

Tooth brushing among 11- to 15-year-olds in Denmark: combined effect of social class and migration status.

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Objective: Regular tooth brushing in adolescence predicts stable tooth brushing habits later in life. Differences in tooth brushing habits by ethnic background and socioeconomic position have been suggested. We investigated migration status and social class in relation to infrequent tooth brushing both separately and combined. **Methods:** The study population was 11-15 year-olds chosen from a clustered random sample of schools. Univariate and multivariate logistic regression analyses estimated the separate and combined effects of migration status and social class on less than twice daily tooth brushing. **Results:** 10,607 respondents: a response rate of 88.3%. Boys of lower social class had higher odds ratio (OR) of infrequent tooth brushing than girls: 1.98 (95% confidence interval 1.62-2.41) vs 1.80 (1.53-2.24). Immigrants and descendants had higher odds compared to adolescents of Danish origin: immigrant boys OR 1.39 (1.05-1.89), girls OR 1.92 (1.47-2.50); descendant boys OR 2.53 (1.97-3.27), girls OR 2.56 (2.02-3.35). Analyses of the combined effect of social class and migration status showed that the social gradient in tooth brushing habits observed among ethnic Danes cannot be found among groups of immigrants and descendants. **Conclusion:** The study shows that both non-Danish origin and low social class increases the risk of infrequent tooth brushing among school-aged children. The study calls for in depth analyses of the processes which influence young people's tooth brushing habits. Further, there is a need to strengthen the promotion of appropriate tooth brushing habits of minority and low social class youths.

Key words: adolescents, school children, tooth brushing, social class, migration status, ethnic background, Denmark

Introduction

Tooth brushing can help prevent some of the oral health diseases considered to be public health problems (Jamieson *et al.*, 2004; Petersen, 2003; Truin *et al.*, 2005). Studies on adolescents have shown that tooth brushing more than once a day predicts more stable tooth brushing habits later in life (Åström, 2004; Kuusela *et al.*, 1996). Therefore, it is important to study predictors of tooth brushing habits in adolescence.

Some studies show that adolescents from higher social classes tend to brush their teeth more regularly than those from the lower social classes (Levin and Currie, 2009; Maes *et al.*, 2006; Truin *et al.*, 2005). Further, studies among adolescents in the Northern European countries show better oral health habits among native than non-native children (Hjern and Grindejord, 2000; Levin and Currie, 2010). Thus, both socioeconomic position and ethnic background may affect personal resources to pay attention to tooth brushing and oral health status in general (Cruz *et al.*, 2004; Selikowitz, 1994).

The term ethnic background covers a range of perspectives, e.g. language, religion, country of birth, family origin, nativity, minority group, and migration status (Bhopal, 2006). The migration perspective addresses the time spent in a recipient country (Berry, 1994), e.g. by separating immigrants, descendants of immigrants, and the native population. Immigrants with a recent arrival and descendants of immigrants with a more distant arrival may handle everyday life and health behaviour differently. During the processes of adaptation related to migration, immigrant children may

change their oral hygiene habits to become more similar to the children they interact with during school time.

In Denmark, the recommendation is that children and adolescents brush their teeth twice a day. The importance of migration status and socioeconomic position for adolescents' adherence to the recommended tooth brushing habits remains unclear. In particular little is known about the combined effect of migration status and socioeconomic status on this issue. Therefore, the objective of this study was first to examine the association between infrequent tooth brushing and migration status and social class, and second, to examine the combined effect of migration status and social class on infrequent tooth brushing.

Methods

This study comprised data from the Danish contribution to the international Health Behaviour in School-aged Children (HBSC) surveys of 2002 and 2006. HBSC studies health and health behaviours in 11-, 13-, and 15-year olds. We restricted the study to Denmark which is one of the few HBSC countries with complete data about migration background and occupational social class. Each survey included children from a nationally random sample of schools and applied similar procedures for sampling, data collection and measurement, i.e. provided comparable data. Thus, pooling data from the two surveys provides a rare opportunity to address social and migrant difference in tooth brushing in a large sample with resulting high statistical power.

In 2002, 68 of 79 randomly chosen schools participated in the study. In 2006, 100 schools were invited and 80

participated. The study population was all pupils in classes at grades five, seven and nine (11-, 13-, and 15-year-olds). Participation rates were 89.3% of the formally enrolled pupils in 2002 (n=4,824), and 88.8% in 2006 (n=6,269), totalling 10,801. We excluded pupils with missing data about tooth brushing leaving 10,607.

The pupils answered the internationally standardised HBSC questionnaire (Roberts *et al.*, 2009). There is no agency for ethical evaluation and approval of questionnaire-based population studies in Denmark. We obtained an ethical approval from the school management, the board of parents, and pupils' council in all schools. Pupils completed questionnaires in the classroom after a standardised instruction from their teacher and were informed that participation was voluntary and anonymous.

Tooth brushing: We measured tooth brushing habits by the question: "How often do you brush your teeth?" Response options: more than once a day; once a day; at least once a week but not daily; less than once a week; never. In the analysis we dichotomised the answers into "more than once a day" and "once a day and less often", according to the recommendation to brush teeth twice a day (Sutton and Sheiham, 1974). As a supplement, we dichotomised the answers into "Once a day or more" or "less frequent". Child and parent self-reporting of tooth brushing correlated well, and children's self-reported tooth brushing habits correlated with their clinically measured oral health (Jamieson *et al.*, 2004).

Social class: Family social class was determined by two questions about father's and mother's occupation: "What is your father's (mother's) job?" and "Please describe exactly what he (she) does". We coded the information into categories 1 (high) to 5 (low) according to the standards of the Danish National Institute of Social Research. The coding scheme is similar to the Registrar General classification used in the UK (Macintyre *et al.*, 2003). Two more categories were added; 6, unclassifiable: parents who were economically active, but impossible to categorise; and 7, economically inactive parents who receive unemployment benefits, disability pension or other kinds of transfer income. Family social class was coded as the highest ranking parent.

We categorised the pupils into social classes high (1,2), middle (3,4), low (5,7) keeping the 14% unclassifiable (6) as a separate category to avoid loss of information about this relatively large proportion of the population. The social class items have been validated and pupils of these ages are capable of answering questions regarding parents' occupation (Vereecken and Vandeghechuchte, 2003).

Migration status: Pupils were asked: "Are you born in Denmark?" and "In which country is your father (mother) born?" Furthermore they were asked to state, "Which language do you speak at home most of the time?" The study population comprises immigrants from more than 40 countries. The specific country of origin was coded in the 2006 dataset but not in the 2002 dataset. The largest groups of immigrants were children from (number in the 2006 dataset shown in parentheses) Bosnia-Herzegovina (n=50), Afghanistan (49), Iraq (36), Somalia (22), Turkey (15). The largest groups of descendants came from Turkey (198), Lebanon (61), Morocco (26), Pakistan (23) and Iraq (22). Due to the relatively small number of pupils from each of these countries we recoded the information into ethnic Danes, immigrants or descendants of immigrants by

the following criteria; Immigrants are not born in Denmark and none of the parents are Danish citizens and born in Denmark. Descendants are born in Denmark and none of the parents are Danish citizens and born in Denmark. Ethnic Danes have at least one parent who is a Danish citizen and born in Denmark. In cases with missing information on parents' country of birth, we included the language spoken at home as a proxy for migration status. Pupils responses to the questions on language spoken at home, and own and parental country of birth are valid indicators of ethnic background, when comparing answers given by children and parents (Nordahl *et al.*, 2011).

Covariates: Gender, age, family type, and year of data collection were included in the analyses as potential confounders. Pupils were asked with whom they were living, resulting in the derived variable family type with four categories: Traditional family, i.e. living with two parents; single parent family; reconstructed family; other.

To take into account the potential confounding of merging datasets from two years of study we included the potential confounder "year of study" (2002 or 2006). There were no noticeable changes in tooth brushing habits between the two years (Rasmussen and Due, 2007).

All analyses were stratified by gender because of gender differences in tooth brushing habits, i.e. girls brush teeth more often than boys (Truin *et al.*, 2005). Preliminary analyses described the data by cross-tabulations, and homogeneity was tested by the chi-square test.

Univariate and multivariate logistic regression analyses investigated associations between migration status and tooth brushing, and the association between social class and tooth brushing. The analyses applied multilevel modelling (SAS PROC GLIMMIX) to account for the cluster sampling. The multivariate analyses applied manual backwards model reduction. All potential confounders were included in the full model and taken out one at a time, the ones with the highest p-values first. The final model included only confounders significantly associated with tooth brushing in the adjusted analyses. Finally, we analysed the combined effects of immigrant and socioeconomic background and used participants of Danish origin and high social class as reference group. Results are expressed as odds ratios (OR) with 95% confidence intervals. In addition, separate analyses for the 2002 and 2006 samples checked whether patterns of associations were stable across the two data collection waves.

Furthermore, we conducted analyses of sensitivity for the dichotomising of tooth brushing habits (more than once a day vs. less frequent; at least once a day vs. less frequent). These analyses demonstrated that the choice of cut-off point did not change the direction of the association and did not substantially change the estimates.

Results

Table 1 describes characteristics of the three groups of adolescents: Danish origin, immigrants, and descendants. The social class distribution varies between immigrant boys and girls, e.g. 31.0% of the immigrant boys but only 19.1% of the immigrant girls are middle class. Among boys of Danish origin about 25% have infrequent (once daily or less) tooth brushing habits, the proportion among girls is 16%. For boys and girls of immigrant or descendant background

Table 1. Participants distributed according to the applied variables by gender and migration status

	Boys				Girls			
	Danish origin	Descendants	Immigrants	p-value	Danish origin	Descendants	Immigrants	p-value
	n=4,710	n=244	n=203		n=4,943	n=282	n=225	
	n (%)	n (%)	n (%)		n (%)	n (%)	n (%)	
Tooth brushing				0.0001				0.0001
Twice a day	3,524 (74.8)	128 (52.5)	135 (66.5)		4,132 (83.6)	182 (64.5)	165 (73.3)	
Once a day	943 (20.0)	80 (32.8)	48 (23.7)		661 (13.4)	74 (26.2)	52 (23.1)	
Less frequent	243 (5.2)	36 (14.8)	20 (9.9)		150 (3.0)	26 (9.2)	8 (3.6)	
Social class				0.0001				0.0001
High	1,167 (24.8)	31 (12.7)	32 (15.8)		1,121 (22.7)	26 (9.2)	34 (15.1)	
Middle	2,098 (44.5)	70 (28.7)	63 (31.0)		2,395 (48.5)	67 (23.8)	43 (19.1)	
Low	777 (16.5)	97 (39.8)	77 (37.9)		808 (16.4)	142 (50.4)	100 (44.4)	
Unclassifiable	668 (14.2)	46 (18.9)	31 (15.3)		619 (12.5)	47 (16.7)	48 (21.3)	
Age				0.0001				0.0001
11 years	1,651 (35.1)	89 (36.5)	48 (23.6)		1,830 (37.0)	102 (36.2)	53 (23.6)	
13 years	1,663 (35.3)	91 (37.3)	69 (34.0)		1,693 (34.3)	109 (38.7)	84 (37.3)	
15 years	1,396 (29.6)	64 (26.2)	86 (42.4)		1,420 (28.7)	71 (25.2)	88 (39.1)	
Family type				0.0001				0.0001
Traditional	2,809 (59.6)	162 (66.4)	122 (60.1)		2,802 (56.7)	181 (64.2)	149 (66.2)	
Single parent	814 (17.3)	31 (12.7)	33 (16.3)		842 (17.0)	42 (14.9)	30 (13.3)	
Reconstructed	519 (11.0)	3 (1.2)	20 (9.9)		615 (12.4)	8 (2.8)	14 (6.2)	
Other	568 (12.1)	48 (19.7)	28 (13.8)		684 (13.8)	51 (18.1)	32 (14.2)	

Table 2. Odds ratios (OR) for infrequent tooth brushing in relation to migration status and other variables

	Boys			Girls		
	Model 1*	Model 2**	Model 3***	Model 1*	Model 2**	Model 3***
	OR (95%CI)					
Migration status						
Danish origin	1.00 reference					
Descendants	2.42 (1.89-3.12)	2.53 (1.97-3.27)	2.31 (1.79-2.98)	2.53 (2.00-3.20)	2.56 (2.02-3.25)	2.30 (1.81-2.93)
Immigrants	1.40 (1.06-1.86)	1.39 (1.05-1.84)	1.28 (0.96-1.70)	1.84 (1.41-2.41)	1.92 (1.47-2.51)	1.73 (1.32-2.27)
Social class						
High	1.00 reference	1.00 reference		1.00 reference	1.00 reference	
Middle	1.40 (1.17-1.67)	1.38 (1.16-1.65)		1.24 (1.01-1.53)	1.25 (1.01-1.53)	
Low	2.00 (1.64-2.44)	1.98 (1.62-2.41)		1.82 (1.46-2.28)	1.80 (1.44-2.26)	
Unclassifiable	1.64 (1.33-2.04)	1.64 (1.32-2.03)		1.82 (1.44-2.31)	1.79 (1.41-2.28)	

* Model 1: Crude ORs; ** Model 2: Adjusted ORs (adjusted for age, family type and year); *** Model 3: Adjusted ORs (adjusted for age, family type, year and social class)

Table 3. Odds ratios (OR) for infrequent tooth brushing by combined variables of gender, social class and migration status

Gender and migration status	High social class OR (95%CI)	Middle social class OR (95%CI)	Low social class OR (95%CI)
Boys	(n=1,230)	(n=2,231)	(n=951)
Danish origin	1.00 reference	1.38 (1.14-1.66)	1.89 (1.53-2.34)
Descendants	3.47 (1.81-6.70)	2.92 (1.84-4.64)	4.29 (2.87-6.43)
Immigrants	0.83 (0.29-2.32)	2.16 (1.32-3.56)	2.12 (1.34-3.36)
Girls	(n=1,181)	(n=2,505)	(n=1,050)
Danish origin	1.00 reference	1.26 (1.01-1.58)	1.71 (1.33-2.19)
Descendants	3.08 (1.50-6.23)	3.86 (2.47-6.04)	3.12 (2.17-4.48)
Immigrants	1.88 (0.87-4.05)	1.68 (0.80-3.52)	2.84 (1.88-4.29)

the proportions are markedly higher (varying from 26-47%). For both genders there are higher proportions in the lower social class among immigrants and descendants than among adolescents of Danish origin.

Table 2 presents unadjusted and mutually adjusted odds ratios (OR) for infrequent tooth brushing by migration status and social class. The crude analysis in model 1 reveals ORs (95% confidence interval (CI)) of 1.40 (1.06-1.86) for immigrant boys and 2.42 (1.89-3.12) for descendant boys, and 1.84 (1.41-2.41) and 2.53 (2.00-3.20) respectively for girls, when compared to boys and girls with Danish origin. Adolescents from middle and lower social classes have statistically significant higher odds of infrequent tooth brushing compared to high social class. Control for potential confounders (model 2) did not change the estimates noticeable. When including the effect of social class (model 3), the estimates for the association between migration status and tooth brushing habits decreased from 2.53 to 2.31 (1.79-2.98) for descendant boys and from 2.56 to 2.30 (1.81-2.93) for descendant girls.

Table 3 shows the combined effects of social class and migration status on tooth brushing habits for boys and girls, with Danish origin of high social class as reference group. Estimates are adjusted for confounders. The social gradient in tooth brushing habits observed among the group with Danish origin cannot be found among immigrants and descendants. Exception for immigrant boys in high social class and immigrant girls in middle social class, both statistically insignificant, immigrants and descendants in all social classes have markedly higher odds for infrequent tooth brushing habits, OR-estimates between 2.2 and 4.3.

We performed sensitivity analyses with a different cut point for our outcome (tooth brushing at least once a day vs. less frequent). The OR (95% CI) for immigrant and descendant boys compared to Danish origin was 2.53 (1.87-3.41) and 3.67 (2.46-5.48). The OR (95% CI) for immigrant and descendant girls was 2.56 (1.89-3.45), and 6.91 (4.97-9.61). Similarly, the OR for infrequent tooth brushing was 2.17 (1.52-3.07) and 2.42 (1.68-3.49) for boys in medium and low social class, and 1.73 (1.21-2.48) and 1.88 (1.28-2.75) for girls in medium and low social class.

The OR estimates were similar across the 2002, 2006 and pooled samples.

Discussion

We found differences in tooth brushing habits according to social class and migration status among adolescents in Denmark. Low social class and immigrant or descendant background was associated with poorer tooth brushing habits. Among boys, the OR for infrequent tooth brushing was 3.47 among descendants and 0.87 among immigrants. We had expected tooth brushing practices to be more similar to the Danish majority in second generation immigrant boys. We have no explanation for this unexpected difference between first and second generation immigrant boys.

Others have previously shown similar results in studies of tooth brushing habits and indicators of socioeconomic position (Levin and Currie, 2009; Maes *et al.*, 2006). In line with the few existing studies we found poorer tooth brushing habits among immigrants and descendants (Hjern and Grindefjord, 2000; Levin and Currie, 2010).

When including social class in the analyses of the association between migration status and tooth brushing habits the estimates decreased. This suggests that some of the association between migration status and tooth brushing may be explained by the high proportion of immigrants and descendants of low social class. The analysis of the combined effects implies that there is not the same social gradient in tooth brushing habits among groups of immigrants and descendants, compared to adolescents with Danish origin. Independently of social class, immigrants and descendants have much higher odds for poor tooth brushing habits. This could imply, that social class does not have the same influence on tooth brushing habits among adolescents of immigrant and descendant background, as it has among ethnic Danish adolescents, and that other factors than social class are of greater influence on tooth brushing habits in these groups.

The study population of 10,607 gives sufficient statistical power to study tooth brushing habits in subgroups of migrant status, social class, and gender differences. Further, the study population represents great variation in social class and migration status with relatively large contrast in the exposures under study.

The sampling procedures, data collection, and measurements were identical in the two samples which support the decision to merge. Further, we adjusted all analyses for year of data collection and also conducted separate analyses for the two datasets. These precautions did not reveal any problems related to the combined dataset. The cross-sectional design of the HBSC-study is generally not suited for documentation of causal relations. It is however likely that the families' socioeconomic position and ethnic background were established before tooth brushing habits. The two national samples are representative for the 11-, 13-, and 15-year-olds in 2002 and 2006.

Yet another design issue is the cluster sampling which results in less precise estimates than sampling of individuals. This may be a particular problem in this study because immigrants and descendants are concentrated in a smaller number of schools. The use of multilevel modelling should however reduce these problems.

The study had a high response rate (88.3%), but only students attending school on the day for data collection answered the questionnaire. We suspect that there are higher proportions of students of low social class and of non-Danish background among those not attending school and we may thereby have underestimated the associations.

The data are self-reported but a recent study found high parent-child agreement in reports of ethnic background suggesting that these measurements are sufficiently valid (Nordahl *et al.*, 2011). Prior validation studies have suggested that young people's reports about tooth brushing (Jamieson *et al.*, 2004) and parents' occupation (Vereecken and Vandeghechuchte, 2003) are fairly valid. We acknowledge that parents' occupation may be a suboptimal indicator of socioeconomic position among immigrant populations (Braveman *et al.*, 2005). Further, social class is only one of many potentially relevant aspects of socioeconomic position (Macintyre *et al.*, 2003) and the use of income and education might have revealed other patterns. Unfortunately, the dataset does not include this information.

Categorising people based solely on their migration status has obvious limitations. One of them being the

risk of hiding within-group differences, e.g. by collapsing people from many parts of the world into one category of immigrants. Unfortunately, the study population does not have sufficient statistical power for analyses of immigrants from specific countries. There are also advantages in using migration status instead of concepts such as race or ethnicity: it is objective and it is easy to categorise people without making assumptions of racial character that can be ethically inappropriate. Further, according to Berry (1994) all immigrants share the stress burden of migration: Immigrants and descendants have in common, that they are living in another culture than their ancestors, and therefore have to handle differences in norms and lifestyles, which can impact their choices related to health behaviour.

As descendants and their families have been living in Denmark longer, we expected better tooth brushing habits among descendants than among immigrants. One explanation for the discrepancy could be the heterogeneity in groups of immigrants and descendants in Denmark. The largest groups of immigrants in the study population come from Iraq, Bosnia-Herzegovina, Afghanistan and Somalia, whereas the largest proportion of descendants link to Turkey. Due to limited numbers it was not meaningful to study tooth brushing habits in relation to country of birth.

The study demonstrates that we still know too little about ethnic background and tooth brushing among adolescents. We suggest that future research focus on other aspects of ethnic background, i.e. self-perceived ethnicity, and also include qualitative studies to gain more understanding of the processes which influence adolescents' tooth brushing habits. The study also demonstrates the need for improvement of tooth brushing habits among adolescents. The situation in Denmark is favourable because there is a free and comprehensive dental care service for adolescents with regular dental examinations of almost all school-age children. This dental care service is already focusing on teaching of good tooth brushing habits, an effort which apparently needs to give more attention to adolescents of non-Danish and low social class origin.

Conclusion

The study shows that both non-Danish origin and low social class origin increases the risk of infrequent tooth brushing among adolescents. This calls for in depth analyses of the processes which influence adolescents tooth brushing habits. Further, there may be a need to strengthen the teaching of appropriate tooth brushing habits for minority and low social class youth.

Acknowledgements

The Health Insurance Fund, the Nordea Foundation, the Ministry of Social Welfare, and the Ministry of Health funded this study. We thank the directors of the Danish HBSC study, Dr Pernille Due and Dr Mette Rasmussen, for access to data.

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