Dental health patterns in young adults in Lithuania: an exploratory, analytical approach

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Patterns of variation in experience related to caries and treatment with regard to psychosocial, socio-economic, lifestyle, and oral healthcare-related characteristics were explored. A random sample of 382 (response rate 51%) subjects residing in 10 areas of Lithuania was examined (35 to 44-year-olds). Participants were given a dental examination and asked to complete a structured questionnaire. Experience related to caries and treatment differed with regard to residency and between genders. Analysis of self-reported data elucidated different aspects of psychosocial and socio-economic status and a variety of lifestyle factors. Interrelationships between the studied determinants were also analysed. Different patterns of dental health were revealed for men and women and for urban and rural participants. It can be concluded that factors influencing the dental status of Lithuanians are not only multiple, they seem also to influence dental health in complex ways. An exploratory approach should therefore be considered as a prerequisite to a causal approach of studying caries in populations. □ *Adults; dental health; factor analysis*

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Most studies relating variation in caries experience to multiple factors are risk studies (1–5) searching for strong predictors aimed at finding individuals with high levels of risk; only a few studies have aimed at explaining caries occurrence in populations (6, 7). In contrast to a risk approach, the causal approach aims to identify relationships in order then to influence the causes of disease (8). At present, selection of an adequate frame of reference for a causal approach cannot readily be guided by existing theory.

With a causal approach, an analysis of dental health within a broader framework has been suggested (9). Patterns of variation in dental health should therefore be explored primarily in order to detect possible causal associations. In this context, the dental health of individuals is influenced by lifestyle, formed within social networks and represented by psychosocial, socio-demographic, and dental healthcare characteristics. It is necessary to acknowledge that concepts that reflect complex phenomena, or measure parts of them, provide an incomplete picture of the complex system (10). In addition, there are difficulties in conceptualizing multi-dimensional entities such as knowledge, attitudes, lifestyle, and social class. Such entities are not easily reducible to simple, unitary variables, and if equated with simple univariate scores much information may be lost (11, 12). Therefore, a more complete range of events should be considered, requiring a broader range of parameters than is usually applied.

In the present study, psychological well-being, absence of stress, and coping with stress represented the psychosocial concept. Social network has been shown to have a significant impact on health-maintaining or disease-promoting behavior (13). Furthermore, illnesses have been related to individual behavior, especially long-term behavior patterns often referred to as lifestyle (14). The concept of lifestyle has been shown to consist of personal behavior, as well as knowledge, beliefs, and values, all shaped by lifelong experience and living conditions. The organizational structure of healthcare has also been shown to reflect the values, beliefs, knowledge, attitudes, and practices shared by members of the general public and professionals (15).

The aim of the present study was to explore patterns of variation in caries and treatment experience in Lithuanian 35 to 44-year-olds. In order to understand how caries varies in sub-populations, an approach combining determinants with multiple aspects has been employed.

Material and methods

The study was performed in 1997–98 with the permission of the Health Ministry of Lithuania. The sample was stratified into low (<1.0 ppm) and high (≥1.0 ppm) fluoride regions; 10 places, 7 with low fluoride and 3 with high fluoride levels, were selected as representative of regional variations in Lithuanian society. Random selection from the National Central Register was performed in each of these 10 places. The total sample comprised 742 individuals in the age range 35–44 years, and each participant received a written invitation with a short explanation of the aims of the study and a guarantee of confidentiality. After 3 invitations, combined with tele-

Table 1. Study variables and their range of measurements

Clinical measurements
Oral hygiene levels (according to Green–Vermillion Index (6)
Caries and treatment experience measurements expressed as a number of decayed surfaces (DS), a number of filled surfaces (FS), a number of missing teeth (MT), and a calculated number of decayed, missing, and filled teeth (DMFT).
Self-reported measurements
Residency (1–2)
Gender
Psychological well-being (1–6)
Satisfaction with personal life (1–6)
Bothered by nervousness (1–6)
Feeling under any strain, stress, or pressure (1–6)
Firm control of one's behavior, thoughts, emotions (1–6)
Education (1–7)
Occupation (1–12)
Income (1–7)
Toothbrushing frequency (1–7)
Use of fluoridated toothpaste (1–4)
Smoking (1–7)
Alcohol use (1–11)
Frequency of use of 'sweets and candy'; 'biscuits, cakes, cream cakes'; 'sweet pies, buns';' jam or honey'; 'chewing gum with sugar'; 'lemonade, cola, or other soft drinks'; 'fruit eating frequency' (1–6)
Time since the last dental visit (1–6)
Dental visit costs (1–2)
Reason for dental visit (1–4)
Satisfied with the cost of the last dental treatment (1–2)
A belief that 'dental visit solves teeth, gums, and denture problems' (1–5)
Dental attitudes that 'teeth are detrimental to appearance'; 'dental problems affecting organism as a whole'; 'dental status is of great importance'
Attitude of dentists 'examining their patients carefully'; 'explaining all dental problems'; 'devoting enough time, attention' (1–5)
Dental knowledge that 'brushing prevents decay'; 'brushing makes for healthy gums'; 'floss is no guarantee for healthy gums'; 'fluoride is a harmless way of preventing caries'; 'fluoridated water protects teeth'; 'sweet are bad for teeth'; 'tobacco is bad for teeth and mouth' (1–5)

phone calls and home visits, 382 participants (response rate 51%) were contacted and examined. Of all those not examined (non-responders), 45% were briefly interviewed by telephone or during a home visit. Non-responders and responders were compared by chi-square statistic with regard to gender, residency, socio-economic status, and dental visit pattern (DVP). No selection bias was detected except for a slightly lower socio-economic status in the non-responders' group.

All participants were clinically examined and asked to complete a standard questionnaire (see Table 1). The examination took place in public clinics and included scorings on caries and treatment experience and estimates of oral hygiene levels (16). In accordance with the WHO criteria, caries was measured at cavitation level (17). Clinical data were collected by one of the authors (JA), trained and calibrated at the Faculty of Dentistry, University of Oslo, prior to the study. Because of the difficulties with response rates, diagnostic intra-examiner consistency was evaluated using a double scoring of 34 participants with a 2 h intermission period. Given the high prevalence of decayed, missing, and filled surfaces and that Cohen's kappa was beyond 0.90, for clinical recordings, the reliability of clinical estimates was considered satisfactory.

Experience related to caries and treatment was

Table 2. Caries and treatment experience according to residency, fluoride in the drinking water, and gender

Related parameter*	DMFT mean (SD)	DS mean (SD)	FS mean (SD)	MT mean (SD)
Fluoride area	$P = 0.000$	$P = 0.009$	$P = 0.003$	$P = 0.010$
Low (<1.0 ppm)	15.7 (5.6)	8.5 (11.0)	26.2 (19.9)	4.9 (4.8)
High (≥1.0 ppm)	11.4 (5.8)	5.6 (8.2)	19.7 (18.9)	3.7 (3.2)
Residency	$P = 0.018$	$P = 0.044$	$P = 0.063$	$P = 0.009$
Urban	14.8 (5.9)	6.2 (8.9)	27.0 (20.0)	4.2 (4.4)
Rural	13.0 (6.3)	11.1 (12.7)	15.8 (16.7)	5.2 (4.3)
Gender	$P = 0.000$	$P = 0.077$	P = 0.000	$P = 0.344$
Males	12.3 (5.9)	8.6 (10.4)	16.5 (16.4)	4.2 (4.2)
Females	15.9 (5.7)	6.7 (10.1)	30.1 (20.2)	4.7 (4.5)

* Means compared by *t* test and Mann-Whitney U test.

Table 3. Factor loading matrix of exploratory factor analysis*

Clusters of variables introduced into factor analysis	Factor abbreviation and factor loading†	
	Factor 1	Factor 2
Mental conditions (MC)	MCF	
Psychological well-being	0.781	
Bothered by nervousness	0.772	
Feeling under any strain, stress or pressure	0.738	
Satisfaction with personal life	0.696	
Firm control of one's behavior, thoughts, emotions	−0.656	
Socio-economic status (SES)	SESF	
Education	0.856	
Occupation	0.760	
Income	−0.774	
Dental visit pattern (DVP)	DVPF1	DVPF 2
Satisfied with the cost of the last visit	0.820	
Dental treatment costs	0.814	
Dental visit in solving teeth, gums, dentures problems		0.697
Reason for the last dental visit		−0.575
Last dental visit		0.541
Dental knowledge (DK)	DKF1	DKF2
'Brushing prevents decay'	0.810	
'Brushing makes for healthy gums'	0.701	
'Sweet are bad for teeth'	0.521	
'Tobacco is bad for teeth and mouth'	0.493	
'Fluoride is a harmless way of preventing caries'		0.889
'Fluoridated water protects teeth'		0.864
Dental attitudes (DA)	DAF1	DAF 2
Dental problems affecting organism as a whole	0.726	
Poor teeth are detrimental to appearance	0.698	
Teeth status is of great importance		0.708
Conserving one's teeth is not important		−0.704
Attitudes about dentists (AD)	ADF	
Attitude of dentists examining their patients carefully	0.838	
Attitude of dentists devoting enough time, attention	0.794	
Attitude of dentists explaining all dental problems	0.620	
Individual oral hygiene measures (OHM)	OHMF	
Toothbrushing frequency	−0.870	
Use of fluoridated toothpaste	0.750	
Clinical estimate of oral hygiene levels	0.742	
Lifestyle (LS)	LSF1	
Smoking	0.784	
Alcohol use behavior	0.784	
Diet (D)	DF1	DF2
Biscuits, cakes, cream cakes	0.798	
Sweet pies, buns	0.768	
Sweets/candy	0.713	
Jam or honey	0.585	
Fruit eating frequency		0.816
Lemonade, cola, or other soft drinks		−0.646

* Promax rotation, factor derived when eigenvalue 1.0 or more.
† Factor loading below 0.40 not presented.

expressed as number of decayed surfaces (DS), filled surfaces (FS), missing teeth (MT) and as total number of decayed, missing, and filled teeth (DMFT). The mean values of DS, FS, MT, and DMFT between genders, residency, and high and low fluoride area groups were compared by means of a *t* test and Mann-Whitney U test (Table 2). In the next step, the question was asked whether these groups differ with regard to a variety of psychosocial, socio-economic knowledge, attitudes, and lifestyle-related characteristics. The characteristics to represent these concepts (Table 1) were chosen from explanatory, prediction, and caries risk studies. The questionnaire consisted of questions from standardized questionnaires (18, 19). The internal consistency of questionnaires was tested applying Cronbach's α method (20). Cronbach's α was found to be beyond 0.7 or higher for different items from the questionnaire, indicating a moderate to high internal consistency.

In the present study, securing full information when embarking on the analyses was emphasized. A method was needed which could join the multiple aspects of inter-related effects, and for this purpose a factor analysis technique (principal component analysis) was chosen. Two rotation techniques, i.e. varimax and promax, were compared (21). As varimax and promax rotation presented similar results, only the results from the promax rotation are presented and discussed. The factor analysis served 2 purposes: to simplify data analysis and to obtain a conceptually meaningful summary of data for further interpretation. Firstly, highly related variables were linked and their relative importance explored. Secondly, fewer complex concepts obtained through factor analysis made further analyses more interpretable, particularly for exploratory purposes. Related concepts were linked into common constructs (factors) through factor analyses. The principal component analysis provided a set of new constructs that were combinations of the original variables (22). A construct is an unobservable complex estimate that is used to label the pattern of observable ones (original variables) and that results in new derived factors (23). Factor analysis was performed separately for each of the strata, consisting of meaningful highly interrelated variables (Table 3). The extraction of factors was guided by scree plots. A factor was extracted when the eigenvalue was greater or equal to 1. Turning to the validation of the factor analysis, the question was whether the exploratory sample results could be replicated in the validation sample. Shrinkage values tested in a random split sample presented the difference in factor loadings below 0.15, which can be considered satisfactory.

In the present study, factor analysis was applied to psychosocial, socio-economic, dental knowledge, attitudes, and lifestyle-related measures (Table 3). A score for each subject on each factor was computed and each original variable contributed to the factor score based on its relative importance as indicated by factor loading (Table 3).

Results

A difference in caries and treatment experience was observed between groups from low and high fluoride areas; it also differed between genders and between urban and rural inhabitants (Table 2). Mean DMFT levels differed statistically significantly in all groups studied. Means of DS did not differ significantly between genders; the difference in FS means between residency groups did not reach statistical significance and means of MT did not differ substantially between males and females (Table 2).

Factors from each stratum consisting of highly related variables were extracted (Table 3). The factors were named according to the concept represented by the original variables. Columns 2 and 3 present the first and second derived factors in each stratum corresponding to contributions from different variables, listed and indicated with factor loading.

The MCF comprised information about different aspects of mental health, i.e. well-being ('psychological well-being' and 'satisfaction with personal life'), experiencing stress ('bothered by nervousness' and 'feeling under any strain, stress, or pressure') and coping with stress ('firm control of one's behavior, thoughts, emotions'). DVP, dental knowledge (DK), dental attitudes (DA), and diet (D) concepts proved to be two-dimensional, i.e. each of these strata was represented by two factors.

The dental knowledge factor 1 (DKF1) comprised knowledge about oral-health-related habits ('brushing prevents decay'; 'brushing makes for healthy gums'; 'sweets are bad for teeth', and 'tobacco is bad for teeth and mouth'). The dental knowledge factor 2 (DKF2) consisted of information about knowledge and beliefs about fluorides ('fluoride is a harmless way of preventing caries' and 'fluoridated water protects teeth'). The item 'diet' comprised two dimensions, one negative (DF1), i.e. use of different sweet items and one positive (DF2), i.e. use of fruits and avoidance of soft drinks.

Further analytical proceedings gave insight about relatedness among a variety of constructed concepts (factors). As fluoride in the drinking water was considered to have an independent protective effect, correlations were therefore studied and compared only between the two genders (Table 4) and between urban and rural participants (Table 5).

Many differences were found between male and female subsamples. For men, the MCF correlated significantly with the DVP factor (DVPF1) and with the lifestyle factor (LSF). For women, the MCF correlated significantly with socio-economic status (SESF). Of all, the SESF presented the strongest statistically significant correlation both for male and for female groups. For men, the SESF correlated with the dental knowledge factor 2 (DKF2), with the dental attitudes factor 2 (DAF2), with both DVP factors (DVPF1 and DVPF2), with the attitude about dentist factor (ADF), with the diet factor (DF1) and with the oral hygiene factor (OHMF). For women, the SESF was related to DKF2, DAF1 and DAF2, ADF, DF1, and OHMF. Both dental knowledge factors (DKF1 and DKF2) presented only a few significant correlations, i.e. for men DKF1 correlated significantly with DAF1 and DKF2 to OHMF. For women, DKF1 correlated with DKF2 and DKF2 with ADF. For men, the LSF (comprising information about smoking and alcohol use) was related to the MCF, oral hygiene measures factor (OHMF) and the diet factor 1 (DF1), while for women, LSF related significantly and negatively with the diet factor 2 (DF2).

Comparison of urban and rural subsamples also revealed some significant differences (Table 5). The mental condition factor (MCF) did not present any significant correlations in urban subsamples. For rural participants, this MCF related significantly with dental attitude factors (DAF1 and DAF2), with the DVP factor (DVPF1), with the attitude about dentist factor (ADF), with the lifestyle factor (LSF), and with the oral hygiene measurement factor (OHMF). Social class (SESF) also showed differences between urban and rural residents. For urban inhabitants, the SESF factor correlated with the dental attitude factor 2 (DAF2), with both DVP factors (DVPF1

Table 4. Correlation matrix (Spearman) of derived factors for men (women)* subsamples. Significant correlation coefficients are shown in bold.

		MCF	SESF	DKF1	DKF2	DAF1	DAF2	DVPF1	DVPF2	ADF	LSF	DF1	DF2
SESF	coeff.	**−0.02 (0.15)**											
	P-value	**0.77 (0.03)**‡											
DKF1	coeff.	0.05 (0.11)	0.08 (0.00)										
	P-value	0.55 (0.13)	0.29 (0.97)										
DKF2	coeff.	0.05 (−0.12)	−0.18 (−0.19)	−0.08 (−0.20)									
	P-value	0.51 (0.09)	0.02 (0.01)	0.32 (0.01)									
DAF1	coeff.	0.01 (−0.05)	**−0.11 (−0.16)**	**0.18 (0.08)**	0.12 (−0.00)								
	P-value	0.93 (0.50)	**0.15 (0.02)**‡	**0.03 (0.25)**†	0.14 (0.99)								
DAF2	coeff.	−0.09 (0.02)	**0.15 (0.18)**	0.10 (0.06)	−0.03 (−0.12)	**0.26 (0.17)**							
	P-value	0.26 (0.78)	**0.05 (0.01)**‡	0.22 (0.43)	0.68 (0.09)	**0.00 (0.02)**†‡							
DVPF1	coeff.	**0.20 (0.02)**	**−0.44 (−0.18)**	−0.14 (−0.12)	−0.02 (−0.00)	−0.07 (−0.01)	**−0.22 (−0.12)**						
	P-value	**0.01 (0.74)**†	**0.00 (0.01)**†‡	0.09 (0.11)	0.80 (0.97)	0.40 (0.85)	**0.01 (0.10)**†						
DVPF2	coeff.	−0.09 (−0.11)	**−0.36 (−0.07)**	−0.02 (0.04)	0.08 (0.03)	0.07 (0.03)	−0.13 (−0.03)	**0.26 (0.02)**					
	P-value	0.26 (0.13)	**0.00 (0.35)**†	0.82 (0.60)	0.33 (0.71)	0.38 (0.60)	0.11 (0.73)	**0.00 (0.77)**†					
ADF	coeff.	0.05 (−0.06)	−0.19 (−0.26)	0.13 (0.04)	**0.09 (0.16)**	**0.23 (0.09)**	0.01 (−0.10)	**0.13 (0.16)**	0.04 (0.02)				
	P-value	0.49 (0.39)	0.02 (0.00)	0.10 (0.55)	**0.24 (0.03)**‡	**0.00 (0.19)**†	0.92 (0.16)	**0.11 (0.03)**‡	0.60 (0.76)				
LSF	coeff.	**−0.19 (0.02)**	−0.02 (0.13)	0.03 (0.03)	−0.02 (−0.08)	0.02 (0.02)	−0.03 (0.13)	−0.02 (−0.05)	0.09 (−0.04)	−0.14 (0.06)			
	P-value	**0.02 (0.75)**†	0.78 (0.06)	0.67 (0.71)	0.82 (0.28)	0.78 (0.75)	0.70 (0.06)	0.79 (0.51)	0.26 (0.60)	0.08 (0.42)			
DF1	coeff.	0.01 (0.02)	**0.21 (0.14)**	−0.07 (0.07)	−0.05 (0.03)	−0.06 (−0.09)	−0.06 (−0.05)	−0.08 (0.01)	**−0.20 (0.02)**	−0.05 (0.01)	−0.14 (0.05)		
	P-value	0.87 (0.83)	**0.01 (0.05)**†‡	0.41 (0.37)	0.57 (0.68)	0.43 (0.21)	0.47 (0.50)	0.31 (0.90)	**0.02 (0.84)**†	0.54 (0.86)	0.08 (0.53)		
DF2	coeff.	0.03 (0.07)	−0.14 (0.06)	−0.05 (−0.05)	−0.02 (0.01)	−0.08 (−0.04)	−0.02 (0.02)	**0.17 (0.04)**	0.04 (−0.02)	−0.07 (−0.08)	**−0.18 (−0.23)**	**−0.16 (0.13)**	
	P-value	0.70 (0.34)	0.07 (0.38)	0.57 (0.49)	0.84 (0.93)	0.33 (0.63)	0.84 (0.75)	**0.04 (0.53)**†	0.63 (0.83)	0.38 (0.30)	**0.03 (0.00)**†‡	**0.04 (0.08)**†	
OHMF	coeff.	0.13 (−0.08)	−0.49 (−0.38)	−0.03 (0.08)	0.25 (0.11)	0.04 (0.08)	−0.11 (−0.11)	**0.36 (0.11)**	**0.34 (−0.07)**	0.11 (−0.03)	**0.19 (−0.02)**	**−0.30 (−0.10)**	**0.14 (−0.23)**
	P-value	0.11 (0.26)	0.00 (0.00)	0.72 (0.26)	0.00 (0.15)	0.65 (0.26)	0.17 (0.12)	**0.00 (0.13)**†	**0.00 (0.32)**†	0.17 (0.71)	**0.02 (0.81)**†	**0.00 (0.20)**†	**0.10 (0.00)**‡

* For women, correlation coefficients and *P*-values are presented in parentheses.
† Correlation significant for men, but not for women.
‡ Correlation significant for women, but not for men.
†‡ Correlation significant for both men and women.
SESF = socio-economic status factor, DKF1, DKF2 = dental knowledge factors, DAF1, DAF2 = dental attitude factors, DVPF1, DVPF2 = dental visit pattern factors, ADF = attitude about dentist factor, LSF = lifestyle factor, DF1, DF2 = diet factors, OHMF = oral hygiene factor.

Table 5. Correlation matrix (Spearman correlation) of derived factors for urban (rural) *subsamples. Significant correlation coefficients are shown in bold.

		MCF	SESF	DKF1	DKF2	DAF1	DAF2	DVPF1	DVPF2	ADF	LSF	DF1	DF2
SESF	coeff.	0.07 (0.08)											
	P-value	0.29 (0.40)											
DKF1	coeff.	0.07 (0.10)	−0.07 (0.30)										
	P-value	0.25 (0.35)	0.23 (0.00)										
DKF2	coeff.	−0.05 (0.08)	**−0.11 (−0.27)**	−0.11 (−0.18)									
	P-value	0.44 (0.42)	**0.07 (0.01)**†‡	0.07 (0.08)									
DAF1	coeff.	0.03 (−0.18)	**−0.14 (−0.21)**	**0.16 (0.06)**	0.05 (0.08)								
	P-value	0.61 (0.08)	**0.03 (0.04)**†‡	**0.01 (0.57)**†	0.46 (0.47)								
DAF2	coeff.	**0.01 (−0.22)**	**0.10 (0.16)**	0.03 (0.10)	−0.04 (−0.15)	**0.26 (0.10)**							
	P-value	**0.93 (0.03)**‡	**0.00 (0.11)**†	0.66 (0.33)	0.47 (0.16)	**0.00 (0.35)**†							
DVPF1	coeff.	**0.08 (0.29)**	**−0.20 (−0.17)**	−0.09 (−0.20)	0.00 (−0.12)	−0.05 (−0.10)	**−0.09 (−0.30)**						
	P-value	**0.20 (0.01)**‡	**0.01 (0.11)**†	0.14 (0.06)	10.0 (0.26)	0.44 (0.33)	**0.15 (0.00)**‡						
DVPF2	coeff.	−0.07 (−0.11)	**−0.20 (−0.05)**	0.01 (0.03)	0.02 (0.15)	0.07 (−0.09)	−0.03 (−0.12)	**0.13 (0.06)**					
	P-value	0.23 (0.32)	**0.01 (0.65)**†	0.84 (0.81)	0.80 (0.18)	0.23 (0.42)	−0.59 (0.25)	**0.03 (0.60)**†					
ADF	coeff.	**0.04 (−0.22)**	**−0.18 (−0.14)**	0.11 (−0.01)	**0.16 (0.06)**	**0.15 (0.13)**	0.01 (−0.13)	0.12 (0.12)	0.01 (0.11)				
	P-value	**0.52 (0.03)**‡	**0.00 (0.16)**†	0.08 (0.90)	**0.01 (0.60)**†	**0.01 (0.22)**†	0.87 (0.20)	0.05 (0.27)	0.92 (0.29)				
LSF	coeff.	−0.05 (0.20)	0.06 (0.01)	0.02 (0.06)	0.05 (0.12)	−0.00 (−0.13)	0.07 (−0.08)	0.07 (0.11)	0.07 (0.17)	0.07 (−0.09)			
	P-value	0.40 (0.05)	0.31 (0.96)	0.74 (0.59)	0.47 (0.25)	0.97 (0.20)	0.27 (0.42)	0.23 (0.29)	0.25 (0.11)	0.26 (0.37)			
DF1	coeff.	−0.06 (0.19)	0.20 (0.14)	−0.04 (0.13)	0.01 (−0.04)	**−0.16 (0.13)**	−0.07 (0.01)	−0.03 (0.04)	−0.04 (−0.20)	−0.01 (0.01)	0.03 (−0.18)		
	P-value	0.37 (0.08)	0.00 (0.18)	0.47 (0.23)	0.89 (0.73)	**0.01 (0.23)**†	0.22 (0.96)	0.60 (0.71)	0.51 (0.07)	0.83 (0.95)	0.60 (0.09)		
DF2	coeff.	0.08 (−0.19)	−0.02 (0.10)	−0.03 (−0.06)	−0.05 (−0.11)	−0.01 (−0.07)	0.01 (0.09)	−0.00 (0.16)	−0.06 (0.07)	−0.12 (−0.06)	**−0.34 (−0.20)**	0.01 (−0.07)	
	P-value	0.21 (0.07)	0.80 (0.36)	0.63 (0.60)	0.43 (0.32)	0.91 (0.50)	0.89 (0.38)	0.95 (0.16)	0.35 (0.54)	0.06 (0.57)	**0.00 (0.06)**†	0.82 (0.49)	
OHMF	coeff.	**0.02 (0.23)**	**−0.27 (−0.40)**	0.13 (−0.14)	**0.15 (0.26)**	0.06 (−0.03)	−0.08 (−0.11)	**0.16 (0.24)**	0.11 (0.19)	0.04 (−0.06)	**0.23 (0.37)**	**−0.14 (−0.28)**	**−0.23 (−0.09)**
	P-value	**0.77 (0.03)**‡	**0.00 (0.00)**†‡	0.05 (0.20)	**0.02 (0.02)**†‡	0.36 (0.78)	0.22 (0.31)	**0.01 (0.03)**†‡	0.08 (0.10)	0.56 (0.56)	**0.00 (0.00)**†‡	**0.03 (0.01)**†‡	**0.00 (0.41)**†

* For rural subsamples, correlation coefficients and *P*-values are presented in parentheses.
† Correlation significant for urban, but not for rural participants.
‡ Correlation significant for rural, but not for urban participants.
†‡ Correlation significant for both urban and rural participants.
SESF = socio-economic status factor, DKF1, DKF2 = dental knowledge factors, DAF1, DAF2 = dental attitude factors, DVPF1, DVPF2 = dental visit pattern factors, ADF = attitude about dentist factor, LSF = lifestyle factor, DF1, DF2 = diet factors, OHMF = oral hygiene factor.

and DVPF2), with the attitude about dentist factor (ADF), with the diet factor (DF1) and with the oral hygiene measurement factor (OHMF). For rural participants, the SESF correlated with both dental knowledge factors (DKF1 and DKF2), with the dental attitude factor 1 (DAF1), and with the factor of oral hygiene (OHMF). Other differences were also reported. In urban, but not in rural subsamples, the dental knowledge factor 2 (DKF2) was found to be significantly correlated to the attitude about dentist factor (ADF) Similarly, the correlation between the two DVP factors (DVPF1 and DVPF2) was found to be significant for urban but not for rural participants. Concomitantly, the oral hygiene measures factor (OHMF) presented relatively similar correlation in both urban and rural subsamples, except for the correlation OHMF with MCF and OHMF with DF2.

Discussion

Patterns in variation of experience related to caries and treatment in young adults were explored. The results in the present material support complex patterns of dental caries in populations. Most factors presented many interrelated effects. Moreover, different patterns for genders and rural/urban residents were documented. A closer scrutiny of these interrelationships has to be performed in the process of future causal model building.

In the present study, a way of exploring patterns related to variations in dental health has been introduced. Although factor analysis is common in medical and psychosocial research, this analysis is rarely applied in dental research. The combined factor analysis and correlation was a useful technique in exploring patterns of dental-health-related determinants. Moreover, these analyses enabled researchers to use measurements of complex concepts in a more realistic way, i.e. to employ multiple measurements instead of a common approach where complex entities are usually represented by single measurements.

Another potential advantage of aggregated information was to simplify subsequent analysis and interpretation. Towards a causal understanding, treating information about complex phenomena by factor analysis and correlation analysis offers a possibility to elucidate patterns of interrelationships between determinants. This contrasts the usual multiple regression approach, where one response variable is related to a block of several explanatory variables. The reality represents several response variables with interrelated effects, the patterns of which are difficult if not impossible to disclose by a multiple regression approach (24). In addition to the limitations to reveal interrelationships, a commonly applied regression technique may be misleading if highly associated measurements (collinear variables) are introduced in the same run. Factor analysis, on the other hand, is particularly applicable for highly related measurements.

Some findings of the present study might be discussed specifically. A geographical approach to the measurement of inequality has been of value when studying dental health (25). As expected, caries and treatment experience were found to be lower in high fluoride areas than in low fluoride areas. However, different patterns of dental-health-related determinants found between the two genders and between urban and rural participants were unexpected.

It is interesting to note that two genders presented many different aspects with regard to determinants. The main difference was related to DVP. Therefore, it should not be surprising that treatment experience (FS) of women was almost twice as extensive as of men. In this context, the questions presented were: Did women care more for dental health than men did? Did women present more dental problems or did their respective habits differ? Caries experience (DS) differed, or did they have more dental problems due to gender differences, or did they differ in dental care-related habits? In the present study, the number of decayed surfaces did not differ significantly between genders and there was no clear difference with regard to dental-health-related knowledge and attitudes. Although it is generally reported that women's diet is more conducive to dental health than that of men, there is no clear evidence from the present study to support this statement.

Another distinction is that urban inhabitants present a better dental health-promoting lifestyle than rural dwellers, i.e. health-promoting knowledge, attitudes, and behavior. This is in accordance with previous reports that dental-health-related behavior and attitudes differ between various residential areas (25).

The present approach has demonstrated that an exploratory approach is a necessity if we are to understand or explain dental health variation patterns even within a single community. We have to acknowledge that factors determining the health status of a population are not only multiple and complicated, they seem also to influence each other in ways that are much more intricate than is commonly appreciated. In addition, these factors have their effects over long periods of time; their link is neither immediate nor direct (26). When key differences among sub-populations are not understood, causal testing without prior knowledge about the population of interest may be difficult to elaborate, because many important aspects related to variations in dental health can be missed. Such an exploratory approach is needed in order to take into account the complex ways in which biological factors are influenced by economic, social, and psychological factors and their role in the development of chronic diseases. Such an approach may also reveal biological and social 'critical periods' during which particular groups of individuals can be protected against an accumulation of risk (27).

In conclusion, the present exploratory approach has shown distinct patterns of dental disease in different subgroups of 35 to 44-year-old Lithuanians. The exploratory approach should therefore be considered as a preliminary and necessary step to a causal testing of caries occurrence in populations.

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