RESEARCH

Health risk behaviours among adolescents in Argentina: trends between 2007, 2012 and 2018 national cross-sectional school surveys

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Abstract

Background: The aim of this study was to assess trends of various health risk behaviours among adolescents across three different surveys in Argentina.

Methods: Data from 115,697 adolescents (mean age: 14.6 years, SD = 1.2) that participated in three cross-sectional national school surveys in 2007, 2012 and 2018 were analysed. In all, 27 health risk behaviours were assessed through a self-administered questionnaire. Significance of a linear trend was tested by treating study year as categorical variable in logistic regression analyses, adjusted by age group and food insecurity for boys and girls separately.

Results: Among both sexes, four health risk behaviours (current cigarette use, passive smoking, trouble from alcohol use, and physically attacked) significantly reduced from 2007 to 2018. Among boys five health risk behaviours (experience of hunger, parental tobacco use, current alcohol use, involvement in physical fighting, and multiple sexual partners), and among girls, inadequate physical activity significantly reduced over time. Among both sexes, the prevalence of four health risk behaviours (overweight/obesity, obesity, leisure-time sedentary behaviour and insufficient fruit intake) significantly increased among both sexes, and among girls ten health risk behaviours (not walking/biking to school, current other tobacco use, bullying victimisation, lifetime drunkenness, having no close friends, suicide plan, suicidal ideation, worry-induced sleep disturbance, loneliness, and ever sexual intercourse) significantly increased over time.

Conclusion: Nine health risk behaviours among boys and five health risk behaviours among girls decreased, and four health risk behaviours among boys and 14 health compromising behaviours among girls increased over a period of 11 years. School health programmes for adolescents should be strengthened in Argentina.

Keywords: substance use, physical activity, diet, sexual behaviour, injury, mental health, violence, Argentina

Background

In Southern Cone States (Uruguay, Paraguay, Chile, Brazil, and Argentina), most death (75.3%) is caused by non-communicable diseases (NCDs), and in Argentina, an upper middle-income country, 78% of death is caused by NCDs [1]. There has been an increase of NCDs and its risk factors in Latin America, including in Argentina [1, 2]. In Southern Cone States, the prevalence of

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behavioural NCD risk factors in 2016 was 23.5% for adult obesity and 10.2% for adolescent obesity (Argentina 28.3% adult and 14.4% in adolescent obesity), 17.2% and 10.8% for current tobacco smoking among adults and adolescents, respectively (Argentina 21.9% and 20.2% for current tobacco smoking among adults and adolescents, respectively), and 44.3% for adult physical inactivity (Argentina 41.6%) [1]. In a survey among adults in primary care in Central Argentina, the prevalence of inadequate fruit and vegetable intake was 91.8%, physical inactivity 71.5%, dyslipidaemia 43.5%, obesity 35.2%, hazardous alcohol use 28%, and smoking 22.5% [3]. Generally, among adults in Argentina there has an increase of poor diet, physical inactivity, obesity, diabetes, and dyslipidaemia, but a decrease in tobacco use [4]. It is estimated that among young people and adults globally, “alcohol use, dietary behaviours, drug use, mental health, physical activity, sexual behaviours, tobacco use, violence and unintentional injury” are leading causes of morbidity and mortality [5].

In 26 countries in Latin America and the Caribbean 84.5% of adolescents (83.3% in Argentina in 2012) were not physically active [6], and in 12 countries 50% and more adolescents reported sedentary behaviour (50.8 sedentary in Argentina in 2012) [6]. The prevalence of past 12-month physical injury was in 2012-2013, for example 27.1% in Argentina and 29.5% in Uruguay [7]. In a sample of adolescents in Argentina, 6% were traditional bullies [8], and in a national sample of school adolescents in Argentina, the prevalence of past-month bullying victimization was 24.4% [9]. Comparing 13-15 year-old school adolescent from the Argentina 2007 and 2012 Global School-based Student Health Survey (GSHS) and Global Youth Tobacco Survey, found a prevalence of overweight (24.5%) and obesity (4.4%) in 2007 and 28.6% and 5.9%, respectively in 2012, and the prevalence of insufficient vegetable and fruit consumption was 86.0% in 2007 and 82.4% in 2012, physical inactivity 87.3% in 2007 and 83.3% in 2012, sedentary behaviour 49.2% in 2007 and 50.3% in 2012, current smokers 24.5% in 2007 and 19.6% in 2012, and exposure to passive smoking at home 54.7% in 2007 and 44.5% in 2012 [10]. In 21 Latin American and Caribbean Countries, the prevalence of suicidal ideation with planning was 7.5% and 17.5%, among male and female adolescents, respectively, loneliness 10.0% in Argentina in 2012, no close friends 5.3% in Argentina in 2012, and food insecurity 3.8% in Argentina in 2012 [11]. In a study among school adolescents in 25 countries in Latin America and the Caribbean 18.1% reported loneliness and/or having no close friends [12]. The prevalence of current alcohol among 13–15-year-olds in Argentina in 2007 was 51.9% [13], and among adolescents from eight countries in South America and the Caribbean, 18.4% had suicidal ideation, 8.7% anxiety, 15.0% multiple sexual partners and 33.8% school truancy [14]. Among national school adolescent surveys in Bolivia, Costa Rica, Honduras, Peru, and Uruguay, 33.2% had been involved in physical fighting, 37.8% were bullied and 6.7% had not used a condom at last sex [15], while in a large national study among adolescents in Brazil, 30.8% had not used a condom at last sex, and more than 63% had multiple sexual partners (>63%) in Brazil [16]. In terms of protective factors, among adolescents in five Caribbean countries, the prevalence of parental supervision was 38.2%, parental connectedness 32.9% and parental bonding 40.2% [17].

The prevalence of health risk behaviours in adolescents need to be monitored over time at country level to make intervention strategies more appropriate and successful [18, 19]. For example, in a trend study among school-going adolescents in Morocco from 2006 to 2016, “five health risk behaviours (being physically attacked, annual injury, passive smoking, zero days walking or biking to school, and poor hand hygiene after toilet use) significantly declined over time, and inadequate fruit intake and current tobacco use increased over time.” [20].

No trend study among adolescents on various health risk behaviours has been identified in Latin America, including Argentina. Therefore, the aim of this study was assessing trends of 27 health risk behaviours in the 2007, 2012 and 2018 Argentina GSHS. Findings from such a trend study on the epidemiology of health compromising behaviours may help us to understand and design better school health promotion strategies [20].

Methods
Sample and procedure
Data from 115,697 adolescents (mean age:14.6 years, SD=1.2) that participated in three cross-sectional national school surveys in 2007, 2012 and 2018 in Argentina were analysed [5]. For the 2007 Argentina GSHS the response rate was 77%, for the 2012 Argentina GSHS 71% and for the 2018 Argentina GSHS 63% [5]. Details of the GSHS and the dataset can be accessed [5]. Briefly, “using a two-stage cluster sampling strategy (schools were selected by probability to size sampling and random selection of classrooms with students 13 to 17 years of age), nationally representative samples of middle school students were produced.” [5] “All students who attended a selected class were eligible to participate, regardless of their age, and completed a self-administered questionnaire in their language under the supervision of trained external survey administrators.” [5] The study was granted ethics approval by a national ethics committee and written informed consent was obtained from the participants or their guardians before the survey [5].
Measures
All health risk behaviours of the GSHS measure [5] that were administered in the 2007, 2012 and 2018 Argentina GSHS were included in this study (see Table 1). This included body weight and dietary behaviour (overweight or obesity, obesity, food insecurity or hunger, and vegetable and fruit intake), leisure-time sedentary behaviour, walking or biking to school, and physical activity, substance use (parental tobacco use, current cigarette use, current other tobacco use, passive smoking, current alcohol use, drunkenness, trouble as a result of drinking alcohol), injury and violence (bullied, attacked, and in a physical fight), psychological health (having friends, loneliness, worry-induced sleep problems, suicide plan, and suicidal ideation), and sexual behaviour (ever sexual intercourse, multiple sexual partners, and non-condom use). In addition, protective measures included peer support, school attendance, and parental support. The intake of “less than two or more servings of fruits in a day” and “less than three or more servings of vegetables a day” were classified as inadequate [21]. “Inadequate physical activity was defined as not daily at least 60 minutes of moderate to vigorous-intensity physical activity.” [22]. “Leisure-time sedentary behaviour was defined as spending three or more hours per day sitting.” [23].

Data analysis
Cross-sectional national datasets from three Argentina GSHS in 2007, 2012 and 2018 were merged, and weighted for probability selected and non-response. Chi-square tests were utilized for analysing differences in proportions, and descriptive health risk behaviour information was reported as percentages for each study year. The significance of linear trends was analysed by using study year as categorical variable in logistic regression analyses, adjusted by age group and food insecurity for boys and girls separately. Taylor linearization methods were used in statistical analyses accounting for sample weight and multi-stage sampling. Missing data were excluded from the analyses, and \( p < 0.05 \) was accepted as significant. All statistical analyses were done using STATA software version 15.0 (Stata Corporation, College Station, Texas, USA).

Results
Sample characteristics
The total sample included 115,697 adolescents (Mean age:14.6 years, SD=1.2), and 51.9% were females. Compared to the first two surveys, the students attending ‘2nd year/11th grade polymodal or 4th year of high school’ or ‘3rd year/12th grade polymodal or 5th year of high school’ were included in the third survey \( (p < 0.001) \) (see Table 2).

Outcome variables

Body weight and dietary behaviour
The prevalence of overweight or obesity was 21.5% among boys and 12.4% among girls in 2007, which significantly increased to 35.2% among boys and 25.9% among girls in 2018. Similarly, the proportion of obesity increased among both boys and girls from 2007 (3.0% and 1.9%, respectively) to 2018 (9.7% and 5.2%, respectively). The prevalence of inadequate fruit consumption increased from 70.6% to 79.6% among boys and from 65.4% to 78.6% among girls from 2007 to 2018, while the prevalence of inadequate vegetable intake did not significantly change among both boys and girls over time. Experiencing hunger was low and decreased significantly in boys from 4.3% in 2007 to 2.3% in 2018 but did not change among girls over time.

Physical activity and sedentary behaviour
Both male and female adolescents reported a high prevalence of physical inactivity (boys: 82.7% and girls: 92.2%), which decreased significantly among girls (87.1%) and remained unchanged among boys (79.6%) over time. Leisure-time sedentary behaviour significantly increased among both boys from 44.7% in 2007 to 52.8% in 2018 and girls from 51.0% in 2007 to 57.7% in 2018. Not walking/biking to school significantly increased from 26.2% in 2007 to 34.0% in 2018 among girls but remained unchanged among boys.

Substance use
Among both boys and girls, parental tobacco use decreased over time from 38.4% to 33.8% among boys and 38.6% to 35.2% among girls. The prevalence of current cigarette use, significantly decreased from 24.3% in 2007 to 17.2% in 2018 among boys and from 26.9% in 2007 to 20.6% in 2018 among girls. However, among girls, current other tobacco use, almost doubled from 4.3% in 2007 to 8.0% in 2018, while among boys, current other tobacco use remained unchanged. The proportion of passive smoking reduced significantly among both boys and girls over time. Current alcohol use, significantly declined among boys but not among girls over time. Trouble from alcohol use decreased significantly among both boys and girls from 2007 to 2018, while lifetime drunkenness significantly increased among girls from 31.2% in 2007 to 38.8% in 2018 and remained unchanged among boys.

Violence and injury
The proportion of injury did not change significantly among boys and girls from 2007 to 2018. Bullying victimisation increased in both boys and girls, but only in girls significantly from 23.6% in 2007 to 34.9% in 2018. Being physical assaulted reduced in both sexes over time.
Table 1  Description of study variables.

| Variables                        | Question                                                                 | Response options (coding scheme)                                                                 |
|----------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Age                              | "How old are you?"                                                      | "11 years old or younger to 16 or 18 years old or older"                                         |
| Sex                              | "What is your sex?"                                                     | "Male, Female"                                                                                   |
| Grade                            | "In what grade/class/standard are you?"                                 |                                                                                                  |
| Food insecurity                  | "During the past 30 days, how often did you go hungry because there was not enough food in your home?" | "1 = never to 5 = always"                                                                         |
|                                  |                                                                          | (coded 1 = 0, 2–3 = 2 and 4–5 = 1)                                                                |
| Body weight and dietary behaviour | Height "How tall are you without your shoes on?"                         |                                                                                                  |
|                                  | Weight "How much do you weigh without your shoes on?"                    |                                                                                                  |
|                                  | Fruits "During the past 30 days, how many times per day did you usually (past 7 days how many times did you) eat fruit such as apples, bananas, or mandarins?" | "1 = I did not eat fruit during the past 30 days/7 days to 7 = 5 or more/4 or more times per day" |
|                                  |                                                                          | (coded <2 times/day)                                                                               |
|                                  | Vegetables "During the past 30 days/7 days, how many times per day did you usually (past 7 days) eat vegetables, such as lettuce, tomatoes, carrots, or pumpkin?" | "1 = I did not eat vegetables during the past 30 days to 7 = 5 or more/4 or more times per day"   |
|                                  |                                                                          | (coded <3 times/day)                                                                               |
|                                  | Hunger "During the past 30 days, how often did you go hungry because there was not enough food in your home?" | "1 = never to 5 = always"                                                                         |
|                                  |                                                                          | (coded 1–3 = 0 and 4–5 = 1)                                                                          |
| Physical activity and sedentary behaviour | "Physical activity"                                                                 | "0 = 0 days to 7 = 7 days"                                                                         |
|                                  |                                                                          | (coded 0–6 = 0 and 7 = 1)                                                                            |
|                                  | "Leisure-time sedentary behaviour"                                      | "1 = less than 1 hour per day; 2 = 1-2 hrs/day; 3 = 3-4 hrs/day; 4 = 5-6 hrs/day; 5 = 7-8 hrs/day and 6 = 8 or more hours per day" |
|                                  | "Walking or biking to school"                                           | "1 = 0 days to 8 = 7 days"                                                                          |
|                                  |                                                                          | (coded 1 = 1 and 2–8 = 0)                                                                           |
| Substance use                    | "Parental tobacco use"                                                  | "Neither, My father or male guardian, My mother or female guardian, Both"                         |
|                                  |                                                                          | (coded 0 = neither and 1 = either)                                                                  |
|                                  | "Current smoking cigarettes"                                            | "1 = 0 days to 7 = All 30 days"                                                                  |
|                                  |                                                                          | (coded 1 = 0 and 2–7 = 1)                                                                           |
|                                  | "Current other tobacco use"                                             | "1 = 0 days to 7 = All 30 days"                                                                  |
|                                  |                                                                          | (coded 1 = 0 and 2–7 = 1)                                                                           |
|                                  | "Passive smoking"                                                      | "1 = 0 days to 5 = all 7 days"                                                                    |
|                                  |                                                                          | (coded 1 = 0 and 2–5 = 1)                                                                           |
|                                  | "Current alcohol use"                                                   | "1 = 0 days to 7 = All 30 days"                                                                  |
|                                  |                                                                          | (coded 1 = 0 and 2–7 = 1)                                                                           |
|                                  | "Drunk"                                                                 | "1 = 0 times to 4 = 10 or more times"                                                             |
|                                  |                                                                          | (coded 1 = 2 = 4 and 0 = 1)                                                                         |
|                                  | "Trouble from alcohol use"                                              | "1 = 0 times to 4 = 10 or more times"                                                             |
|                                  |                                                                          | (coded 1 = 2 = 4 and 0 = 1)                                                                         |
| Injury and violence              | "Injury"                                                                | "1 = 0 times to 8 = 12 or more times"                                                              |
|                                  |                                                                          | (coded 1 = 0 and 2–8 = 1)                                                                           |
from 30.2% to 19.3% among boys and from 19.2% to 15.9% among girls and participation in physical fighting decreased significantly among boys from 43.8% to 33.3% and reduced among girls from 19.6% to 16.5% but not significantly.

**Psychological health**
All five indicators ("having no close friends, worry-induced sleep disturbance, loneliness, suicidal ideation and suicide plan") significantly increased among girls but not among boys over time.
**Sexual behaviour**

Ever having had sexual intercourse significantly increased among girls from 24.4% in 2007 to 36.4% in 2018 but remained unchanged among boys. The prevalence of having multiple sexual partners significantly reduced from 34.8% to 28.4% among boys but not among girls (from 13.6% to 16.9%). The proportion of non-condom use at last sex remained unchanged among both boys and girls over time.

**Protective indicators**

School attendance in the past 30 days significantly increased among both boys and girls from 2007 to 2018. Peer support significantly decreased among girls but not among boys over time. Parental supervision and connectedness decreased significantly among both boys and girls from 2007 to 2018, while parental bonding did not change over time (see Tables 3 and 4).

**Table 2** Characteristics of adolescent students for 2007, 2012 and 2018 surveys in Argentina

| Variable                          | 2007 (N=1,980) | 2012 (N=56,736) | 2018 (N=56,981) |
|-----------------------------------|---------------|----------------|-----------------|
| **Sex**                           |               |                |                 |
| Male                              | 957 (48.0)    | 26728 (48.3)   | 27083 (48.0)    |
| Female                            | 994 (52.0)    | 29248 (51.7)   | 29362 (52.0)    |
| Missing                           | 29            | 760            | 536             |
| **Age in years**                  |               |                |                 |
| 13 years or younger               | 370 (18.7)    | 11412 (26.0)   | 10767 (21.0)    |
| 14                                | 600 (27.0)    | 16354 (29.5)   | 12946 (25.0)    |
| 15                                | 576 (29.6)    | 15448 (25.4)   | 12812 (22.0)    |
| 16 years or older                 | 400 (24.8)    | 12812 (19.2)   | 20348 (31.9)    |
| Missing                           | 34            | 468            | 108             |
| **Grade**                         |               |                |                 |
| A                                 | 732 (38.4)    | 28576 (37.2)   | 8581 (14.7)     |
| B                                 | 880 (32.0)    | 19944 (33.5)   | 11913 (26.9)    |
| C                                 | 337 (29.7)    | 16574 (29.3)   | 12448 (23.3)    |
| D-E                               | 0             | 0              | 22978 (35.1)    |
| Missing                           | 31            | 1642           | 1061            |
| **Food insecurity (as proxy for socioeconomic status)** |        |  |                      |
| None                              | 1321 (67.1)   | 35222 (64.4)   | 38257 (68.4)    |
| Moderate                          | 588 (29.8)    | 18680 (31.7)   | 17162 (29.6)    |
| Severe                            | 58 (3.1)      | 2140 (3.9)     | 1063 (2.0)      |
| Missing                           | 13            | 694            | 499             |

A—’8th grade of primary school/polimodal or 1st year of high school'; B—’9th grade of primary school/polimodal or 2nd year of high school'; C—’1st year/10th grade polimodal or 3rd year of high school'; D=—2nd year/11th grade polimodal or 4th year of high school'; E —3rd year/12nd grade polimodal or 5th year of high school'.

**Discussion**

Results show for the first time that across three GSHS in 2007, 2012 and 2018 in Argentina, among both sexes a significant decrease in the prevalence of current cigarette use, passive smoking, trouble from alcohol use, and physically attacked, and among boys, experience of hunger, parental tobacco use, current alcohol use, involvement in physical fighting, and multiple sexual partners, and among girls, inadequate physical inactivity. However, overweight/obesity, obesity, leisure-time sedentary behaviour and insufficient fruit intake significantly increased among both boys and girls, and among girls not walking/biking to school, current other tobacco use, bullying victimisation, lifetime drunkenness, having no close friends, loneliness, worry-induced sleep disturbance, suicidal ideation, suicide plan, and ever sexual intercourse significantly increased over time.

The significant reduction in current cigarette use, and passive smoking, also found in the Argentina Global Youth Tobacco Survey [10], may be attributed to the introduction of the smoke-free law in Argentina in 2011, including a “total ban on smoking in public settings, prohibition of advertising and promotional activities.
regarding tobacco use, and enforcing manufacturers to include messages warning of the harmful effects of cigarette smoking on health.” [24, 25]. However, of concern is that the prevalence of other tobacco use, significantly increased among girls from 2007 to 2018. Current alcohol decreased among boys, trouble from alcohol use decreased among both boys and girls, and lifetime drunkenness increased among girls. Current alcohol use is high in both sexes (52% among boys and 56% among girls) and is among adolescents often associated with negative health outcomes, such as interpersonal violence [13]. Public health interventions may be indicated to reduce alcohol use among adolescents in Argentina [13]. Although some national policies and interventions are

| Outcome variable                      | 2007 | 2012 | 2018 | Differencea | p-for trendb |
|---------------------------------------|------|------|------|-------------|--------------|
| **Body weight and dietary behaviour** |      |      |      |             |              |
| Overweight/obesity                    | 21.5 | 35.0 | 35.2 | +13.7       | <0.001       |
| Obesity                               | 3.0  | 8.9  | 9.7  | +6.7        | <0.001       |
| Fruits <2 times/day                   | 70.6 | 64.6 | 79.6 | +9.0        | <0.001       |
| Vegetable <3 times/day                | 92.3 | 87.6 | 89.9 | -2.4        | 0.076        |
| Went hungry (mostly/always)           | 4.3  | 4.6  | 2.3  | -2.0        | 0.013        |
| **Physical activity and sedentary behaviour** |      |      |      |             |              |
| Physical inactivity                   | 82.7 | 78.1 | 79.6 | -3.1        | 0.220        |
| Leisure-time sedentary behaviour      | 44.7 | 46.9 | 52.8 | +8.1        | 0.003        |
| 0 days walk or bike to school         | 27.0 | 31.3 | 30.0 | +3.0        | 0.458        |
| **Substance use**                     |      |      |      |             |              |
| Parental tobacco use                  | 38.4 | 37.6 | 33.8 | -4.6        | 0.036        |
| Current cigarette use                 | 24.3 | 19.2 | 17.2 | -7.1        | <0.001       |
| Current other tobacco use             | 8.3  | 8.8  | 8.2  | -0.1        | 0.965        |
| Passive smoking                       | 77.9 | 71.0 | 64.3 | -13.6       | <0.001       |
| Current alcohol use                   | 61.5 | 52.0 | 52.4 | -9.1        | 0.008        |
| Lifetime drunk                        | 38.7 | 32.8 | 35.7 | -3.0        | 0.299        |
| Trouble from alcohol use              | 25.2 | 22.3 | 12.6 | -12.6       | <0.001       |
| **Injury and violence**               |      |      |      |             |              |
| Any serious injury                    | 42.2 | 42.4 | 38.4 | -3.8        | 0.157        |
| Bullied                               | 26.6 | 24.3 | 29.7 | +3.1        | 0.094        |
| In physical fight                     | 43.8 | 44.7 | 33.3 | -10.5       | <0.001       |
| Physically attacked                   | 30.2 | 30.4 | 19.3 | -10.9       | <0.001       |
| **Poor mental health**                |      |      |      |             |              |
| Having no close friends               | 4.5  | 6.6  | 5.9  | +1.4        | 0.073        |
| Loneliness                            | 7.5  | 5.8  | 10.1 | +1.4        | 0.053        |
| Worry-induced sleep disturbance       | 7.6  | 5.7  | 8.1  | +0.5        | 0.362        |
| Suicidal ideation                     | 14.0 | 11.7 | 13.8 | -0.2        | 0.773        |
| Suicide plan                          | 11.2 | 11.9 | 11.0 | -0.2        | 0.960        |
| **Sexual behaviour**                  |      |      |      |             |              |
| Ever sex                              | 44.4 | 48.2 | 48.2 | +3.8        | 0.298        |
| Multiple sexual partners              | 34.8 | 25.9 | 28.4 | -6.4        | 0.036        |
| Non-condom use                        | 10.2 | 8.9  | 7.7  | -2.5        | 0.055        |
| **Protective factors**                |      |      |      |             |              |
| School attendance                     | 60.0 | 65.9 | 68.3 | +8.3        | 0.002        |
| Peer support (mostly/always)          | 50.1 | 47.1 | 46.8 | -3.3        | 0.316        |
| Parents/guardians supervision (mostly/always) | 37.7 | 32.4 | 30.4 | -7.3        | 0.005        |
| Parents/guardians connectedness (mostly/always) | 52.6 | 46.8 | 42.9 | -9.7        | <0.001        |
| Parents/guardians bonding (mostly/always) | 53.9 | 49.6 | 53.2 | -0.7        | 0.837        |

*a Difference between 2007 and 2018; bAdjusted for age and socioeconomic status (food insecurity)
in place for alcohol use in Argentina, such as legal minimum age for on or off premise sales of alcoholic beverages (18 years), and legally binding regulations on alcohol advertising, health warning labels on alcohol advertisements, there is no written national alcohol policy, no legally binding regulations on alcohol sponsorship, and no restrictions for on-/off-premises sales of alcoholic beverages [26].

Overweight/obesity and obesity, sedentary behaviour, not walking/biking to school (particularly among girls), and inadequate fruit consumption increased from 2007 to 2018, which may be attributed to a nutritional

| Table 4 | Health risk behaviours among female adolescents in 2007, 2012 and 2018 in Argentina |
|-------------------|----------------------------------|------------------|------------------|-------------------|------------------|
| **Outcome variable** | **2007** | **2012** | **2018** | **Difference** | **p-for trend** |
| **Body weight and dietary behaviour** |  |  |  |  |  |
| Overweight/obesity | 12.4 | 21.0 | 25.9 | +13.5 | <0.001 |
| Obesity | 1.9 | 3.4 | 5.2 | +3.3 | <0.001 |
| Fruits <2 times/day | 65.4 | 59.1 | 78.6 | +13.2 | <0.001 |
| Vegetable <3 times/day | 90.8 | 86.4 | 89.2 | -1.6 | 0.427 |
| Went hungry (mostly/always) | 1.8 | 3.1 | 1.7 | -0.1 | 0.483 |
| **Physical activity and sedentary behaviour** |  |  |  |  |  |
| Physical inactivity | 92.2 | 87.8 | 87.1 | -5.1 | <0.001 |
| Leisure-time sedentary behaviour | 51.0 | 52.8 | 57.7 | +6.7 | 0.036 |
| 0 days walk or bike to school | 26.2 | 32.1 | 34.0 | +7.8 | 0.046 |
| **Substance use** |  |  |  |  |  |
| Parental tobacco use | 38.6 | 35.8 | 35.2 | -3.4 | 0.114 |
| Current cigarette use | 26.9 | 21.3 | 20.6 | -6.3 | 0.005 |
| Current other tobacco use | 4.3 | 5.8 | 8.0 | +2.7 | 0.006 |
| Passive smoking | 78.5 | 76.7 | 68.4 | -9.9 | <0.001 |
| Current alcohol use | 53.2 | 51.3 | 55.7 | +2.5 | 0.290 |
| Lifetime drunk | 31.2 | 29.5 | 38.8 | +7.6 | <0.001 |
| Trouble from alcohol use | 20.8 | 21.8 | 13.3 | -8.5 | <0.001 |
| **Injury and violence** |  |  |  |  |  |
| Any serious injury | 26.2 | 25.3 | 28.4 | +2.2 | 0.171 |
| Bullied | 23.6 | 23.5 | 34.9 | +11.3 | <0.001 |
| In physical fight | 19.6 | 24.1 | 16.5 | -3.1 | 0.075 |
| Physically attacked | 19.2 | 19.8 | 15.9 | -3.3 | 0.042 |
| **Poor mental health** |  |  |  |  |  |
| Having no close friends | 4.0 | 4.7 | 5.3 | +1.3 | 0.043 |
| Loneliness | 12.8 | 13.1 | 23.1 | +10.3 | <0.001 |
| Worry-induced sleep disturbance | 13.7 | 11.9 | 18.0 | +4.3 | <0.001 |
| Suicidal ideation | 19.8 | 22.2 | 28.6 | +8.8 | <0.001 |
| Suicide plan | 15.8 | 19.6 | 22.6 | +6.8 | <0.001 |
| **Sexual behaviour** |  |  |  |  |  |
| Ever sex | 24.4 | 35.2 | 36.4 | +12.0 | <0.001 |
| Multiple sexual partners | 13.6 | 14.9 | 16.9 | +3.3 | 0.210 |
| Non-condom use | 7.0 | 7.8 | 8.4 | +1.4 | 0.532 |
| **Protective factors** |  |  |  |  |  |
| School attendance | 65.7 | 69.3 | 72.3 | +6.6 | 0.016 |
| Peer support (mostly/always) | 57.8 | 53.8 | 44.5 | -13.3 | <0.001 |
| Parents/guardians supervision (mostly/always) | 37.0 | 28.6 | 26.6 | -10.4 | <0.001 |
| Parents/guardians connectedness (mostly/always) | 54.9 | 49.7 | 40.0 | -14.9 | <0.001 |
| Parents/guardians bonding (mostly/always) | 59.2 | 58.0 | 56.9 | +0.7 | 0.116 |

* Difference between 2007 and 2018; *Adjusted for age and socioeconomic status (food insecurity)
Among boys, all mental health indicators remained unchanged, while among girls all five mental health indicators (suicide plan, loneliness, suicidal ideation, no close friends, and worry-induced sleep disturbance) significantly increased from 2007 to 2018. In response to this a gender-responsive health for suicide prevention programme through the establishment of school-based health advisory services has recently been implemented and is being roll-out in Argentina [37]. The overall prevalence of suicidal ideation (18.4%) in this study was similar to the study among adolescents in five Latin American countries (19.5%) [15].

Regarding protective aspects, school attendance increased among both boys and girls, while peer support significantly decreased among girls but not among boys. Parental supervision and connectedness significantly decreased among both boys and girls over time in this study. This decline in parental support may be related to recent changes in family transformations in Argentina, including “increases in the age at marriage, marital dissolution, nonmarital births, and cohabitation, and with women increasingly contributing to the economic support of their families.” [38]. It is possible that the decline of parental supervision and connectedness contributed to poorer mental health, in particular among girls in this study. Overall, the prevalence of parental support (parental supervision 31.2%, parental connectedness 47.1% and parental bonding 54.9%) in this study was lower in terms parental supervision (38.2%) but higher regarding parental connectedness (32.9%) and parental bonding (40.2%) than among adolescents in five Caribbean countries [17].

Study findings highlight a wide range of health risk behaviours that can be targeted in school health promotion activities among in Argentina. Comprehensive Protection of the Rights of Boys, Girls and Adolescents, PROSANE is developed as an “Integrated Care Policy for children and adolescents”. PROSANE is part of the Primary Health Care strategy strengthening the link between the school and the health centre makes it possible to identify issues that require promotional actions in schools. PROSANE promotes and develops health promotion actions in conjunction with teachers, managers, and families, promoting learning and integral human development, improving the quality of life and the collective well-being of children and adolescents and other members of the community [39].

**Study limitations**

“Secondary education net-enrolment ratio” was 85.9% in Argentina in 2012 and 90.7% in 2018 [40], which implies that some adolescents not attending school were not included in this study in Argentina. Some GSHS study variables, such as oral and hand hygiene,
soft drink and fast-food consumption, were not included in this paper, since they were only assessed in one or two waves of the Argentina GSHS. The study design was cross-sectional, which precludes from causal inferences. The GSHS collected anonymously data by self-report that could have contributed to some bias but may nevertheless have reported valid data, in particular on sensitive issues [41].

Conclusions
Nine health risk behaviours (current cigarette use, passive smoking, trouble from alcohol use, physically attacked, experience of hunger, parental tobacco use, current alcohol use, and involvement in physical fighting) among boys and five health risk behaviours (current cigarette use, passive smoking, trouble from alcohol use, physically attacked, and inadequate physical inactivity) among girls decreased, and four health risk behaviours (overweight/obesity, obesity, leisure-time sedentary behaviour and insufficient fruit intake) among boys and 14 health compromising behaviours (overweight/obesity, obesity, leisure-time sedentary behaviour and insufficient fruit intake, not walking/biking to school, current other tobacco use, bullying victimisation, lifetime drunkenness, having no close friends, loneliness, worry-induced sleep disturbance, suicidal ideation, suicide plan, and ever sexual intercourse) among girls increased over a period of 11 years. School health programmes for adolescents should be strengthened in Argentina.

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

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

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Availability of data and materials
The datasets generated during and/or analysed during the current study are available in the World Health Organization NCD Microdata Repository, https://extranet.who.int/ncds/microdata/index.php/catalog/ Public access to this database is open.

Declarations
All methods were carried out in accordance with relevant guidelines and regulations and have been performed in accordance with the Declaration of Helsinki. Ethics approval and consent to participate
The study was granted ethics approval by a national ethics committee and written informed consent was obtained from the participants or their guardians before the survey.

Consent for publication
Not applicable

Competing interests
The authors declare that they have no competing interests.

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