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**Associations of unhappiness with sociodemographic factors and unhealthy behaviours in Chinese adolescents**

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## **ABSTRACT**

**Background:** Evidence on the effects of lack of physical exercise, alcohol drinking, and smoking on happiness is limited and inconsistent. We examined the associations of unhappiness with sociodemographic factors and these unhealthy behaviours in Chinese adolescents.

**Methods:** In a school-based survey in 2012-13 in Hong Kong, 45857 secondary school students (mean age 14.8 years, 54.0% boys) reported their happiness level (not happy at all/not very happy/happy/very happy), frequency of physical exercise, alcohol drinking status, smoking status, and sociodemographic factors. A main and a sensitivity analysis examined the associations of unhappiness with the study factors, treating unhappiness as a binary (combining “not happy at all” and “not very happy”) and a 4-level ordered variable, respectively.

**Results:** The main and the sensitivity analysis both showed that unhappiness was associated with older age, very poor families, non-intact families, more co-residing smokers, lack of physical exercise, and alcohol drinking; current smokers were unhappier than never and ex-smokers; unhappiness also increased significantly with the number of unhealthy behaviours (p for trend < 0.001).

**Conclusions:** In Chinese adolescents, unhappiness levels were higher in those who had a very poor family, a non-intact family, and more co-residing smokers, and in those who were physically inactive, drank alcohol, and smoked.

**Keywords:** sociodemographic factor; physical exercise; alcohol drinking; smoking; adolescent

## INTRODUCTION

Happiness is a global measure of subjective well-being and regarded as a fundamental human goal.<sup>1</sup> While wealth, social support, and life events (eg, marriage) are known to affect happiness,<sup>2</sup> the role of health-related behaviours is unclear. Lack of physical exercise, heavy alcohol drinking or alcohol dependence, and smoking have been prospectively associated with mental disorders,<sup>3-6</sup> although the evidence on moderate drinking is inconsistent.<sup>7</sup> The protective effect of physical exercise on mental health is also supported by randomised controlled trials.<sup>3</sup>

However, mental health and happiness are different psychological dimensions and only moderately correlated.<sup>8</sup> Therefore, the associations of these behaviours with mental health may be different from their associations with happiness. Moreover, mental disorders, as outcomes of interest, are of limited relevance because they affect only a fraction of the population, whereas happiness varies in the entire population.

A link between physical exercise and happiness has been found in several studies based on cross-sectional,<sup>9-12</sup> prospective,<sup>13</sup> and instrumental variable (IV) analyses,<sup>14</sup> although null cross-sectional findings were also reported.<sup>15, 16</sup> Alcohol drinking was linked to happiness in cross-sectional study and a study using IV analysis,<sup>17, 18</sup> but not in some other cross-sectional studies.<sup>10, 11, 15</sup> An inverse association between smoking and happiness was found in several cross-sectional studies,<sup>18-22</sup> but a positive association and null findings were also reported.<sup>10, 11, 15</sup> One study used prospective design and found no association between quitting and happiness.<sup>22</sup>

Generally, the evidence is inconsistent whether lack of physical exercise, alcohol drinking, and smoking have adverse effects on happiness, and we found no such evidence in Chinese adolescents. However, evidence for the adverse effects should be useful both in promoting happiness and in encouraging healthy behaviour change. We also found no study on the associations of sociodemographic factors with

happiness in Chinese adolescents, except for one study which found Chinese adolescent boys were happier than girls.<sup>23</sup>

The present study examined the associations of unhappiness with sociodemographic factors and alcohol drinking, smoking, and lack of physical exercise, in Chinese adolescents, using cross-sectional data of secondary school students in Hong Kong.

## **METHODS**

### **Data source**

A cross-sectional survey of 45858 students from 75 secondary schools was conducted in 2012-13 in Hong Kong. The survey used a random sample of secondary schools stratified by districts in Hong Kong, with a school and a student level response rate of 19% and 96%. The survey used an anonymous questionnaire and was conducted in classrooms. More detailed survey methods have been reported elsewhere.<sup>24</sup> Ethics approval was granted by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster.

### **Measures**

Happiness was assessed by one question: “All things considered, you think you are:”, with options of “very happy”, “happy”, “not very happy”, and “not happy at all”. This simple subjective assessment of happiness has been used extensively and found to be strongly correlated with other objective indicators of well-being.<sup>25</sup> Moreover, despite the simplicity, single-item measures for happiness have been found to have adequate validity and reliability.<sup>26</sup>

Lack of physical exercise was assessed by one question: “In the past 7 days, besides physical exercise lessons, how many days did you exercise for 30 minutes or above?”, with the options (0 day/1/2/3/4/5/6/7) recoded into three roughly evenly distributed categories: “3-7 days” (30.1%), “1-2” (38.4%), and “0”

(31.5%). Alcohol drinking was assessed by one question: “How often do you drink alcohol or alcoholic beverages?”, with the options recoded as “non-drinking” (option: I do not drink), “less than monthly” (less than 1 day a month), “monthly” (1-3 days a month), “weekly” (1-3 days a week/4-6), and “daily” (every day). To assess smoking status, students were asked (1) if they smoked in the past 30 days and (2) to choose one of the following options: (i) “I have never smoked”; (ii) “I have smoked once or a few times (for fun or to try a puff)”; (iii) “I used to smoke occasionally (not everyday) but have quit now”; (iv) “I used to smoke everyday but have quit now”; (v) “I occasionally smoke (not everyday)”; and (vi) “I smoke everyday”. Those reporting smoking in the past 30 days for question (1) were classified as “current smokers”, and the others as “non-current smokers”. Among the non-current smokers, those choosing (i) or (ii) for question (2) were classified as “never smokers”, and the others as “ex-smokers”. Among the 1294 classified as ex-smokers, 71 chose (v) (ie, smoking occasionally) for question (2), and 47 chose (vi) (ie, smoking everyday), suggesting slight misclassification. To examine the association of quitting with unhappiness, those who smoked once or a few times were grouped into “never smokers”. Another variable, indicating the number of unhealthy behaviours (0-3), was generated, with 0 day of physical exercise per week, any alcohol drinking, and current smoking each defined as an unhealthy behaviour.

Several smoking-related characteristics were reported, including starting smoking to feel less depressed or bored (yes/no) and to relieve stress (yes/no), current intention to quit (yes/no), and quit attempts in the past 12 months (yes/no).

Students also reported their age (in years), sex, perceived family affluence (relatively poor/poor to average/average/average to rich/relatively rich), father and mother’s education levels (post-secondary, university or above/secondary/primary/no formal education/do not know), and number of co-residing smokers (0/1/2 or more). Students reported whether they lived with their father (yes/no) and mother (yes/no), and a binary variable indicating family structure was generated, with the students choosing “yes” for both parents deemed to have an “intact family”, and otherwise a “non-intact family”.

## Analysis

A binary outcome variable indicating unhappiness was generated, with the options of the happiness question grouped into an unhappy (not happy at all/not very happy) and a happy group (very happy/happy). Poisson regression models with robust variance estimators yielded prevalence ratios (PRs) of unhappiness related to the study factors.<sup>27</sup> All these associations were examined again in a sensitivity analysis in which unhappiness was treated as a 4-level ordered outcome variable (not happy at all/not very happy/happy/very happy), and ordered probit regression models yielded  $\beta$  coefficients for these associations. PRs were presented as the main results because they allow straightforward assessments of the strength of the associations, while  $\beta$  coefficients are difficult to interpret. PRs were chosen over odds ratios (ORs) because the prevalence of unhappiness was relatively high, and ORs, if interpreted as PRs, could be misleading in such situations.

The associations of unhappiness with sex, age, perceived family affluence, father and mother's education levels, family structure, and numbers of co-residing smokers were examined first in univariable models and then with mutual adjustment of all these sociodemographic factors. After the adjustment, the factors associated with unhappiness were selected for adjustment in subsequent models. The associations of unhappiness with lack of physical exercise, alcohol drinking, and smoking were examined first in univariable models, then with adjustment of the selected sociodemographic factors, and finally with further mutual adjustment of these behaviours. The associations of unhappiness with the number of unhealthy behaviours were examined first in univariable models and then with adjustment of the selected sociodemographic factors. The number of unhealthy behaviours was also modelled as a continuous variable to examine linear trend. The associations of unhappiness with several smoking-related characteristics in current smokers were examined first in univariable models and then with adjustment of the selected sociodemographic factors. All the regression models adjusted for potential school clustering effect. All analyses used Stata 13.0, with statistical significance set at  $p < 0.05$ .

## RESULTS

Table 1 shows that the sample's mean age (standard deviation) was 14.8 (1.9) years, and 54.0% were boys. In response to the happiness question, 3.3%, 12.2%, 59.6%, and 25.0%, respectively, reported “not happy at all”, “not very happy”, “happy”, and “very happy” (not shown in the tables). Current and ex-smoking were reported by 7.1% and 2.8%; less than monthly, monthly, weekly, and daily alcohol drinking were reported by 18.4%, 9.7%, 4.2%, and 1.4%, respectively; 3-7, 1-2, and 0 day of physical exercise per week were reported by 30.1%, 38.4%, and 31.5%, respectively.

Table 1 shows that, after mutual adjustment of all the sociodemographic factors, unhappiness was associated with male sex, older age, non-intact families, and more co-residing smokers; compared with being “relatively rich”, unhappiness was associated with being “relatively poor” and inversely associated with being “average to rich” and “average”. Lower parental education levels were associated with unhappiness before but not after the adjustment. The sensitivity analysis in which unhappiness was treated as an ordered variable yielded results (Supplementary file, Table A.1) that were similar with the above, with a few exceptions: After the adjustment, unhappiness was associated with female sex; compared with being “relatively rich”, unhappiness was associated with being “poor to average” and “relatively poor” but not with being “average to rich” or “average”.

Table 2 shows that unhappiness was associated with lack of physical exercise, alcohol drinking, and smoking before and after adjusting for the sociodemographic factors and after further mutual adjustment of these behaviours. After the mutual adjustment, the students reporting 1-2 and 0 day of physical exercise per week were 9% (95% confidence interval, 2%-16%) and 32% (22%-42%) more likely to be unhappy than those reporting 3-7. Less than monthly, monthly, weekly, and daily alcohol drinkers were, respectively, 40% (32%-48%), 68% (56%-82%), 134% (110%-160%), and 179% (148%-213%) more likely to be unhappy than non-drinkers. Current and ex-smokers were 61% (49%-74%) and 32% (17%-



48%) more likely to be unhappy than never smokers; current smokers were significantly more likely to be unhappy than ex-smokers, given the non-overlapping confidence intervals. Unhappiness was also associated with more unhealthy behaviours before and after adjusting for the sociodemographic factors. After the adjustment, the students reporting 1, 2, and 3 unhealthy behaviours were, respectively, 20% (14%-26%), 66% (53%-79%), and 172% (148%-199%) more likely to be unhappy than those reporting 0 ( $p$  for trend  $< 0.001$ ). The results of the sensitivity analysis (Supplementary file, Table A.2) were similar with the above, except that, after the mutual adjustment, ex-smoking (compared with never smoking) was not associated with unhappiness.

Table 3 shows that, in current smokers and after adjusting for the sociodemographic factors, unhappiness was not associated with starting smoking to feel less depressed or bored, starting smoking to relieve stress, intention to quit, or quit attempts. The results of the sensitivity analysis (Supplementary file, Table A.3) were similar with the above.

## **DISCUSSION**

We found older age was associated with unhappiness. This agrees with the Health Behaviour of School-aged Children (HBSC) 2013-14 study, which surveyed nearly 220000 children aged 11, 13, or 15 years from 42 countries in Europe and North America.<sup>28</sup> The association may be related to the increased academic pressure and complexity of life events in older adolescents. We found lower parental education levels were associated with unhappiness before but not after adjusting for other sociodemographic factors. This suggests an effect of parents' education achievements on adolescents' happiness and that this effect is mediated by other factors. Further mediation analyses (not shown in the tables) suggested a mediating role of family affluence. We found non-intact families were associated with unhappiness, suggesting an effect of family structure on adolescents' happiness. We found more co-residing smokers were associated with unhappiness, which is consistent with our earlier finding that more co-residing smokers were associated with family unhappiness in children.<sup>29</sup> These associations may be due to residual confounding

or family smoking's adverse effects on children's happiness and families' interpersonal well-being. The main analysis found an association of unhappiness with male sex, but the sensitivity analysis found an association with female sex. The absolute values of these estimates were small, indicating small sex effect. A study of Chinese adolescents and the findings in most but not all of the countries in the HBSC study agree with the sensitivity analysis.<sup>23,28</sup> The main analysis found the most affluent adolescents were unhappier than those slightly less affluent, but the sensitivity analysis found no difference. The main and the sensitivity analysis both found the least affluent adolescents were the unhappiest group. These findings suggest that, in adolescents, very poor families lead to unhappiness, but, in situations where family wealth is above a certain level, being wealthier does not lead to more happiness. While social inequality in health is well known, the observed associations of unhappiness with lower parental education levels and very poor families reveal social inequality in happiness in adolescents, which also warrants attention.

We found alcohol drinking and lack of physical exercise were associated with unhappiness. We also found current smokers were unhappier than never and ex-smokers. Although causality cannot be inferred from these cross-sectional associations, causal interpretations in which the unhealthy behaviours lead to unhappiness are supported by some plausible mechanisms. Physical exercise releases endorphin, which binds to the opioid receptors in the brain and thus leads to euphoria.<sup>30</sup> Moreover, exercise distracts people from negative thoughts and also increases self-efficacy, self-esteem, and social contact, and all of these could contribute to happiness.<sup>30</sup> Alcohol may trigger genetic markers that increase depressed mood.<sup>31</sup> Moreover, adolescent drinkers may encounter many undesirable situations, eg, interference with school work, fights or conflicts with friends, feeling of alcohol dependence, and personality change.<sup>32</sup> The "nicotine deprivation reversal model" posits that nicotine withdrawal between cigarettes causes repeated mood deterioration during the day, which results in deteriorated mood overall.<sup>33</sup> A study monitoring the happiness trend of smokers and non-smokers during the day found smokers had lower average happiness scores than non-smokers.<sup>34</sup> Also relevant are some shared neurobiological pathways that may underlie the

effects of these behaviours. Mood can be elevated by increases of monoamines (ie, serotonin, norepinephrine and dopamine) and neurogenesis promoted by brain-derived neurotrophic factors (BDNF).<sup>30</sup> While exercise increases monoamines and BDNF,<sup>30,9</sup> alcohol drinking and smoking both decreases BDNF,<sup>35, 36</sup> and respectively decreases norepinephrine levels and serotonin function.<sup>37, 38</sup>

The association of lack of physical exercise with unhappiness in the present study agrees with most of the other cross-sectional studies,<sup>9-12</sup> a longitudinal study,<sup>13</sup> and a study using IV analysis,<sup>14</sup> but disagrees with two cross-sectional studies with null findings.<sup>15, 16</sup> This association is generally supported by current evidence. The association between alcohol drinking and unhappiness in the present study agrees with a cross-sectional study and a study using IV analysis,<sup>17, 18</sup> but disagrees with several cross-sectional studies that yielded null findings.<sup>10, 11, 15</sup> The samples of the studies with null findings had substantially higher drinking prevalence than our sample. In settings where drinking is prevalent, non-drinking may be associated with lack of social contact or support, which may confound the association of drinking with happiness.

Only five cross-sectional studies, including the present study, have compared happiness levels among never, current, and ex-smokers.<sup>19-22</sup> Three of them found that never smokers were happier than current smokers,<sup>19, 20</sup> while the other two found no difference.<sup>21, 22</sup> All of them found that ex-smokers were happier than current smokers. One of them had follow-up data but found no prospective association of quitting with happiness.<sup>22</sup> This synthesis of findings has important policy implications. The United States Food and Drug Administration recently proposed to discount the benefit of tobacco control measures in its economic evaluations, based on the rationale that smoking increases pleasures and happiness.<sup>20, 22</sup> Current evidence, the present study included, however, does not support this rationale.

We found associations of unhappiness with each of the behaviours and a significant increase of unhappiness with the number of unhealthy behaviours. The finding that half of those reporting all the

three unhealthy behaviours also reported unhappiness is concerning and calls for actions to improve the well-being of adolescents afflicted by both unhappiness and unhealthy behaviours. Our findings also add to the evidence for adverse effects of the unhealthy behaviours on happiness. For stronger evidence for such effects, we recommend researchers include happiness as a secondary outcome in randomised trials promoting healthy behaviours. Such effects, if confirmed, should be communicated to the public to promote healthy behaviours, especially in young people. Health messages incorporating benefits on happiness may be more refreshing than the traditional messages of preventing chronic diseases, which generally do not occur until middle age.

Our study has several limitations. First, because the study used cross-sectional design, its findings may have been affected by reverse causality. Unhappiness may lead to physical inactivity, and adolescents may use smoking and alcohol drinking to cope with unhappiness. The coping hypothesis implies that the smokers who start smoking because of being unhappy contribute to current smokers' low happiness levels. However, we found unhappiness was associated with neither starting smoking to feel less depressed or bored nor starting smoking to relieve stress, both of which may have reflected unhappiness before smoking initiation. The coping hypothesis also implies that unhappy smokers are less likely to quit, but we found unhappiness was associated with neither intention to quit nor quit attempts. Although prospective data are needed to confirm temporal sequences, these findings do not support the coping hypothesis in our sample. Such analysis was not conducted for alcohol drinking, because of the absence of corresponding variables. Second, unmeasured confounders may exist between unhealthy behaviours and unhappiness. For example, conscientiousness may influence both healthy behaviours and happiness.<sup>39</sup> Therefore, future studies with adjustment of personality traits (eg, conscientiousness and extraversion) should provide stronger evidence for causal inference. In addition, a co-twin study suggested confounding effect of genes between physical exercise and happiness.<sup>40</sup> Third, the study was based on a survey with a low school-level response rate (19%). However, non-participation was mainly due to administrative reasons,<sup>24</sup> and the recruited and not recruited schools were similar with regard to key indicators of

socioeconomic status, ie, districts, funding sources, and mediums of instruction (Chi-square tests,  $P_s > 0.05$ ).

To conclude, in Chinese adolescents, unhappiness levels were higher in those who had a very poor family, a non-intact family, and more co-residing smokers, and in those who were physically inactive, drank alcohol, and smoked.

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### **Conflict of interests**

None declared.

### **Key points**

- In Chinese adolescents, unhappiness was associated with very poor and non-intact families, more co-residing smokers, lack of physically exercise, alcohol drinking, and smoking.
- Half of the adolescents with all the three unhealthy behaviours reported unhappiness. Such finding calls for actions to improve the well-being of adolescents afflicted by both unhappiness and unhealthy behaviours.
- The adverse effects of unhealthy behaviours on happiness, if confirmed, should be communicated to the public to promote healthy behaviours.

### **REFERENCES**

- 1 Veenhoven R. Hedonism and happiness. *J Happiness Stud* 2003;4:437-57.

- 2 Ryan RM, Deci EL. On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annu Rev Psychol* 2001;52:141-66.
- 3 Physical Activity Guidelines Advisory Committee. Physical activity guidelines advisory committee report, 2008. U.S. Department of Health and Human Services:  
<http://health.gov/paguidelines/report/pdf/committeereport.pdf> [accessed Sep 2016]
- 4 Paschall MJ, Freisthler B, Lipton RI. Moderate alcohol use and depression in young adults: findings from a national longitudinal study. *Am J Public Health* 2005;95:453-7.
- 5 Fergusson DM, Boden JM, Horwood LJ. Tests of causal links between alcohol abuse or dependence and major depression. *Arch Gen Psychiatry* 2009;66:260-6.
- 6 Chaiton MO, Cohen JE, O'Loughlin J, Rehm J. A systematic review of longitudinal studies on the association between depression and smoking in adolescents. *BMC Public Health* 2009;9:1.
- 7 Peele S, Brodsky A. Exploring psychological benefits associated with moderate alcohol use: a necessary corrective to assessments of drinking outcomes? *Drug Alcohol Depend* 2000;60:221-47.
- 8 Bergsma A, Veenhoven R. The happiness of people with a mental disorder in modern society. *Psychology of Well-Being: Theory, Research and Practice* 2011;1:1-6.
- 9 Moljord IEO, Moksnes UK, Eriksen L, Espnes GA. Stress and happiness among adolescents with varying frequency of physical activity. *Percept Mot Skills* 2011;113:631-46.
- 10 Piqueras JA, Kuhne W, Vera-Villarreal P, van Straten A, Cuijpers P. Happiness and health behaviours in Chilean college students: a cross-sectional survey. *BMC Public Health* 2011;11:443.
- 11 Kye SY, Park K. Health-related determinants of happiness in Korean adults. *Int J Public Health* 2014;59:731-8.
- 12 Richards J, Jiang X, Kelly P, Chau J, Bauman A, Ding D. Don't worry, be happy: cross-sectional associations between physical activity and happiness in 15 European countries. *BMC Public Health* 2015;15:1.

- 13 Wang F, Orpana HM, Morrison H, de Groh M, Dai S, Luo W. Long-term association between leisure-time physical activity and changes in happiness: analysis of the Prospective National Population Health Survey. *Am J Epidemiol* 2012;176:1095-100.
- 14 Ruseski JE, Humphreys BR, Hallmann K, Wicker P, Breuer C. Sport participation and subjective well-being: Instrumental variable results from German survey data. *J Phys Act Health* 2014;11:396-403.
- 15 Kawada T, Kuratomi Y, Kanai T. Lifestyle determinants of depressive feeling and a feeling of unhappiness among workers: a study in Japan. *Work* 2009;33:255-60.
- 16 Diener E, Seligman ME. Very happy people. *Psychol Sci* 2002;13:81-4.
- 17 Morioka H, Itani O, Kaneita Y, et al. Factors affecting unhappiness at school among Japanese adolescents: an epidemiological study. *PLoS One* 2014;9(11):e111844.
- 18 Mentzakis E, Suhrcke M, Roberts B, Murphy A, McKee M. Estimating the causal effect of alcohol consumption on well-being for a cross-section of 9 former Soviet Union countries. *Soc Sci Med* 2013;89:1-7.
- 19 Shahab L, West R. Differences in happiness between smokers, ex-smokers and never smokers: cross-sectional findings from a national household survey. *Drug Alcohol Depend* 2012;121:38-44.
- 20 Stickley A, Koyanagi A, Roberts B, Leinsalu M, Goryakin Y, McKee M. Smoking status, nicotine dependence and happiness in nine countries of the former Soviet Union. *Tob Control* 2015;24:190-7.
- 21 Wang MP, Wang X, Lam TH, Viswanath K, Chan SS. Ex-smokers are happier than current smokers among Chinese adults in Hong Kong. *Addiction* 2014;109:1165-71.
- 22 Weinhold D, Chaloupka FJ. Smoking status and subjective well-being. *Tob Control*: <http://tobaccocontrol.bmj.com/content/early/2016/04/20/tobaccocontrol-2015-052601.abstract> [accessed Sep 2016]
- 23 Ma ZW, Zeng WN, Ye KY. Gender differences in Chinese adolescents' subjective well-being: the mediating rol of self-efficacy. *Psychol Rep* 2015;116:311-21.

- 24 Jiang N, Wang MP, Ho SY, Leung LT, Lam TH. Electronic cigarette use among adolescents: a cross-sectional study in Hong Kong. *BMC Public Health* 2016;16:202.
- 25 Oswald AJ, Wu S. Objective confirmation of subjective measures of human well-being: Evidence from the USA. *Science* 2010;327:576-9.
- 26 Yang Y. Social inequalities in happiness in the United States, 1972 to 2004: An age-period-cohort analysis. *Am Sociol Rev* 2008;73:204-26.
- 27 Barros AJ, Hiraakata VN. Alternatives for logistic regression in cross-sectional studies: an empirical comparison of models that directly estimate the prevalence ratio. *BMC Med Res Methodol* 2003;3:21.
- 28 Inchley J, Currie D, Young T, et al. Growing up unequal: gender and socioeconomic differences in young people's health and well-being. Health Behaviour in School-aged Children (HBSC) study: international report from the 2013/2014 survey. World Health Organization: [http://www.euro.who.int/\\_data/assets/pdf\\_file/0003/303438/HSBC-No7-Growing-up-unequal-full-report.pdf](http://www.euro.who.int/_data/assets/pdf_file/0003/303438/HSBC-No7-Growing-up-unequal-full-report.pdf) [accessed Sep 2016]
- 29 Chen JJ, Ho SY, Au WM, Wang MP, Lam TH. Family smoking, exposure to secondhand smoke at home and family unhappiness in children. *Int J Environ Res Public Health* 2015;12:14557-70.
- 30 Anderson E, Shivakumar G. Effects of exercise and physical activity on anxiety. *Front Psychiatry* 2013;4:27.
- 31 Nurnberger Jr JI, Foroud T, Flury L, et al. Evidence for a locus on chromosome 1 that influences vulnerability to alcoholism and affective disorder. *Am J Psychiatry* 2001;158:718-24.
- 32 White HR, Labouvie EW. Towards the assessment of adolescent problem drinking. *J Stud Alcohol* 1989;50:30-7.
- 33 Parrott AC. Why all stimulant drugs are damaging to recreational users: an empirical overview and psychobiological explanation. *Hum Psychopharmacol* 2015;30:213-24.
- 34 Adan A, Sánchez-Turet M. Effects of smoking on diurnal variations of subjective activation and mood. *Hum Psychopharmacol* 2000;15:287-93.



- 35 Hauser SR, Getachew B, Taylor RE, Tizabi Y. Alcohol induced depressive-like behavior is associated with a reduction in hippocampal BDNF. *Pharmacol Biochem Behav* 2011;100:253-8.
- 36 Moylan S, Jacka FN, Pasco JA, Berk M. How cigarette smoking may increase the risk of anxiety symptoms and anxiety disorders: a critical review of biological pathways. *Brain Behav* 2013;3:302-26.
- 37 Getachew B, Hauser SR, Taylor RE, Tizabi Y. Alcohol-induced depressive-like behavior is associated with cortical norepinephrine reduction. *Pharmacol Biochem Behav* 2010;96:395-401.
- 38 Malone KM, Waternaux C, Haas GL, Cooper TB, Li S, Mann JJ. Cigarette smoking, suicidal behavior, and serotonin function in major psychiatric disorders. *Am J Psychiatry* 2003;160:773-9.
- 39 Bogg T, Roberts BW. Conscientiousness and health-related behaviors: a meta-analysis of the leading behavioral contributors to mortality. *Psychol Bull* 2004;130:887-919.
- 40 Stubbe J, De Moor M, Boomsma D, de Geus EJ. The association between exercise participation and well-being: a co-twin study. *Prev Med* 2007;44:148-52.

**Table 1. Participants' (N=45857) sociodemographic factors and their associations with unhappiness (year: 2012-13; location: Hong Kong)**

	N (%) <sup>b</sup>	Unhappiness <sup>a</sup> (N=6879, 15.4%)		
		Unhappiness (%) <sup>c</sup>	Crude PR (95% CI) <sup>d</sup>	Adjusted PR (95% CI) <sup>e</sup>
<b>Sex</b>				
Girls	21117 (46.1)	14.7	1	1
Boys	24740 (54.0)	16.1	1.10 (1.03, 1.16) **	1.05 (1.00, 1.10) *
Mean age in years (SD)	14.8 (1.9)			
<b>Age, years</b>				
≤12	6108 (13.3)	11.7	1	1
13	7172 (15.6)	13.4	1.15 (1.04, 1.27) **	1.13 (1.02, 1.25) *
14	7595 (16.6)	15.3	1.31 (1.19, 1.44) ***	1.26 (1.15, 1.39) ***
15	8214 (17.9)	16.2	1.39 (1.24, 1.55) ***	1.28 (1.15, 1.43) ***
16	7895 (17.2)	16.1	1.38 (1.25, 1.52) ***	1.23 (1.12, 1.35) ***
≥17	8873 (19.4)	18.5	1.58 (1.43, 1.76) ***	1.30 (1.18, 1.43) ***
<b>Perceived family affluence</b>				
Relatively rich	964 (2.1)	22.3	1	1
Average to rich	5351 (11.7)	11.6	0.52 (0.44, 0.61) ***	0.63 (0.54, 0.47) ***
Average	25480 (55.7)	12.6	0.57 (0.49, 0.65) ***	0.66 (0.58, 0.76) ***
Poor to average	10648 (23.3)	19.7	0.89 (0.77, 1.02)	0.97 (0.85, 1.11)
Relatively poor	3273 (7.2)	27.3	1.23 (1.06, 1.43) **	1.25 (1.08, 1.45) **
<b>Father's education level</b>				
Post-secondary or above	7742 (16.9)	13.2	1	1
Secondary	20093 (43.8)	14.8	1.12 (1.04, 1.21) **	0.94 (0.88, 1.01)
Primary	6132 (13.4)	18.0	1.36 (1.25, 1.49) ***	1.00 (0.93, 1.09)
No formal education	797 (1.7)	24.5	1.85 (1.57, 2.18) ***	1.09 (0.93, 1.29)
Do not know	11093 (24.2)	16.2	1.23 (1.14, 1.32) ***	0.90 (0.83, 0.98) *
<b>Mother's education level</b>				
Post-secondary or above	6420 (14.0)	13.4	1	1

Secondary	21854 (47.7)	14.5	1.08 (1.00, 1.17) *	0.95 (0.88, 1.02)
Primary	6383 (13.9)	18.0	1.34 (1.22, 1.46) ***	1.00 (0.92, 1.10)
No formal education	1240 (2.7)	20.0	1.49 (1.28, 1.74) ***	0.92 (0.78, 1.08)
Do not know	9960 (21.7)	16.5	1.23 (1.14, 1.33) ***	1.08 (0.98, 1.19)
Family structure				
Intact family	35323 (77.0)	13.7	1	1
Non-intact family	10534 (23.0)	21.3	1.56 (1.50, 1.62) ***	1.37 (1.33, 1.43) ***
Number of co-residing smokers				
0	28205 (62.1)	12.7	1	1
1	12449 (27.4)	16.7	1.32 (1.25, 1.39) ***	1.29 (1.23, 1.36) ***
≥2	4759 (10.5)	28.4	2.24 (2.05, 2.46) ***	2.10 (1.93, 2.29) ***

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$

<sup>a</sup> Binary variable: unhappy (not happy at all & not very happy), happy (happy & very happy)

<sup>b</sup> Number and proportion unless otherwise stated.

<sup>c</sup> Proportion of unhappiness by sociodemographic factors.

<sup>d</sup> PR=Prevalence ratio, CI=Confidence interval. Adjusted for school clustering effect.

<sup>e</sup> Mutually adjusted for all the variables in the table and adjusted for school clustering effect.

**Table 2. Participants' (N=45857) unhealthy behaviours and their associations with unhappiness (year: 2012-13; location: Hong Kong)**

	N (%)	Unhappiness <sup>a</sup> (N=6879, 15.4%)			
		Unhappiness (%) <sup>b</sup>	Crude PR (95% CI) <sup>c</sup>	Adjusted PR (95% CI) <sup>d</sup>	Adjusted PR (95% CI) <sup>e</sup>
<b>Lack of physical exercise</b>					
(days of physical exercise per week)					
3-7	13393 (30.1)	15.2	1	1	1
1-2	17066 (38.4)	14.5	0.95 (0.89, 1.02)	0.98 (0.92, 1.05)	1.09 (1.02, 1.16) **
0	14019 (31.5)	16.6	1.09 (1.01, 1.19) *	1.09 (1.01, 1.18) *	1.32 (1.22, 1.42) ***
<b>Alcohol drinking</b>					
Non-drinking	29633 (66.3)	11.7	1	1	1
Less than monthly	8221 (18.4)	17.3	1.48 (1.39, 1.58) ***	1.41 (1.33, 1.50) ***	1.40 (1.32, 1.48) ***
Monthly	4319 (9.7)	22.5	1.93 (1.80, 2.08) ***	1.78 (1.66, 1.92) ***	1.68 (1.56, 1.82) ***
Weekly	1886 (4.2)	37.4	3.21 (2.90, 3.55) ***	2.61 (2.38, 2.87) ***	2.34 (2.10, 2.60) ***
Daily	641 (1.4)	52.2	4.48 (4.10, 4.90) ***	3.23 (2.91, 3.59) ***	2.79 (2.48, 3.13) ***
<b>Smoking</b>					
Never smoking	41049 (90.0)	13.2	1	1	1
Ex-smoking	1294 (2.8)	25.3	1.91 (1.69, 2.16) ***	1.61 (1.44, 1.81) ***	1.32 (1.17, 1.48) ***
Current smoking	3250 (7.1)	39.4	2.98 (2.75, 3.23) ***	2.26 (2.11, 2.43) ***	1.61 (1.49, 1.74) ***
<b>Number of unhealthy behaviours<sup>f</sup></b>					
0	22276 (48.6)	12.3	1	1	-
1	16607 (36.2)	14.7	1.19 (1.13, 1.26) ***	1.20 (1.14, 1.26) ***	-
2	5819 (12.7)	22.4	1.82 (1.67, 1.98) ***	1.66 (1.53, 1.79) ***	-
3	1155 (2.5)	48.0	3.89 (3.54, 4.27) ***	2.72 (2.48, 2.99) ***	-
<i>p</i> for trend			<0.001	<0.001	-

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$

<sup>a</sup> Binary variable: unhappy (not happy at all & not very happy), happy (happy & very happy)

<sup>b</sup> Proportion of unhappiness by unhealthy behaviours.

<sup>c</sup> PR=Prevalence ratio, CI=Confidence interval. Adjusted for school clustering effect.

<sup>d</sup> Adjusted for sex, age, perceived family affluence, family structure, number of co-residing smokers, and school clustering effect.

<sup>e</sup> Mutually adjusted for lack of physical exercise, alcohol drinking, and smoking in addition to the adjustment in c.

<sup>f</sup> Zero day of physical exercise per week, any alcohol drinking, and current smoking were each deemed an unhealthy behaviour.

**Table 3. Smoking-related characteristics and their associations with unhappiness in current smokers (N=3250) (year: 2012-13; location: Hong Kong)**

	N (%)	Unhappiness <sup>a</sup> (N=1214, 39.4%)		
		Unhappiness (%) <sup>b</sup>	Crude PR (95% CI) <sup>c</sup>	Adjusted PR (95% CI) <sup>d</sup>
Starting smoking to feel less depressed or bored				
No	2600 (80.0)	40.4	1	1
Yes	650 (20.0)	35.4	0.88 (0.78, 0.99) *	0.92 (0.81, 1.04)
Starting smoking to relieve stress				
No	2617 (80.5)	40.0	1	1
Yes	633 (19.5)	36.7	0.92 (0.82, 1.03)	0.97 (0.87, 1.09)
Current intention to quit				
No	920 (46.1)	42.0	1	1
Yes	1077 (53.9)	40.0	0.95 (0.86, 1.05)	0.99 (0.90, 1.09)
Quit attempts in the past 12 months				
No	847 (37.6)	42.3	1	1
Yes	1403 (62.4)	38.5	0.91 (0.82, 1.01)	0.95 (0.86, 1.05)

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$

<sup>a</sup> Binary variable: unhappy (not happy at all & not very happy), happy (happy & very happy)

<sup>b</sup> Proportion of unhappiness by smoking-related characteristics

<sup>c</sup> PR=Prevalence ratio, CI=Confidence interval. Adjusted for school clustering effect.

<sup>d</sup> Adjusted for sex, age, perceived family affluence, family structure, number of co-residing smokers, and school clustering effect