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ORIGINAL ARTICLE

Health investment behaviours and oral/gingival health condition, a cross-sectional study among Swedish 19-year olds

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ABSTRACT

Objectives To test the hypothesis that certain individual, environmental and lifestyle factors are positively associated with beneficial health investment behaviours and oral/periodontal health among adolescents. **Methods** Five hundred and six randomly selected 19-year old subjects living in two different areas (Fyrbodal and Skaraborg) in the county council of Västra Götaland, Sweden participated in a clinical examination and answered questionnaires covering psycho-social and health behavioural issues. Two oral-health models were estimated with gingivitis score as an objective and self-perceived oral health as a subjective indicator. Three health- investment behaviour models were designed with indicators directly related to oral health and two with indicators related to general health as well. The explanatory variables included gender, upper secondary education programme, native country, living area, general self-efficacy and parents' education level. **Results** In the objective oral-health model, theoretical studies and living in the Skaraborg area were both positively associated with a lower gingivitis score. For the subjective oral-health indicator, none of the explanatory variables showed statistical significance. In the investment-behaviour model with 'tooth-brushing ≥ 2 times daily' as a health indicator, female gender and theoretical studies showed statistically significant associations. With the indicators 'no/few missed dental appointments', 'no tobacco use' and 'weekly exercise', theoretical studies were statistically significant and positively associated. In the investment model with 'perceived oral health care attention' as an indicator, a high score of general self-efficacy was significantly associated with the feeling of taking good care of the teeth. **Conclusions** Individual, environmental and lifestyle factors are associated with young individuals' oral health investment behaviours and gingival health conditions.

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Introduction

Oral health is an integral part of general health and well-being.[1–3] However, what motivates people to invest in their oral health differs. In fact, several individual, psychosocial and environmental factors may interact with health-related behaviours, perceptions and conditions [4,5] and theoretical models have been developed to explain their influence on human behaviour and health.[6]

With regard to periodontal health promotion, the most important measure is to motivate young individuals to adopt adequate oral hygiene behaviours. In Sweden, all residents up to 20 years of age are offered regular dental care including prevention and oral health promotion programmes free of charge. Even so, recent epidemiological surveys reveal poor oral hygiene conditions among Swedish adolescents, as evident by high scores of plaque and gingivitis.[7,8] Moreover, compared to lifestyle factors such as housing, clothes and leisure time, priority for dental care was rated low and ~35% of 19-year olds did not plan for future regular dental visits after the age of 20, when they would be charged a tax-subsidized fee for their care.[9]

Among individual and environmental determinants shown to be associated with adolescents periodontal conditions are education, occupation and income level of the parents [10,11] as well as their migrant background.[12] Moreover, studies involving adolescents revealed that positive perceptions and attitudes towards oral health issues are associated with more favourable oral hygiene conditions and that females show more favourable attitudes and behaviours towards oral health than males.[13–15] Associations have also been reported between oral hygiene behaviours and adolescents' education achievement and career aspiration,[16,17] as well as between

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periodontal conditions and type of secondary school programme attended.[18]

The interaction between external and internal influences on human behaviour, including health behaviour, is forming the concept of self-efficacy.[19] Self-efficacy relates to an individual's perceived ability or confidence to handle different life events and to carry out the behavioural actions necessary to reach certain results or health goals. The self-efficacy theory has been applied in dental practice and a review of studies within this field [20] indicates that self-efficacy might be a useful tool for predicting oral health-related behaviours, such as investments in self-care behaviour in periodontal treatment.

An economic approach to health-related behaviours is the human-capital model, introduced by Grossman [21] and extended to a family context by Jacobson [22] and Bolin et al.[23,24] It rests on the proposition that health is demanded because the individual appreciates the flow of returns from health; partly for its own sake and partly because good health facilitates participation in appreciated activities. In this model health is seen as a kind of immaterial capital, which depreciates over time, but the individual can counteract by investing in health, utilizing healthcare and adopting a healthy lifestyle. However, investments in health require time and money and compete with all other activities that the individual finds important, nice, etc. Individuals will make different trade-offs between the immediate pleasures of enjoyment and investments for the future, depending on their preferences and their time and money constraints. The main explanatory variables derived from this theory are age, education, wage rate and wealth.

Based on health behavioural theory and results of previous empirical studies, the aim of this study was to test the hypothesis that gender (female), education (theoretical upper secondary education programme), general self-efficacy, native country (Scandinavia) and parents' education level (higher education/university) are positively associated with beneficial health investment behaviours and oral/gingival health conditions among adolescents.

Materials and methods

The study population was based on a computer-based random selection of 10% of 19-year old individuals born in 1987 and living in two different areas (Fyrbodal and Skaraborg) of the county council of Västra Götaland, Sweden. The two areas chosen were both characterized as mainly rural with small municipalities and a few medium-sized cities, and without any major differences in socio-economic characterization of the populations (for details see Östberg et al.).[9] Out of 708 invited by mail, 506 subjects (72%) agreed to participate.[8] Forty-six per cent were males and 7% were born outside the Scandinavian countries. The study protocol was approved by The Ethics Committee at the University of Gothenburg (Dnr: 146-05).

The participants completed a series of questionnaires immediately before a clinical examination. The questionnaire package took ~25 min to complete. The questionnaire Self-Perceived Oral Health (SPOH) was covering aspects of perceptions, attitudes and behaviour towards dental care and oral health. The questions were constructed with three or four fixed reponse alternatives based on the results of previous studies [25] and tested in a pilot study involving another group of adolescents. The questionnaire package also included the General Self-Efficacy (GSE) instrument [26,27] developed to assess the individual's trust in his/her own ability to cope with situations and to implement healthy behaviours. The GSE contains 10 items with a possible range of sum score of 10–40, where higher scores indicate greater sense of perceived self-efficacy.

The clinical examination involved assessments of dental plaque, gingivitis (scored as the presence of bleeding following angulated probing of the sulcus area at six sites per tooth) and probing pocket depths and gingival recessions at all teeth (3rd molar excluded) using a standard periodontal probe (UNC 15)

Table 1. Characteristics of the subject sample—frequency distribution.

Variables	%	*n*
Gender		
Females	54	272
Males	46	234
Native country		
Scandinavia	93	469
Other	7	37
Area of living		
Fyrbodal	49	250
Skaraborg	51	256
Missed dental appointments		
≤ 1	85	276
≥ 2	15	47
Parental education/mother		
Elementary school	18	88
Upper secondary	45	224
Higher education/university	29	145
Don't know	9	45
Parental education/father		
Elementary school	27	131
Upper secondary	39	193
Higher education/university	22	106
Don't know	13	62
Upper secondary programme		
Theoretical	47	228
Vocational	48	230
Other	5	23
How do you consider your oral health status?		
Good	34	172
Fairly good	56	282
Quite poor	10	50
Poor	—	1
How often do you brush your teeth?		
Twice daily	76	383
Once daily	20	101
A few times/week	3	17
Once or less/week	1	4
According to your own opinion, how well do you take care of your teeth?		
Good	24	122
Fairly good	60	304
Quite bad	15	73
Bad	1	6
Tobacco use		
Yes	28	142
No	72	360
Weekly exercise		
Yes	66	332
No	34	173
General self-efficacy		
≥ 30	47	233
<30	53	268
Gingivitis score*		
Lowest quartile (score $\leq$41%)	25	126
Otherwise	75	380

*Gingivitis score = bleeding on superficial probing.

(for details see Ericsson et al.).[8] The clinical examinations were performed by four experienced dental hygienists. They attended a 2 days education/training programme for the study and were calibrated against a reference person (JW) to ≥ 95% agreement in clinical assessments. For the purpose of the present study only the data describing the gingival conditions (gingivitis score in %) were utilized in the analyses. Pertinent characteristics of the subject sample are given in Table 1.

Models of oral health and health investment behaviour

For the analysis of data on oral health outcomes and health investment behaviours we applied empirical models based on the theoretical framework of the human-capital model.[21–24]

Two empirical models were estimated for oral health; an objective measure of oral health behaviour was used as the dependent variable in one model and a subjective indicator in the other. The objective measure of oral health was the gingivitis score (%). The subjective indicator was self-perceived oral health as defined by the response to the questionnaire item 'How do you consider your oral health status?'

For health-investment behaviours, five empirical models were specified and estimated; three of the models used dependent variables directly related to oral health behaviour, while the other two used indicators related to general health behaviour as well. The first three were toothbrushing frequency (data from questionnaires), number of missed dental appointments during the last 3 years (data retreived from the subject's dental record) and self-perceived oral-health care attention (questionnaire item 'According to your own opinion, how well do you take care of your teeth?'). The indicators related to health in general were tobacco habits and physical exercise (data from questionnaires).

The explanatory variables included were the same for all seven models and chosen among available study data to represent both main variables of the human-capital theoretical framework and variables known from previous empirical studies to be associated with the selected indicators of oral health and oral-health investment behaviours. Empirical representations of theoretical explanatory variables related to the human-capital model were; gender, the individual's occupation/chosen upper secondary education programme, native country and parents' education level (all data from questionnaires). Upper secondary programme (theoretical/vocational) was defined in accordance with The Swedish National Agency for Education.[28] In addition, the individual's trust in her/his own ability to cope with situations and to implement healthy behaviours (measured by the psychometric instrument GSE) and living area (Fyrbodal or Skaraborg) were included as explanatory variables, the latter in order to take into account the potential impact of differences in availability of dental care or other supply-side characteristics.

Data handling and analysis

Models estimating oral health and health-investment behaviours were formulated using multiple logistic regression analysis. For the objective dependent measure of oral health, i.e., gingivitis score, the mean (SD) score for the study population was 56% (±19%). The lowest quartile of scores (≤ 41%) was chosen to represent the least diseased individuals and as cut-off in order to achieve a group size of reasonable magnitude in the statistical analysis. For GSE, scores equal to or greater than the mean (= median) for the study population (≥ 30) were chosen to identify individuals with a greater sense of perceived self-efficacy.[29] For other questionnaire-based variables, the rationale for dichotomization was based on previously presented results (for details see Ericsson et al.).[15]

The variables included in the regression models (Table 1) were dichotomized as follows:

Dependent variables

Oral health:

gingivitis score; the lowest quartile (scores ≤ 41%) = 1, otherwise = 0
'How do you consider your oral health?'; good = 1, otherwise = 0

Health-investment behaviours:
tooth brushing; ≥ 2 times/day = 1, otherwise = 0
missed dental appointments; ≤ 1 = 1, otherwise = 0
tobacco use; no = 1, otherwise = 0
weekly exercise; yes = 1, otherwise = 0
'According to your own opinion, how well do you take care of your teeth?'; good = 1, otherwise = 0

Explanatory variables

gender; female = 1, male = 0
upper secondary education programme; theoretical = 1, otherwise = 0
parent with the highest education level; higher education/university = 1, otherwise = 0
GSE; score equal to or greater than the mean (≥ 30) = 1, otherwise = 0
native country; Scandinavia = 1, otherwise = 0
living area; Skaraborg = 1, Fyrbodal = 0 Descriptive and correlation analyses among explanatory variables were processed by the use of the Statistical Package Service Solutions (SPSS, version 18.0). For the multiple logistic regression models, the Stata 12.1 was used. A p-value < 0.05 was considered statistically significant.

Results

Table 2 describes the percentage proportion of females and males fulfilling the defined criteria with regard to the various dependent indicator variables used in the models estimating oral health and health investment behaviours. With respect to the objective oral health variable (gingivitis score) and the health investment behaviour variables tooth-brushing and tobacco use, the percentage of females was statistically significantly higher than for males.

Oral health models

Estimates of the oral-health models are presented in Table 3. As for the objective oral-health indicator (gingivitis score),

Table 2. Percentage proportion of females and males fulfilling the defined criteria with regard to the various dependent indicator variables used in the models estimating oral health and health investment behaviours.

Variables	Females ($n = 272$)	Males ($n = 234$)	*p*value*
Oral health			
Gingivitis score ($\leq 41\%$)	29%	21%	0.018
How do you consider your oral health status? (good)	36%	32%	0.393
Health investment behaviours			
Tooth-brushing (≥ 2 times/day)	81%	70%	0.003
Missed dental appointments (≤ 1)	56%	53%	0.515
Tobacco use (no)	77%	65%	0.002
Weekly exercise (yes)	67%	65%	0.708
According to your own opinion, how well do you take care of your teeth? (good)	89%	79%	0.259

*ChiSquare Test.

only type of educational programme and living area showed statistical significance ($p < 0.05$); theoretical studies and living in the Skaraborg area were both positively associated with a lower gingivitis score. As for the subjective oral-health indicator, none of the explanatory variables showed statistical significance. The only variable close to being statistically significant was the GSE sum score ($p = 0.07$).

Health investment behaviour models

Estimates of the investment-behaviour equations are reported in Table 4. As for 'tooth brushing at least twice daily', gender

Table 3. Oral health models. Results of the multiple logistic regression estimations, using an objective indicator of oral health (model 1) and a subjective indicator (model 2), respectively.

Variables	Odds ratio	*p* value	Standard error	95% CI
Model 1: Gingivitis score*				
Gender (female)	1.47	0.108	0.35	0.92–2.36
Upper secondary programme (theoretical)	1.72	0.025	0.42	1.07–2.76
Parent with the highest education level (higher education/university)	1.17	0.528	0.29	0.72–1.90
General Self-Efficacy (sum score ≥ 30)	1.18	0.495	0.28	0.74–1.87
Native country (Scandinavia)	1.88	0.210	0.95	0.70–5.07
Living area (Skaraborg)	10.83	0.000	3.21	6.06–19.35
Model 2: 'How do you consider your oral health status?'				
Gender (female)	1.12	0.563	0.22	0.76–1.65
Upper secondary programme (theoretical)	1.01	0.977	0.20	0.68–1.49
Parent with the highest education level (higher education/university)	1.21	0.354	0.25	0.81–1.81
General Self-Efficacy (sum score ≥ 30)	1.42	0.074	0.28	0.97–2.10
Native country (Scandinavia)	1.01	0.985	0.40	0.47–2.18
Living area (Skaraborg)	0.91	0.627	0.18	0.62–1.34

*Gingivitis score = bleeding on superficial probing.

Table 4. Health investment behaviour models. Results of the multiple logistic regression estimations, using five dependent indicators of (oral) health investment behaviour (model 1–5), respectively.

Variables	Odds ratio	*p*-value	Standard error	95% CI
Model 1: Tooth-brushing ≥ 2 times/daily				1.02–2.47
Gender (female)	1.59	0.040	0.04	
Upper secondary programme (theoretical)	1.69	0.026	0.04	
Parent with the highest education level (higher education/university)	1.13	0.61	30.04	0.71–1.81
General Self-Efficacy (sum score ≥ 30)	0.74	0.179	0.04	0.47–1.15
Native country (Scandinavia)	1.45	0.377	0.07	0.64–3.31
Living area (Skaraborg)	0.85	0.478	0.04	0.55–1.33
Model 2: Missed dental appointments (≤ 1)				
Gender (female)	1.54	0.209	0.53	0.78–3.04
Upper secondary programme (theoretical)	2.68	0.012	1.05	1.24–5.78
Parent with the highest education level (higher education/university)	1.66	0.195	0.65	0.77–3.57
General Self-Efficacy (sum score ≥ 30)	1.10	0.790	0.37	0.56–2.14
Native country (Scandinavia)	2.73	0.060	1.46	0.96–7.78
Living area (Skaraborg)	1.46	0.328	0.57	0.68–3.14
Model 3: No tobacco use				
Gender (female)	1.53	0.050	0.33	1.00–2.33
Upper secondary programme (theoretical)	2.82	0.000	0.04	1.78–4.45
Parent with the highest education level (higher education/university)	0.92	0.734	0.04	0.59–1.45
General Self-Efficacy (sum score ≥ 30)	0.87	0.507	0.04	0.56–1.33
Native country (Scandinavia)	1.06	0.894	0.08	0.46–2.43
Living area (Skaraborg)	0.82	0.370	0.04	0.54–1.26
Model 4: Weekly exercise				
Gender (female)	0.95	0.814	0.20	0.64–1.43
Upper secondary programme (theoretical)	2.86	0.000	0.62	1.87–4.36
Parent with the highest education level (higher education/university)	1.30	0.232	0.28	0.85–1.99
General Self-Efficacy (sum score ≥ 30)	1.17	0.442	0.24	0.78–1.75
Native country (Scandinavia)	0.97	0.932	0.40	0.43–2.17
Living area (Skaraborg)	1.31	0.195	0.27	0.87–1.95
Model 5: 'According to your own opinion, how well do you take care of your teeth?'				
Gender (female)	1.25	0.311	0.28	0.81–1.94
Upper secondary programme (theoretical)	0.79	0.291	0.18	1.50–1.23
Parent with the highest education level (higher education/university)	0.95	0.839	0.22	0.60–1.51
General Self-Efficacy (sum score ≥ 30)	2.20	0.001	0.50	1.40–3.44
Native country (Scandinavia)	1.35	0.533	0.64	0.53–3.44
Living area (Skaraborg)	1.01	0.961	0.22	0.66–1.56

and type of educational programme showed statistical significance ($p < 0.05$); being a woman and theoretical studies were both positively associated with frequent tooth brushing. As for 'missed dental appointments', only educational programme showed statistical significance; theoretical studies were associated with fewer missed appointments. Also with regard to tobacco habits, only educational programme showed statistical significance; theoretical studies were associated with no tobacco use. In addition, female gender was close to significance ($p = 0.05$). As for 'weekly exercise', theoretical studies showed positive association ($p < 0.001$). Finally, for 'According to your own opinion, how well do you take care of your teeth?', a GSE sum score of ≥ 30 was significantly associated with the opinion of taking good care of one's teeth ($p = 0.001$).

Correlation analysis among explanatory variables

Correlation analysis (Spearman's rho) revealed a statistically significant relationship between the adolescents' upper secondary education programme and mothers' educational level (rho = 0.15; $p < 0.01$). Hence, a theoretical study programme was positively associated with a higher education level of the mother. In addition, the education levels of the mother and the father were positively associated (rho = 0.42; $p < 0.001$). No further significant relationships were found between explanatory variables.

Discussion

The present study revealed that, in four of the five empirical health-investment models, studying a theoretical upper secondary programme was a significant explanatory variable for investments in oral health. This positive association could be anticipated from the predictions of the theoretical human-capital model [30] and is in line with observations made among Italian 14–16 years old individuals [18] showing that type of secondary school programme was an indicator of oral health. An explanation could be that individuals studying at a theoretical programme are more accustomed to deal with and embrace instructions and information. Although a significant positive correlation was found between the adolescents' upper secondary education programme and mothers' educational level, as well as between mothers' and fathers' level of education, the combined variable 'parent with the highest education level' as an explanatory variable did not reach statistical significance in any of the multiple models on health-investment behaviours and gingival health outcomes. In contrast to observations made by Julihn et al.,[12] an association between migrant background and gingival conditions could not be confirmed in the present study, which may be due to the limited number of individuals born outside the Scandinavian countries (7%).

Female gender was positively associated with investments in oral health, as indicated by toothbrushing twice or more daily. The relationship between female gender and positive oral-health related attitudes and behaviour has been reported frequently [14,15,31–33] and might be related to gender differences with regard to normative values and expectations.[34] In addition, in the present study a high GSE sum score was observed to be positively associated with oral health investments, a finding that points in the same direction as the results of a previous study by Kakudate et al.,[35] indicating that assessment of self-efficacy is an effective means in predicting oral self-care behaviour in periodontal treatment and that behavioural approaches might be useful to improve self-efficacy for self-care habits and oral hygiene performance.

As for the two empirical versions of the oral-health model, studying at a theoretical upper secondary programme and living in the Skaraborg area both showed a positive association with the objective oral health indicator, while none of the explanatory variables was significantly associated with the subjective oral health indicator. Whereas the positive association between education and oral health could be expected based on the human-capital theory, factors behind the association between living in the Skaraborg area and the oral health indicator can only be speculated on. The four dental hygienists who performed the assessements were carefully trained and calibrated and, hence, inter-examiner variability in the clinical assessments as a factor accaunting for the observed association between living area and the objective oral health indicator is less likely. Since there were no evident differences between the two living areas regarding socioeconomic indicators, number of inhabitants, population density or the availability of public dental clinics (based on available statistical data from 2005), one potential explanation might be differences in design and content of oral health prevention programmes between the two living areas, but demands further evaluation.

In addition to the results discussed above, some interesting findings regarding the relation between oral health and overall health investment behaviour were noted. Hence, positive oral health investment behaviour (toothbrushing twice or more daily, no or few missed dental appointments) and positive overall health investment behaviour (no tobacco consumption and weekly exercise) were linked to the same explanatory variable—upper secondary school programme. Further, a high sum score of GSE (≥ 30) was an explanatory variable of importance for health investments. Results from a recent study by Gísladóttir et al. [36] point in the same direction, i.e., physical exercise and a strong belief in oneself and what one can cope with are related. In the study referred to, ~11 000 pupils (14–16 years old) in Iceland completed a questionnarie regarding physical-exercise related issues. The results indicated that frequent participation in sports-club activities affect young people positively, with better physical and mental conditions and a stronger belief of success in areas such as their studies and chance to get a good job in the future, compared to adolescents who participated less often. Hence, knowledge about overall health perspective is important for the dental personnel in their daily interaction with young individuals and also in the planning of oral health promotion strategies.

Our observations are also partly in line with the results of a study by MacGregor et al.,[37] who investigated the relation between some lifestyle factors and motivation for toothbrushing in a sample of 14–15 year olds in the UK. The results of their

questionnaire-based study revealed that motivation for toothbrushing was associated with health (i.e., to avoid dental problems) as well as with appearance and social participation. In addition, motivation for toothbrushing varied significantly with smoking behaviour; committed smokers were more inclined to brush for cosmetic reasons, whereas never smokers were more concerned to brush in order to avoid dental problems. Hence, people perform their oral hygiene for different reasons and such aspects need to be taken into account when formulating health messages.

A strength of the current study is the randomized subject sample with a participation rate of 72%, which is high compared to other recent epidemiological surveys among adolescents in Sweden reporting participation rates of 58–65%.[7,38] However, a limitation of the study is the generalizability of the results since the included living areas were rural, i.e., no data from urban residents were included. Moreover, even though the human-capital model [21,39] was employed as our theoretical framework, some 'typical' Grossman-model variables—wage rate and wealth—were lacking in the data set. This may be of less importance for the age group in question, but family income and wealth might well have been as indicated by the associations among adolescents education programme and parents' education level. Furthermore, the theoretical model is dynamic so true estimations should be based on longitudinal individual data, reaching over a longer time period, while the data in the present study were cross-sectional. The results should be interpretated with these limitations in mind. In addition, as for all studies the results are limited to the variables/factors that are explored and, hence, further studies focusing also on other factors with potential impact on oral-health investment behaviours are warranted.

In conclusion, based on the results from the present study, a positive health investment profile of young individuals could be proposed; toothbrushing at least twice daily and consider themselves to take good care of the teeth, rarely miss dental appointments, do not use any tobacco, practice regular (weekly) physical exercise, have a high sum-score of GSE and are studying at a theoretical education programme. Thus, individual, environmental, as well as lifestyle factors are interacting with young individuals' investment behaviours in oral health and oral/gingival health conditions.

Disclosure statement

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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