

# Trends of alcohol use, dietary behaviour, interpersonal violence, mental health, oral and hand hygiene behaviour among adolescents in Lebanon: cross-sectional national school surveys from 2005, 2011 and 2017

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## SUBJECT AREAS

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## KEYWORDS

*alcohol use, violence, injury, mental health, hygiene, protective factors*

## Abstract

**Background** This investigation aimed to report the trends in the prevalence of various health risk behaviours among adolescents in Lebanon.

**Methods** Cross-sectional nationally representative data were analysed from 13,109 adolescents (14 years median age) that participated in three waves (2005, 2011 and 2017) of the “Lebanon Global School-Based Student Health Survey (GSHS)”.

**Results** Significant improvements were found among both boys and girls in the decline of interpersonal violence (bullying victimization, being physically attack and involvement in physical fighting), poor washing of hands after using the toilet, and among girls only suicidal ideation and suicide plan. Significant increases were found among both boys and girls in the prevalence of inadequate fruit consumption, unintentional injury and among boys only poor washing of hands prior to eating and among girls only having no close friends and school truancy.

**Conclusion** Several decreases but also increases of health risk behaviours were found over three assessment points during a period of 12 years calling for continued health enhancing activities in this adolescent population.

## Background

In Lebanon, an upper middle-income country in the Arab region, “91% of all death are attributed to non-communicable diseases” [1]. The “burden of non-communicable diseases (cardiovascular disease, cancer, chronic lung diseases, and diabetes)” is on the increase in the Arab world, including Lebanon [2]. “Behavioural risk factors, including tobacco use, unhealthy diets, and physical inactivity are prevalent, and obesity in adults and children has reached an alarming level.” [2] Assessing behavioural risk factors, such as injury and violence, poor mental health, substance use, unhealthy diet and sedentary lifestyle, over time may aid in improving strategies to prevent or ameliorate reducing health risk behaviours in the adolescent population [3–5].

Studies investigating trends in health risk behaviours among adolescents showed different results [4, 5], ranging from increases in the prevalence fruit and vegetable intake (one study) and in being bullied to decreases in physical inactivity, bullying victimization, fighting and injury. In a trend study

in Oman poor hand hygiene behaviour increased [5], while it decreased in the Philippines [4]. In terms of interpersonal violence, a high prevalence of involvement in physical fight (almost 42%) and weapon carrying (17%) were found among school adolescents in Beirut, Lebanon [6]. In a national sample of adolescents in Lebanon in 2009, “76.4% and 81.2% of these had experienced physical and verbal/emotional abuse respectively at least once at school.” [7], and in an investigation in 1028 Lebanese children (8–17 years), “approximately 30% of the children reported at least one incident of witnessing violence, 65% reported at least one incident of psychological abuse and 54% reported at least one incident of physical abuse over a 1-year period.” [8], and 30% were involved in bullying [9]. Regarding mental health, in a study among adolescents (N = 510) in Beirut the prevalence of suicidal ideation or attempt was 4.3% [10], 76.5% had poor sleep quality [11], and 26.1% had 30-day psychiatric disorders, including 13.1% anxiety disorders [12].

The current investigation assessed trends of the prevalence of 19 different health risk behaviours and protective factors in the 2005, 2001 and 2017 Lebanon “Global School-based Student Health Survey (GSHS)”. It is hypothesized that the proportion of the various unhealthy behaviours assessed would be different across the three cross-sectional survey assessments over a period of 12 years. Study findings on various health risk behaviours over time could be aid in strategies promoting health programme activities in schools [13].

## Methods

### Sample and procedure

Cross-sectional nationally representative data from the 2005, 2011 and 2017 Lebanon GSHS were analyzed [14]. More detailed information on the methods of the GSHS and the data can be accessed [14]. “A national ethics committee approved the study and written informed consent was obtained from the participating schools, parents and students.” [14]

### Measures

The questionnaire used is shown in supplementary file 1 [14]. The consumption of less than “two or more servings of fruits in a day” and less than “three or more servings of vegetables a day” were considered inadequate [15].

### Data analysis

Statistical analyses were done with “STATA software version 15.0 (Stata Corporation, College Station, Texas, USA)”. Logistic regression analyses were used for estimating each study outcome adjusted by sociodemographic factors, other health risk behaviours and protective factors for boys and girls separately. Missing values were excluded from the analysis.  $P < 0.05$  was considered significant.

## Results

### *Study sample description*

The three Lebanon GSHS samples consisted of 13,109 school-going adolescents, 53.0% females and 47.0% males (14 years median age, 2 years interquartile range). For the 2005 Lebanon GSHS the response rate was 88%, 2011 87% and 2017 82% [14]. The proportion older adolescents increased across the three different surveys ( $P < 0.001$ ) (see Table 1).

### *Health risk behaviour outcomes*

*Poor diet.* Among students, 42.2% of males and 47.2% of females, that ate less than two fruit servings daily in 2005, the proportion of inadequate fruit intake significantly increased to 50.3% among boys and 54.4% among girls in 2017. Inadequate vegetable consumption decreased from 2005 to 2011 but remained the same in 2017. The prevalence of students who reported frequently experiencing hunger did not significantly change from 2005 to 2017 in both males and females.

*Alcohol use and misuse.* The prevalence of current alcohol use (27.8% among boys and 12.2% among girls in 2005), ever drunk and trouble from drinking alcohol did not significantly change from 2005 to 2017; trouble from alcohol use only declined in both boys and girls on 2011.

*Injury and violence-related behaviour.* While the prevalence of annual injury increased significantly in both sexes from 2005 to 2017, being bullied, victim of physical assault and involved in physical fighting significantly decreased in both sexes from 2005 to 2017.

*Oral and hand hygiene.* The prevalence of inadequate tooth brushing was 38.4% among male and 30.4% among female students in 2005, which remained high over time. Not always washing hands prior to eating significantly increased among boys, while not always washing hands after using the

toilet decreased both among boys and girls from 2005 to 2017, and “not always washing hands with soap” did not change over time.

*Poor mental health.* Among all five poor mental health indications (having no close friends, worry-induced sleep disturbance, loneliness, suicidal ideation and suicide plan), there was no significant change among boys, while suicidal ideation and suicide plan decreased and having no close friends increased among girls from 2005 to 2017. Worry-induced sleep disturbance decreased among girls in 2011 and loneliness did not change among girls.

*Protective factors.* School truancy did not change in boys but increased in girls over time, and peer support did not change among both girls and boys from 2005 to 2017. Two of the three parental support indicators (supervision and bonding) decreased among boys but not among girls from 2005 to 2017. Parental or guardian connectedness did not change over time for both boys and girls (see Tables 2 and 3).

## Discussion

The study found across three GSHS in 2005, 2011 and 2017 in Lebanon significant decreases among both boys and girls in interpersonal violence (bullying victimization, being physically attack and involvement in physical fighting), inadequate hand hygiene (after toilet use), and among girls only suicidal ideation and suicide plan. Significant increases were found among both boys and girls in unintentional injury and inadequate fruit intake, and among boys only inadequate hand hygiene (before eating) and among girls only having no close friends and school truancy. In a “prospective observational study involving 50 schools from different areas of Lebanon, around 70% of the involved schools offered health-related courses in their curricula” [16]. “Dental health (74%), smoking cessation (72%) and physical activity (68%) were among other most addressed topics, while mental health was the least discussed (20%).” [16] “The study findings suggest that despite weaknesses, the majority of the sampled schools had either implemented or were in the process of implementing a health promoting school programme to improve health education and students’ well-being.”[16] Following implementation of a network of health promoting schools (HPS) in Lebanon in 2010, a cross-sectional evaluation comparing HPS with non-HPS was conducted in 2011–2012, which found no

significant differences between HPS and non-HPS in the assessed risk behaviours (drug use, smoking and alcohol use) [17].

Violence-related behaviour (being bullied, physically attacked and participation in a physical fight) decreased in this study, which concurs with four other studies [3, 18–20], while a few studies found an increase in one or more types of interpersonal violence, e.g., in Oman [5], the Philippines [4] and Venezuela [21]. In several older studies among adolescents in Lebanon, high rates of interpersonal violence have been reported [6–8], which compares with our high rates of interpersonal violence in the 2005 GSHS. It is possible that the high rates of interpersonal violence in 2005 were still related to the post-conflict situation in Lebanon, which subsequently subsided so that interpersonal violence decreased from 2005 to 2017. On the other hand, injury prevalence increased in this study among both boys and girls, while in the trend study in the Philippines a similar increased was observed [4], in Oman, no significant trend differences were found [5] and in Morocco a decline in the prevalence of injury among adolescents was found [22]. Considering the significant increase in annual injury prevalence in this study intensified safety promotion and injury prevention programming is indicated in Lebanon.

The prevalence of inadequate fruit and vegetable intake was high in the 2005 GSHS and increased over the study period, which was also shown in a trend study in Oman [5] and other countries in the Arab region [23]. The experience of hunger (or food insecurity) was low and did not significantly differ among girls over time, while it significantly increased among boys in the 2011 survey. In a national survey among adolescents conducted in 2015 in Lebanon, a high prevalence of household food insecurity (55.2%) was observed [24], which may explain the higher prevalence of food insecurity in our 2011 survey.

The prevalence of sub-optimal oral hygiene (tooth brushing < twice/day) was high across the three school surveys (almost 40%), much higher than in a study among school adolescents in four Southeast Asian countries (22.4%) [25]. In a survey among adolescent students (N = 830) in Beirut, Lebanon, in 2014, also a high prevalence of sub-optimal tooth brushing was found [26], calling for oral hygiene health promotion programmes targeting schoolchildren and their parents [26]. Although poor

hand washing after toilet use decreased between both sexes, poor hand washing before eating increased among boys in this study. In the Oman trend study sub-optimal hand hygiene pattern increased [5], while it decreased in the Philippines [4]. It is possible that poor hand washing after toilet use decreased among adolescents in Lebanon from 2011, after the “Call to Action for WASH in Schools campaign was formally launched in 2010” in Lebanon [27].

Regarding mental health indicators (having no close friends, loneliness, worry-induced sleep disturbance, suicidal ideation and suicide plan), no significant changes were found for boys over time, while having no close friends increased and suicidal ideation and suicide plan decreased among girls. In comparison, in the Philippines trend study, the prevalence of suicidal ideation and suicide plan decreased among boys and suicidal ideation increased among girls over time [4]. As found in previous investigations [10–12], poor mental health, such as suicidal behaviour and anxiety-related disturbances, has been identified as a significant problem among adolescents in Lebanon.

In terms of protective factors, school truancy increased among girls, peer support did not change, and parental support indicators did not change for girls but decreased for two parental indicators (parental supervision and parental bonding) among boys. In the Philippines trend study protective factors did not change over time [5], in the Oman trend study only one of the protective factors (peer support) improved over time [4], while in New Zealand trend study positive family and school connections improved over time [3].

#### Limitations of the study

“Secondary education enrolment ratio” was 80% in Lebanon in 2005, 76% in 2011 and 63% in 2017 [28], yet this school survey did not represent all adolescents in Lebanon. Some study variables (such as sedentary behaviour, tobacco use, sexual behaviour and physical activity) were not included in this analysis, since they had not been assessed in all the three Lebanon GSHS. Although self-reported weight and height was collected, the missing values were in the wave one survey more than 30%, and therefore body mass index was not included in this report. Further, the study is limited because of its cross-sectional design and self-reported data collection.

#### Conclusions

In this investigation of nationally representative school adolescents over a period of 12 years in Lebanon, significant improvements were found among both boys and girls in the decline of interpersonal violence (bullying victimization, being physically attack and involvement in physical fighting), inadequate hand hygiene (after toilet use), and among girls only suicidal ideation and suicide plan. Significant increases were found among both boys and girls in the prevalence of inadequate fruit intake, unintentional injury and among boys only inadequate hand hygiene (before eating) and among girls only having no close friends and school truancy. Several decreases but also increases of health risk behaviours were identified over three cross-sectional surveys from 2005 to 2017 calling for continued interventions in promoting health behaviour in this adolescent population.

## **Abbreviations**

GSHS: Global School-Based Student Health Survey; STATA: Statistics and data

## **Declarations**

### **Ethics approval and consent to participate**

The study was conducted in accordance with the Declaration of Helsinki. “A national ethics committee approved the study and written informed consent was obtained from the participating schools, parents and students.” [18]

### **Consent for publication**

Not applicable.

### **Availability of data and materials**

The data for the current study are publicly available at the World Health Organization NCD Microdata Repository (URL: <https://extranet.who.int/ncdsmicrodata/index.php/catalog>).

### **Competing interests**

The authors declare that they have no competing interests.

## **Funding**

Not applicable.

### **Authors' contributions**

All authors fulfill the criteria for authorship. SP and KP conceived and designed the research, performed statistical analysis, drafted the manuscript and made critical revision of the manuscript for key intellectual content. All authors read and approved the final version of the manuscript and have agreed to authorship and order of authorship for this manuscript.

### **Acknowledgement**

The data source, the World Health Organization NCD Microdata Repository (URL: <https://extranet.who.int/ncdsmicrodata/index.php/catalog>), is hereby acknowledged.

### **References**

1. World Health Organization - Noncommunicable Diseases (NCD) Country Profiles, 2018, Lebanon. URL: [https://www.who.int/nmh/countries/lbn\\_en.pdf](https://www.who.int/nmh/countries/lbn_en.pdf)
2. Rahim HF, Sibai A, Khader Y, Hwalla N, Fadhil I, Alsiyabi H, Mataria A, Mendis S, Mokdad AH, Husseini A. Non-communicable diseases in the Arab world. *Lancet*. 2014 Jan 25;383(9914):356-67. doi: 10.1016/S0140-6736(13)62383-1. Epub 2014 Jan 20. PMID: 24452044.
3. Clark,T.,Fleming, T., Bullen, P., Crengle, S., Denny, S., Dyson, B., ... Lewycka, S. (2013). Health and well-being of secondary school students in New Zealand: trends between 2001, 2007 and 2012. *Journal of Paediatrics and Child Health*, 49, 925-34.
4. Peltzer, K., & Pengpid, S. (2015). Health risk behaviour among in-school adolescents in the Philippines: Trends between 2003, 2007 and 2011, a cross-sectional study. *International Journal of Environmental Resesearch and Public Health*, 13(1), 73. doi: 10.3390/ijerph13010073.
5. Pengpid, S., & Peltzer, K. (2019) Trends of dietary behaviour, physical activity,

interpersonal violence and hand hygiene behaviour among school-going adolescents in Oman: cross-sectional national surveys from 2005, 2010 and 2015. *Vulnerable Children and Youth*. DOI: 10.1080/17450128.2019.1710632

6. Sibai T, Tohme RA, Beydoun HA, Kanaan N, Sibai AM. Violent behavior among adolescents in post-war Lebanon: the role of personal factors and correlation with other problem behaviors. *J Public Health (Oxf)*. 2009;31(1):39–46.  
doi:10.1093/pubmed/fdn100
7. El Bcheraoui C, Kouriye H, Adib SM. Physical and verbal/emotional abuse of schoolchildren, Lebanon, 2009. *East Mediterr Health J* 2012;18(10):1011–1020.  
doi:10.26719/2012.18.10.1011
8. Usta J, Farver JM, Danachi D. Child maltreatment: the Lebanese children's experiences. *Child Care Health Dev* 2013;39(2):228–236. doi:10.1111/j.1365-2214.2011.01359.x
9. Halabi F, Ghandour L, Dib R, Zeinoun P, Maalouf FT. Correlates of bullying and its relationship with psychiatric disorders in Lebanese adolescents. *Psychiatry Res*. 2018;261:94–101. doi:10.1016/j.psychres.2017.12.039
10. Baroud E, Ghandour LA, Alrojolah L, Zeinoun P, Maalouf FT. Suicidality among Lebanese adolescents: Prevalence, predictors and service utilization. *Psychiatry Res*. 2019;275:338–344. doi:10.1016/j.psychres.2019.03.033
11. Chahine R, Farah R, Chahoud M, Harb A, Tarabay R, Sauleau E, Godbout R. Assessing sleep quality of Lebanese high school students in relation to lifestyle: pilot study in Beirut. *East Mediterr Health J*. 2018 Oct 10;24(8):722–728. doi: 10.26719/2018.24.8.722. PMID: 30328602.
12. Maalouf FT, Ghandour LA, Halabi F, Zeinoun P, Shehab AA, Tavitian L. Psychiatric disorders among adolescents from Lebanon: prevalence, correlates, and treatment

gap. Soc Psychiatry Psychiatr Epidemiol. 2016;51(8):1105–1116. doi:10.1007/s00127-016-1241-4

13. World Health Organization. Regional Office for the Eastern Mediterranean (2013). Health-promoting schools initiative in Oman: a WHO case study in intersectoral action / World Health Organization. Regional Office for the Eastern Mediterranean. URL: [http://applications.emro.who.int/dsaf/EMROPUB\\_2013\\_EN\\_1587.pdf](http://applications.emro.who.int/dsaf/EMROPUB_2013_EN_1587.pdf) (accessed 2 May 2019)
14. World Health Organization (WHO). Global school-based student health survey (GSHS), 2020. URL: <https://www.who.int/ncds/surveillance/gshs/en/> (accessed 10 April 2020)
15. Centers for Disease Control (CDC) (2013). State indicator report on fruits and vegetables. Available online: <http://www.cdc.gov/nutrition/downloads/state-indicator-reportfruits-vegetables-2013.pdf> (Accessed 10 Oct 2018).
16. Akela M, Fahsa I, Salameh P, Godeaub E. Are Lebanese schools adopting a health promotion approach in their curricula? Health Education J 2019; 78(4): 476-485. <https://doi.org/10.1177/0017896918801716>
17. El Halabi, S. and Salameh, P. (2019) Incorporating HPS Model into Lebanese Public Schools: Comparison of Adolescents' Smoking, Alcohol and Drug Use Behavior in HPS versus Other Public and Private Schools in Lebanon. Open Journal of Nursing, 9, 418-448. <https://doi.org/10.4236/ojn.2019.94038>
18. Chester, K. L. ,Callaghan, M.,Cosma, A., Donnelly, P., Craig, W., Walsh, S., & Molcho, M. (2015). Cross-national time trends in bullying victimization in 33 countries among children aged 11, 13 and 15 from 2002 to 2010. *European Journal of Public Health*, 25 Suppl 2, 61-4.
19. Finkelhor,D., Turner, H. A., Shattuck, A., & Hamby, S. L. (2015). Prevalence of childhoodexposure to violence, crime, and abuse: Results from the National Survey

- of Children's Exposure to Violence. *JAMA Pediatrics*, 169(8), 746-54. doi: 10.1001/jamapediatrics.2015.0676.
20. Vieno, A., Lenzi, M., Gini, G., Pozzoli, T., Cavallo, F., & Santinello, M. (2015). Time trends in bullying behavior in Italy. *Journal of School Health*, 85, 441-5.
  21. Granero, R., Poni, E. S., Escobar-Poni, B. C., & Escobar, J. (2011). Trends of violence among 7th, 8th and 9th grade students in the state of Lara, Venezuela: The Global School Health Survey 2004 and 2008. *Archives of Public Health*, 69, 7.
  22. Shaikh, M. A. (2015). Prevalence, correlates, and changes in injury epidemiology between 2006 and 2010 among 13-15 year Moroccan school attending adolescents. *Journal of the Pakistan Medical Association*, 65, 552-4.
  23. Al Ani, M. F., Al Subhi, L. K., & Bose, S. (2016). Consumption of fruits and vegetables among adolescents: a multi-national comparison of eleven countries in the Eastern Mediterranean Region. *British Journal of Nutrition*, Nov 21, 1-8.
  24. Naja F, Itani L, Kharroubi S, Diab El Harake M, Hwalla N, Jomaa L. Food insecurity is associated with lower adherence to the Mediterranean dietary pattern among Lebanese adolescents: a cross-sectional national study [published online ahead of print, 2020 Jan 3]. *Eur J Nutr*. 2020;10.1007/s00394-019-02166-3. doi:10.1007/s00394-019-02166-3
  25. Peltzer K, Pengpid S. Oral and hand hygiene behaviour and risk factors among in-school adolescents in four Southeast Asian countries. *Int J Environ Res Public Health*. 2014 Mar 7;11(3):2780-92. doi: 10.3390/ijerph110302780.
  26. Bitar KA. Assessment of dental decays and oral hygiene among adolescents: a comparison between private and public schools. Master of Science Major: Epidemiology, American University of Beirut, 2015. URL:

<https://scholarworks.aub.edu.lb/bitstream/handle/10938/10810/b18361018.pdf?sequence=1> (accessed 30 April 2020)

27. United Nations Children's Fund (UNICEF). WASH: Water Sanitation and Hygiene in schools; guidelines for Lebanon (n.d.). URL:  
[https://www.unicef.org/wash/schools/files/WASH\\_in\\_Schools\\_Guidelines\\_Lebanon.pdf](https://www.unicef.org/wash/schools/files/WASH_in_Schools_Guidelines_Lebanon.pdf)  
(accessed 30 April 2020)
28. United Nations Development Programme. Human Development Reports, Gross enrolment ratio, secondary (% of secondary school-age population), 2019. URL:  
<http://hdr.undp.org/en/indicators/63306> (accessed 2 April 2020).

## Tables

Table 1: Characteristics of participating students for 2005, 2011 and 2017 surveys in Lebanon (N=13,109)

Variable	2005 (N=5,115)	2011 (N=2,286)	2017 (N=5
	N (%)	N (%)	N (%)
Gender			
Male	2333 (47.7)	1064 (46.7)	2330 (46.8)
Female	2776 (52.3)	1220 (53.3)	3370 (53.2)
Missing	16	27	8
Age in years			
13 years or younger	2211 (43.1)	910 (38.5)	1543 (31.3)
14	1341 (26.1)	619 (28.6)	953 (19.1)
15	1020 (20.3)	477 (22.6)	925 (15.9)
16 years or older	522 (10.5)	267 (10.3)	2271 (33.7)
Missing	21	9	6
Grade			
7	1988 (38.8)	922 (38.1)	1247 (23.5)
8	1578 (32.1)	910 (32.7)	1125 (20.0)
9	1540 (29.1)	452 (29.2)	783 (17.1)
10-12	0	0	2526 (39.4)
Missing	13	2	2

Table 2: Health risk behaviours in 2005, 2011 and 2017 among male in-school adolescents in Lebanon

<b>Variable</b>	2005	2011	2017	Change over time compared to	
	N (%)	N (%)	N (%)	2011 Adjusted <sup>1</sup> OR (95% CI)	2017 Adj
<b><i>Dietary behaviour</i></b>					
Fruits <2 day	989 (42.2)	463 (45.4)	1152 (50.3)	1.05 (0.84, 1.30)	1.3
Vegetable <3 day	1890 (81.4)	820 (76.6)	1888 (82.0)	0.66 (0.54, 0.82)***	0.9
Went hungry (mostly/always)	78 (3.4)	57 (5.1)	71 (3.4)	2.05 (1.26, 3.33)**	0.8
<b><i>Alcohol use</i></b>					
Current alcohol use	637 (27.8)	320 (35.7)	497 (22.9)	1.38 (0.79, 2.39)	0.6
Ever drunk	490 (21.2)	239 (25.9)	381 (17.4)	1.26 (0.72, 2.20)	0.7
Trouble from alcohol use	540 (23.7)	70 (8.2)	366 (19.3)	0.28 (0.19, 0.41)***	0.7
<b><i>Injury and violence</i></b>					
Any serious injury	622 (37.0)	413 (44.0)	865 (43.5)	1.30 (1.04, 1.62)*	1.3
Bullied	790 (38.7)	331 (33.3)	438 (21.0)	0.77 (0.60, 0.97)*	0.3
In physical fight	1493 (64.6)	742 (70.2)	1231 (55.1)	1.26 (1.02, 1.54)*	0.5
Physically attacked	1137 (50.0)	512 (46.0)	577 (25.0)	0.86 (0.68, 1.07)	0.3
<b><i>Oral and hand hygiene</i></b>					
Brushing teeth (≤once/day)	897 (38.4)	415 (41.9)	959 (39.4)	1.18 (0.84, 1.67)	0.9
Wash hands before eating (not always)	624 (26.4)	314 (32.4)	774 (32.9)	1.27 (1.05, 1.54)*	1.3
Wash hands after toilet/ latrine use (not always)	364 (15.7)	120 (11.6)	262 (10.7)	0.65 (0.45, 0.95)*	0.6
Wash hands with soap (not always)	585 (25.5)	271 (25.1)	565 (22.4)	1.11 (0.81, 1.52)	0.8
<b><i>Poor mental health</i></b>					
Having no close friends	85 (3.7)	42 (4.0)	90 (3.5)	1.05 (0.59, 1.90)	1.2
Loneliness	436 (7.7)	197 (8.6)	536 (8.2)	0.92 (0.57, 1.49)	1.1
Worry-induced sleep disturbance	214 (9.3)	88 (8.9)	233 (9.6)	0.95 (0.67, 1.33)	1.1
Suicidal ideation	333 (14.5)	125 (12.1)	277 (12.7)	0.73 (0.49, 1.11)	1.0
Suicide plan	248 (11.0)	104 (10.2)	176 (7.8)	0.82 (0.52, 1.20)	0.8
<b><i>Protective factors</i></b>					
Truancy	462 (20.9)	247 (22.5)	464 (20.2)	1.14 (0.93, 1.41)	0.9
Peer support (mostly/always)	1489 (64.5)	644 (65.5)	1305 (64.3)	1.05 (0.87, 1.27)	0.8
Parents/guardians supervision (mostly/always)	1168 (51.2)	518 (47.4)	949 (47.0)	0.81 (0.65, 1.02)	0.7
Parents/guardians connectedness (mostly/always)	1058 (46.0)	471 (45.4)	953 (46.6)	0.96 (0.77, 1.20)	0.9
Parents or guardians bonding (mostly/always)	1014 (44.3)	500 (49.1)	826 (40.9)	1.40 (1.07, 1.83)*	0.8

\*\*\*P<0.001; \*\*P<0.01; \*P<0.05; <sup>1</sup>Adjusted for age, study year, dietary behaviour, alcohol use, injury and violence, oral and hand hygiene, poor mental health and protective factors

Table 3: Health risk behaviours in 2005, 2011 and 2017 among female in-school adolescents in

<b>Variable</b>	2005	2011	2017	Change over time compare	
	N (%)	N (%)	N (%)	2011 Adjusted <sup>1</sup> OR (95% CI)	2 A
<b><i>Dietary behaviour</i></b>					
Fruits <2 day	1301 (47.2)	629 (52.8)	1835 (54.4)	1.28 (1.06, 1.55)**	1
Vegetable <3 day	2353 (85.7)	986 (81.2)	2873 (84.7)	0.63 (0.48, 0.85)**	0
Went hungry (mostly/always)	71 (2.6)	38 (2.7)	91 (3.2)	0.79 (0.47, 1.32)	1
<b><i>Alcohol use</i></b>					
Current alcohol use	329 (12.2)	222 (20.3)	319 (12.8)	1.40 (0.71, 2.77)	0
Ever drunk	192 (7.1)	167 (15.8)	206 (8.1)	2.04 (0.92, 4.54)	1
Trouble from alcohol use	300 (11.1)	27 (2.1)	234 (9.6)	0.14 (0.08, 0.26)***	0
<b><i>Injury and violence</i></b>					
Any serious injury	594 (28.4)	382 (35.3)	915 (31.5)	1.31 (1.10, 1.56)**	1
Bullied	736 (29.4)	191 (16.6)	371 (12.6)	0.39 (0.27, 0.54)***	0
In physical fight	798 (29.0)	357 (30.2)	728 (23.5)	1.00 (0.81, 1.24)	0
Physically attacked	911 (33.4)	426 (35.6)	550 (16.6)	1.16 (0.92, 1.46)	0
<b><i>Oral and hand hygiene</i></b>					
Brushing teeth (≤once/day)	839 (30.4)	342 (29.9)	1129 (30.9)	0.91 (0.68, 1.21)	0
Wash hands before eating (not always)	751 (27.3)	377 (31.2)	1073 (31.1)	1.15 (0.92, 1.43)	1
Wash hands after toilet/ latrine use (not always)	321 (11.6)	113 (10.1)	224 (7.5)	0.87 (0.65, 1.16)	0
Wash hands with soap (not always)	509 (18.6)	187 (15.5)	609 (16.6)	0.89 (0.66, 1.21)	0
<b><i>Poor mental health</i></b>					
Having no close friends	90 (3.3)	45 (3.3)	178 (4.6)	1.05 (0.66, 1.65)	1
Loneliness	436 (16.1)	197 (16.4)	536 (15.2)	0.92 (0.72, 1.18)	0
Worry-induced sleep disturbance	483 (17.7)	194 (14.5)	605 (17.2)	0.70 (0.54, 0.90)**	0
Suicidal ideation	471 (17.5)	209 (17.8)	487 (14.1)	0.97 (0.75, 1.25)	0
Suicide plan	299 (11.2)	158 (12.9)	322 (9.1)	1.18 (0.73, 1.91)	0
<b><i>Protective factors</i></b>					
Truancy	281 (10.3)	176 (15.1)	432 (13.3)	1.50 (1.07, 2.10)**	1
Peer support (mostly/always)	2002 (73.3)	818 (72.2)	2248 (72.8)	0.86 (0.65, 1.13)	0
Parents/guardians supervision (mostly/always)	1303 (47.4)	505 (42.2)	1393 (45.5)	0.80 (0.64, 1.00)	0
Parents/guardians connectedness (mostly/always)	1330 (48.7)	555 (49.4)	1504 (49.4)	0.93 (0.74, 1.17)	1
Parents or guardians bonding (mostly/always)	1427 (52.3)	616 (56.3)	1652 (54.5)	1.07 (0.89, 1.30)	1

\*\*\*P<0.001; \*\*P<0.01; \*P<0.05; <sup>1</sup>Adjusted for age, study year, dietary behaviour, alcohol use, injury and violence, oral and hand hygiene, poor mental health and protective factors

## Supplementary Files

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Supplementaryfile1.docx

