



Article

Weight Categories among Male Adolescents Linked to Risky Behaviors: High or Low BMI, Which Is Worse?

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Abstract: The literature about the relationship between extreme BMI and at-risk behaviors is quite inconsistent, and few articles focus on the underweight male population. This study aimed to analyze BMI level and its association with risky behavior, such as psychoactive substances use, gaming, and gambling, in a representative sample of the male adolescent population. Psychosocial variables were considered to better describe the possible at-risk profiles. This study used data from the 2018 ESPAD[®] Italia cross-sectional study, a survey using a self-administered anonymous questionnaire. For the purpose of the paper, males only were included in the analysis, with a total sample of 6938 students aged 15–19 years. Multinomial logistic regression showed that being overweight is positively associated with the gambler profile, the perception of a low financial family situation, and dissatisfaction with health conditions. Furthermore, being underweight was positively associated with gaming. Both extremes of BMI were associated with a frequent alcohol consumption and a sedentary lifestyle. This study provides important information regarding both extremes of BMI conditions, underlining the presence of at-risk behavior and self-related perceptions with shared factors between underweight and overweight.

Keywords: body mass index (BMI); overweight/obesity; underweight; at risk behaviors; male adolescents; alcohol consumption



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1. Introduction

Weight abnormalities are significant health concerns with physical and psychological consequences. An excessive BMI, especially during childhood and puberty, may lead to obesity during adulthood and related non-communicable diseases such as diabetes and cardiovascular diseases, as well as premature death [1–3]. Scientific literature remarks that overweight and obese subjects show psychosocial problem rates higher than normal-weight subjects. Indeed, the social stigma associated with weight abnormalities could lead to being bullied more often and marginalized by peers with possible emotional consequences [4]. The significance of underweight status (BMI below the 5th percentile for age and gender) has been associated with negative health outcomes, although this is less significant compared with the association to obesity. Moreover, among male adolescents, being underweight may be linked to a negative body image due to the reduced muscle mass [5]. Considering the consequences of being overweight, many authors have analyzed the relationship between the Body Mass Index (BMI) [6] and other variables as social-economical context [7–9], relationship with parents [10–12], self-esteem [13,14], and addiction to drugs or to other risk behaviors. High BMI levels can be associated with psychological problems, including eating disorders (EDs) [15]. Particularly, obesity is mainly associated with Binge Eating Disorder (BED) [16,17], namely recurrent episodes of overeating large quantities of food losing control [18] (APA, 2013), and Bulimia Nervosa (BN) (recurrent episodes of

binge eating associated with purging and compensatory behaviors [18]). Both BED and BN have been linked to impulse control impairment, therefore in comorbidity with other mental disorders such as anxiety, mood disorders, and addiction behaviors [17,18]. In fact, many studies reported that Substance Use (SU) is prevalently associated with BN and BED [19]. Moreover, literature findings point out the association of BED and BN, not only with SU but also with behavioral addictions such as gambling [17,20–22]. The relationship between SU and BED could rely on the overlap of similar neurobiological pathways [21,23], while the comorbidity between BN and SU could depend on genetic characteristics [24,25]. Concerning gambling, several authors speculated that the link between this kind of phenomenon and BED and BN can be ascribed to the presence of similar personality traits, mostly among male subjects with high BMI levels in comorbidity with BED [20].

Scientific evidence about the relationship between BMI, substance use, and dependence showed important gender differences. Regarding legal psychoactive substances, overweight and obesity are associated with increased risk for lifetime alcohol abuse and dependence in men but not in women [26]. Moreover, adolescents who regularly smoke cigarettes or drink alcohol have a higher BMI than those who do not [27]. In addition, it was widely accepted that nicotine influences hunger to the point that nicotine is also used for controlling weight [28,29]. Additionally, literature suggests that the consequences of behavioral disorders due to the consumption of alcohol and tobacco may be dependent on genetic factors, by inducing, for instance, plasticity in the brain circuits involved in reward and learning [30]. More in general, literature suggests that there is a complex relationship between genetics and environmental/experiences factors and children or adolescents' cognitive, behavioral, and emotional development, highlighting the importance of considering social, psychological, and biological factors and their interactions in order to obtain a comprehensive picture of a phenomenon [30].

On the other hand, concerning illicit substance use, no clear associations were found: data showed possible associations between high BMI levels and lower illicit drug use but differences in substance type use and gender should be considered [26,31]. The use of stimulants may alter not only the amount of food intake but also the food choice leading to an underweight status with long-term consequences for health [32]. Furthermore, some authors found a positive association between underweight status, bullying victimization, and parental supervision. Other factors associated with being underweight among male adolescents may include physical inactivity and alcohol use [33,34].

Regarding the association between BMI and other behavioral addictions, gambling habits, and videogame use, misuse or addiction should be investigated. To date, these associations have rarely been investigated and without a clear reference to BMI ranges. The literature highlights the association between gambling or pathological gambling and a higher BMI as well as other poor health conditions [35,36]. Among adolescents, the results are even more uncertain: while Yip and colleagues [37] did not find any significant correlation, Algren and colleagues [38] found an association between obesity and problematic gambling.

Findings of the relationship between gaming and BMI are heterogeneous [39–44].

Given the inconsistent conclusions reported above, the gender differences affecting the few available results [45], and the lack of information about male adolescents, a more in-depth study of the link between risk behaviors and inadequate BMI may be useful both epidemiologically and to address clinical studies. In the hypothesis of multifactorial interactions occurring in defining a risk profile, the objective of the present study is to analyze the link between BMI abnormalities and potentially addictive behaviors within a representative sample of Italian male adolescents. In order to achieve this objective, we focus on the relationship between BMI and: (a) legal psychoactive substance use (smoking cigarettes; alcohol use; medicines without prescription; supplements use); (b) illegal psychoactive substance use (e.g., cannabis and stimulant use); and (c) behavioral addictions such as problematic gambling and gaming behaviors.

2. Materials and Methods

2.1. Design

Data were drawn from the ESPAD[®]Italia (European School Survey Project on Alcohol and Other Drugs), a national school survey performed annually to monitor risk behaviors and their effects among the Italian youth population.

The ESPAD survey has been led by the Institute of Clinical Physiology of the Italian National Research Council (CNR) since 1995. The Italian survey is the national focus of a larger European research project (ESPAD) aimed at collecting representative and comparable data on alcohol and drug consumption patterns in many countries. Student participation is anonymous and voluntary. Referring to the ESPAD methodology [46], a representative sample of high school students, aged 15–19 years, completed a self-administered questionnaire composed of 164 items.

The response rate of participating schools was 85.0%.

For the purposes of the present study, only data of male respondents to the ESPAD[®]Italia 2018 were used.

2.2. Participants

The study sample was composed of male students ($N = 6938$), aged 15–19 years ($M = 16.97$; $SD = 1.43$), height (cm) $M = 178$ and $SD = 37$, and weight (kg) $M = 78.46$ and $SD = 79.83$. The sample was representative of the Italian general adolescent male population.

2.3. Measures

2.3.1. Dependent Variable

Body Mass Index (BMI) was assessed by the ESPAD[®]Italia 2018 asking students to enter their height and weight in the questionnaire. BMI categories were defined according to the cut-off points of the 2006 BMI-for-age reference: for children and adolescents aged 5–19 years, underweight was defined as a BMI-for-age value under -2 SD, overweight as a BMI-for-age value over $+1$ SD, and obesity as a BMI-for-age value over $+2$ SD [47]. Given the paucity of obese boys, in order to carry out the analysis, they were counted together with those who were overweight.

2.3.2. Independent Variables

In order to investigate the risk factors potentially associated with BMI or the possible confounding factors, many variables were analyzed.

Psychosocial variables included physical activity frequencies (often/hardly ever or rarely), quality of the relationship with parents (satisfying/unsatisfying), self-satisfaction (satisfying/unsatisfying), his own health satisfaction (satisfying/unsatisfying), family's financial situation (high/low), and school performance (high/low).

Risk behaviors included gambling and gaming. Concerning the gambling activity, the South Oaks Gambling Screen: Revised for Adolescents (SOGS-RA) (Cronbach's $\alpha = 0.78$; acceptable) [48,49] was used to identify three different gambling profiles: non-problematic, at risk, and problematic. To assess the gaming activity, the level of agreement (agree or disagree) with the following two items was used: "I think that I spend way too much time gaming" and "My parents tell me that I spend way too much time gaming".

Finally, psychoactive substance use was assessed both in terms of (a) use and non-use and (b) frequency.

The considered independent variables, related questions, and codes are reported in Table 1.

Table 1. Independent variables considered (except age), questions, and codes.

Independent Variables	Questions	Codes
Psychosocial Variables		
<i>Physical activity = hardly ever/rarely</i>	Think back over the last 12 month. How often did you exercise?	Hardly ever/rarely = Never; few times/year; 1–2 times/week vs. Often = 3–4 times/week; almost every day
<i>Relationship with parents</i>	In general, how satisfied are you with the relationship with your parents?	Very satisfied; satisfied vs. neither satisfied nor dissatisfied; not so satisfied; unsatisfied
<i>Self-satisfaction</i>	In general, how satisfied are you with yourself?	Very satisfied; satisfied vs. neither satisfied nor dissatisfied; not so satisfied; unsatisfied
<i>Health satisfaction</i>	In general, how satisfied are you with your health?	Very satisfied; satisfied vs. neither satisfied nor dissatisfied; not so satisfied; unsatisfied
<i>Family's financial situation</i>	How well off is your family compared to other families in your country?	Medium/high financial situation = very much better off; much better off; better off; about the same vs. low financial family situation = less well off; much less well off; very much less well off
<i>School performance</i>	Which of the following best describes your average grade at the end of the last term?	Excellent; good = high vs. medium; low = on the average; below the average
Risk behaviors variable		
<i>Gambling</i>	South Oaks Gambling Screen: Revised for Adolescents (SOGS-RA)	Non-problematic, at risk, and problematic profile
<i>Gaming</i>	"I think that I spend way too much time gaming" "My parents tell me that I spend way too much time gaming"	Agree = strongly agree; partly agree vs. not agree = neither nor, partly disagree; strongly disagree
<i>Psychoactive: Illegal substance use—cannabis</i>	During the last 30 days, on how many occasions (if any) have you used cannabis?	Less than 10 times vs. 10 or more times
<i>Psychoactive: Illegal substance use</i>	During the last 12 months, on how many occasions (if any) have you used: - Heroin, cocaine, hallucinogens, stimulants - Tranquillizers or sedatives	Use = one or more times vs. non-use = never
<i>Psychoactive: Legal substance use—tobacco</i>	Think back again over the last 30 days. How many cigarettes did you smoke per day?	Less than 6 = never, less than 1 cigarette/week, less than 1 cigarette/day, 1–5 cigarettes/day vs. 6 or more = 6–10 cigarettes/day, 11–20 cigarettes/day, 20 or more cigarettes/day
<i>Psychoactive: Legal substance use—alcohol</i>	Think back again over the last 30 days. On how many occasions (if any) have you had any alcoholic beverages to drink?	Less than 10 vs. more than 10

2.4. Statistical Analysis

Students' social background and the different at-risk behaviors such as gaming, gambling, and the consumption of legal and illegal substances were examined in relation to the different BMI categories the adolescents belong to. A test of normality, Kolmogorov–Smirnov, was used to test the normal distribution of the variable BMI. Descriptive analysis of the sample was conducted by calculating the proportion of all the variables considered in our study. Additionally, a compare column proportions test was performed by applying Bonferroni's correction for multiple comparisons (see Supplementary Materials).

The normal-weight category was identified as the reference category. Overweight and obese boys were included in the same class of weight (overweight). A univariate logistic regression model was performed including each single independent variable and age as a covariate.

A multinomial logistic regression model was finally performed including all variables that were statistically significant ($p < 0.05$) within the univariate analysis.

Statistical analysis was carried out through SPSS Statistic 26 and the results are expressed as Odds Ratio (OR) and 95% confidence interval.

3. Results

As shown in Figure 1, in the overall sample, the prevalence of underweight adolescents was 16.7% while 11.1% exceeded in weight (overweight 9.9%; obese 1.2%).

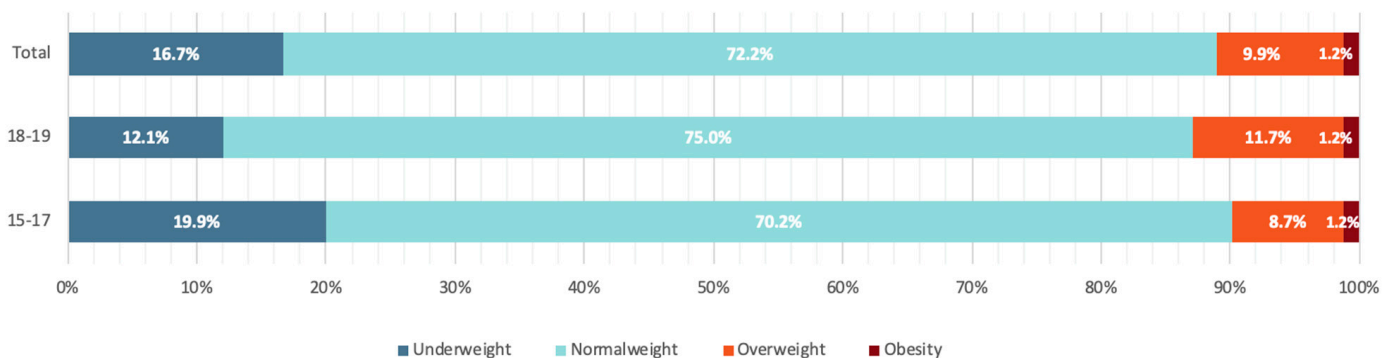


Figure 1. Distribution of BMI categories among male students' population.

The percentage of underweight boys was higher among those aged 15–17 years (19.9%; 18–19 = 12.1%); conversely, the percentage of overweight boys was higher among those aged ≥ 18 years (15–17 = 9.9%; 18–19 = 12.9%). According to the Chi-square test, differences by age and BMI categories were statistically significant ($p < 0.000$) (Figure 1).

Multinomial Logistic Regression Results

All the variables that were significant in the univariate analysis, Table 2, were included in the multinomial logistic regression model.

According to multinomial logistic regression model (Table 3), "rarely or never" performing physical activity was positively associated with both being overweight (OR: 1.9 $p < 0.001$) and underweight (OR: 1.62 $p < 0.005$) as well as drinking 10 or more alcoholic drinks in a month (underweight = OR: 1.68 $p < 0.05$; overweight = OR: 1.59 $p < 0.05$).

Table 2. Univariate logistic regression analysis between several risk factors and BMI condition: underweight and overweight vs. normal weight adolescents.

	Underweight OR (95% CI)	<i>p</i> -Value	Overweight OR (95% CI)	<i>p</i> -Value
Physical activity = hardly ever/rarely	1.575 (1.358; 1.827)	***	1.602 (1.392; 1.843)	***
Low financial family situation	n.s.	n.s.	1.556 (1.259; 1.924)	***
Dissatisfied with health	1.460 (1.178; 1.809)	**	1.638 (1.354; 1.981)	***
Dissatisfied with himself	n.s.	n.s.	1.238 (1.055; 1.454)	**
Dissatisfied with relationship with parents	n.s.	n.s.	n.s.	n.s.
High academic performance	n.s.	n.s.	0.797 (0.694; 0.916)	**
I think I spend way too much time gaming = I agree	0.834 (0.702; 0.992)	*	n.s.	n.s.
My parents tell me, I spend way too much time gaming = I agree	n.s.	n.s.	1.209 (1.025; 1.426)	*
Gambler's profile = at risk	n.s.	n.s.	n.s.	n.s.
Gambler's profile = problem	n.s.	n.s.	1.656 (1.257; 2.181)	***
Drinking 10 or more times in a month	n.s.	n.s.	1.412 (1.161; 1.716)	**
Smoking 6 or more cigarettes per day	0.687 (0.519; 0.910)	*	n.s.	n.s.
Smoking cannabis 10 or more times in a month	n.s.	n.s.	n.s.	n.s.
Use of energy drinks during last year	0.821 (0.709; 0.951)	**	n.s.	n.s.
Use of anabolic/testosterone during last year	n.s.	n.s.	n.s.	n.s.
Use of any other illegal substances during last year	n.s.	n.s.	n.s.	n.s.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, n.s.: $p \geq 0.05$.

Table 3. Multinomial logistic regression model: association of extreme categories of BMI with possible risk factors.

	Underweight OR (95% CI)	<i>p</i> -Value
Being under 18	0.633 (0.569; 0.705)	***
Physical activity = hardly ever/rarely	1.627 (1.228; 2.155)	**
Low financial family situation	n.s.	n.s.
Dissatisfied with health	n.s.	n.s.
Dissatisfied with himself	n.s.	n.s.
High academic performance	n.s.	n.s.
I think I spend way too much time gaming = I agree	n.s.	n.s.
My parents tell me, I spend way too much time gaming = I agree	1.800 (1.295; 2.501)	***
Gambler's profile = at risk	n.s.	n.s.
Gambler's profile = problem	n.s.	n.s.
Drinking 10 or more alcoholic drink in a month	1.683 (1.135; 2.497)	*
Smoking 6 or more cigarettes per day	n.s.	n.s.
Use of energy drinks during last year	n.s.	n.s.

	Overweight OR (95% CI)	<i>p</i> -value
Being under 18	n.s.	n.s.
Physical activity = hardly ever/rarely	1.969 (1.538; 2.521)	***
Low financial family situation	1.649 (1.145; 2.374)	**
Dissatisfied with health	2.132 (1.512; 3.007)	***
Dissatisfied with himself	n.s.	n.s.
High academic performance	n.s.	n.s.
I think am spending too much time to play = I agree	n.s.	n.s.
My parents tell me, that I am spending too much time to play = I agree	n.s.	n.s.
Gambler's profile = at risk	n.s.	n.s.
Gambler's profile = problem	1.804 (1.280; 2.542)	**
Drinking 10 or more alcoholic drink in a month	1.597 (1.160; 2.198)	**
Smoking 6 or more cigarettes per day	n.s.	n.s.
Use of energy drinks during last year	n.s.	n.s.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, n.s.: $p \geq 0.05$.

Being overweight was also associated with a family economic condition perceived as low (OR: 1.64 $p < 0.005$), being unsatisfied with his own health (OR: 2.13 $p < 0.001$), and problematic gambling profile (OR: 1.8 $p < 0.001$).

Finally, being underweight was associated with the statement “My parents tell me, I spend way too much time gaming” (OR: 1.8 $p < 0.001$).

No associations were found regarding being dissatisfied with himself, smoking 6 or more cigarettes per day, having a high academic performance, thinking he spends too much time playing, and using energy drinks.

4. Discussion

This study aimed to investigate the relationship between extreme BMI categories and potential addictive behaviors within a sample of Italian male adolescents. Concerning BMI condition, it emerged that among the youngest, there is a higher percentage of underweight boys, while the proportion of overweight and obese boys is higher among students aged 18–19 years (Figure 1). These results are consistent with other Italian surveys showing that the percentage of the population with higher BMI levels increases with age [50]. Physiologically, muscle mass increases during puberty in males and this could result in an increase in weight; this occurs especially in physically active and trained subjects. Moreover, our results could have been influenced by the period of development at the time of data collection. In fact, there is a physiological alternation of proceritas and turgor phases during development that could result in apparent underweight or overweight status [51].

The multinomial logistic regression model showed that lower levels of physical activity (hardly ever/rarely), compared to performing physical activity with a good frequency (often), are associated with a greater probability of being both underweight (OR = 1.62; 95%CI (1.22–2.15)) and overweight (OR = 1.96; 95%CI (1.53–2.52)). This is in line with other studies stating that both underweight and overweight boys tend to have a sedentary lifestyle [33,52,53].

Moreover, among underweight adolescents, our analysis also showed the risk from excessive videogame use attested by the positive association between underweight status and having parents who complain about the time spent by their sons playing videogames. No significant association emerged among overweight boys. This could depend on the higher prevalence of underweight among minors; therefore, boys are likely to still exhibit childlike behavior. Another possible explanation may refer to the assumption that being underweight could be a social stigma source for boys and playing games (alone or with digital playmates) can provide an escape from the pressing of social obligations and problems. This assumption is confirmed by Jacobs and colleagues [54] who observed an increased risk of social isolation due to extreme weight condition.

Our results also showed that the two BMI extremes (underweight OR = 1.68, 95%CI (1.12–2.50); overweight OR = 1.45, 95%CI (1.10–2.50)) are both linked to frequent alcohol consumption (twenty or more times in a month). Several authors concluded that the relationship between BMI and alcohol is very complex and still unclear [55–57].

Overweight adolescents also reported a lower family income (OR = 2.13, 95%CI (1.51–3.00)). This finding is in line with previous results [7,9,58] which underline the tendency of low-income households to purchase less healthful foods compared with higher income households [59].

Otherwise, according to other studies about the general population [35,36], overweight status is associated with gambling habit (OR = 1.92, 95%CI (1.35–2.74)). Black et al. speculated that the relationship between overweight and gambling could be mediated by a sedentary and unhealthy lifestyle due to the habits of sitting for long periods and having more chances for snacking [35]. However, the cross-sectional nature of this study does not allow us to make any causal inferences and it could also be that overweight boys tend to have a more problematic gambling behavior due to other causes.

Finally, although being overweight is not associated with the boys’ self-dissatisfaction, differently from what happens among girls [60–64], it is associated with a greater dissat-

isfaction about their own health condition. This could suggest psychological or general health concerns but not necessarily aesthetic ones.

Our study also shows that controlling for confounding variables, cigarette smoking is not associated with the BMI categories, in contrast with other literature results [28,29]. Nevertheless, it generally confirms the positive association between overweight and unhealthy habits (such as sedentary life and frequent alcohol consumption) in a national representative sample of adolescent boys. Moreover, it points out that a higher BMI level is positively associated with a problematic gambling profile in males. This relationship has been little analyzed but deserves particular attention because it may worsen the global picture both physically (i.e., gambling may imply sitting for long periods and changes in eating habits) and psychologically (i.e., negative consequences of problematic gambling).

It is also important to note that overweight and obese adolescents have received great attention from research because of the consequences of excessive weight on psychosocial health and the association with the development of non-communicable diseases during adulthood. Moreover, although our study did not directly look into mental disorders associated with higher BMI levels, considering the assumption of a potential relationship between these last two factors and the use of psychoactive substances and behavioral addictions [64–70] could be interesting to better investigate this association in future studies. Indeed, obesity is an alarming public health issue that often brings about other risk behaviors. Conversely, there is limited knowledge about underweight adolescents who have been poorly investigated in empirical research [71]. In addition, underweight boys also show unhealthy habits. They were more likely to consume alcohol frequently and have a sedentary lifestyle, underlining a U-shape relationship between these two variables and BMI. Moreover, our study suggests a positive association between being underweight and playing videogames. This aspect has received minimal research attention and merits more research in future as it may have a negative impact on relationship with peers and consequences on adolescents' social development.

Strengths and Limitations

The major strengths of this study are the consistent methodology used for collecting data and the large sample of Italian adolescent boys who filled the ESPAD questionnaires. The sample is representative of the national adolescent population.

Furthermore, this study is specially focused on males, providing information on a sample that is less investigated in regard to the Body Mass Index and its correlates.

Despite the strengths, some limitations should be mentioned. Firstly, we used a self-report questionnaire with its common limitations (e.g., memory recall biases and social desirability biases). Secondly, this is a cross-sectional study, so it does not allow us to establish causal relationships between risk factors and outcomes but only their associations. Thirdly, the prevalence of obese boys in our sample was very low so they were grouped with the overweight ones. This implies a loss of the provided information. Finally, not having information on the possible presence of eating disorders represents a limitation of the present research; nevertheless, their prevalence among males in Italy is very low, 0.3–2% [50], and it was interesting to analyze the possible association of BMI with risk factors apart from eating disorders.

5. Conclusions

This study's findings provide evidence that both extreme values of BMI are associated with risky behaviors and unhealthy lifestyle, with a common habit of frequent alcohol consumption. These behaviors, as a whole, can negatively affect personal and social life with possible consequences during adulthood. Further research is needed, especially focusing on male adolescents.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/adolescents2010012/s1>; File S1: Descriptive table; File S2: ESPAD_METHODODOLOGY.

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Informed Consent Statement: To achieve the survey goals, CNR requires the authorization of the selected school principals to participate in ESPAD-Italia[®]. The survey is included in the Scholastic Plan for Education (Decree of the President of the Italian Republic n.275/1999, Art. 8), edited and approved by Collegial Bodies, including teachers, parents, and students (Legislative Decree n.297/1994). There was no need to present any scientific ethical statement in order to collect data.

Data Availability Statement: Aggregated data presented in this study are available at: <https://www.politicheantidroga.gov.it/media/2445/339911.pdf> (accessed on 10 March 2022); https://www.emcdda.europa.eu/data/stats2018/gps_en (accessed on 10 March 2022). Microdata analyzed in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare that they have no conflict of interest, or affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge, or beliefs) in the subject matter or materials discussed in this manuscript.

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