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Changes in Perceived Oral Health in a Longitudinal Population-based Study

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Abstract

Objectives

The aim was to examine if the changes in different measures of perceived oral health (POH) were similar and related to each other over 11 years in the Finnish adult population in a longitudinal setting. Perceived oral health was measured by means of subjective oral health (SOH), self-assessed treatment need (STN) and oral health related quality of life (OHRQoL.

Methods

The data were collected as part of the nationally representative Health 2000 and Health 2011 (BRIF 8901) surveys on Finnish adults born in 1981 or earlier. SOH and STN were measured using single items and OHRQoL using the 14-item Oral Health Impact Profile (OHIP-14). The changes in STN, and OHRQoL were reported by age group and by gender. Age groups (born in 1971 or later, in 1956-1970, in 1946-1955, or in 1945 or earlier) were based on access to subsidized oral health care. General linear mixed models for changes in perceived oral health variables were conducted.

Results

Subjective oral health and oral health related quality of life with impacts occurring occasionally, fairly often or very often (OFoVo), showed similar results, and remained good or improved in the majority of the participants. Self-assessed treatment need in the population showed less consistent results.

Subjective oral health was good in the adult population. About half of the participants, regardless of age and gender, reported self-assessed treatment need in both years, showing a decrease among women and an increase in the youngest group. Perceived oral health improved significantly in the two oldest age groups regardless of the measure. The General linear mixed model revealed that changes in all three perceived oral health variables were related even when adjusted for age and gender

Conclusion

Multiple perceived oral health measures might be useful for service planning, since the changes in the three separate measures used in this longitudinal study were various and thus measured different aspects of perceived oral health. Research including both self-perceived and clinical indicators is needed to understand need for care as a whole.

Introduction

Clinical diagnoses and indices yield information on oral health and treatment need as assessed by professionals, but they do not reveal patient´s attitudes or perceptions or capture his/her experiences and concerns of oral health. However, there is an association between perceived and clinically determined oral health.[1] Perceived oral health is an individual conception of the health of the mouth and teeth and of their effect on wellbeing which are the major reasons for seeking care in populations[2]. Therefore also perceived oral health might be used for screening purposes in oral health care planning[1]. To better understand the various determinants and impacts of oral health, the aspects of perceived oral health should also be studied thoroughly in populations. Especially in countries where people have access to comprehensive oral health care, it is essential to study not only the professionally determined clinical outcomes of care, but also the population's perceptions of these outcomes, such as perceived oral health.

Perceived oral health has been studied in nationally representative health surveys in the UK[3], Australia and the USA[4], Germany[5], Canada[6], Norway[7] and Finland[8]. In these studies, perceived oral health has been measured with single-item subjective oral health and multi-item and multi-dimensional scales of oral health related quality of life. Also measures reflecting self-assessed treatment need have been surveyed[9,10]. In the Adult Dental Health Survey in 1998 and 2009 in the UK[3] oral health related quality of life (OHRQoL) was assessed with the Oral Health Impact Profile-14 (OHIP-14). The prevalence of impacts occurring occasionally, fairly often or very often (OFoVo) was significantly lower (41%) in 2009 than in 1998 (51%). In Australia the corresponding OHIP-14 OFoVo-prevalence was 18% in 1999[11] and 16% in 2002[4]. In these cross-sectional population studies age differences were substantial while gender differences were not. Additionally, repeated cross-sectional studies in Finland from 2001, 2004 and 2007 revealed only minor fluctuations in perceived oral health measured by a single item of subjective oral health[12]. As outcomes and development of the results of the previous studies vary, these different measures may capture different aspects of perceived oral health. To the best of our knowledge, no nationally representative longitudinal studies on changes of perceived oral health have been published.

For planning and monitoring the existing comprehensive oral health care services, it is essential to know not only the clinically measured oral health, but also the changes in perception of oral health and self-assessed treatment need in the population. Thus, our aim was to examine the changes and similarities in perceived oral health measures over a period of eleven years in a nationally representative longitudinal setting. We measured perceived oral health by means of subjective oral health (SOH), self-assessed treatment need (STN) and oral health related quality of life.

Material and methods

This study was based on two nationally representative health surveys of the adult population in Finland. The Health 2000 survey was conducted in 2000–2001 by the National Public Health Institute (KTL). The Health 2011 survey was conducted by the National Institute for Health and Welfare (THL). The Ethics Committee of the University Hospital Region of Helsinki, Finland, gave permission for both surveys. Informed consent was obtained from each survey participant. The survey population was over 18 years of age, without an upper age limit. A stratified two-stage cluster sampling design was used. University hospital districts were used as strata and health centers as clusters. First, the health centers in the fifteen most populous cities were chosen and then a subsequent random selection of 65 health centers, so that the total number of health centers was 80. Participants were chosen randomly from these in the year 2000[13]. Those who were invited to participate in the survey in 2000 were also invited in 2011. To match the population sizes in different clusters and to form a nationally representative data set of adult Finns, the participants were weighted using inverse probability weighting, which is a statistical technique for calculating statistics standardized to a population different from that in which the data was collected.

The participants included in the present study answered questions in interviews or via questionnaires in 2000 and 2011 (Figure 1). Detailed description of the different phases of the study have been presented earlier[13,14]. The number of participants in the longitudinal setting varied between the different main variables (Figure 1). The outcomes indicating perceived oral health in this study were subjective oral health (SOH), self-assessed treatment need (STN) and oral health related quality of life (OHRQoL). OHRQoL was not assessed among 19- to 29-year-olds in the year 2000.

SOH was measured with a single item. The subjects were asked if they rated their oral health as good, fairly good, average, fairly poor or poor. It was dichotomized into good (good or fairly good)

and poor (average, fairly poor or poor). The question of subjective oral health was only included in the interviews. Respondents with a missing value in the year 2000 or 2011 for a question on subjective oral health were excluded from the corresponding analysis.

STN was asked with a single item: Do you think you are in need of dental services? Yes/No, the first indicating poor perceived oral health. Those not providing an answer to treatment need in the year 2000 or 2011 were excluded from the corresponding analysis.

OHRQoL was measured using a Finnish translation of the 14-item Oral Health Impact Profile (OHIP-14) as it was valid and reliable and had been used in a nationally representative survey to get population estimates for prevalence, extent, and severity[15]. The fourteen questions cover physical, psychological, functional, and social problems related to oral health. Responses were coded as follows: 0 = never, 1 = hardly ever, 2 = occasionally, 3 = fairly often, and 4 = very often. For those with one or two missing values for the OHIP-14 items (owing to non-response or answering 'don't know') the missing values were replaced with the sample mean of the other OHIP-14 items of the survey year. Participants with more than two missing answers were not included in the analysis. Three outcome variables were formed[11]. Severity (range 0-56) is the sum of the responses, which also takes into account impacts experienced occasionally or hardly ever, extent (range 0-14) is the number of items reported occasionally, fairly often or very often (OFoVo), and prevalence is was coded to be 1 for those reporting at least one impact OFoVo and 0 for others, describing the percentage of people reporting one or more items OFoVo. Severity and extent were calculated for comparability to other studies, and we chose OFoVo prevalence as the main OHRQoL. Those reporting one or more items OFoVo were considered having poor perceived oral health.

The background variables used in this study were age and gender. Age was categorized by year of birth: 1971 or later, 1970–1956, 1955–1946, and 1945 or earlier. Categorization of the year of birth was chosen on the basis of eligibility for subsidized care. The two younger groups have had access to subsidized services, the two older groups gained access to services during the study.

We recoded 4-class change variables for each dichotomized outcome: stable good (good at both time points), improvement (poor at baseline, good in the end), stable poor (poor at both time points), and worsening (good at baseline, poor in the end).

Descriptive statistics were calculated, and statistical significances of changes between 2000 and 2011 in SOH, STN and OHRQoL were evaluated using McNemar test and Wilcoxon signed rank test; separately for men and women and separately for different age groups. Also, odds ratios (OR) for good SOH, STN and OFoVo in 2011 were calculated among those reporting good SOH, STN or OFoVo in 2000 (reference poor SOH, STN or OFoVo prevalence). General linear mixed models for changes in perceived oral health variables were conducted in a longitudinal setup, a separate model for all three perceived oral health variables: SOH, STN and OFoVo prevalence. Independent variables were 4-class change variables in the other two perceived oral health variables, gender and age. Associations between SOH, STN and OFoVo prevalence were assessed using Odds Ratios (OR). All analyses were conducted using weights. The statistical analyses of the study were completed with SPSS 22 software; the reporting complies with the STROBE guidelines.

Results

Only 29% in 2000 and 24% in 2011 of the adult population reported "average/poor" subjective oral health (SOH). The gender differences persisted as the proportion of those reporting "average/poor" SOH decreased both among women and men between 2000 and 2011. The self-assessed treatment need (STN) was substantial at both time points (47% in 2000 and 46% in 2011). During the study years, STN decreased statistically significantly among women, but not among men. Changes in oral health related quality of life followed the change pattern of SOH, regardless of which OHRQoL outcome variable was used. The OFoVo prevalence decreased from 32% to 26% between 2000 and 2011. The OFoVo extent and severity scores were low in 2000 and decreased in both genders over the 11 years, the OHIP-14 extent score among men being an exception (Table 1).

The percentage changes by gender in a longitudinal setting revealed changes in both directions. The proportion of those with average/poor SOH remained low and decreased. STN remained or appeared among 46% of all the respondents. The situation improved (e.g. need decreased) in women but not in men. Simultaneously, OFoVo prevalence remained at a low level or decreased, indicating the same pattern as SOH among the majority of respondents. These changes in SOH and OFoVo prevalence were similar in both genders. (Table 2).

When looking at different age groups, SOH improved significantly in all age groups except the youngest age group, in which, STN increased significantly. OFoVo prevalence improved significantly in the two oldest age groups. (Table 3)

Age- and gender-specific results revealed that SOH changed for the better in the three oldest age groups in both genders, the only exception being women in the age group born in 1946–1955. Only among men in the youngest age group the situation worsened. Changes in STN were inconsistent. STN increased among men in the youngest age group but decreased among men in the second youngest group and women in the oldest age group. Change towards better OHRQoL was statistically significant in both genders in the two oldest age groups (Table 4).

All measures of perceived oral health were interrelated, (p-values <0.001 for all associations), but the strength of the associations varied. Associations between SOH and STN were the highest (OR 5.2 in 2000 and 4.2 in 2011) and the lowest between STN and OFoVo prevalence (OR 2.3 in 2000 and 2.5 in 2011. A change to poor subjective oral health was more probable among subjects with other than stable good self-assessed treatment need or OHIP impacts. The same was seen also for changes for self-assessed treatment need and OHIP impacts, respectively (Table 5).

Discussion

Changes in perceived oral health measured by three different instruments were not similar. The global single-item subjective oral health measure revealed similar information and followed the same pattern as did the multi-dimensional OHIP-14 by both genders and by all age groups. A proportion of those reporting average/poor subjective oral health or impacts OFoVo remained low or improved in the majority of the Finnish adult population during the 11-year period. Self-assessed treatment need remained substantial despite the decrease seen among women. In addition, the youngest age group reported more self-assessed treatment need during the study years. However, changes in separate perceived oral health measures were related to each other, the associations varied between the measures. A change to poor in any of the perceived oral health measures was most strongly associated with those having stable poor in the other two measures, respectively.

The response rate in the study was high. The loss to follow up in the study sample between 2000 and 2011 was moderate, which can be considered as a major strength in this study. The analyses

were conducted using weights to correct the effects of non-response. Thus, the results were representative of the Finnish adult population. The main variables subjective oral health and OHIP-14 and the methods used in this study are well established and widely used in oral health research of perceived oral health[3,4,5]. We also performed sensitivity analyses using both FoVo and OFoVo cut-off points for OHIP-14 outcome variables. The outcome was similar at both cut-off points and thus not dependent on the cut-off point. The participants in this study reported rather good perceived oral health. Thus, the less stringent cut-offs for OHIP-14 and subjective oral health were used. The OFoVo cut-off was also used as it was comparable with the UK studies[3]. A further strength of this study was that self-assessed treatment need has seldom been used in population studies, especially longitudinally. A limitation is that we were not able to compare our self-reported measures to clinically determined oral health. In addition, our data did not include information on changes in the oral health care system which were implemented between the study years.

Comparison with other nationally representative surveys revealed a similar pattern of improvement in perceived oral health. Our results concerning changes in subjective oral health mainly followed the patterns reported in repeated cross-sectional studies elsewhere. In a prospective cohort study in Sweden, participants between the ages of 50 to 65 years reported stable satisfaction (60-66% were satisfied with their teeth) over 15 years[16]. Among the same age group in 2000 in our study, subjective oral health in the group remained good for 50% over the 11-year time period. No gender differences were reported in Sweden, whereas in our study gender differences persisted. Improvement among men and women was similar; women reported better subjective oral health at both points in Finland. However, it should be noted that satisfaction with teeth and subjective oral health are not necessarily similar concepts. Change for the better in oral health-related quality of life was statistically significant in both genders. In nationally representative population studies in the UK, OFoVo impacts decreased by 10% in 11 years. In our study the decrease was 6% over the same time period. The impact prevalences in our study were comparable to other national surveys at both cut-offs[4,11,17]. However, none of these national studies were longitudinal.

Self-assessed treatment need changed statistically significantly in the two youngest age groups among men. There was a deterioration in the change experienced in the youngest group. This may relate to the oral health care reform implemented in Finland in 2002. As a consequence of the reform, access to public health care may have become more difficult in the youngest age groups.

Self-assessed treatment need and poor subjective oral health have been strong predictors of unmet dental treatment need in Canada[18].

For planning and monitoring oral health services it is important to know not only the clinical measures of oral health but also the perceived oral health in the population. According to our results, multiple perceived oral health measures might be useful for screening purposes, since the three used in this study provided different results and thus measured different aspects of perceived oral health. The factors behind the changes in perceived oral health and self-assessed treatment need in age-groups and the pathways to oral health service use also need to be explained. Research including both perceived and clinical indicators is needed to understand need for care as a whole.

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Table 1. Descriptive statistics of subjective oral health (SOH, women n=2483, men n=1975), self-assessed treatment need (STN, women n=3025, men n=2420) and oral health-related quality of life (OHIP-14 OFoVo[1] prevalence, extent and severity, women n=1894, men n=1477).

	Women			Men		
	2000	2011	p^2	2000	2011	p^2
Average/Poor SOH (%)	27	21	<0.001	31	28	0.012
STN (%)	48	44	0.003	47	48	0.471
OHIP-14 OFoVo prevalence (%)	32	26	<0.001	32	25	0.001
OHIP-14 OFoVo extent (mean)	0.91	0.82	0.004	0.87	0.82	0.208
OHIP-14 severity (mean)	3.30	2.78	<0.001	3.45	2.96	<0.001

[1] oral impacts occurring occasionally, fairly often or very often

2   based on McNemar test (percentages) or Wilcoxon signed rank test (means)

Table 2. Distributions of 4-class change variables for subjective oral health (SOH), self-assessed treatment need (STN), and oral impacts occurring occasionally, fairly often or very often (OFoVo prevalence) in 2000–2011.

		n	Worsening	Stable poor	Stable good	Improvement	p[1]	OR[2]
All	SOH	4458	11	13	60	16	<0.001	4.54
	STN	5445	21	25	32	22	0.094	1.79
	OFoVo prevalence	3371	11	15	58	16	<0.001	4.51
Men	SOH	1975	13	16	55	16	0.012	4.35
	STN	2420	22	26	31	21	0.471	1.78
	OFoVo prevalence	1477	11	15	58	16	0.001	5.06
Women	SOH	2483	10	11	63	16	<0.001	4.65
	STN	3025	19	24	34	23	0.003	1.82
	OFoVo prevalence	1894	12	14	57	17	<0.001	4.14

[1] based on McNemar test
[2] OR for risk of being good (or poor) in 2011 when reported good (or poor) in 2000

Table 3. Age-specific distributions of 4-class change variables for subjective oral health (SOH), self-assessed treatment need (STN), and oral impacts occurring occasionally, fairly often or very often (OFoVo prevalence) in 2000–2011.

Born		n	Worsening	Stable poor	Stable good	Improvement	p[1]	OR[2]
1971	SOH	610	12	6	71	11	0.485	3.56
	STN	931	24	23	34	19	0.042	1.66
1956-70	SOH	1451	9	13	64	14	<0.001	6.27
	STN	1746	20	29	28	23	0.123	1.82
	OFoVo prevalence	1301	12	12	61	15	0.108	3.99
1946-55	SOH	1127	12	14	58	16	0.011	4.42
	STN	1306	19	25	32	23	0.054	1.79
	OFoVo prevalence	1026	10	14	58	18	<0.001	4.56
-1945	SOH	1270	12	17	50	21	<0.001	3.39
	STN	1462	19	21	38	22	0.125	1.78
	OFoVo prevalence	1044	12	18	54	16	0.010	5.10

[1] based on McNemar test
[2] OR for risk of being good (or poor) in 2011 when reported good (or poor) in 2000

Table 4. Age- and gender-specific distributions of 4-class change variables for subjective oral health (SOH), self-assessed treatment need (STN), and oral impacts occurring occasionally, fairly often or very often (OFoVo prevalence) in 2000–2011.

	Born		n	Worsening	Stable poor	Stable good	Improvement	p[1]	OR[2]
SOH	1971-	Men	263	16	8	66	10	0.060	3.27
		Women	347	8	5	76	11	0.358	4.07
	1956-70	Men	648	9	16	61	14	0.030	7.83
		Women	803	9	9	68	14	0.006	4.81
	1946-55	Men	520	14	17	51	18	0.011	3.43
		Women	607	10	12	64	14	0.072	5.71
	-1945	Men	544	14	19	47	20	<0.001	3.10
		Women	726	11	16	53	20	<0.001	3.63
STN	1971-	Men	427	27	24	33	16	<0.001	1.82
		Women	504	21	23	33	23	0.427	1.60
	1956-70	Men	783	20	32	25	23	0.034	1.82
		Women	963	20	27	30	23	0.232	1.80
	1946-55	Men	602	20	24	33	23	0.054	1.74
		Women	704	19	26	31	24	0.090	1.82
	-1945	Men	608	22	21	36	21	0.089	1.65
		Women	854	18	20	39	23	0.034	1.89
OFoVo prevalence	1956-70	Men	566	14	12	61	13	0.924	4.18
		Women	735	12	12	60	16	0.088	3.91
	1946-55	Men	460	8	14	59	19	<0.001	5.70
		Women	566	11	14	57	18	0.017	3.86
	-1945	Men	451	11	15	58	16	0.010	6.02
		Women	593	12	17	54	17	0.037	4.51

[1] based on McNemar test
[2] OR for risk of being good (or poor) in 2011 when reported good (or poor) in 2000

Table 5. Association of changes in average/poor subjective oral health (SOH), self-assessed treatment need (STN) and oral impacts occurring occasionally, fairly often or very often (OFoVo prevalence) from 2000 to 2011 by gender, birth year, SOH, STN and OFoVo prevalence analyzed by General linear mixed model

	Reference group	OR for	Average/poor SOH		STN		OFoVo prevalence	
			OR	p	OR	p	OR	p
Gender	Women	Men	1.48	<0.001	0.98	0.767	0.88	0.009
Born	–1945	1956–70	0.60	<0.001	1.70	<0.001	0.68	<0.001
		1946–55	0.75	<0.001	1.31	<0.001	0.76	<0.001
SOH	Stable good	Stable poor			4.14	<0.001	3.79	<0.001
		Worsening			2.01	<0.001	2.42	<0.001
		Improvement			2.45	<0.001	2.06	<0.001
STN	Stable good	Stable poor	5.60	<0.001			1.95	<0.001
		Worsening	2.13	<0.001			1.26	0.007
		Improvement	2.79	<0.001			1.33	0.003
OFoVo prevalence	Stable good	Stable poor	3.51	<0.001	1.81	<0.001		
		Worsening	2.29	<0.001	1.47	<0.001		
		Improvement	2.01	<0.001	1.21	0.010		

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Table 1. Descriptive statistics of subjective oral health (SOH, women n=2483, men n=1975), self-assessed treatment need (STN, women n=3025, men n=2420) and oral health-related quality of life (OHIP-14 OFoVo[1] prevalence, extent and severity, women n=1894, men n=1477).

Table 2. Distributions of 4-class change variables for subjective oral health (SOH), self-assessed treatment need (STN), and oral impacts occurring occasionally, fairly often or very often (OFoVo prevalence) in 2000–2011.

Table 3. Age-specific distributions of 4-class change variables for subjective oral health (SOH), self-assessed treatment need (STN), and oral impacts occurring occasionally, fairly often or very often (OFoVo prevalence) in 2000–2011.

Table 4. Age- and gender-specific distributions of 4-class change variables for subjective oral health (SOH), self-assessed treatment need (STN), and oral impacts occurring occasionally, fairly often or very often (OFoVo prevalence) in 2000–2011.

Table 5. Association of changes in average/poor subjective oral health (SOH), self-assessed treatment need (STN) and oral impacts occurring occasionally, fairly often or very often (OFoVo prevalence) from 2000 to 2011 by gender, birth year, SOH, STN and OFoVo prevalence analyzed by General linear mixed model.

Figure 1. Participants at the different phases of the study.