et al. (2008) in their study on non-participation in a case-control study of periodontitis. Determinants with a participation probability < 1 are less likely to be present in the participant or non-participant group compared to the eligible population. For example 35.7% of the eligible children had low SES. The participation among parents of low SES was 32.9%. This yields a participation-ratio of $32.9 / 35.7 = 0.92$.

Since caries is a disease with a skewed distribution, describing characteristics (ds, ms, fs, dmfs, care-index) were tested by a non-parametric technique (Mann-Whitney) to analyze possible differences between participants and non-participants. Since all participating and non-participating children are also members of the eligible group, a one-sample t-test is preferable to test the differences between these groups respectively. For all tests, the level of significance was set at alpha = 0.05.

Results

Reasons given for non-participation were mostly lack of time (46%), inconvenience for the child (18%), lack of interest (17%) of 'my child is no guinea pig (7%). The remaining 12% did not provide a reason. Parental characteristics of the eligible, participating and non-participating children are presented in Table 1 together with calculated determinant-specific participation probability ratios. Concerning non-participants, an over-representation of male accompanying parents, immigrants and parents with low SES was found with participation probabilities of 1.35, 1.68 and 1.40 respectively. Furthermore parents in the non-participation group are less likely, but statistically significantly, to eat all three regular meals themselves (participation probability: 0.88), to brush more than once a day (participation probability: 0.93), and to use interdental cleaning supplies (participation probability: 0.80), but more likely to use commercial mouth rinses (participation probability: 1.4). A lower level of knowledge was found in parents of non-participating children as well as a lower self-reported willingness to invest money, time and effort compared to participating children as well as the total eligible group. However, comparison between parents of participating and eligible children did not show statistically significant differences.

Characteristics of eligible, participating children and non-participating children are presented in Table 2 together with calculated determinant-specific participation probability ratios. The non-participating children were slightly less likely to hold on to regular meals (participation probability: 0.88). However, this was only statistically significant for eating all regular meals ($X2 = 3.12$; $p = 0.05$) but not breakfast, lunch and dinner separately. The mean reported number of between-meal snacks did not differ between the three groups. Children of the non-participation group were more likely to be held responsible for brushing their own teeth (participation probability: 1.2) than children in the non-participation group (participation probability: 0.96). The OHI-s index was found to be higher in the non-participating children ($t = -2.91$; $p = 0.006$). However, dmfs-scores of non-participating children were (although not statistically significant) lower compared to all eligible children and participating children. Furthermore children of the non-participation group were found to have less extracted surfaces and less filled surfaces than non-participating children ($Z = -2.05$, $p = 0.04$; $Z = -1.80$, $p = 0.07$ respectively). Besides that, children of the non-participation-group had lower scores on their care-index (fs/ds+fs) ($Z = -2.72$, $p = 0.007$). When the clinical variables of the participating children were compared to all eligible children, differences were not statistically significant.

Discussion

Based on the findings of the present study, the assumption that non-participating children are unfavorable in all caries related variables beforehand cannot be held. Using the calculated participation-ratios it can easily be identified where the major differences can be expected. Despite less favorable socio-economic and dietary circumstances, the non-participating children did not appear to have more decayed, missing and filled surfaces than their participating peers or all eligible children. The group did show little more untreated carious surfaces but less extracted and filled surfaces, leaving a more positive dmfs than what was to be expected from earlier studies on non-participation in a caries prevention program (Splieth et al. 2005; Davies et al. 2007). Our results challenge the conclusions of studies that non-participation will bias the results of a study on preventive programs in favor of the intervention because firstly the non-participating children had lower dmfs, and secondly there were no statistically significant differences between participants and eligible children, suggesting that the external validity of the current RCT is not much affected, despite differences between the participants and non-participants, seen from the participation probability point of view. The largest differences were found in SES. Correcting for this covariate surprisingly polarized the initial results. Other factors than SES therefore must contribute to explain differences in dmfs-levels in the groups of children. One possible explanation is that non-participating children visit the dentist less regularly. The fact than the non-participating children had more untreated carious surfaces can support this suggestion: it is not unlikely that less dental visits will result in fewer surfaces treated (by either restoration or extraction). Another explanation for lower dmfs scores in our non-participant group may be related to more favorable health-attitudes and health-behaviour than the children in the participants-group. Parental attitudes were dealt with in various recent studies (Tickle et al., 2003; Skeie et al., 2006; Vermaire et al., 2010). The rationale behind this is that parents who are aware of their own 'power to prevent' may act differently than their counterparts who consider caries as an inevitable, hereditary disease or parents who are mainly focused on esthetics in their child or those who are too preoccupied with other things. Of course every possible way to minimize the effect of non-participation in clinical trial is welcomed. We therefore encourage further use of the proposed method of inversed probability weighting (López et al., 2008) to correct for possible overrepresentation of important variables. However, we also expect the impact of these corrections on the external validity to be modest in this RCT, considering the found participation probability ratios.

The first aim of this study was to identify and quantify differences between eligible participants and non-participants of an RCT on caries preventive strategies in young children. Differences in socioeconomic, behavioral and clinical variables were found between non-participants and participants but not between participants and the eligible group. The second aim was to establish whether the non-participants bias would have considerable impact on the external validity of an RCT. Seen from the participation probability point of view in this study (instead of the non-participants point of view) the impact was considered quite modest. Therefore, it is suggested that the external validity of an RCT on caries-preventive strategies is not necessarily affected by non-participation bias.

Table 1: Parent's characteristics accompanying participating and non-participating children. Ratio indicates the determinant-specific participation probability divided by the overall participation probability

		eligible		participants		participation probability ratio	non-participants		non-participation probability ratio
		n	(%)	n	(%)		n	(%)	
All		342	(100)	286	(83.6)	1	56	(16.4)	1
Gender	Male	68	(19.9)	53	(18.5)	0.93	15	(26.8)*	1.35
	Female	274	(80.1)	233	(81.5)	1.02	41	(73.2)*	0.91
SES	Low	122	(35.7)	94	(32.9)	0.92	28	(50.0)*	1.40
	Medium	122	(35.7)	105	(36.7)	1.03	17	(30.4)*	0.85
	High	98	(28.6)	87	(30.4)	1.06	11	(19.6)*	0.68
Ethnicity	Autochthonous	235	(68.7)	208	(72.7)	1.06	27	(48.2)**	0.70
	Immigrant	105	(30.7)	76	(26.6)	0.87	29	(51.8)**	1.68
	Unknown	2	(0.6)	2	(0.70)	1.20	0	(0)	-
Family situation									
	Both parents	292	(85.4)	245	(85.7)	1.00	47	(83.9)	1.01
	Single parent	50	14.6)	41	(14.3)	0.98	9	(16.1)	1.10
Dietary habits									
	Breakfast	311	(90.9)	264	(92.3)	1.02	47	(83.9)	0.92
	Lunch	321	(93.9)	271	(94.8)	1.00	50	(89.3)	0.95
	Dinner	330	(96.5)	277	(96.9)	1.00	53	(94.6)	0.98
	All regular meals	298	(87.1)	255	(89.2)	1.02	43	(76.8)	0.88
	Number of between-meal snacks	mean: 5.38 (± 2.51)		mean: 5.34 (± 2.50)			mean: 5.61 (± 2.54)		

		eligible		participants		participation probability ratio	non-participants		non-participation probability ratio
		n	(%)	n	(%)		n	(%)	
Oral hygiene habits									
Brushing frequency									
	Not every day	4	(1.2)	4	(1.40)	1.20	0	(0.0)	-
	Once a day	63	(18.4)	53	(18.5)	1.01	10	(17.9)	0.97
	More than once a day	265	(77.5)	229	(80.1)	1.03	46	(82.1)	0.93
Use of dental aids									
	Nothing	3	(0.9)	2	(0.70)	0.80	1	(1.80)	1.99
	Toothbrush/toothpaste	130	(38.0)	108	(37.8)	0.99	22	(39.3)	1.03
	+ Toothpicks/dental floss	151	(44.2)	132	(46.2)	1.05	19	(33.9)	0.80
	+ Commercial mouth rinse	60	(17.5)	46	(16.1)	0.92	14	(25.0)	1.42

	eligible mean (± SD)		participants mean (± SD)		t	p	non-participants mean (SD)		t	p
Knowledge										
Mean number of correct answers (of 10)	7.00	(1.88)	7.23	(1.83)	-1.71	0.09	5.87	(2.14)	10.36	0.000
Willingness to invest (maximum)										
Money (€ / month)	28.15	(29.18)	29.16	(21.74)	-0.60	0.55	22.18	(20.24)	3.54	0.000
Time (brushing mins/ day)	6.27	(3.84)	6.49	(3.85)	-1.01	0.31	4.90	(3.45)	6.15	0.000
Time (dental visits / year)	3.46	(1.80)	3.50	(1.79)	-0.34	0.74	3.26	(1.65)	1.97	0.050

* indicates p-level < 0.05
** indicates p-level < 0.01

Table 2: Child's characteristics of participating and non-participating children. Ratio indicates the determinant-specific participation probability divided by the overall participation probability

		eligible		participants		participation probability ratio	non-participants		non-participation probability ratio
		n	(%)	n	(%)		n	(%)	
All		342	(100)	286	(83.6)	1	56	(16.4)	
Gender	Male	169	(49.4)	140	(49.0)	0.99	29	(51.8)	1.05
	Female	173	(50.6)	146	(51.0)	1.01	27	(48.2)	0.95
Dietary habits									
	Breakfast	308	(90.0)	260	(90.9)	1.01	48	(85.7)	0.92
	Lunch	321	(93.9)	271	(94.8)	1.01	50	(89.3)	0.95
	Dinner	328	(95.9)	275	(96.2)	1.01	53	(94.6)	0.98
	All regular meals	297	(86.8)	254	(88.8)	1.02	43	(76.8)*	0.88
	Number of between-meal snacks (mean)	5.70	(± 2.63)	5.72	(± 2.66)		5.64	(± 2.48)	
Oral hygiene									
Tooth brushing									
	Mostly by child alone	102	(29.8)	82	(28.7)	0.96	20	(35.7)*	1.20
	By parent as well	240	(70.2)	204	(71.3)	1.02	36	(64.3)*	0.91
Brushing frequency									
	Not every day	73	(21.4)	59	(20.6)	0.97	14	(25.0)	1.17
	Once a day	115	(33.6)	97	(33.9)	1.01	18	(32.1)	0.96
	More than once a day	154	(45.0)	130	(45.5)	1.01	24	(42.9)	0.95

	eligible mean (± SD)		participants mean (± SD)		t	p	non-participants mean (SD)		t	p
Oral hygiene										
OHI-s (0-3)	0.95	(0.72)	0.88	(0.72)	26	21	1.25	(0.67)	2.91	0.006
Caries presence										
ds	1.69	(3.72)	1.58	(3.52)	-0.49	0.62	2.16	(4.48)	0.79	0.44
ms	2.79	(7.26)	3.12	(7.73)	0.67	0.50	1.32	(4.45)	-2.47	0.02
fs	2.02	(3.55)	2.20	(3.73)	0.75	0.45	1.21	(2.41)	-2.50	0.02
dmfs	5.93	(9.31)	6.28	(9.76)	0.56	0.58	4.43	(6.88)	-1.63	0.11
Care-index (fs/ds+fs)	0.55	(0.41)	0.59	(0.41)	1.00	0.32	0.37	(0.36)	-2.56	0.02

* indicates p-level < 0.05