

A controlled, longitudinal study of home visits compared to telephone contacts to prevent early childhood caries

KATHRYN A. PLONKA^{1,2}, MARGARET L. PUKALLUS^{1,2}, ADRIAN BARNETT³,
TREVOR F. HOLCOMBE², LAURENCE J. WALSH¹ & W. KIM SEOW¹

¹Centre for Paediatric Dentistry, School of Dentistry, The University of Queensland, Brisbane, Qld, Australia, ²Oral Health Program, Logan-Beaudesert Division, Metro South Health Service District, Queensland Health, Kingston, Qld, Australia, and

³Institute of Health and Biomedical Innovation, Queensland University of Technology, Brisbane, Qld, Australia

International Journal of Paediatric Dentistry 2013; 23: 23–31

Background. Home visits (HV) provide excellent opportunities for health promotion.

Aim. This longitudinal study compared the effects of HV and telephone contacts (TC) in preventing early childhood caries (ECC) and colonisation of mutans streptococci (MS) and lactobacilli (LB) from 0 to 24 months.

Design. A total of 325 children were recruited from community health centres at mean age of 42 days, and randomly assigned to receive either HV or TC. A total of 188 children completed three, 6 monthly HV, and another 58 had three, 6

monthly TC. An additional 40 age-matched children from childcare facilities served as reference controls (RC). At 24 months, all groups were examined at a community dental clinic.

Results. At 24 months, three HV children of 188 (1.5%) had caries, compared to four TC of 58 (6.8%) and nine RC of 40 (22.5%) ($P < 0.001$ for HV *versus* RC; $P = 0.05$ for HV *versus* TC and $P = 0.03$ for TC *versus* RC). There were also more children with MS in the TC (47%) and RC (35%) compared to HV (28%) group ($P = 0.01$ and $P = 0.02$).

Conclusions. Home visits and telephone contacts conducted 6 monthly from birth are effective in reducing ECC prevalence by 24 months.

Introduction

Early childhood caries (ECC) is currently one of the most challenging conditions in paediatrics. Risk factors which have been consistently associated with ECC include early colonisation with cariogenic bacteria, mutans streptococci (MS), inadequate oral hygiene, frequent consumption of sugars and enamel hypoplasia¹. A central issue for ECC prevention is that infants' oral health is highly dependent on their mothers' motivation and ability to undertake the tasks required for oral care. Thus, ECC is significantly associated with maternal oral health risk factors such as low educational levels and socio-economic status^{2–4}. Most of the behavioural factors which are directly connected with ECC, such as drinking sweet fluids from nursing bottles

at sleep-time, and lack of toothbrushing have been associated with low maternal education and motivation¹.

Preventive programs for ECC that show most success are usually those which focussed on the mother. Previous studies have demonstrated that maternal education delivered during the antenatal period and 2 years following the child's birth is associated with reductions in caries rates^{5,6}. Furthermore, reduction in maternal oral counts of MS by xylitol consumption, brushing with chlorhexidine gel as well as restorative treatment has resulted in less MS transmission and less caries in the child compared with untreated mothers^{7–11}.

Home visits (HVs) provide excellent opportunities for motivation and instruction of mothers during early childhood. Motivational interviews of parents have been successful in reducing caries rates in the children¹². Furthermore, dental health education programs involving HVs for mothers of young infants have yielded efficient cost benefits¹³. Also, in

Correspondence to:

W. Kim Seow, Centre for Paediatric Dentistry, School of Dentistry, The University of Queensland, 200 Turbot St, Brisbane, Qld 4000, Australia. E-mail: k.seow@uq.edu.au

a Brazilian study, HVs undertaken for nutritional intervention have shown some benefits for reducing ECC¹⁴. We hypothesise that HV are effective in reducing ECC as HV provide an optimal setting for dental educators to give personal instruction in oral hygiene and motivate mothers to provide good infant oral care. The aims of this study, therefore, were to investigate the efficacy of HV as intervention techniques for reducing MS and lactobacilli (LB) colonisation and ECC compared with telephone contacts (TC) and no contact in a group of children from a low socio-economic district.

Material and methods

Home visits, telephone contacts and reference controls

Ethical clearance for the study was obtained from the relevant institutions. The participants were recruited from the public health facilities of the Logan-Beaudesert area which has one of lowest socio-economic status in the state of Queensland, Australia¹⁵. All mothers presenting to these facilities in the period between January 2007 and June 2008 were approached regarding the study, and consent to participate was given by over 85%. All mothers were assigned to the HV or TC groups in sequential blocks. Because of

ethical requirements, they were given the choice to belong to either group (Zelen's design)¹⁶. Overall, 91% of mothers remained, however, in the assigned groups. The distribution of the children in the groups is shown in Fig. 1.

The HV, which were approximately 30 min in duration, were conducted by pairs of oral health therapists at approximate ages of 6, 12 and 18 months. These therapists were trained and calibrated to ensure that standardised examination and instruction protocols were applied to all the mothers throughout the study. At each HV, a validated questionnaire on the child's social, medical, dental feeding histories and oral hygiene habits was first administered¹. This was followed by a lap examination of the child using head-mounted lighting. The mothers were questioned on whether they had any difficulty in cleaning the child's teeth and whether they persisted if the child was uncooperative. This was followed by the examiner observing the mothers brushing the infants' teeth and assisting them with advice and practical demonstrations.

At every visit, the mothers were instructed to brush the child's teeth twice per day (morning and evening) with a smear of low-dose fluoride (304 ppm) children's toothpaste on a child's toothbrush. The use of low-dose fluoride toothpaste for children below 5 years of age is the current general recom-

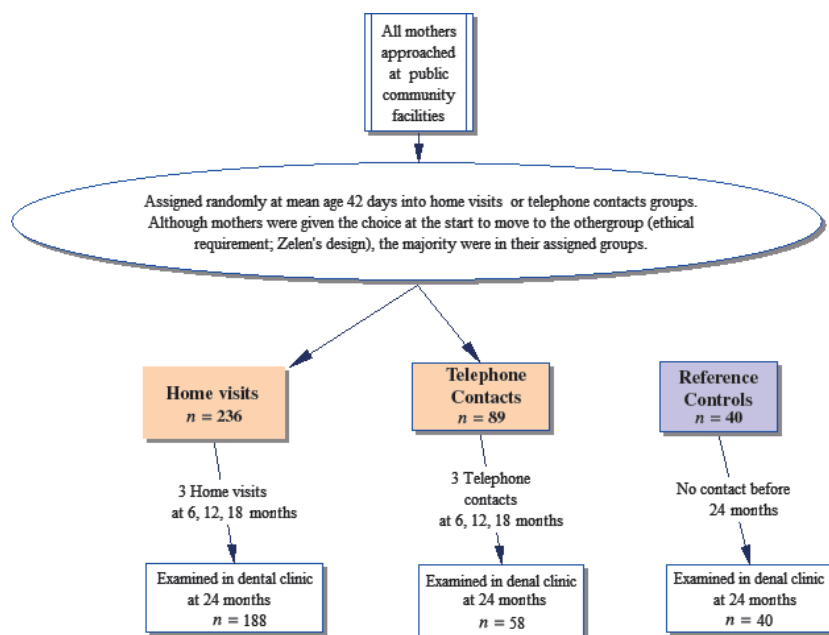


Fig. 1. Diagram showing the randomisation process and distribution of children in the home visits, telephone contacts and reference control groups.

mendation in Australia¹⁷. The pastes and brushes were supplied free of charge (Colgate Oral Care, Sydney, Australia). Oral health education including dietary advice and tooth-brushing instruction was given. A microbiological sample was taken from each child at every appointment and the mother at recruitment, 6 and 24 months by lightly rubbing all teeth surfaces with cotton-tipped swabs which were applied immediately to the culture media provided in the commercial microbial test kit.

The mothers in the TC group were also contacted when the children were aged approximately 6, 12 and 18 months. The questionnaire and oral hygiene instructions were delivered over the telephone, and free toothbrushes and toothpastes were mailed to the mothers. At the 24-month visit, all the mothers and children in the HV and TC groups attended the community dental clinic where they were examined. An oral examination was performed in the dental chair or using the knee-to-knee examination. Dental lighting and a mouth mirror were used to examine for oral abnormalities and number of teeth present. The teeth were dried using cotton rolls and checked for cavitations and white spots lesions of early caries¹⁸. All mothers also received a dental examination and had a swab of the teeth taken for analysis of MS and LB counts using the commercial test kit.

Reference controls

A reference control group of children, approximately 24 months of age, was recruited from day care centres in the same district by including all children who gave consent for the study within a 2-month period. The children were examined in the community dental clinic using head-mounted lighting and mouth mirrors. As with the HV and TC groups, at this visit, all reference controls (RC) mothers also received a dental examination and had plaque samples taken for analysis of MS and LB counts.

At 24 months, dental examinations of all children in the study at the community dental clinic were conducted by seven blinded operators who were calibrated using

repeat examinations of over 290 teeth from dental photographs of 17 children with ECC. The intra- and inter-examiner consistency¹⁹ of these examiners was 0.86 (range 0.85–0.91).

Microbiological analysis

Mutans streptococci and LB counts were assessed using a commercial microbiological kit (CRT[®] Bacteria; Ivoclar Vivadent, Schaan, Liechtenstein), a reliable diagnostic test which has shown good correlations with other MS tests for ECC²⁰. The oral swab was spread immediately across the surfaces of the Mitis-Salivarius-Bacitracin agar and the Rogosa agar strips provided in the kit. After incubation at 37°C for 48 h, the kits were removed from the incubator and bacterial growth assessed by one of three calibrated examiners using the reference charts provided by the manufacturer. The intra- and inter-examiner consistency¹⁹ for these examiners was 0.93 for repeat examination of 20 culture strips.

Sample size

To detect caries rates of 5% in the HV group and 20% in the control groups with 80% power required 158 in the HV group and 40 children in the TC and reference control groups. This is based on using a Chi-squared test with a two-sided 5% significance level. Anticipating a dropout rate per year of 20% in the HV group and 40% in the TC group, the target sample size was 228 participants in the HV group and 79 in the TC group.

Statistical analysis

Data were analysed using the SPSS software package (PASW[®] Statistics 18, IBM, Chicago, IL, USA). Chi-square, *t*-tests and ANOVA, as appropriate, were used to test differences between the groups. The level of significance was set at 0.05.

Results

As shown in Fig. 1, a total of 246 children (75%) completed the three HV or TC, and an

Table 1. Characteristics of subjects at baseline (neonatal period) and 24 months.

	Baseline (neonatal period)									
	Home visits		Telephone contacts		Home visits (HV)		Telephone contacts (TC)		24 months Reference controls (RC)	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
<i>N</i>	236		89		188		58		40	
Child age (mean $\pm$ SD)	44 $\pm$ 84 days		10 $\pm$ 22 days		26 $\pm$ 3 months		26 $\pm$ 2 months		27 $\pm$ 4 months	
Mother's age in years at child's birth (mean $\pm$ SD)	29 $\pm$ 6		27 $\pm$ 6		29 $\pm$ 6		27 $\pm$ 6		28 $\pm$ 5	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Birth Type	158	67	54	61	120	64	37	64	27	68
Natural	78	33	35	39	68	36	21	36	13	33
Caesarean										
Sex	109	46	45	51	81	43	31	53	22	55
Male	127	54	43	49	107	57	27	47	18	45
Female										
Missing	0		1		0		0		0	
Mother born in Australia	158	74	49	73	140	75	44	76	32	80
Yes	56	26	18	27	46	25	14	24	8	20
No	22		22		2		0		0	
Missing										
Main language spoken at home	202	94	63	94	177	95	54	93	37	93
English	12	6	4	6	9	5	4	7	3	7
Not English					2		0		0	
Missing										
Mother's highest education level	7	3	0		4	2	0		1	3
Primary*	92	43	38	57	71	38	30	52	16	40
High*	58	27	19	28	56	30	18	31	14	35
Technical	57	27	10	15	55	30	10	17	9	23
Tertiary	22		22		2		0			
Missing										
Mother's with dental cavitation/s at baseline	29	12	16	18	19	10	6	10	–	–
Yes	207	88	73	82	169	90	52	90	–	–
No										
Mother's MS count	70	30	19	21	52	28	11	20	9	24
0	115	49	40	45	97	52	33	60	19	51
<10 ⁵	51	22	30	34	36	19	12	21	9	24
>10 ⁵					3		2		3	
Missing										
Mother's LB count	104	44	32	36	77	42	24	43	10	27
0	118	50	47	53	94	51	28	50	20	54
<10 ⁵	14	6	10	11	13	7	4	7	7	19
>10 ⁵					4					
Missing										
Dropout [‡]					48	20	31	35	n.a.	

n.a., not applicable.

*Categories combined for analysis.

†Based on chi-square test.

‡Main reason for dropouts was inability to contact and relocation beyond a reasonable distance.

additional 40 children served as RC. Within the 2-year period of study, there was a total of 79 (25%) children who dropped out from the study, mainly because of the fact that they could not be contacted again for the next follow-up visit. Table 1 shows that for those who completed the study, the children in the HV, TC and RC groups were comparable in the demographical variables and key caries risk variables at the initial and 24-month visits. At the 6-month visit, the percentages of children who were breast-fed and bottle-fed were also comparable (Table 3). Antibiotic usage was recorded and there were no differences between the groups.

Figure 2 shows the MS and LB counts in the children at 24 months. As shown in Fig. 2, there are significantly more children with MS in the TC compared with the HV ($P = 0.01$) but no difference between the HV and RC ($P = 0.46$) and TC and RC ($P = 0.30$). With regard to children with MS $> 10^5$ CFU/mL, there are significantly fewer children in the HV compared with the TC ($P = 0.02$) and between the HV and RC ($P = 0.001$). There are, however, no statistically significant differences between the TC and RC ($P = 0.49$). In addition, Fig. 2 also shows that in contrast to MS, the number of children with LB in all the groups was similar ($P > 0.1$).

Table 2 shows the caries rates of the HV, TC and RC groups at 24 months. As shown in Table 2, the percentages of children with caries were three of 188 (2%), four of 58 (7%) and nine of 40 (23%), in the HV, TC and RC groups, respectively, ($P < 0.001$). All the carious lesions included in the analysis were cavitations and there were no pre-carious white spot lesions. In the children with caries, the mean number of carious teeth in the HV children (1.3 ± 0.58) was much less compared to the TC and RC means (3.0 ± 3.3 and 3.0 ± 2.7 , respectively) (Table 2). These results did not reach statistical significance. Similarly, there were no significant associations of caries with MS or LB presence.

Table 3 shows the differences in caries risk behaviours in the HV and TC groups at 6 months, and Table 4 shows these differences among the HV, TC and RC groups at 24 months. As seen in Table 4, there were no

significant differences between the HV and TC groups at both 6 months and 24 months, but highly significant differences were found between these groups and the RC at 24 months ($P = 0.024$ to $P < 0.001$) (Table 4). As shown in Table 4, there were more RC mothers who gave the child a bottle to take to bed for both day and night sleeps (both $P < 0.001$), were less likely to brush the child's teeth at 24-months of age ($P = 0.002$) and were more likely not to persevere with toothbrushing when the child was not cooperative ($P = 0.024$) (Table 4). Furthermore, 43% of children in the RC group had plaque present on the maxillary incisors compared with only 20% in the HV group and 30% in the TC group ($P = 0.009$).

Discussion

It is well established that ECC is associated with early colonisation with MS, frequent consumption of sugar in foods and drinks and lack of toothbrushing¹. The risks for ECC largely rest with the mother as she is the most likely source of cariogenic bacteria that is transmitted to the infant²¹ as well as the fact that she controls the child's feeding and oral hygiene habits. Thus, improving maternal oral health behaviours is likely to decrease the risks for ECC in her child. HVs are an effective way to reach mothers of infants, particularly those in low socioeconomic status communities, as these parents lack the resources to obtain professional care^{22,23}. An English study where children were recruited at a mean age of approximately 11 months and given yearly HVs by dental health educators for 3 years, reported that only 4% of test children developed caries compared to 33% of controls²³. In this study, we obtained similar results of caries reduction from 23% in the RC to only 2% in HV group despite the fact that we commenced the HVs much earlier and provided the visits twice as frequently. Additionally, the inclusion of the TC and reference control groups allowed us to discriminate between the effects of personal contact against the effects of the health education delivered via the telephone as well as the effects of no contact. To our knowl-

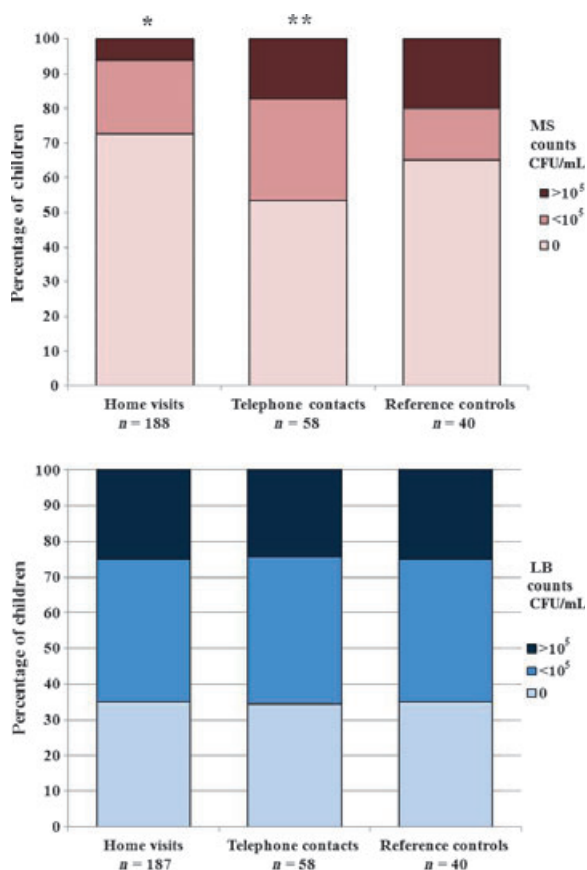


Fig. 2. Percentages of children with mutans streptococci (MS) and lactobacilli (LB) at 24 months in the home visits (HVs), telephone contacts (TC) and reference groups.

* $P = 0.02$ for HVs compared to reference controls.

** $P = 0.01$ for HVs compared to TC.

edge, this is the first study which compares HVs with TC and reference control groups to prevent ECC.

The present results clearly showed the benefits of personal contact for delivery of health education in HVs, as well as over the tele-

Table 3. Differences in behaviours between home visit (HV) and telephone contacts (TC) groups at 6 months.

		HV	TC	HV versus TC
Variable		%	%	P-value [†]
Feeding type	Breast-fed	27	22	0.39
	Bottle-fed	35	38	
	Combination	38	40	
Sugar added to bottle	Yes	4	5	0.9
	No	96	95	
Teeth present	Yes	52	53	0.93
	No	48	47	
Mother brushed child's teeth	Yes	73	75	0.86
	No	27	25	
Frequency of brushing child's teeth	<2	64	50	0.34
	2+	36	50	

[†]Based on Chi-square analysis.

phone, as both methods yielded significantly reduced caries rates compared to RC who received no contact. In the HVs group, there were, however, significantly fewer children who had MS or who developed ECC compared to the TC groups. Furthermore, although the numbers were too few to reach statistical significance, in the children who developed ECC, those in the HV group showed fewer carious lesions compared to the TC and RC group.

Further examination of the present data showed that there were no significant differences in oral health behaviour in the HV and TC mothers at 24 months, suggesting that TC is as effective as HV in producing the same optimal oral health behaviours as reported by the mothers. Yet, the home visited children showed a greater percentage without MS and less caries. The reasons for the greater

Table 2. Children with caries at 24 months in the home visits (HV) and telephone contacts (TC) groups compared to reference controls (RC).

	HV	TC	RC	Total	P-value HV versus TC	P-value HV versus RC	P-value TC versus RC
	N = 188	N = 58	N = 40	N = 286			
Children with caries N (%)	3 (1.5)	4 (6.8)	9 (22.5)	16 (5.6)	* $P = 0.05$	* $P < 0.0001$	* $P = 0.03$
Mean number of carious teeth in children with caries (mean $\pm$ SD)	1.3 $\pm$ 0.58	3.0 $\pm$ 3.3	3.0 $\pm$ 2.7	2.7 $\pm$ 2.5	# $P = 0.6$		

*Fisher's Exact Test.

#One-way ANOVA.

Table 4. Differences in behaviours between home visits (HV), telephone contacts (TC) and reference control (RC) groups at 24 months.

	HV TC			RC All groups	
Variable	%	%	HV versus TC	%	P-value
Bottle taken to bed at night 24 months*					
Yes	5	5	0.91	25	<0.001
No	95	95		75	
Bottle taken to bed for day naps at 24 months*					
Yes	5	3	0.95	25	<0.001
No	95	97		75	
Mother brushed child's teeth					
Yes	98	100	0.60	85	<0.001
No	2	0		15	
Frequency of brushing child's teeth					
<1 [†]	2		0.51	16	0.002
1-2 [†]	26	33		41	
2+	73	67		43	
Mother did not persevere with brushing when child was uncooperative					
No	75	80	0.56	55	0.024
Sometimes [†]	3	2		24	
Yes/rushed through brushing [†]	22	18		21	
Plaque on child's maxillary incisors					
Absent	80	70	0.21	57	0.009
Present	20	30		43	

*No significant differences in content of bottles.

[†]Categories combined for analysis.

preventative results in the HV group compared to the TC group are likely to be related to the fact that the dental educators in the HV group were able to personally instruct mothers in oral hygiene techniques for the infants which the TC educators were not able to do. Thus, the greater reduction in caries rates in the HV group is likely due to more effective toothbrushing, as shown by the fact that there were less children with visible plaque on the maxillary incisors in the HV group compared to the TC and RC groups.

The importance of personal instruction in toothbrushing in HVs is evidenced by the comparatively larger reduction in caries rates observed in the present investigation compared with that reported in another study where nutritional students gave dietary advice during HVs but no oral hygiene instruction¹⁴. The importance of plaque removal has been previously demonstrated in several studies that proved that presence of plaque is a clear ECC risk indicator^{1,24}, as well as our previous investigations which provided evidence that

introduction of toothbrushing in infants can remove MS after a few weeks²⁵.

Besides improvement in oral hygiene from personal toothbrushing instruction, the reduced MS colonisation and caries rates associated with HVs in this study may have also resulted from increased motivation of mothers to brush the children's teeth more frequently and to persist with toothbrushing when a child was uncooperative. The increased motivation in the mothers was likely stem from the direct interaction with the oral health therapists and the personal instruction in oral health education. The greater likelihood of mothers in the HV group to follow good feeding practices such as not using the bottle to put a child to sleep and not feeding her child frequently with sugar could also have resulted from increased motivation. Our findings are thus supported by previous studies which demonstrated that motivational interviewing is effective in improving the oral care of infants by mothers and reducing the rates of ECC²⁶.

It is well known that maternal counts of cariogenic bacteria is important for colonisation in the child's mouth and that mothers with MS counts of 10⁶ CFU/mL have the highest risks for transmission to their children²¹. In this study, it is notable that the mean maternal levels of MS at 24 months did not change from baseline, and the proportions of mothers with MS counts of >10⁵ CFU/mL remained fairly constant and were not significantly different among the groups. This suggests that the risk of MS transmission from the mothers to the infants was not significantly different among the HV, TC and RC groups and that the differences in percentages of MS-free children and caries prevalence probably resulted from other factors. These include the variables shown in Table 4, namely differences in toothbrushing, snacking frequency and whether the nursing bottle was taken to sleep.

It is interesting to note that, in contrast to MS and caries rates, the lactobacilli counts did not differ among the three groups of children despite differences in oral hygiene. As carbohydrate intake is thought to influence lactobacilli counts²⁷, it is likely that the

similarities in levels of lactobacilli in the children reflect similarities of carbohydrate consumption, a fact that is confirmed from the dietary histories.

Although for ethical reasons, the mothers could choose between HVs and TC, the majority of mothers remained in the assigned group. Comparability of the groups was demonstrated by the fact that there were no significant differences among the HV and TC groups in the key socio-demographic variables which are known to impact on ECC, such as mother's level of education, immigrant status and MS and LB levels. Furthermore, comparability among the groups remained at the end of the study which suggests that the characteristics of mothers who dropped out were not different from those who remained in the study. The dropout rate of approximately 12% per year is considered low for a cohort from a low socio-economic community who is well known to be highly itinerant. In this study, the main reason for dropout was the inability to contact the mother and relocation beyond a reasonable distance from the research clinic.

Although HVs are labour intensive, they have been shown to be efficacious in England where a dental health education program of HVs commencing at 8 months of age resulted in a costs effectiveness ratio of approximately 24. The cost-effectiveness of HVs is likely to be enhanced by the employment of dental auxiliaries as was undertaken in this study. In addition, the inclusion of other preventive methods such as the application of fluoride varnish during the HVs is likely to further increase their cost-effectiveness.

In conclusion, both HVs and TC conducted 6 monthly from birth are effective in reducing ECC prevalence compared to RC by 24 months. HVs are also associated with fewer children with MS compared with TC and RC at 24 months.

Why this paper is important to paediatric dentists

- This study provides evidence to paediatric dentists that 6 monthly health promotion given to mothers through HVs or TC from the time of birth is effective in preventing ECC at 2 years of age.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgements

The authors thank all mothers and children who participated in the study and acknowledge the generous funding of this project from the Dental Board of Queensland and the following Queensland Health Departments: Office of Health and Medical Research Fellowship, Health Practitioners Research Grant and Metro South Health Service District, Oral Health Program (Logan-Beaudesert Division). We also thank Colgate Oral Care, Sydney, Australia, for donation of toothbrushes and pastes.

References

- 1 Seow WK, Clifford H, Battistutta D, Morawska A, Holcombe T. Case-control study of early childhood caries in Australia. *Caries Res* 2009; **43**: 25–35.
- 2 Lai PY, Seow WK, Tudehope DI, Rogers Y. Enamel hypoplasia and dental caries in very low birthweight children: a case-controlled longitudinal study. *Pediatr Dent* 1997; **19**: 42–49.
- 3 Schroth RJ, Moffatt MEK. Determinants of early childhood caries (ECC) in a rural Manitoba community: a pilot study. *Pediatr Dent* 2005; **27**: 114–120.
- 4 Qin M, Li J, Zhang S, Ma W. Risk factors for severe early childhood caries in children younger than 4 years old in Beijing, China. *Pediatr Dent* 2008; **30**: 122–128.
- 5 Günay H, Dmoch-Bockhorn K, Günay Y, Geurtsen W. Effect on caries experience of a long-term preventive program for mothers and children starting during pregnancy. *Clin Oral Investig* 1998; **2**: 137–142.
- 6 Gomez SS, Weber AA. Effectiveness of a caries preventive program in pregnant women and new mothers on their offspring. *Int J Paediatr Dent* 2001; **11**: 117–122.
- 7 Brambilla E, Felloni A, Gagliani M, Malerba A, García-Godoy F, Strohmenger L. Caries prevention during pregnancy: results of a 30-month study. *J Am Dent Assoc* 1998; **129**: 871–877.
- 8 Nakai Y, Shinga-Ishihara C, Kaji M, Moriya K, Murakami-Yamanaka K, Takimura M. Xylitol gum and maternal transmission of mutans streptococci. *J Dent Res* 2010; **89**: 56–60.
- 9 Tenovuo J, Hakkinen P, Paunio P, Emilson CG. Effects of chlorhexidine-fluoride gel treatments in mothers on the establishment of mutans streptococci

- in primary teeth and the development of dental caries in children. *Caries Res* 1992; **26**: 275–280.
- 10 Alaluusua S, Renkonen OV. *Streptococcus mutans* establishment and dental caries experience in children from 2 to 4 years old. *Scand J Dent Res* 1983; **91**: 453–457.
 - 11 Rotter J. Generalised expectancies for internal versus external control of reinforcement. *Psychol Monogr* 1966; **80**: 1–28.
 - 12 Weinstein P, Harrison R, Benton T. Motivating mothers to prevent caries: confirming the beneficial effect of counseling. *J Am Dent Assoc* 2006; **137**: 789–793.
 - 13 Kowash MB, Toumba KJ, Curzon MEJ. Cost-effectiveness of a long-term dental health education program for the prevention of early childhood caries. *Eur Arch Paediatr Dent* 2006; **7**: 130–135.
 - 14 Feldens CA, Giugliani ERJ, Duncan BB, Drachler MdL, Vítolo MR. Long-term effectiveness of a nutritional program in reducing early childhood caries: a randomized trial. *Community Dent Oral Epidemiol* 2010; **38**: 324–332.
 - 15 Public Health Information Development Unit Australia. *Population Health Profile of the Logan Area Division of General Practice: Supplement*, 70a edn. Edited by. Public Health Information Development Unit Australia. Adelaide: Commonwealth of Australia, 2007.
 - 16 Adamson J, Cockayne S, Puffer A, Torgerson DJ. Review of randomised trials using the post-randomised consent (Zelen's) design. *Contemp Clin Trials* 2006; **27**: 305–319.
 - 17 Australian Dental Association. Community oral health promotion – fluoride use. *ADA policy statement* 2.2.1. 2010:1–6.
 - 18 Drury TF, Horowitz AM, Ismail AI, Maertens MP, Rozier RG, Selwitz RH. Diagnosing and reporting early childhood caries for research purposes. A report of a workshop sponsored by the National Institute of Dental and Craniofacial Research, the Health Resources and Services Administration, and the Health Care Financing Administration. *J Public Health Dent* 1999; **59**: 192–197.
 - 19 Landis L, Koch G. The measurement of observer agreement for categorical data. *Biometrics* 1977; **33**: 159–174.
 - 20 Tanabe Y, Park JH, Tinanoff N, Turng BF, Lilli H, Minah GE. Comparison of chairside microbiological screening systems and conventional selective media in children with and without visible dental caries. *Pediatr Dent* 2006; **28**: 363–368.
 - 21 Berkowitz RJ, Turner J, Green P. Maternal salivary levels of *Streptococcus mutans* and primary oral infection of infants. *Arch Oral Biol* 1981; **26**: 147–149.
 - 22 Hale KJ. Oral health risk assessment timing and establishment of the dental home. *Pediatrics* 2003; **111**(5 Pt 1): 1113–1116.
 - 23 Kowash MB, Pinfield A, Smith J, Curzon ME. Effectiveness on oral health of a long-term health education programme for mothers with young children. *Br Dent J* 2000; **188**: 201–205.
 - 24 Alaluusua S, Malmivirta R. Early plaque accumulation – a sign for caries risk in young children. *Community Dent Oral Epidemiol* 1994; **1**: 273–276.
 - 25 Seow WK, Cheng E, Wan V. Effects of oral health education and tooth-brushing on mutans streptococci infection in young children. *Pediatr Dent* 2003; **25**: 223–228.
 - 26 Harrison R, Benton T, Everson-Stewart S, Weinstein P. Effect of motivational interviewing on rates of early childhood caries: a randomized trial. *Pediatr Dent* 2007; **29**: 16–22.
 - 27 Duchin S, van Houte J. Relationship of *Streptococcus mutans* and lactobacilli to incipient smooth surface dental caries in man. *Arch Oral Biol* 1978; **23**: 779–786.

Copyright of International Journal of Paediatric Dentistry is the property of Wiley-Blackwell and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.