Modelling the factors influencing general and oral hygiene behaviours in adolescents

MOJTABA DORRI, AUBREY SHEIHAM & RICHARD G. WATT

Department of Epidemiology and Public Health, University College London, UK

Background. Health behaviour models have been mainly used to explain indicators and the development of hygiene behaviours. However, health behaviour models do not explain and predict general and oral hygiene behaviours.
Aim. To develop and test a theoretical model of the factors influencing oral and general hygiene behaviours in male and female adolescents in Mashhad, Iran.
Design. A representative stratified random sample of 1132 6th grade Iranian students in Mashhad, with an average age of 12.4 (SD = 0.8) years, answered a 37-item questionnaire. The questionnaire had items on socio-demographic characteris-tics, education achievement and future aspiration, Sense of Coherence, toothbrushing frequency, frequency of showering and changing underwear, and peer social networks. Confirmatory structural equation modelling was used to test the validity of the model in the whole sample and among two sexes separately.
Results. All measurement models fitted the data. Significant correlations among latent variables were observed. Fit indices indicated good representation of the data in the whole sample. Goodness-of-fit statistics were significant among the two sexes.
Conclusions. The proposed theoretical model of the factors influencing general and oral hygiene behaviours in adolescents was valid. Further studies should further investigate the properties of this model in different populations.

Introduction

Personal hygiene is one of the most important factors affecting the health of the public[1]. Therefore it is important to gain insights into factors influencing hygiene behaviours to improve preventive strategies. Hygiene behaviours have usually been considered as part of general health behaviours. Consequently, studies have used health behaviour models to explain indicators and the development of hygiene behaviours[2–4]. Unsurprisingly, because hygiene behaviours are very different from other health behaviours such as dietary behaviours, current health behaviour models fail to explain and predict hygiene behaviours[5,6]. Hygiene behaviours differ from other health behaviours in that many people practice hygiene as grooming behaviours[7]. They are mainly health related and not necessarily health directed. So there is a need for models that specifically explain hygiene behaviours.

To date, there is only one published theoretical model of factors influencing hygiene behaviours[8]. That model, proposed by Bergler[8], has not been fully tested and the findings of recent studies cast doubt on some of the factors in the model. For example, Bergler[8] regarded personal level of information and knowledge as an indicator of hygiene behaviours. However, a recent systematic review on the impact of oral health promotion on oral hygiene questioned the clinical and public health significance of changes in oral hygiene following health education[9]. Furthermore, psychological indicators relating to hygiene behaviours such as self-image, self-esteem and self-efficacy are necessary but not sufficient in predicting hygiene behaviours[10]. Another shortcoming of Bergler's model is the large number of factors included and the levels of their effects. That makes the model difficult to interpret and test. The main

Correspondence to:
Dr Mojtaba Dorri, 1-19 Torrington Place, Department of Epidemiology and Public Health, University College London, London WC1E 6BT, UK.
E-mail: mojtabadorri@yahoo.com

objective of this study was to develop and test a rational model of factors affecting hygiene behaviours in adolescents. Adolescents were chosen for the study because they were more readily available for study and behaviours developed in that period are relatively stable and continue into adulthood[11]. As Bergler's model was the only one that incorporated some of the factors considered to be important for hygiene behaviours, we used a modified version of Bergler's model as a basis for the proposed new model that will be tested in this study. The modifications included deleting some of the pathways he suggested and adding factors.

The rationale of the proposed model is discussed here. In the study model, oral and general hygiene behaviours are assumed to share common indicators (Fig. 1). This is based on findings indicating that oral and general hygiene behaviours are strongly associated[7,8,12]. Some psychological factors, such as self-esteem, usually considered as predictors of hygiene behaviours have not been shown to be important in some populations[10]. Whereas a psychological concept that is not commonly used in predicting hygiene behaviours, namely Sense of Coherence (SOC)[13], has a significant association with toothbrushing in adolescents[3,14]. Therefore it was decided to include SOC, which encompasses a number of psychological factors[13], in the study model.

Peer social networks in the proposed study model, represents the communication, networks, socialization and norms used in Bergler's model. Traditionally, the frequency of exposure to peers has been taken as the indicator of peer social networks. In our study model, the quality as well as the quantity of peer social networks in adolescents was measured. One measure of strength of relationships is degrees of trust, social support and social engagement[15,16].

In the study model, socio-demographic factors, education and sex are assumed to influence hygiene behaviours through SOC and peer social networks. As adolescents are mainly students and do not have an occupation, their future aspiration was used as an indicator of adolescents' future status and occupation. Those with stronger future aspirations would care more about their hygiene to live longer and in a better condition, and concentrate more on studying to secure a better future and social position. In view of the close link between education achievement and future aspiration, these items were jointly considered under education in our model.

Studies have consistently reported a sex difference in hygiene behaviours. Universally, girls are cleaner than boys[7,8,17,18]. This suggests that there are sex differences in factors influencing hygiene behaviours. Therefore, a further objective of this study was to test whether the proposed model applied equally to female and male Iranian adolescents in Mashhad.

Materials and methods

Sample

Subjects were 6th grade Iranian students in Mashhad, Iran. A two-stage stratified random sampling method was used. Strata were from different distinct socio-economic regions identified by the local education authority. First, middle schools (primary sampling units) within three distinct socio-economic regions were randomly selected to represent equal proportions of 6th grade students within each socio-economic region. Second, 6th grade classes (secondary sampling units) within the selected schools were randomly selected to provide equal proportions of 6th grade students within each school. Randomisation was carried out using random number tables. There is no consensus on the optimal sample size for measuring the fitness of a theoretical
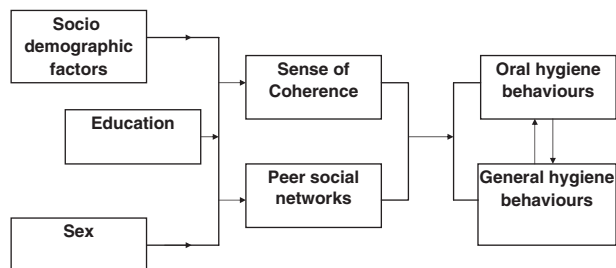

Fig. 1. The theoretical model of the factors influencing general and oral hygiene behaviours in adolescents (adapted from Bergler 1989).

model. Sample sizes between 100 and 500 have been recommended[19,20]. However, this study was part of a project which required a larger sample size of 1132.

Ethical approval was obtained from the Iranian National Ethics Committee. Parents were informed about the process and the purpose of the study and their written consent was sought for a self-administered questionnaire. Students were briefed about the study on the day of data collection and their verbal consent was sought. No school officials attended the data collection session and students were assured that data collection is confidential and their responses would not affect their school assessment. They were free to withdraw from the study at any stage. Subjects with disabilities, with chronic systemic diseases in the past six months, those wearing or who had worn an orthodontic appliance in the last two years, were excluded.

Instruments and measures

A 37-item questionnaire with questions on socio-demographic background (age and parents' level of education), sex, education (last year's final average mark and future aspiration), oral hygiene behaviours (frequency of toothbrushing), general hygiene behaviours (frequency of taking shower and frequency of changing underwear), peer social networks (club membership, number of close friends, frequency of meeting friends after school time, and strengths of ties between friends) and Sense of Coherence was used in this study. To measure SOC, Antonovsky's SOC scale was used[13]. This instrument has been used in 33 languages[21]. One version of SOC, SOC-13, has 13 items with a 7-point Likert-type scale. The scores for these 13 items were combined to calculate total SOC score. Higher scores indicated stronger SOC[13]. SOC score was calculated for those who answered all 13 items. As the questionnaire was originally developed in English, it was translated and validated in the pilot study for use in the target Persian-speaking population. For this purpose, the linguistic validation method introduced by Acquadro *et al.*[22] was employed, with some modifications. Sixty participants, 30 girls and 30 boys,

took part in the pilot study. The validation of the Persian version of Antonovsky's SOC-13 has been reported elsewhere[14].

To test the reliability of students responses to the questionnaire, 40 randomly selected male and female students were asked to answer the questionnaire again after one week span. The test-retest correlation in one week span was 0.74.

Statistical analysis

Data were entered using the Statistical Package for Social Sciences (SPSS for Windows, version 14.0/PC; SPSS, Chicago, IL, USA). Confirmatory Structural Equation Modelling approach was used to investigate the validity of the present study model. The Structural Equation Modelling analysis was carried out using LISREL 8.80 (Scientific Software International Inc., Lincolnwood, IL, USA). In the present study, measures of goodness of fit for each latent variable, with more than one indicator, were reported. The latent variables loaded by only one indicator (including oral hygiene behaviours and Sense of Coherence) may be acceptable if there is a confidence in the measure's validity and reliability. This condition was fulfilled in this study model by the past literature and the nature of some of variables. For example, toothbrushing frequency is a valid indicator of its corresponding latent variable; oral hygiene behaviours. Sense of Coherence has also been successfully validated and tested in several populations[21]. Four fit tests were reported as recommended by Kline[23]. They include Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Square Residual (SRMR). CFI and TLI range from 0 to 1. TLI values greater than 0.95 are acceptable[24]. Marsh and Hau[25] indicated that CFI values greater than 0.90 represent adequate fit. SRMR and RMSEA values less than 0.05 are widely considered good fit and below 0.08 indicate adequate fit[26]. The same measures of fit used to test the measurement models were reported for the structural model. Structural coefficients and their significance were also reported.

Results

A total of 1132 sixth graders in Mashhad, Iran, were recruited; 29 did not meet inclusion criteria and were excluded. Another 49 were excluded either because of lack of parent's consent, absence on day of study or withdrawing from study resulting in a response rate of 93.1%. In addition, there are missing data for some items in the questionnaire, ranging from 0.5% to 13.6%. Therefore, data for 911 participants were complete and used in the data analysis.

Descriptive analysis

The majority of students were males (59.2%). The mean age for the sample was 12.42 (SD = 0.79); 12.31 (SD = 0.71) for girls and 12.49 (SD = 0.83) for boys (Table 1). 69.5% of students reported that they intended to go to university after school (Table 1). 21.4% of fathers and 16.2% of mothers had a university degree (Table 1). Girls (52.9%) were significantly more likely than boys (38.6%) to report brushing teeth at least twice a day ($P < 0.001$) (Table 2). 55% of participants reported taking a shower at least twice a week (Table 2). Girls (64.2%) were more likely than boys (48.1%) to take showers twice a week or more ($P < 0.001$). Similar results were found for the frequency of changing underwear (Table 2). Boys (45.7%) were significantly more likely than girls (25.6%) to report changing underwear only once a week or less ($P < 0.001$). Boys were significantly more likely to be registered with a club ($P < 0.001$) and had more close friends and met their friends more frequently than girls ($P < 0.001$) (Table 2). The mean score for quality of peer social networks for boys (1.90, SD = 0.65) were significantly higher than that of girls (1.76, SD = 0.58) ($P < 0.001$) (Table 2). Girls had significantly a weaker Sense of Coherence than boys ($P = 0.04$).

Measurement models

Seven measurement models were fitted to determine the factor structure for socio-

Table 1. Frequency distribution of socio-demographic factors, education achievement and future aspiration among Iranian adolescents in Mashhad, by sex.

	Male	Female	Total
Age			
Mean (SD)	12.49 (0.83)	12.31 (0.71)	12.42 (0.79)
Minimum-Maximum	11–16	11–16	11–16
Number of participants	623	426	1049
Father's education level (%)			
Illiterate/primary school	40.4	39.3	39.9
Completed middle school	10.9	22.8	15.8
Completed secondary school	23.9	17.7	21.4
Had a university degree	22.8	19.3	21.4
Do not know	2.1	0.9	1.6
Total	100.0 (624)	100.0 (430)	100.0 (1054)
Mother's education level (%)			
Illiterate/primary school	48.1	46.5	47.4
Completed middle school	8.7	20.7	13.6
Completed secondary school	23.1	18.4	21.2
Had a university degree	18.1	13.5	16.2
Do not know	2.1	0.9	1.6
Total	100.0 (624)	100.0 (430)	100.0 (1054)
Last year's final average mark (%)			
Less than 10	1.1	0.5	0.9
10–14.99	10.5	5.9	8.6
15–16.99	17.9	14.5	16.5
17–20	70.5	79.1	74.0
Total	100.0 (615)	100.0 (427)	100.0 (1042)
Future aspiration (%)			
University*	67.9	71.7	69.5
Business**	12.6	8.0	10.6
None***	19.5	20.3	19.9
	100.0 (611)	100.0 (421)	100.0 (1032)

*Those who intended to go to university after school.
**Those who intended to learn a trade or become an apprentice or get a job after school.
***Those who did not intend to do higher school or do not know or others.

demographic background, sex, education, Sense of Coherence, peer social networks, general hygiene behaviours and oral hygiene behaviours. Table 3 displays the structural coefficients and the fit statistics for measurement models. One factor comprising three demographic indicators adequately fitted the data (TLI = 0.961, CFI = 0.903, RMSEA = 0.01, SRMR = 0.02) (Table 3). Socio-demographic background was defined by age, father's education level and mother's education level. Unlike age, the coefficients for parent's education level were positive. Age had the lowest structural coefficient

Table 2. Frequency distribution of general and oral hygiene behaviours, peer social networks and Sense of Coherence among Iranian adolescents in Mashhad, by sex.

	Male	Female	Overall
Frequency (%) of toothbrushing			
Twice a day or more	39.1	53.1	44.0
Once a day or less	60.9	46.9	56.0
Total	100.0 (611)	100.0 (416)	100.0 (1027)
Frequency (%) of showering			
Twice/week or more	48.1	64.2	54.6
Once/week or less	51.9	35.8	45.4
Total	100.0 (604)	100.0 (401)	100.0 (1005)
Frequency (%) of Changing underwear			
Twice/week or more	54.3	74.4	62.5
Once/week or less	45.7	25.6	37.5
Total	100.0 (589)	100.0 (405)	100.0 (994)
Club membership (%)			
Yes	67.0	39.8	55.9
No	33.0	60.2	44.1
Total	100.0 (624)	100.0 (430)	100.0 (1054)
Number of close friends (%)			
None	3.5	4.9	4.1
1–3	43.2	55.9	48.4
4–6	18.9	22.1	20.2
More than 6	34.4	17.0	27.3
Total	100.0 (620)	100.0 (429)	100.0 (1049)
Frequency of meeting friends (%)			
Every day	12.2	7.5	10.3
4–6 days a week	21.8	11.7	17.6
2–3 days a week	22.8	17.0	20.4
Once a week or less	20.2	24.4	22.0
Not at all	23.0	39.4	29.7
Total	100.0 (614)	100.0 (429)	100.0 (1043)
Quality of peer social networks			
Mean (SD)	1.90 (0.65)	1.76 (0.58)	1.85 (0.62)
Minimum–Maximum	1.00–4.00	1.00–3.67	1.00–4.00
Number of participants	596	420	1016
Sense of coherence			
Mean (SD)	49.1(10.6)	47.9(10.7)	48.6 (10.7)
Minimum–Maximum	20.0–82.0	22.0–79.0	20.0–82.0
Number of participants	530	381	911

(−0.129). Two observed variables, last year's final average mark and future aspiration, were loaded on single latent variable, namely education, and adequately fitted the data (TLI = 0.931, CFI = 0.919, RMSEA = 0.04, SRMR = 0.01) (Table 3). Both indicators presented similar structural coefficients (0.638). Four observed variables on the quantity and quality of friendship were loaded on a single latent variable, peer social networks, and adequately fitted the data (TLI = 0.958, CFI = 0.881, RMSEA = 0.03, SRMR = 0.05) (Table 3). The observed variables included number of close friends, frequency of meeting friends, club membership and quality of peer social networks. The structural coefficients for these four variables ranged from 0.373 (club membership) to 0.490 (frequency of meeting friends). Frequency of taking showers and frequency of changing underwear were combined to form the latent variable general hygiene behaviours. This one factor solution perfectly fitted the data (TLI = 0.989, CFI = 0.978, RMSEA <0.001, SRMR <0.001) (Table 3). The structural coefficient was the same for both indicators, 0.583.

Structural model

Significant correlations among latent variables were observed (Fig. 2). Socio-demographic background showed a direct association with Sense of Coherence (β = 0.111, $P < 0.01$) and peer social networks (β = 0.040, $P < 0.01$). Similarly, sex was positively associated with Sense of Coherence (β = 0.231, $P < 0.05$) and peer social networks (β = 0.094, $P < 0.05$). Education was also positively associated with Sense of Coherence (β = 0.036, $P < 0.01$) and peer social networks (β = 0.024, $P < 0.05$).

Sense of Coherence and peer social networks were positively associated with oral hygiene behaviour; β = 0.144, $P < 0.01$ and β = 0.175, $P < 0.01$ respectively. Similarly, Sense of Coherence and peer social networks were positively associated with general hygiene behaviours; β = 0.093, $P < 0.01$ and β = 0.076, $P < 0.01$ respectively. Oral hygiene behaviours and general hygiene behaviours had direct positive effects on each other; β = 0.595, $P < 0.001$ and β = 0.682, $P < 0.001$ respectively.

Fit indices indicated good representation of the data in the whole sample (TLI = 0.961, CFI = 0.946, RMSEA = 0.01, SRMR = 0.02). The hypothetical model was also tested among boys and girls separately. Goodness-of-fit statistics was significant among two sexes. The model had a slightly better fit among boys (TLI = 0.973, CFI = 0.958, RMSEA = 0.01, SRMR = 0.02) than girls (TLI = 0.959, CFI = 0.942, RMSEA = 0.01, SRMR = 0.02).

Table 3. Structural (path) coefficients and fit statistics for measurement models.
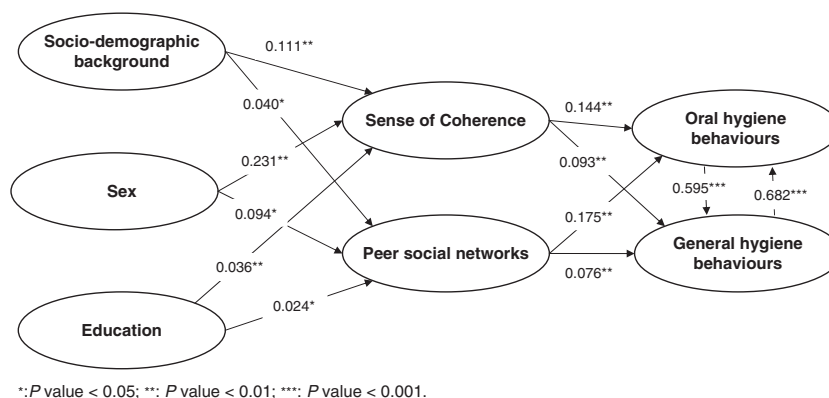
Item	Model 1 (n = 1045) Socio-demographic background	Model 2 (n = 1046) Education	Model 3 (n = 1054) Peer social networks	Model 4 (n = 1043) General hygiene behaviours
Father's education level	0.537			
Mother's education level	0.538			
Age	−0.129			
Last year's final average mark		0.638		
Future aspiration		0.638		
Number of close friends			0.437	
Frequency of meeting friends			0.490	
Club membership			0.373	
Quality of peer social networks			0.378	
Frequency of changing underwear				0.583
Frequency of taking shower				0.583
TLI*	0.961	0.931	0.958	0.989
CFI**	0.903	0.919	0.881	0.978
RMSEA***	0.01	0.04	0.03	<0.001
SRMR****	0.02	0.01	0.05	<0.001

*Tucker-Lewis index.
**Comparative Fit Index.
***Root Mean Square Error of Approximation.
****Standardized Root Mean Square Residual.

*:P value < 0.05; **: P value < 0.01; ***: P value < 0.001.

Fig. 2. Structural model depicting standardized paths among socio-demographic background, education, sex, Sense of Coherence and peer social networks, and oral hygiene behaviours and general hygiene behaviours.

Discussion

The results confirmed that this study theoretical model adequately fitted the data. The fit indices of the model were beyond recommended cut-off values. However, these cut-offs, although recommended, are arbitrary[27]. The findings indicate that the factors influencing hygiene behaviours in Iranian adolescents in Mashhad and the interrelationship between these factors can be explained by the model, namely, socio-demographic factors, sex and education influence hygiene behaviours in adolescents through their impact on Sense of Coherence and peer social networks. However, the findings do not guarantee the universal application of this model. The model is hypothetical for the correlations between hygiene behaviours and their psychosocial determinants which are supported by the body of the literature and the results of the analysis in the present study.

In the theoretical model, all the structural path coefficients were significant. The highest path coefficient was for the path between oral hygiene behaviours and general hygiene

behaviours. The relationship between oral and general hygiene behaviours were also strongly significant ($P < 0.001$). The coefficients for the paths between Sense of Coherence and peer social networks, and oral and general hygiene behaviours were almost similar. That further confirms the close relationship between oral and general hygiene behaviours and their psychosocial indicators and is in line with findings of earlier studies which demonstrated a strong association between oral and general hygiene behaviours in adolescents and adults[7,8,12]. The findings have important application for researchers and hygiene promoting programme developers. Oral and general hygiene promoting programmes should be designed and implemented in close collaboration with each other. This would improve the outcomes and avoid duplication of efforts.

The theoretical model for this study also showed acceptable results when tested separately for boys and girls. Similar to results from the whole sample, fit indices values for both sexes were acceptable. The values were slightly higher among boys than girls. The findings are important specially when considering the universal sex differences in hygiene among adolescents[7,8,17,18]. Moreover, although girls were cleaner than boys, the factors influencing hygiene behaviours in the two sexes are similar. This implies that similar approaches are required to promote hygiene behaviours for boys and girls.

All measurement models fitted the data obtained from this study. This further confirms that changes introduced in the original Bergler[8] model were valid. Furthermore, this indicates the validity of the observed variables used to measure the factors included in the present model. Those factors with a single observed variable were not included in this analysis. The validity and reliability of factors, such as Sense of Coherence, are supported by the literature[21]. Age, unlike other observed variables, had a negative structural coefficient. In this study model, this may translate as a negative association between age and hygiene behaviours. This assumption disagrees with findings from previous studies which indicated better oral hygiene behaviours for older adolescents[18]. Older children are normally more engaged in social communities and therefore, more influenced by socialization and peer groups. They have also a more highly developed Sense of Coherence[13]. This may result in better hygiene behaviours. The disagreement with other studies can be because the majority (89.2%) of adolescents in our study were 12–13 years old. Therefore, the present study sample was not appropriate to investigate the influence of age on hygiene behaviours. Furthermore, as the participants were all 6th graders, the older subjects were mainly those with poor school performance who had failed a year. There is a positive association between school performance and hygiene behaviours in adolescents[17]. Therefore, the findings on association between age and other factors in the model are inconclusive.

Although 1054 students participated in the study, there was missing data for different variables resulting in 911 being included in the structural equation modelling analysis. However, the sample size was large enough to fulfil the requirements set by different recommended sample size estimations[19,20].

There is wide disagreement on which fit indices to report[23,28]. Kline[23] recommends reporting at least four tests. On this basis, in the present study, four fit indices including CFI, TLI, RMSEA and SRMR were reported. It is recommended to avoid using fit indices which are affected by study characteristics. In this study, four fit indices, less affected by sample size, were presented. RMSEA and CFI are relatively unaffected by sample size[29,30]. There are several types of fit indices according to the concepts the indices are based on. The four fit indices in this study were chosen as they belonged to different concepts to be able to identify the possible errors tailored to different types of fit indices. The types of fit indices in this study were absolute fit indices (SRMR), relative fit indices (TLI), and non-centrality-based indices (RMSEA and CFI).

Girls and boys schools are separated in the Iranian education system. On this basis, local education authority required the research team to use male and female study teams. Although, appropriate measures such as calibrating the teams, were taken, some bias may have occurred.

In conclusion, the proposed theoretical model for factors influencing hygiene behaviours in adolescents was valid. Further studies should further investigate the properties of this model in different populations. Future studies are also required to explore effective interventions to modify factors influencing hygiene behaviours in adolescents.

What this paper adds
- This paper provides a model of the factors influencing general and oral hygiene behaviours in adolescents.

Why this paper is important for paediatric dentists
- This paper offers paediatric dentists a better understanding of indicators and the development of hygiene behaviours in adolescents.

References

1 Pruss A, Kay D, Fewtrell L *et al.* Estimating the burden of disease from water, sanitation, an hygiene at a global level. *Environ Health Perspect* 2002; **110**: 537–542.

2 Tillis TS, Stach DJ, Cross-Poline GN *et al.* The transtheoretical model applied to an oral self-care behavioral change: development and testing of instruments for stages of change and decisional balance. *J Dent Hyg* 2003; **77**: 16–25.

3 Ayo-Yusuf OA, Reddy PS, van den Borne BW. Adolescents' sense of coherence and smoking as longitudinal predictors of self-reported gingivitis. *J Clin Periodontol* 2008; **35**: 931–937.

4 Morowatisharifabad M, Shirazi KK. Determinants of oral health behaviors among preuniversity (12th-grade) students in Yazd (Iran): an application of the health promotion model. *Fam Community Health* 2007; **30**: 342–350.

5 Kegeles SS, Lund AK. Adolescents' health beliefs and acceptance of a novel preventive dental activity: a further note. *Soc Sci Med* 1984; **19**: 979–982.

6 Ndiokwelu E. Applicability of Rosenstock-Hochbaum health behaviour model to prevention of periodontal disease in Enugu students. *Odontostomatol Trop* 2004; **27**: 4–8.

7 Hodge HC. *Factors Associated with Toothbrushing Behaviour in Adolescents*. Manchester: University of Manchester, 1979.

8 Bergler R. Personal hygiene and cleanliness in an international comparison. *Zentralbl Bakteriol Mikrobiol Hyg [B]* 1989; **187**: 422–507.

9 Watt RG, Marinho VC. Does oral health promotion improve oral hygiene and gingival health? *Periodontol 2000* 2005; **37**: 35–47.

10 Koerber A, Graumlich S, Punwani IC *et al.* Covariates of tooth-brushing frequency in low-income African Americans from grades 5 to 8. *Pediatr Dent* 2006; **28**: 524–530.

11 Jessor R. Problem behavior and developmental transition in adolescence. *J Sch Health* 1982; **52**: 295–300.

12 Dorri M, Sheiham A, Watt R. Relationship between general hygiene behaviours and oral hygiene behaviours in Iranian adolescents. *Eur J Oral Sci* 2009; **117**: 407–412.

13 Antonovsky A. *Unraveling the Mystery of Health. How People Manage Stress and Stay Well*. San Francisco: Jossey Bass, 1987.

14 Dorri M, Sheiham A, Hardy R *et al.* The relationship between Sense of Coherence and toothbrushing behaviours in Iranian adolescents in Mashhad. *J Clin Periodontol* 2010; **37**: 46–52.

15 Kawachi I, Kim D, Coutts A *et al.* Commentary: Reconciling the three accounts of social capital. *Int J Epidemiol* 2004; **33**: 682–690.

16 Samdal O. *The School Environment as a Risk or Resource for Students' Health-related Behaviours and Subjective Well-being*. Bergen: Research Centre for Health Promotion, University of Bergen, 1998.

17 Kuusela S, Honkala E, Kannas L *et al.* Oral hygiene habits of 11-year-old schoolchildren in 22 European countries and Canada in 1993/1994. *J Dent Res* 1997; **76**: 1602–1609.

18 Maes L, Maser M, Honkala S. Oral health. In: Currie C, Roberts C, Morgan A *et al.* (eds). *Young People's Health in Context. Health Behaviour in School-aged Children (HBSC) Study: International Report from the 2001/2002 survey*. Copenhagen: World Health Organisation, 2004: 130–133.

19 Hoyle RH. *Structural Equation Modeling: Concepts, Issues, and Applications. An Introduction Focusing on AMOS*. Thousand Oaks, CA: Sage Publications, 1995.

20 Schumacker RE, Lomax RG. *A Beginner's Guide to Structural Equation Modeling*, 2nd edn. Mahwah, New Jersy: Lawrence Erlbaum Associates, 2004.

21 Eriksson M, Lindstrom B. Validity of Antonovsky's sense of coherence scale: a systematic review. *J Epidemiol Community Health* 2005; **59**: 460–466.

22 Acquadro C, Conway K, Giroudet C *et al. Linguistic Validation Manual for Patient-reported Outcomes (PRO) Instruments*. Lyon: Mapi research institute, 2004.

23 Kline RB. *Principles and Practice of Structural Equation Modeling*. New York: Guilford Press, 1998.

24 Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct Equ Modeling* 1999; **6**: 1–55.

25 Marsh HW, Hau KT. Assessing goodness of fit: is parsimony always desirable? *J Exp Educ* 1996; **64**: 364–390.

26 Kline RB. *Principles and Practice of Structural Equation Modeling*. London: The Guilford Press, 2005.

27 Bollen KA. *Structural Equations with Latent Variables*. New York: Wiley, 1989.

28 Jaccard J, Wan CK. *LISREL Approaches to Interaction Effects in Multiple Regression*. Thousand Oaks, CA: Sage Publications, 1996.

29 Bollen KA. Overall fit in covariance structure models: two types of sample size effects. *Psychol Bull* 1990; **107**: 256–259.

30 Fan X, Thompson B, Wang L. Effects of sample size, estimation method, and model specification on structural equation modeling fit indexes. *Struct Equ Modeling* 1999; **6**: 56–83.