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Social gradient in caries experience of Belgian adults 2010

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Objective: This study aims to explore the caries experience of the Belgian population in relation to social indicators. ***Basic research design:*** Data collection (2009-2010) consisted of an oral health questionnaire and examination during a home visit. ***Participants:*** Representative sample of the Belgian population (>5 years old). Only the economically active population was included for final analyses. ***Main outcome measures:*** ANOVA and multivariable regression analyses were used to reveal associations between social indicators, oral hygiene, untreated decay, DMFT and edentulousness. ***Results:*** 2742 participants completed the questionnaire, of whom 2563 were examined clinically. Most (53%) were female and mean age was 43.3 years (95% CI= 41.2 - 45.4). In the total population, 11.1 % were caries-free (DMFT = 0) and mean DMFT was 10.8 (95% CI = 10.0-11.5). In the analysed subsample, higher educated participants had lower DMFT scores than those with low or no educational qualifications ($p = 0.003$). Employment status was associated with the presence of untreated tooth decay, especially in the youngest age group ($p = 0.015$), and with edentulousness (p = 0.02), with a higher risk among unemployed women of being completely edentulous (OR = 5.32; 95% CI = 1.75-16.12). Untreated tooth decay was related to frequency of tooth brushing and plaque index ($p < 0.002$ and < 0.001 respectively). ***Conclusions:*** Caries experience in Belgium, expressed as mean DMFT and proportion of untreated tooth decay, is more associated with level of education and employment status than with family income, which is still the main criterion for larger government allowances for healthcare in Belgium.

Key words: *Dental caries (MeSH), Epidemiology (MeSH), Social Determinants of Health (MeSH), Adult (MeSH), Socioeconomic Factors (MeSH)*

Introduction

More educated and affluent persons live longer and are healthier on average than less educated and underprivileged individuals, indicating that the health of an individual is influenced by social parameters (WHO, 2008). The same pattern applies to oral health. Various national and international reports show that the prevalence of oral diseases is not equally distributed, despite their widespread occurrence (Sabbah *et al*., 2007; Vanobbergen *et al*., 2010; Costa *et al*., 2012). Socio-economic oral health inequalities and social gradients exist in most countries, resulting in subgroups in society whose members are at greater "risk" of experiencing severe caries and periodontal diseases (Sanders *et al*., 2006). This association between low socio-economic status and oral diseases seems to be stronger in high-income countries (Schwendicke *et al*., 2015).

Oral health inequalities can be considered unfair systematic differences in oral health among populations in society, judged to be avoidable by reasonable action. Solar and Irwin (2010) argue that health inequalities are determined by patterns of social stratification arising from the systematic 'unequal distribution of power, prestige and resources among groups in society'. The unequal distribution of these factors is not only associated with worse health outcomes: there also seem to be clear socio-economic gradients in health behaviour, showing people with lower educational levels reporting a higher frequency of health-compromising behaviours (Singh *et al*., 2013).

The existence of a social gradient indicates that oral health risks do not have an on/off-switch but rather appear as a continuum. The most underprivileged groups are at highest risk, while the wealthiest groups have the lowest risk (which is, however, never reduced to zero). There are several possible explanations for this gradient, according to Mackenbach (1994). The "artefact theory", stating that the observed social gradient is purely a matter of observational bias and methodological errors, is the least plausible explanation. A second explanation theory is "selection theory", according to which poor health leads to decreased social mobility and so to a lower socio-economic position. This hypothesis comprises both intra-generational and inter-generational selection. The former emphasises the fact that a less healthy individual is less likely to obtain a higher socio-economic position in adult life, while inter-generational selection describes the cumulative effect of health on social mobility over generations. However, health inequalities can also follow the opposite direction: "causation theory" holds that material and structural deprivation (housing, resources), as well as differences in lifestyle, will lead to worsened health outcomes. Probably, a combination of both causation and selection are involved in the existing social gradient in general and oral health (Mackenbach, 1994).

In Belgium, universal health care insurance coverage was introduced in the 1960s with the aim of reducing the barriers to (oral) health care for all layers of the population.

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The cost of 75-80% of many oral health care services is covered by compulsory insurance. For children and vulnerable persons a full reimbursement of the standard care package is guaranteed. Furthermore, a third party payment is also available for these two groups, which is unavailable for other residents. However, in health care policy and organization, 'vulnerability' is almost exclusively defined by financial measures, in particular family income. Belgian residents can be entitled to the increased healthcare allowance when the annual family income is lower than €18,730.66 (increased by €3,467.55 for every additional family member). Other factors that could describe residents' social context, such as educational level, employment and origin are not considered (Jarman, 1991). For this reason, this study aims to explore the possible relationship between caries experience and oral hygiene behaviour, and a broad range of social indicators, within a representative sample of Belgian adults, in order to improve targeted policy interventions. The survey was commissioned by the National Institute for Health and Disability Insurance (NIHDI) of the Belgian Federal Government.

Methods

The data included in the study were derived from the Belgian Oral Health Data Registration and Evaluation System (OHDRES 2009-2010). This exercise was conducted by the Interuniversity Consortium of Epidemiology. It consisted of both a health questionnaire survey (self-administered) and a health examination survey (data obtained in an oral examination by a trained and calibrated dentist-examiner during a home visit). All data were collected between September 2009 and November 2010. More details about the methods of this survey have been previously published (Declerck *et al.*, 2013). Research protocols were approved by the Research Ethics Committee of Ghent University Hospital (Protocol B67020071382, approved March 8, 2007).

The target population consisted of all persons (> 5 years old) listed in the National Register of Belgian residents. For practical reasons, prisoners, residents of a religious community consisting of more than eight people and other institutionalised persons (except residents of nursing homes and residential care centres) were excluded. A multi-stage, stratified clustered sampling technique was used in order to obtain a representative sample of the Belgian population aged 5 years and older with a 10% oversampling of persons 75 years and older. The sampling stages were: region, province, municipality and finally households. Households were ranked hierarchically by statistical sector (territorial subdivision of a municipality), household size and age of the reference person (head of household) (Statistics Belgium, 2012). In Belgium, population data are most readily available on household level. For that reason the basic sampling unit in the present study was the household, although the unit of analysis was the individual participant.

The self-administered questionnaire appeared in either Dutch, French or German, depending on the official language of the locality. It comprised 34 questions covering several domains: oral hygiene habits, barriers to dental attendance, dietary habits, oral health-related impairments, oral health-related quality of life, tobacco use, general health, educational level and employment status. Oral health behaviour was recorded by means of self-reported frequency of tooth brushing: participants could report brushing their teeth 'twice or more per day', 'once a day', 'less than once a day', 'never' or 'I don't know'.

To explore social inequalities, statistical analysis was restricted to economically active adults, which means that students and retired adults were excluded. Explanatory variables consisted of gender and age and the following socio-economic parameters: educational attainment, occupational status, economic status (being entitled to increased allowance for health costs), nationality and country of birth. The last two variables were categorised in 3 subgroups: 'Belgium', 'other West European countries incl. USA, Canada and Australia' and 'other countries'. Educational attainment was categorised as 'primary or no diploma', 'lower secondary', 'higher secondary' or 'higher education'. Occupational status was subdivided into four subgroups: 'has a job', 'unemployed', 'retired' and 'student'. Since retirement and attending school are determined far more by age than by social status, the retired and student subgroups were excluded for further analysis on social parameters. For the same reason (to avoid bias), in the inferential analyses all participants <18years old were excluded, because minors are not supposed to have a job or to have obtained a higher education degree. All the variables used in the analyses are summarized in table 1.

Oral health examination was conducted by 68 trained and calibrated dentist-examiners. Calibration was undertaken, using a series of full-mouth photographs simulating the clinical examination of patients, set up in a PowerPoint presentation. Five experts in epidemiological screening established the benchmark for clinical examination to be used during calibration. For caries detection, $D_3MFT>0$ sensitivity was 99.6% and specificity 69%; for scoring the presence of plaque a sensitivity of 89% and specificity of 69% were obtained.

The clinical examinations were carried out by the dentist-interviewers, in the participant's home, with the participants sitting on an ordinary chair, preferably in a well-lit room. The mouth was examined using a dental mirror and periodontal probe. Cotton rolls were available for removal of debris (disposable, sterile oral examination kit, Kerr®, Kerr-Hawe, Bioggio, Switzerland). The dentist-interviewers were equipped with a head lamp (Eijlander Electronics, Ede, the Netherlands) to improve visibility.

To measure caries experience, DMFT score was used as an outcome variable, summarising the number of decayed (measured at cavitation into dentine level (D3), according to WHO criteria), missing and filled teeth (Klein *et al.*, 1938). Edentulous participants were considered to have a DMFT score of 28. Being completely edentulous was also separately analysed as dichotomously. The proportion of participants with untreated decay was determined by considering the participants with a D component >0 as a binary outcome.

The dental plaque score proposed by Sillness and Löe was used, calculating the mean buccal surface plaque score of six reference teeth on a scale from 0 (no plaque) to 3 (visible plaque accumulation on more than one third of the buccal surface) (Silness and Löe, 1964). Participants with no natural teeth were excluded for this analysis. Participants were dichotomized into a group having a plaque index of 0 and those with a higher score (PI > 0.0).

Table 1. Summary of the independent and outcome variables

Independent variables	*Type*	*Outcome variables*	*Type*
Gender	Dichotomous	Knowledge score	Continuous [0-10]
Age	Ordinal	Attitude score	Continuous [0-10]
Educational attainment	Ordinal	Self-reported frequency of tooth brushing	Ordinal
Employment	Dichotomous	DMFT	Continuous [0-32]
Economic status	Dichotomous	Untreated caries (D>0)	Dichotomous
Nationality	Nominal	Plaque index (PI>0)	Dichotomous
Country of birth	Nominal		

All analyses used sampling weights determined in terms of age distribution, gender and geographical location, to match the sample to the Belgian population. All descriptive statistics (percentages, means, standard deviations) were weighted, except for the absolute numbers. Given the complex sample design, the use of sampling weights is essential in the analysis. In addition, province was taken into account as a stratification factor and municipality as a cluster effect.

Baseline characteristics were summarized by using means, 95% CI and standard deviations or numbers of non-missing items with percentages, whichever was appropriate, for both the total population of the survey and the subpopulation of adults (≥18 years) with or without a job, being the economically active part of the studied population. As mentioned earlier, retired participants and students were excluded from the analyses.

Analysis of variance (ANOVA), multiple regression analyses (continuous variables) and logistic regression analyses (dichotomous variables) were used to explore possible correlations between social parameters, reported oral hygiene and oral health outcomes after correction for age and gender. Possible interactions between these variables of interest and age and gender were verified. Interactions remained in the model if found significant at the 0.1 level. For other tests, a significance level of 0.05 was applied. Regarding missing data, no correction for non-participation or non-response was applied.

To compare the separate effects of putative determinants with their joint effect on oral health outcomes, multivariable regression analyses were performed. The variables which were univariably significant after correction for age and gender up to the 0.1 level were included in a multivariable model. The model was then simplified by removing non-significant terms ($p>0.05$). Age and gender were forced into the model. Results are presented with regression estimates and standard errors or odds ratios with 95% confidence intervals (CI). When an interaction with age is present, results are presented for the quartiles (Q1, median, Q3) of age.

Analyses were performed using SAS version 9.4 without adjustment for multiple testing.

Results

In total, 2,536 households, aiming for a total sample size of 6,750 participants, were contacted face-to-face or by phone. Written informed consent was obtained from 52% of these households, resulting in a total of 3,057 respondents. Lack of interest was the reason for non-participation in 51% of the non-responders. Questionnaire data were obtained from 2,742 participants (89.7%), and clinical data from 2,563 participants (83.8%).

Table 2 shows selected characteristics of the total sample and the subsample of economically active adults. Mean age was 43.3 years (95% CI = 41.2-45.4) in the total sample and 42.2 years (95% CI = 41.2-43.2) in the subsample. In the total population, 11.1 % of the participants were caries-free (DMFT=0). For both samples, exploration of caries experience resulted in a mean DMFT score of 10.8 (95% CI = 10.0-11.5) and 11.0 (95% CI = 10.0-12.1) respectively. The filled teeth (F) component made up the largest part of the score in both groups. On average, almost one tooth per person was affected by untreated decay (D-component). However, decay was clearly not equally distributed within the population, since only 34.7% of the economically active adults and 28.9% of all participants had untreated cavities after direct visual inspection.

Significant differences in untreated tooth decay were observed in relation to highest educational attainment (table 3). Participants with lower secondary diploma presented the most frequently with untreated decay. Unemployed participants and those with a non-Western nationality had were also more likely to have untreated decay. Beside these social parameters, untreated decay was more common among participants with visible plaque accumulation and whose reported frequency of toothbrushing was less than once a day. These two oral hygiene indicators were linked to each other; people who reported brushing their teeth more than once a day were less likely to present with plaque accumulation. The proportion of completely edentulous participants was almost eight times higher in unemployed individuals, compared to those with a job and 20 times higher in those without a diploma or with a degree below secondary school level than in the higher education group. Belgian participants presented a lower mean DMFT than persons with foreign nationality or country of birth. Entitlement to a higher reimbursement scale was associated with a lower DMFT score ($p=0.04$).

The multivariate analyses are reported in tables 4 and 5. Table 4 confirms the relationship between employment status and presence of untreated tooth decay, but the effect of having a job is predominant in the youngest quartile, with an increased risk of having untreated decay in unemployed young individuals (OR = 3.70; 95% CI 1.30-10.58). Together with employment, oral hygiene and the presence of plaque predicted untreated decay, independent of gender and age.

Table 2. Sample characteristics

	Total Sample		*Professionally active subsample*[1]	
	Absolute numbers	*Weighted proportion (%)*	*Absolute numbers*	*Weighted proportion (%)*
Individuals included	2563	100%	1215	100%
Gender distribution				
Female	1392	53.3%	681	55.8%
Male	1171	46.7%	534	44.2%
Region				
Flemish region	1578	58.9%	773	61.6%
Walloon region	848	26.5%	379	25.4%
Brussels-Capital region	137	14.7%	63	13.1%
Increased allowance				
No	2124	86.6%	1091	92.1%
Yes	439	13.4%	124	7.9%
Visible plaque accumulation on Natural teeth	2185			
No plaque	821	31.4%	421	30.5%
Plaque on at least one tooth	1364	68.6%	712	69.5%
Untreated decay	2559			
Yes	713	28.9%	380	34.7%
No	1846	71.1%	835	65.3%
Edentulous	2559			
Yes	309	6.7%	67	2.9%
No	2250	93.3%	1148	97.1%

Mean age	*Total Sample*	*Analysis Sample*
	43.3 (SD 21.7; 95% CI = 41.2-45.4)	42.2 (SD 11.5, 95% CI =41.2-43.2)

DMFT (N=2547)	*Total Sample*	*Analysis Sample*
Mean	10.8 (SD 8.7; 95% CI = 10.0-11.5)	11.0 (SD 7.0; 95% CI = 10.0-12.1)
D	0.8 (SD 1.9; 95% CI = 0.6-1.0)	0.9 (SD 1.9; 95% CI = 0.7-1.2)
M	4.2 (SD 7.5; 95% CI = 3.5-4.9)	2.9 (SD 5.6; 95% CI = 2.3-3.4)
F	5.7 (SD 5.6; 95% CI = 5.2-6.2)	7.3 (SD 5.6; 95% CI = 6.4-8.1)

[1]economically active adults (>18y) with or without a job

Edentulousness was mainly associated with occupational status. However, there was an interaction with gender, resulting in a higher risk for unemployed women to be edentulous (OR = 5.32, 95% CI 1.75-16.12).

Participants with a higher educational level had lower DMFT than those with low-level or no diploma (Table 5). An interaction was observed between age and nationality in relation to the DMFT. In the youngest quartile, participants with Belgian nationality had higher DMFT than people from other Western European countries including USA, Canada and Australia. In contrast, Belgians had lower DMFT than people from other Western countries when the highest age quartile was considered.

Discussion

The present study describes the caries experience and oral health behaviour of Belgian adults, and aimed to link these oral health outcomes to social determinants of health.

Mean DMFT for the total sample was 10.8 and 11.0 for the economically active participants. WHO published a map with mean DMFT-scores for the different regions of the world (Petersen *et al*., 2005). For the 35-44yrs age group, the mean DMFT in Western Europe exceeded 13.9. For the same age group in this sample of the Belgian population, mean DMFT was 10.3, which is considerably lower. However, the WHO data presented were collected almost 10 years earlier. Furthermore, it is hard to interpret or compare DMFT scores in adults. DMFT is not only confounded by age, but also by the treatment intentions of dentists. In a cross-sectional design, it is impossible to be sure that all presently filled and missing teeth were preceded by tooth decay. For this reason, the D-component of the score was treated as a different variable to count the real number of decayed teeth at the time of examination.

Untreated decay is a widespread problem in Belgium. of the prevalence (28.9% in the total population and 34.7% in the economically active) calls for interventions to increase the level of care. The present findings are comparable to Kassebaum *et al*. (2015)who reported the prevalence of untreated dental decay in the permanent dentition to be 35.8% (95% CI 33.1–39.0) in Western Europe. It is noticeable that the universal health care insurance coverage in Belgium apparently did not have an impact on these proportions, compared to other countries without this universal coverage. Further research is needed to reveal other barriers related to the high level of untreated decay.

Table 3. Univariate analyses for the economically active population (subsample), after correction for gender and age

	No untreated decay (%D=0)	*p*	*No plaque %*	*P*	*Edentulousness %*	*p*	*Mean DMFT (SEM)*	*p*
Employment								
Yes (n=954)	65.4	0.01	30.5	0.92	1.4	0.01	10.4 (0.6)	0.10
No (n=261)	65.1		30.3		10.7		14.5 (1.0)	
Educational level								
Low/No (n=131)	61.8	<0.05	22.9	0.07	12.3*	0.18	12.6 (1.0)	0.16
Lower secondary (n=184)	55.1		29.0		5.3		13.5 (1.4)	
Higher secondary (n=395)	63.8		37.6		2.4		11.6 (0.4)	
Higher education (n=480)	69.0		28.3		0.6*		9.8 (0.8)	
Increased allowance								
Yes (n=124)	64.8	0.77	26.3	0.09	6.3	0.18	10.2 (1.4)	0.04
No (n=1091)	65.4		30.8		2.6		11.1 (0.6)	
Nationality								
Belgian (n=1103)	66.1	<0.001	30.7	0.7	2.9	0.47	7.1 (1.2)	<0.001
Other Western country (n=71)	74.3		33.1		2.9		10.0 (0.8)	
Other (n=33)	42.3		23.9		0.3		11.2 (0.6)	
Country of birth								
Belgian (n=1037)	66.4	<0.001	30.9	0.80	3.0	0.25	7.9 (0.9)	<0.001
Other Western country (n=68)	73.1		30.7		3.1		9.6 (1.0)	
Other (n=101)	55.1		27.1		0.7		11.5 (0.6)	
Frequency of toothbrushing								
≤ 1/day (n=103)	45.7	0.02	8.8	<0.001	11.4	0.07	14.7 (0.8)	0.26
1/day (n=534)	67.8		32.2		1.8		10.7 (0.4)	
≥ 2/day (n=567)	65.9		31.5		2.3		10.7 (0.7)	
Plaque index								
0 (n=421)	80.0	<0.001					10.4 (0.6)	0.16
>0 (n=712)	57.2						10.5 (0.7)	

*p=0.03 comparing Higher education vs Lower or no diploma

Table 4. Multivariable regression models for predictors of the presence of untreated decay and edentulousness among economically active individuals.

Untreated Decay	*interaction gender*[1]	*interaction age*[1]	*OR*	*95%CI*
Profession/employment	-	0.022		
Has a job vs no job		25 yr	3.70	1.30-10.58
		45 yr	1.24	0.72-2.12
		59 yr	0.58	0.24-1.37
Frequency of toothbrushing	0.078	-		
<1 vs 2 or more	Female	-	6.10	0.89-42.09
	Male	-	1.79	0.80-4.00
1 vs 2 or more	Female	-	0.83	0.37-1.85
	Male	-	1.04	0.52-2.08
Plaque index	-	-	2.82	1.85-4.30
Edentulousness				
Employment	0.044	-		
unemployed vs employed	Female	-	5.32	1.75-16.12
	Male	-	1.10	0.29-4.17

Outcome variable: DMFT	*interaction gender*[1]	*interaction age*[1]	*Estimate*	*P*
Higher education vs low/no diploma	-	-	-3.53	0.003
Nationality	-	0.0005		
Belgium vs other western European countries (inl. USA, Canada, Australia)		25 yr.	3.98	0.02
		45 yr.	-0.09	0.95
		59 yr.	-4.16	0.03

[1]when p<0.05, the impact of the explanatory variable on the outcome variable is not equal for all subgroups

Table 5. Multivariable regression model for predictors of DMFT among the economically active population

Outcome variable: DMFT	*interaction gender*[1]	*interaction age*[1]	*Estimate*	*Standard Error*	*P*	*P overall*
Higher education vs low/no diploma	-	-	-3.53	1.16	0.003	
Nationality	-	0.0005				0.003
Belgium vs other western European countries (inl. USA, Canada, Australia)		25 yr.	3.98	1.74	0.02	
		45 yr.	-0.09	1.36	0.95	
		59 yr.	-4.16	1.92	0.03	

Belgian policy measures in oral health care insurance coverage are largely based on a "threshold value" for family income. Reimbursement for dental fees is not stratified, but dichotomized. When people are entitled to the greater allowance for dental treatment, almost all basic dental treatments are completely reimbursed and third-party payment is allowed. In the present study, this was the case for 13.4% of the entire sample and 7.9% of the economically active population. For all other adults, reimbursement is lower and third-party payment not permitted, without any further differentiation. The authors would suggest more stratification and nuancing in this respect. Government initiatives should consider the social gradient. Focusing exclusively on the worst subgroup will probably shift the problem towards those who don't quite meet the inclusion criteria. Preventive actions and policy measures also need a gradient, providing oral health promotion based on the specific needs of every subgroup. This principle is called "proportionate universalism" (Marmot, 2010).

These data also suggest that a purely income-based criterion is not a good predictor to identify high-risk groups for dental caries, since no significant nor relevant differences could be found between participants with and without the increased allowance. In the multivariate analyses the more predictors were occupational status, educational level and frequency of toothbrushing. The link with occupational status and educational level is confirmed by a recent systematic review and meta-analysis that identified 83 surveys with caries experience significantly higher in individuals of low socio-economic position, compared to the opposite effect (Schwendicke *et al.,* 2015). The odds of having DMFT/dmft > 0 were greater in those whose educational or occupational background or those of their parents was low . The association between low educational background and having DMFT/dmft > 0 was greater in highly developed countries (1.32 0.53–2.13). The huge importance of education and employment in tackling health inequity is also clearly emphasised in Marmot's influential review. A common risk approach is indispensable in this context (Marmot, 2010).

Whilst our study confirms the association between oral health and occupational background, it also provides further detail by exploring age and gender interactions. Employment status was associated with the proportion of participants with untreated decay but only in the youngest age group: unemployed adults younger than 25 (excluding students) were 3.7 times more likely to have untreated tooth decay than their peers with a job. This higher risk was not present in older age groups, suggesting that policy interventions should pay special attention to young unemployed adults. Employment was also related to edentulousness, but this correlation was linked to gender: unemployed women were 5 times more likely to be edentulous than their employed counterparts. The finding that dental caries is more prevalent in women is well-known. Lukacs (2011) summarized the international literature on gender differences in caries experience and reported genetic, hormonal and environmental factors associated with higher dental caries rates in women.

In this study, educational level was the only parameter capable of demonstrating a social gradient, since all other explanatory variables were dichotomized. When educational level was ranked from low to high, absolute figures suggest a decreasing trend in the proportion of edentulousness (12.3%; 5.3%; 2.4%; 0.6%). However, only the difference between the highest and lowest educated groups was significant.

Apart from social factors, frequency of toothbrushing was also an important determinant of oral health outcomes. However, Singh *et al.* (2013) observed that oral health behaviour and social status do not only affect oral health separately but also correlate. Oral health promotion should therefore also pay particular attention to oral hygiene in socially vulnerable groups. Tighter collaborations between oral health workers and organizations in the field of employment and education could be recommended. Oral health promotion can be integrated in school curricula, with higher intensity in schools of lower educational level, according to the principle of proportionate universalism. Accordingly, organisations working with unemployed individuals can be a useful partner in oral health promotion programs. Both strategies need further investigation to confirm a possible positive effect on oral health outcomes and oral health behaviour.

Notwithstanding the strengths of this study, some limitations regarding sampling and data collection must be borne in mind. The National Register, used for sampling, offers the most accurate available representation of the Belgian population. However, its use means that people not appearing in the register (e.g. homeless people and illegal immigrants) could not be included in the survey. Prisoners, residents of religious communities and other institutionalized people (except residents of nursing homes and care centres) were also excluded. Furthermore, the publication reports a high proportion of refusals (48%), mainly due to lack of interest (51%), further data of non-responders were not available. It is possible that oral health outcomes were different in responders and non-responders, resulting in bias. During two evaluation meetings with dentist-interviewers (n= 22 and 12), it became clear that the informed consent procedure was elaborate and complex. Examiners commented that some participants were even intimidated by the complexity of the consent form. Further research is needed to explore a possible impact on the validity of the results.

Conclusions

The findings of the survey reported here are that: the proportion of Belgian adults with untreated decay is considerable. Differences in caries experience and untreated tooth decay were not predicted by family income, so much as oral hygiene, level of education and employment status. The data suggest that the criterion for reimbursement of dental fees might be modified to incorporate assessment of occupational status.

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