

# Oral and general health behaviours among Chinese urban adolescents

Poul Erik Petersen<sup>1,2</sup>, Han Jiang<sup>2,3</sup>,  
Bin Peng<sup>3</sup>, Bao Jun Tai<sup>3</sup> and Zhuan Bian<sup>3</sup>

<sup>1</sup>Global Oral Health Programme, Department of Chronic Diseases and Health Promotion, World Health Organization, Geneva, Switzerland, <sup>2</sup>Department for Community Dentistry and Graduate Studies, School of Dentistry, Faculty of Health Sciences, University of Copenhagen, Copenhagen, Denmark, <sup>3</sup>Department of Preventive Dentistry, School of Stomatology, Wuhan University, Wuhan, China

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**Abstract – Objectives:** The objectives of this study were to measure the association of general and oral health-related behaviours with living conditions and to explore the interrelationships between general and oral health-related behaviours in Chinese urban adolescents. **Methods:** A cross-sectional survey of 2662 adolescents was conducted in eight Chinese provincial capitals. The response rate was 92%. The study population was selected through multistage cluster sampling and comprised three age groups: 11, 13 and 15 years. Data on oral and general health, lifestyles as well as living conditions were collected by means of self-administered structured questionnaires. Several additive indices were constructed from answers to the questions on specific behaviour, and participants were categorized according to scores on each component of health-related behaviour for statistical analyses by frequency distributions, regression analyses and factor analyses. **Results:** Oral health-related behaviours among adolescents were associated with socioeconomic status of parents, school performance and peer relationships. The odds of a dental visit was 0.63 in adolescents of poorly educated parents and the corresponding figure for regular oral hygiene practices was 0.62. Odds of tobacco use was 3 for adolescents with poor performance in school while odds of consuming sugary foods/drinks was 1.3. Adolescents with high levels of preventive oral health practices also demonstrated general health-promoting behaviours. In factor analysis of general and oral health-related behaviours, three factors were isolated: (a) risk behaviours (loadings 0.48–0.66), (b) health-promoting behaviours (loadings 0.60–0.64) and (c) help-seeking behaviours (loadings 0.56–0.67). **Conclusion:** The findings support a multidimensional model of health behaviour. Several approaches and multiple methods should be applied in oral health education in order to modify behaviours that affect oral health.

**Key words:** dietary habits; general health; multivariate analysis; oral health; physical exercise; tobacco; use of health services

Prof. Poul Erik Petersen, World Health Organization, Global Oral Health Programme, Department of Chronic Disease and Health Promotion, 20 Avenue Appia, CH-1211 Geneva, Switzerland  
e-mail: petersenpe@who.int

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Healthy lifestyles are fundamental to public health. Health behaviour has been defined as human activities protecting, promoting or maintaining the health of the individual, while risk behaviour relates to actions which have negative impacts on health (1). Research on health-related behaviours and their correlations is of interest to public health for several reasons. First, implementation of successful health promotion programmes depends on both information about the prevalence of such behaviours and an understanding of their determinants. Secondly, research may highlight interac-

tions between health related behaviours which may bring about synergistic effects on health status. Thirdly, information about patterns of health related behaviours can provide important data for adjustment of health education interventions within the context of health promotion programmes.

Research carried out in industrialized countries has indicated that oral health is an essential component of general health, and both health dimensions tend to have common risk factors related to lifestyles (2–5). Studies show that health behaviours of children and adolescents are

associated with factors such as gender, age, peers, oral health knowledge and attitudes, parental income and educational background, ethnic group, and school environment (6–11). In both developed and developing countries moreover, physical activity, tobacco and alcohol use, sedentary practices, general hygiene habits and diet are major risk factors to chronic disease (12) and may also be linked to oral health (13–15). Incorporating oral health promotion into general health promotion is becoming increasingly important, as an integrated approach is likely to be more cost-effective than programmes targeting a single disease (16).

Certain health behaviours are shown to interrelate. An association has for example been documented between smoking and alcohol use (17) and similarly between physical inactivity and an unhealthy diet (18). Tobacco consumption has also been linked with unhealthy diet (19). Meanwhile, the association between oral health behaviour and general health behaviour has been investigated in but a few studies. One report (20) revealed that toothbrushing frequency was associated with lifestyles in general health (i.e. smoking, alcohol use, exercise, eating breakfast) and having medical check-ups, and in parallel individuals having regular visits to a dentist were shown to have higher rates of visits to the physician (21). Furthermore, a Canadian study (3) used additive indices to demonstrate that oral health and general health behaviour were significantly correlated. The clustering of oral health-related behaviours was analysed in young adult Danes in order to explore underlying dimensions of these behaviours (22). Information such as this is valuable in designing behaviour modification strategies. If certain health behaviours are highly interrelated, for example, then intervention programmes that target one behaviour may produce favourable effects on nontargeted behaviours. On the other hand, if behaviours are weakly related or are unrelated, then changes in one behaviour cannot be expected to lead to changes in others. This implies that each behaviour must be specifically targeted in health promotion programmes. In China, risk factors assessment in oral health is rare and little is known about the determinants of health-related behaviours in youth. The prevalence of oral health and risk behaviours in Chinese urban adolescents was described in a previous report (23); the objectives of the actual report are to analyse the association of general and oral health-related behaviours in Chinese youth with parent's level of education and

income, school performance, and peer relationship, and to explore the interrelationships between general and oral health-related behaviours.

## Study populations and methods

The study was based on a cross-sectional survey carried out from February through March 2003. The study population was chosen by multistage cluster sampling and covered three age groups: 11, 13 and 15 years. Eight cities were chosen (Beijing, Wuhan, Xi'an, Guangzhou, Shanghai, Lanzhou, Kunming and Shenyang), and details on sampling are given in a previous report (23). The final sample comprised 2662 students, i.e. 948 students aged 11 years, 902 students aged 13 years and 812 students aged 15 years; the overall participation rate was 92%.

The structured questionnaire used for collection of data was designed by the World Health Organization (WHO) Global Oral Health Programme, Geneva, Switzerland, and included the following variables: (a) self-assessment of general health status, (b) self-assessment of oral health status, (c) self-reported oral hygiene practices, (d) general hygiene habits, (e) dietary habits, (f) lifestyles: smoking, use of alcohol and physical activity, (g) oral health knowledge and attitudes, (h) dental visits, (i) visit to physician, (j) school performance, (k) leisure activities, (l) relationship to friends, (m) family status and lifestyle of parents and (n) parent's levels of education and income. The questionnaires were completed by the students themselves in their classrooms, and teachers supervised the procedure. The questionnaire was originally formulated in English, subsequently translated into Chinese, and then retranslated into English. The face validity and reliability of the questionnaire were assessed prior to implementation of the study. To test reliability, 20 students of each age group not covered by the survey completed the questionnaire twice, with an interval of 3 weeks. The consistency rate in responses was over 80%.

All data were transferred to the WHO Collaborating Centre for Community Oral Health Programmes and Research, University of Copenhagen and processed and analysed by means of the SPSS 12.0 system for Windows. Description and analysis of the data were carried out by frequency distributions. The individual questions on behaviour, knowledge and attitudes included a series of items

and in order to study the associations between health behaviours and lifestyle variables, several additive indices were developed. The indices were designed to fit the so-called Guttman scale model (24) which comprises unidimensional and cumulative scales. The coefficient of reproducibility (CR) is the standard measure of the reliability. The following scales were constructed: (a) performance in school (scores 6–22, CR = 0.73), (b) relationship to friends (scores 3–10, CR = 0.75), (c) consumption of sugary drinks and foods (scores 8–32, CR = 0.76), (d) consumption of healthy foods (scores 5–20, CR = 0.89), (e) tobacco habits (scores 2–6, CR = 0.84), (f) alcohol habits (scores 4–17, CR = 0.75), (g) oral hygiene practices (scores 5–13, CR = 0.78), (h) general hygiene practices (scores 3–15, CR = 0.72), (i) knowledge of causes of dental disease (scores 0–6, CR = 0.87), (j) knowledge of prevention of dental disease (scores 0–6, CR = 0.81), (k) attitudes towards dental care (scores 0–9, CR = 0.84), and (l) educational level of parents (scores 0–10, CR = 0.95). For the bivariate data analyses, all scales were classified empirically into tertiles: low, moderate, or high; frequency distributions were computed and differences in proportions were evaluated using the chi-squared test. Multiple logistic regression analysis was applied to study the effect of independent variables on health-related behaviours (dependent variables). Odds ratios (ORs) were calculated for the discrete dependent variables in the logistic

regression model and statistically evaluated by Wald statistics. In order to explore latent factors in the health-related behaviours observed, factor analysis was performed using principal components analysis and Varimax rotation (25). The analyses were based on the original scales. Factors were extracted according to the Kaiser criterion of eigenvalues greater than 1, and scales were developed based on absolute factor loadings >0.40.

## Results

### *Health-related behaviour in relation to socioeconomic status*

The participants were classified according to how often they performed certain habits. Tables 1 and 2 present the proportion of students with high scores on health-related practices by their socioeconomic background. The students with highly educated parents more often reported having had dental visits within the last 12 months compared with those of low-education backgrounds ( $P < 0.001$ ). In addition, students with highly educated parents tended relatively often to have personal oral and general hygiene practices, and they often claimed to have healthy dietary habits and to engage in vigorous physical activity. Furthermore, the consumption of sugary foods/drinks was more frequent among these students than among those with parents of lower

Table 1. The percentage of Chinese adolescents with certain health care practices, healthy dietary habits and physical activity, by parent's level of education and income, school performance and peer relationship

Independent variables	n	Visit to dentist last year	Visit to physician last year	Oral hygiene practices (high scores)	General hygiene practices (high scores)	Healthy dietary habits (high scores)	Physical activity (high scores)
All	2662	25.5	52.6	27.6	28.0	28.5	26.7
Parent's education level							
Low	983	21.5	54.6	22.4	22.4	21.4	21.5
Moderate	782	23.7	52.7	24.8	28.0	29.4	26.2
High	897	31.4***	50.2	35.7***	34.2***	35.7***	32.9***
Family income							
Low	287	23.3	57.1*	20.2	18.5	22.0	22.6
Moderate	1371	24.6	49.7	28.9	28.7	30.6	27.5
High	492	31.7**	54.5	36.0***	33.5***	32.5***	30.9*
School performance							
Low	791	25.2	56.5*	25.3	22.9	25.4	26.4
Moderate	952	23.1	49.6	27.6	26.6	29.1	26.3
High	919	28.2*	52.2	29.5	33.9***	30.7**	27.4
Peer relationship							
Low	757	22.5	54.3	21.8	20.3	24.2	21.7
Moderate	837	27.1	52.7	28.8	28.3	28.0	24.4
High	1068	26.3	51.2	30.7***	33.2***	32.1***	32.1***

\* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ .

Table 2. The percentage of Chinese adolescents with certain health-related behaviour, high consumption of sugary items, tobacco, alcohol, watching TV, playing computer game by parent's level of education and income, school performance and peer relationship

Independent variables	n	Sugary foods/ drinks (high scores)	Tobacco habits (high scores)	Alcohol habits (high scores)	Watching TV (high scores)	Playing computer game (high scores)
All	2662	30.7	2.6	22.6	34.7	37.7
Parent's education level						
Low	983	28.0	2.8	18.8	41.7***	37.3
Moderate	782	31.2	2.8	23.9	35.7	35.4
High	897	33.1*	2.1	25.6**	26.3	40.0***
Family income						
Low	287	24.4	3.1	20.6	38.3	27.5
Moderate	1371	29.5	2.3	22.2	31.9	35.6
High	492	36.4***	3.0	27.8**	35.6	49.0***
School performance						
Low	791	35.1**	5.6***	28.3***	40.8**	44.8***
Moderate	952	31.6	1.6	22.3	32.8	38.8
High	919	25.8	1.1	18.1	31.6	30.5
Peer relationship						
Low	757	25.5	2.6	24.4	33.0	36.6
Moderate	837	31.2	1.8	22.0	34.2	36.7
High	1068	33.9***	3.2	21.8	36.4	39.2

\* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ .

education. Students with high educational background reported relatively often having imbibed alcohol, and they also spent more time playing computer games. A similar response pattern was found for these behaviours in relation to the level of family income. Finally, students with family background of low education were likely to score high on watching television compared to students with highly educated parents ( $P < 0.001$ ).

#### *School environment, peer relationship and health-related behaviour*

Students with good performance in school showed higher percentage of dental visits than those with poor performance (Table 1). Additionally, the scores on general hygiene practices and healthy dietary habits were higher among these students than among poor performers. Students performing poorly in school relatively often reported a higher consumption of sugary foods/drinks, tobacco and alcohol use, and they were also likely to have high scores on watching television and playing computer games (Table 2). Students with active peer relationships relatively often reported regular oral and general hygiene, physical activity and healthy dietary habits, and their scores on consumption of sugary foods/drinks were higher than students with passive peer relationships ( $P < 0.001$ ) (Tables 1 and 2).

#### *Multivariate analysis*

The results of the logistic regression analyses of health behaviours are shown in Tables 3 and 4. Only statistically significant associations are presented. Parents' level of education had a positive effect on the seven dimensions of health behaviour in Chinese adolescents, i.e. dental visits, oral hygiene practices, general hygiene practices, healthy dietary habits, physical activity, alcohol habits, playing computer games and consumption of sugary foods/drinks; meanwhile, watching television was inversely related to education. Other factors being equal, oral hygiene practices were significantly less common among students with negative attitudes towards dental care and low knowledge of the prevention of dental disease. Additionally, risks of tobacco and alcohol use, watching TV, playing computer games and intake of sugary foods/drinks were high for students performing poorly in school. Controlling for other factors, the consumption of tobacco and alcohol and playing computer games were more often found among boys than girls while scores for dental visiting habits were relatively low for boys.

#### *Factor analysis*

Three factors were retained in the factor analysis which explained 43% of the total variance in the health-related behaviour variables (Table 5). Factor

Table 3. Multivariate logistic regression analyses of specific health care practices, healthy dietary habits and physical activity (odds ratio for high score category) by gender, age, parent's level of education and income, performance in school, peer relationship and knowledge and attitudes related to oral health ( $n = 2662$ )

Independent variable	Category	Dental visit (OR)	Visit to physician (OR)	Oral hygiene practices (OR)	General hygiene practices (OR)	Healthy dietary habits (OR)	Physical activity (OR)
Gender	Boys	0.70***	1.04	1.04	0.96	0.90	1.79***
	Girls	–	–	–	–	–	–
Age	11 years	1.36*	0.90	0.83	1.31*	1.15	0.50***
	13 years	1.06	0.92	0.78*	1.28*	0.99	0.71**
	15 years	–	–	–	–	–	–
Parent's education level	Low	0.63***	1.15	0.62***	0.65***	0.48***	0.78*
	Moderate	0.70**	1.09	0.72**	0.79*	0.70***	0.83
	High	–	–	–	–	–	–
Family income	Low	0.96	1.03	0.96	0.69*	0.95	0.94
	Moderate	0.87	0.79**	1.11	0.94	1.12	1.09
	High	–	–	–	–	–	–
Performance in school	Low	1.09	1.13	0.95	0.68***	0.85	0.91
	Moderate	0.88	0.87	1.02	0.75**	0.97	1.03
	High	–	–	–	–	–	–
Peer relationship	Low	0.91	1.10	0.75**	0.62***	0.75**	0.60***
	Moderate	1.07	1.06	0.96	0.84	0.87	0.78**
	High	–	–	–	–	–	–
Attitudes towards dental health	Low	0.80	0.92	0.51***	0.75**	0.66	0.80*
	Moderate	0.98	1.03	0.62***	0.85	0.82	0.91
	High	–	–	–	–	–	–
Knowledge about prevention of dental disease	Low	0.74*	0.89	0.60***	0.88	0.93	1.02
	Moderate	0.66***	1.12	0.67***	0.84	0.79	0.81*
	High	–	–	–	–	–	–

\* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ .

1 was made up of six items: playing computer games, alcohol habits, tobacco habits, watching TV, physical activity and the consumption of sugary foods/drinks. Factor 2 comprised oral hygiene practices, healthy dietary habits and general hygiene practices, and factor 3 consisted of two items: visit to the physician and visit to the dentist. Factor 1 accounted for 17% of the total variance, factor 2 for 14% and factor 3 for 12%.

## Discussion

A previous report from this study has described the prevalence of risk factors to oral and general health in Chinese youth. The scientific gain from this actual report relates to the thorough analysis of the determinants of health behaviours and to the understanding of the interrelationships between general health and oral health behaviours.

The survey was conducted on a national scale but was not based on the involvement of all provinces in China; the data are therefore not representative of the country in pure statistical terms. However, the data are assumed to have

relevance for most urban areas of China and the analytical value is considered substantial. One limitation of the study may relate to the identification of participants which was based on sampling of clusters rather than individuals. Respondents making up such clusters may tend to have harmonized behaviour or attitudes. Students within a classroom are for example likely to share views about the school and life events, and this may also apply to knowledge of and attitudes towards dental care. In the present study, eight provincial capitals in north, south, east, west and central China were selected, to encompass a broad spectrum of urban adolescents. Statistics available on economic development show certain disparities among cities in the country, e.g. the economic growth rate in Beijing, Shanghai and Guangdong is higher than in other cities. Where demographic profiles are concerned there are no notable differences between the eight cities with the exception of number of inhabitants.

Sociological data were collected by means of self-administered questionnaires and thanks to the school-based approach highly acceptable response rates were obtained. The questions concerning oral

Table 4. Multivariate logistic regression analyses of consumption of tobacco, alcohol, watching TV, playing computer game and intake of sugary items (Odds Ratio for high score category) by parent's level of education and income, performance in school, peer relationship, and knowledge and attitudes related to oral health ( $n = 2662$ )

Independent variable	Category	Tobacco habits (OR)	Alcohol habits (OR)	Watching TV (OR)	Playing computer game (OR)	Sugary foods/drinks (OR)
Gender	Boys	2.76***	1.53***	1.05	2.39***	1.04
	Girls	–	–	–	–	–
Age	11 years	0.41***	0.76**	1.76***	0.83	0.57
	13 years	0.68*	0.76**	1.86***	1.04	1.03
	15 years	–	–	–	–	–
Parent's education level	Low	1.12	0.74**	1.98***	0.76**	0.76**
	Moderate	1.35	0.77**	1.61***	0.65***	0.88
	High	–	–	–	–	–
Family income	Low	0.98	0.94	0.79	0.47***	0.67**
	Moderate	1.06	0.84*	0.80*	0.81*	0.73***
	High	–	–	–	–	–
Performance in school	Low	3.01***	1.45**	1.65***	1.53***	1.31*
	Moderate	1.68*	1.25*	1.11	1.22*	1.12
	High	–	–	–	–	–
Peer relationship	Low	0.65*	1.02	0.79*	0.74**	0.61***
	Moderate	0.83	0.91	0.92	0.93	0.89
	High	–	–	–	–	–
Attitudes towards dental health	Low	1.11	1.07	1.38**	1.05	1.02
	Moderate	1.32	1.25*	1.08	0.96	1.04
	High	–	–	–	–	–
Knowledge about prevention of dental disease	Low	1.23	1.09	0.75*	1.02	0.94
	Moderate	1.31	1.14	0.92	0.97	1.04
	High	–	–	–	–	–

\* $P < 0.05$  \*\* $P < 0.01$  \*\*\* $P < 0.001$ .

Table 5. Factor analysis of Chinese adolescent's health behaviours with varimax rotation ( $n = 2662$ )

Variable	Factor 1	Factor 2	Factor 3
Playing computer game	0.66		
Alcohol habits	0.57		
Tobacco habits	0.56		
Watching TV	0.55		
Physical activity	0.53		
Sugary foods/drinks	0.48		
Oral hygiene practices		0.64	
Healthy dietary habits		0.63	
General hygiene practices		0.60	
Visit to physician			0.67
Visit to dentist			0.56

health behaviour have been used successfully in previous studies in China (26, 27), and questions on general health behaviour derived from health surveys conducted by WHO (11). The validity and reliability of questions included in the present study were all pretested in earlier studies (11, 26, 27). Questionnaires used for collection of data on health behaviour may however have certain limitations. Individual perceptions of ideal oral self-care and lifestyles may lead to overestimation of positive oral and general hygiene habits and

attitudes towards dental care, whereas risk behaviours such as consumption of sugary foods and drinks may be under-reported.

Surveys carried out in industrialized countries have shown that the oral and general health behaviour of children and adolescents is highly influenced by the socioeconomic status of their parents (9, 28). This has been confirmed in Hong Kong (29) and by the present study in China, since students with family backgrounds of higher education and income scored relatively high on oral hygiene practices, general hygiene practices, healthy dietary habits and physical activity, and they were likely to visit the dentist. However, they also more often reported experience of alcohol, high consumption of sugary foods/drinks, and spending more time playing computer games. This could be due to accessibility to a computer at home, and to the affordability for them of alcohol and sugary foods/drinks. Notably, after controlling for confounders by multivariate regression analyses, the educational level of parents tended to be a stronger determinant than family income in relation to health-related behaviours.

The school years can be seen as a crucial period for development of an adolescent's self-esteem and health behaviour. A recent European health survey of adolescents revealed that a positive school experience is strongly associated with low risks of smoking and alcohol use (30). Moreover, school performance is consistently correlated with oral health behaviours, especially toothbrushing, consumption of soft drinks and sweets (31, 32), and the present study in China supports these European observations. The Chinese adolescents who performed well in school were relatively likely to have regular dental visiting habits and high scores on general hygiene practices and healthy dietary habits. In contrast, those performing poorly were more likely to have unhealthy lifestyles such as tobacco and alcohol use, consumption of sugary foods/drinks and sedentary habits. The peer relationship is considered one mechanism through which the health-related behaviour of young people can be modified (33). Indeed, young people with a high level of social competence are likely to have a larger number of close friends and to be socially accepted (34). Some reports indicate that good communication skills and a high degree of social attachment have a protective effect against adverse influence from peers, for example as regards alcohol and tobacco use (35, 36). The present study showed that peer relationships were positively associated with health-promoting behaviours such as oral and general hygiene practices, physical activity and healthy dietary habits. However, among Chinese adolescents no significant correlations between peer relationships and tobacco and alcohol use were found and this may be due to the somewhat low prevalence rates of these lifestyles.

In industrialized countries studies have highlighted the relationship between oral health behaviour and general health behaviours (3, 20, 21), however, no such analyses have hitherto been conducted in China. The multivariate analyses suggested that adolescents who engage in preventive oral health behaviours would have general health-promoting practices more often than others, and they are less likely to engage in risk behaviours. In addition, students with regular dental visits were more likely to have seen a physician within the last 12 months than those who did not visit a dentist, and this confirms results of previous studies (20, 21).

Principal component factor analysis of 11 health-related behaviour variables was performed for the

identification of possible interrelationships among health behaviours of adolescents. Three factors explained nearly half of the variance in health behaviours and consistent with other reports (18, 37) the analysis revealed that health behaviours exhibit a multidimensional pattern. The three factors identified related to lifestyles, hygiene practices and use of health services, respectively. As a result of the relatively high loadings on negative behaviours, the first factor should be interpreted as a dimension of risk behaviour; meanwhile, it was surprising that physical activity was closely related to negative behaviours. The second factor reflects health-promoting behaviours because of the dominance of positive health-related variables. Visits to the physician and to the dentist factored together, suggesting that the third factor is a measure of help-seeking behaviour. It is noteworthy that there appears to be more covariance in health-risk behaviours than in health-promoting behaviours and check-up behaviours, suggesting that 'non-conscious' lifestyles are predominant in Chinese adolescents. The empirical clustering of risk behaviours, health-promoting behaviours and help-seeking behaviour also provides support to the conceptual model suggested by Kulbok et al. (37) for the analysis of lifestyles in high-risk adolescents. They provided evidence of a behaviour system comprising problem behaviours (e.g. tobacco and alcohol use), conventional behaviours (e.g. physical examination, toothbrushing, dental examination) and group-related behaviour (e.g. sports).

In conclusion, the present study has shown that oral health-related behaviours among adolescents are associated with living conditions, academic performance, peer relationships and attitudes and knowledge towards oral health care. Adolescents demonstrating oral health behaviours also engaged in general health-promoting behaviours, however some health behaviours were relatively weakly interrelated. Finally, the study confirmed the multidimensionality of health behaviours; consequently, changes in one behaviour would not necessarily contribute to healthier practices in others. Thus, health education strategies in relation to Chinese adolescents need to take individual health behaviours into consideration. Multiple approaches and methods in health education should be applied to modify risk behaviour and encourage healthy lifestyles, and the significant effect that academic performance has on risk behaviour emphasizes the important role of the

Health Promoting School as a setting for the health of children and adolescents.

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