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Oral Health Beliefs in Adolescence and Oral Health in Young Adulthood

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Abstract

According to theory, health beliefs are related to health behaviors. We investigated whether individuals who hold favorable oral-health-related beliefs over time have better adult oral health than those who do not. Beliefs about the efficacy of water fluoridation, keeping the mouth clean, avoiding sweet foods, visiting the dentist, using dental floss, and using fluoridated toothpaste were assessed in a birth cohort at ages 15, 18, and 26 years. At each age, the majority of participants endorsed the importance of each practice. However, there was also evidence of instability across time. Individuals who held stable favorable dental beliefs from adolescence through adulthood had fewer teeth missing due to caries, less periodontal disease, better oral hygiene, better self-rated oral health, and more restorations. Dental beliefs can change between adolescence and young adulthood, and these changes are related to oral health. In particular, unfavorable dental health beliefs are related to poorer oral health.

Keywords

dentistry; longitudinal study; sex differences; oral health beliefs; caries

INTRODUCTION

Health belief theory (Eiser, 1997) suggests that dental health beliefs should be associated with dental health behaviors. This implies that changing beliefs should result in changes in behaviors. Perhaps surprisingly, there have been no published studies on the stability of dental health beliefs or the effect of such stabilities upon oral health behavior. However, some studies have reported on other aspects of dental health beliefs. For example, a Swedish cross-sectional study showed strong associations between young people's self-perceived oral health and their self-reported oral health attitudes and behaviors. There were sex differences, with males having less-favorable attitudes, behaviors, and self-perceived oral health (Östberg *et al.*, 2001). Other studies have considered public apathy to public health measures, most notably water fluoridation (Neenan, 1996; Hastings *et al.*, 1998), how beliefs about dental health professionals affect dental anxiety (Poulton *et al.*, 2001; Abrahamsson *et al.*, 2003), and the relationship of health beliefs with patient adherence/compliance to oral hygiene instructions (Borkowska *et al.*, 1998).

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Accordingly, the aims of this study were: to investigate the stability of dental health beliefs from adolescence to adulthood; to examine sociodemographic correlates of beliefs; and to determine whether favorable and unfavorable beliefs are associated with different oral health outcomes.

METHODS

Background

Participants were members of the Dunedin Multidisciplinary Health and Development Study, a longitudinal investigation of health and behavior in a complete birth cohort. Study members were born in Dunedin, New Zealand, between April, 1972, and March, 1973, and 1037 (91% of eligible births; 52% male) participated in the first follow-up at age 3 yrs; these constituted the base sample for the remainder of the study. Cohort families represented the full range of socio-economic status in New Zealand's South Island, and were mainly white. Follow-ups were done at ages 5, 7, 9, 11, 13, 15, 18, 21, and, most recently, 26 yrs, when we assessed 980 (96%) of the surviving 1019 study members.

The Otago Ethics Committee granted ethics approval for each assessment phase. Study members gave informed consent before participating.

Dental Belief Measures

At ages 15, 18, and 26 yrs, Study members were asked to complete a questionnaire regarding their beliefs about six oral-health-related behaviors. They were asked to rate each as 'extremely important' (scoring '1'), 'fairly important' ('2'), 'doesn't matter much/not very important' ('3'), or 'not at all important' ('4'). The behaviors referred to:

- avoiding a lot of sweet foods;
- using fluoride toothpaste;
- visiting the dentist regularly;
- keeping the teeth and gums very clean;
- drinking fluoridated water; and
- using dental floss.

For the purposes of mean-level and rank-order stability analysis, we constructed a summed dental beliefs rating scale by combining scores from the six belief statements, giving a theoretical range from 6 (very favorable) to 24 (very unfavorable). For analysis by sex and health outcomes, the beliefs data were dichotomized: 'extremely important' and 'fairly important' were combined and designated 'important', while 'doesn't matter much/not very important' and 'not at all important' were designated 'not important'. Finally, a favorable 'stable beliefs' variable was created and scored 0 or 1, with 1 representing individuals who endorsed favorable beliefs at all three ages (15, 18, and 26 yrs).

Dental Health Measures

Dental examinations for caries and missing teeth were conducted at ages 15, 18, and 26 yrs. Repeat examinations for examiner reliability analyses were not possible because of logistical constraints imposed by the tightly scheduled assessment that Study members underwent. Dental examiners were not aware of Study members' socioeconomic status (SES) or questionnaire responses at the time of the examinations. We obtained an estimate of accumulated tooth loss due to caries by observing the presence or absence of each tooth at age

26 yrs, and ascertaining the reason for its absence by asking the Study member at that time. Only those teeth which had been lost because of caries were included in the current analysis.

At age 26 yrs, periodontal measurements (not conducted on individuals who reported a history of cardiac valvular anomalies or rheumatic fever) were made in two quadrants: the upper right and lower left for those whose study ID number was odd, and the upper left and lower right for those with an even ID number; the mix of odd and even numbers was approximately 50:50. Three sites (mesiobuccal, buccal, and distolingual) *per* tooth were examined. Probing depth (PD, the distance from the probe tip to the gingival margin) and gingival recession (GR, the distance from the gingival margin to the amelo-cemental junction) were recorded by means of an NIDR probe. Midbuccal measurements for molars were made at the midpoint of the mesial root. All measurements were rounded down to the nearest whole millimeter at the time of recording. Combined attachment loss (CAL) was computed as the sum of PD + GR. Plaque accumulation was measured according to the Simplified Oral Hygiene Index (OHI-S) (Greene and Vermillion, 1964).

Covariates

The socio-economic status of Study members' families was measured on the basis of the parents' occupational status. Occupation was scaled into one of six categories (*e.g.*, 6 = unskilled laborer through 1 = professional) based on the educational levels and income associated with that occupation in NZ Census data (Elley and Irving, 1985). In the following analyses, the variable 'childhood SES' has been calculated as the average of the highest SES level of either parent, assessed repeatedly from birth to 15 yrs. This method was used because measurement of SES at a single point early in life does not describe cumulative exposure to low SES. Specifically, there is a degree of change in parental SES during childhood—for example, the correlation between SES at birth and at age 15 yrs was only moderate, at $r = 0.5$ (Poulton *et al.*, 2002). Study members were classified as having low (groups 6 and 5), medium (groups 4 and 3), or high (groups 2 and 1) childhood SES.

At ages 21 and 26 yrs, smoking history was obtained by the question, "Have you smoked for one month or more of the previous 12 months?". Those who answered affirmatively at both ages were classified as chronic smokers.

Residential fluoride exposure to age 15 yrs was computed as the percentage of those yrs spent living in a fluoridated area. Residential fluoride exposure to age 26 yrs was computed in the same way. Each of the residential fluoride exposure variables was dichotomized to distinguish those who had spent all of their lives in fluoridated communities from those who had not.

Data Analytic Approach

Data were analyzed by Intercooled Stata version 8. We used regression analyses to test the study hypotheses and derive adjusted estimates for the dependent variables. Poisson regression modeling was used for count data (such as DFS and DS); linear regression was used for continuous variables (such as plaque scores); and logistic regression was used for dichotomous oral health outcomes (such as periodontitis prevalence). The regression modeling controlled for sex and childhood SES, as well as fluoride exposure for caries-related outcomes and smoking for periodontal outcomes.

RESULTS

In total, 742 Study members completed the dental questionnaire at all three ages. SES data were not available for one Study member, and this individual was excluded from the analysis, leaving a total of 741 (72.7% of the surviving cohort at age 26 yrs). Unless otherwise specified,

all subsequent analyses are based on this group. There were higher proportions of low-SES individuals and smokers among the excluded Study members ($P < 0.05$; Table 1).

Unfavorable beliefs were most prevalent regarding the importance of fluoridated water, use of dental floss, or the avoidance of sweet foods (Table 2). The mean number of stable favorable beliefs held by females was significantly greater than for males (Table 3). The greatest stability was associated with 'keeping the teeth and gums very clean', with only 6.1% of Study members changing their views over time, while the least stability was associated with 'drinking fluoridated water', with 52.4% changing their beliefs.

The proportion of Study members holding stable favorable oral-health-related beliefs was marginally greater among those of high SES, non-smokers, and those who had spent all their lives living in fluoridated areas. These associations were not significant. A significant association existed between beliefs and dental visiting patterns, however, with individuals holding fewer stable favorable beliefs being more likely to have an episodic dental visiting pattern (APPENDIX Table).

The mean of the summed scores from the six belief statements was 10.9 (SD 2.6) at age 15 yrs, 11.1 (SD 2.6) at age 18 yrs, and 11.1 (SD 2.4) at age 26 yrs. There were no statistically significant differences in population mean-level stability across those ages; however, the rank-order stability was relatively low, at 0.641 (95% CI 0.594, 0.684), indicating individual instability across time.

Associations with Oral Health Outcomes

After adjustment for potential confounders by regression analysis, those with stable favorable beliefs had a significantly lower prevalence of poor self-rated oral health, fewer sites with bleeding on probing, fewer teeth extracted due to caries, lower plaque scores, and greater mean DFS and FS than those Study members with fewer stable favorable beliefs (Table 4).

By age 26 yrs, 179 Study members (24.2%) had spent all their lives in a fluoridated area, 422 (60.0%) had lived some of their lives in one, and 80 (10.8%) had not. More of those from fluoridated areas considered water fluoridation to be important than those who had never lived in fluoridated areas (76.8% and 63.8%, respectively; $P < 0.05$). No other statistically significant difference in beliefs existed between those groups.

DISCUSSION

These findings suggest that all people's oral health beliefs are not necessarily fixed. For some beliefs, such as the importance of keeping the teeth and gums clean, the vast majority (93.9%) held the same belief at all three ages. For others, such as that relating to the efficacy of fluoridated water, fewer than half held to the same belief at all three assessments. A strong association between sex and oral health beliefs (and their stability) was also identified, with fewer males than females endorsing favorable dental beliefs. For example, approximately 20% more females than males held stable favorable beliefs about water fluoridation.

A substantial proportion of the population are likely to change their beliefs about oral health practices between adolescence and young adulthood. This instability varies according to the particular belief in question, but may be up to 50%. Thus, measuring beliefs at one point in time (as in a cross-sectional survey) is likely to result in considerable misclassification in any investigation of the relation between beliefs and oral health. This suggests that longitudinal studies are of greater utility, because they allow for examination of the 'stability' of health beliefs *via* their repeated measurement over time.

Instability in oral health beliefs was related to increased odds of having poor self-rated oral health, increased risk of gingivitis, high plaque score, and tooth loss due to caries. Individuals with stable favorable dental beliefs tend to have better oral health than those who do not, particularly in terms of gingivitis, self-rated oral health, and tooth loss due to dental caries. An interesting association between stable favorable beliefs and greater mean FS was also found. This may indicate relative over-treatment of those Study members with stable favorable dental beliefs. It is possible that Study members with fewer stable favorable beliefs tended to wait longer to receive dental treatment, thus receiving extractions rather than dental restorations. Note that those with more stable favorable beliefs were less likely to be problematic dental attenders. These findings support the hypothesis that oral health beliefs affect oral health outcomes. Thus, interventions to promote the development and retention of favorable oral health beliefs may be a valid means of improving oral health outcomes.

This study is the first to consider the stability of dental beliefs as a predictor of oral health. However, several limitations are apparent. Our measure of childhood SES was limited to parental occupation and did not incorporate all potential indicators of social inequality. In spite of the low attrition rate in the Dunedin Study, excluded Study members were more likely to be smokers and to be of low SES, raising issues of generalizability. However, these people are both more likely to have poor oral health and to have unfavorable dental beliefs—thus, it is likely that we may have underestimated the true effect of unfavorable dental beliefs upon oral health.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Characteristics of Study Members Who Completed the Dental Questionnaire at 15, 18, and 26 yrs Compared with Those Who Missed One or More Years

	Included Number (%)	Excluded Number (%) ^a	Overall Number (%) ^a
Gender			
Male	377 (50.9)	158 (53.4)	535 (51.6)
Female	364 (49.1)	138 (46.6)	502 (48.4)
Childhood SES [*]			
High	120 (16.2)	47 (16.2) ^b	167 (16.1)
Medium	490 (66.1)	159 (54.8)	649 (62.6)
Low	131 (17.7)	84 (29.0)	215 (20.7)
Unknown		6	6
Smoking at ages 21 and 26 yrs			
No	504 (68.0)	145 (60.9) ^c	649 (66.3)
Yes	237 (32.0)	93 (39.1)	330 (33.7)
Missing	58	58	
Deceased by 26 yrs		18 (6.1)	18 (1.8)
Total ^d	741 (71.0)	296 (29.0)	1037

^aValid %.

^bP < 0.001.

^cP < 0.05.

^dPercent by row.

^{*}SES = socio-economic status.

Table 2
Dental Beliefs Endorsed by Study Members at Ages 15, 18, and 26 yrs

	Belief at 15 Number (%)	Belief at 18 Number (%)	Belief at 26 Number (%)	Belief at at Least One Age, Number (%)
Avoiding a lot of sweet foods				
Important	628 (84.8)	589 (79.5)	591 (79.8)	724 (97.7)
Not important	113 (15.2)	152 (20.5)	150 (20.2)	298 (40.2)
Using fluoride toothpaste				
Important	646 (87.2)	666 (89.9)	694 (93.7)	734 (99.1)
Not important	95 (12.8)	73 (9.8)	46 (6.2)	173 (23.3)
Other/don't know		2 (0.3)	1 (0.1)	
Visiting dentist regularly				
Important	694 (93.7)	676 (91.2)	662 (89.3)	736 (99.3)
Not important	47 (6.3)	65 (8.8)	79 (10.7)	152 (21.5)
Keeping the teeth and gums very clean				
Important	714 (96.4)	728 (98.2)	731 (98.7)	739 (99.7)
Not important	27 (3.6)	13 (1.8)	9 (1.2)	45 (6.1)
Other/don't know		1 (0.1)		
Drinking fluoridated water				
Important	479 (64.6)	459 (61.9)	525 (70.9)	664 (89.6)
Not important	257 (34.7)	280 (37.8)	205 (29.0)	449 (60.6)
Other/don't know	5 (0.7)	2 (0.3)	1 (0.1)	
Using dental floss				
Important	533 (71.9)	517 (69.8)	581 (78.4)	689 (93.0)
Not important	205 (27.7)	224 (30.2)	160 (21.6)	363 (49.0)
Other/don't know	3 (0.4)			

Table 3
Stability of Dental Beliefs Endorsed by Study Members, with Comparisons by Gender

	Males Number (%)	Females Number (%)	Overall Number (%)
Avoiding a lot of sweet foods			
Stable: Important	197 (52.3)	246 (67.6) ^a	443 (59.8)
Stable: Not important	11 (2.9)	6 (1.6)	17 (2.3)
Unstable	169 (44.8)	112 (30.8)	281 (37.9)
Using fluoride toothpaste			
Stable: Important	276 (73.2)	289 (79.4)	565 (76.2)
Stable: Not important	3 (0.8)	1 (0.3)	4 (0.5)
Unstable	98 (26.0)	74 (20.3)	172 (23.2)
Visiting dentist regularly			
Stable: Important	275 (72.9)	307 (84.3)	582 (78.5)
Stable: Not important	3 (0.8)	2 (0.5)	5 (0.7)
Unstable	99 (26.3)	55 (15.1)	154 (20.8)
Keeping the teeth and gums very clean			
Stable: Important	345 (91.5)	350 (96.2)	695 (93.8)
Stable: Not important	1 (0.3)	0 (0.0)	1 (0.1)
Unstable	31 (8.2)	16 (4.4)	45 (6.1)
Drinking fluoridated water			
Stable: Important	110 (29.2)	174 (47.8) ^b	284 (38.3)
Stable: Not important	49 (13.0)	20 (5.5) ^b	69 (9.3)
Unstable	218 (57.8)	170 (46.7)	388 (52.4)
Using dental floss			
Stable: Important	155 (41.1)	220 (60.4) ^b	375 (50.6)
Stable: Not important	37 (9.8)	12 (3.3) ^b	49 (6.6)
Unstable	185 (49.1)	132 (36.3)	317 (42.8)
Mean number of stable favorable beliefs (SD)	3.6 (1.5)	4.4 (1.5) ^b	4.0 (1.5)

^aP < 0.05.

^bP < 0.01.

Table 4

Estimates of Stable Favorable Dental Health Beliefs by Oral Health Outcome Measures at Age 26 yrs after Adjustment for Sex and Childhood SES^{*}, as Well as Fluoride Exposure for Caries-related Outcomes and Smoking for Periodontal-disease-related Outcomes

	5–6 Stable Favorable Beliefs Expected Number	3–4 Stable Favorable Beliefs Expected Number	0–2 Stable Favorable Beliefs Expected Number
% had an extraction due to caries	6.5	8.6	11.3
% cases of periodontal disease	15.5	16.3	17.3
% 'poor' self-rated oral health	36.2	42.6	49.2 ^a
	Expected Mean	Expected Mean	Expected Mean
% of sites where CAL [*] > 4 mm	0.77	0.83	0.91
% of sites bleeding on probing	27.1	29.3	31.7 ^c
Mean CAL	1.47	1.49	1.52
Mean teeth extracted due to caries	0.10	0.14	0.20 ^b
Mean decayed & filled surfaces	11.7	11.2	10.7 ^b
Mean filled surfaces	9.6	8.9	8.3 ^c
Mean plaque score	0.78	0.87	0.96 ^b

^{*} SES = socio-economic status; CAL = combined attachment loss.

^a P < 0.05.

^b P < 0.01.

^c P < 0.001.