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Mon, Apr 8, 2024 at 6:08 AM

Measuring the impact of information sources about substance consumption on adolescents' smoking behaviour: a cross-sectional evaluation

Manuscript Number: HELIYON-D-24-17992

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Abstract:

Background: This study examines the impact of the perceived level of information that adolescents claim about substance use on three smoking methods for consuming tobacco or its active principle, nicotine: cigarettes, e-cigarettes, and hookah. It also explores whether the sources of this information are monitored by public authorities and legislation (schools, parents, and mass media) or not (peers, siblings, and the internet). Methods: We conducted a cross-sectional survey among adolescents in the city of Tarragona. The variables assessed included the level of information regarding substance consumption perceived by the adolescents and the number of monitored and unmonitored sources from which they obtained their information. The information variables were controlled by four individual variables (gender, age, aggressiveness, and rebelliousness) and four environmental variables (family support, family control, peer influence, and religiosity). Results: We observed that while the degree of information that adolescents claim to have regarding substance use is not related to smoking behaviour in any of its forms, the number of monitored and unmonitored sources of information has a significant relation with these behaviours. Information from sources monitored by public authorities consistently has a protective effect. For cigarette consumption, the odds ratio (OR) was 0.626 ($p = 0.014$); for vaping, OR = 0.696 ($p = 0.005$); and for hookah use, OR = 0.620 ($p = 0.004$). In contrast, information from unmonitored sources appears to stimulate consumption. For cigarette consumption, OR = 1.591 ($p = 0.018$); for vaping, OR = 1.818 ($p = 0.002$); and for hookah smoking, OR = 1.930 ($p < 0.001$). Conclusions: These findings have implications for health education and promotion, emphasizing the importance of considering both monitored and unsupervised information sources about substance use, particularly in relation to adolescents' smoking behaviour. The results of the statistical analysis suggest that information from supervised sources regarding the consequences of substance use may inhibit smoking. Analogously, the information obtained from sources with no oversight is linked with greater smoking prevalence.

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To: Samuel PD Anantadjaya <ethan.eryn@gmail.com>

Manuscript Number: HELIYON-D-24-17992

Title: Measuring the impact of information sources about substance consumption on adolescents' smoking behaviour: a cross-sectional evaluation

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Manuscript Number: HELIYON-D-24-17992

Measuring the impact of information sources about substance consumption on adolescents' smoking behaviour: a cross-sectional evaluation

Dear Dr Anantadjaya,

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Measuring the impact of information sources about substance consumption on adolescents' smoking behaviour: a cross-sectional evaluation

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Manuscript Number:	HELIYON-D-24-17992
Article Type:	Original Research Article
Section/Category:	Social Sciences
Keywords:	Adolescents; smoking; tobacco use; nicotine; information sources; Health literacy
Abstract:	Background: This study examines the impact of the perceived level of information that adolescents claim about substance use on three smoking methods for consuming tobacco or its active principle, nicotine: cigarettes, e-cigarettes, and hookah. It also explores whether the sources of this information are monitored by public authorities and legislation (schools, parents, and mass media) or not (peers, siblings, and the internet). Methods: We conducted a cross-sectional survey among adolescents in the city of Tarragona. The variables assessed included the level of information regarding substance consumption perceived by the adolescents and the number of monitored and unmonitored sources from which they obtained their information. The information variables were controlled by four individual variables (gender, age, aggressiveness, and rebelliousness) and four environmental variables (family support, family control, peer influence, and religiosity). Results: We observed that while the degree of information that adolescents claim to have regarding substance use is not related to smoking behaviour in any of its forms, the number of monitored and unmonitored sources of information has a significant relation with these behaviours. Information from sources monitored by public authorities consistently has a protective effect. For cigarette consumption, the odds ratio (OR) was 0.626 ($p = 0.014$); for vaping, OR = 0.696 ($p = 0.005$); and for hookah use, OR = 0.620 ($p = 0.004$). In contrast, information from unmonitored sources appears to stimulate consumption. For cigarette consumption, OR = 1.591 ($p = 0.018$); for vaping, OR = 1.818 ($p = 0.002$); and for hookah smoking, OR = 1.930 ($p < 0.001$). Conclusions: These findings have implications for health education and promotion, emphasizing the importance of considering both monitored and unsupervised information sources about substance use, particularly in relation to adolescents' smoking behaviour. The results of the statistical analysis suggest that information from supervised sources regarding the consequences of substance use may inhibit smoking. Analogously, the information obtained from sources with no oversight is linked with greater smoking prevalence.

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Measuring the impact of information sources about substance consumption on adolescents' smoking behaviour: a cross-sectional evaluation

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Abstract

Background: This study examines the impact of the perceived level of information that adolescents claim about substance use on three smoking methods for consuming tobacco or its active principle, nicotine: cigarettes, e-cigarettes, and hookah. It also explores whether the sources of this information are monitored by public authorities and legislation (schools, parents, and mass media) or not (peers, siblings, and the internet). Methods: We conducted a cross-sectional survey among adolescents in the city of Tarragona. The variables assessed included the level of information regarding substance consumption perceived by the adolescents and the number of monitored and unmonitored sources from which they obtained their information. The information variables were controlled by four individual variables (gender, age, aggressiveness, and rebelliousness) and four environmental variables (family support, family control, peer influence, and religiosity). Results: We observed that while the degree of information that adolescents claim to have regarding substance use is not related to smoking behaviour in any of its forms, the number of monitored and unmonitored sources of information has a significant relation with these behaviours. Information from sources monitored by public authorities consistently has a protective effect. For cigarette consumption, the odds ratio (OR) was 0.626 ($p = 0.014$); for vaping, OR = 0.696 ($p = 0.005$); and for hookah use, OR = 0.620 ($p = 0.004$). In contrast, information from unmonitored sources appears to stimulate consumption. For cigarette consumption, OR = 1.591 ($p = 0.018$); for vaping, OR = 1.818 ($p = 0.002$); and for hookah smoking, OR = 1.930 ($p < 0.001$). Conclusions: These findings have implications for health education and promotion, emphasizing the importance of considering both monitored and unsupervised information sources about substance use, particularly in relation to adolescents' smoking behaviour. The results of the statistical analysis suggest that information from supervised sources regarding the consequences of substance use may inhibit smoking. Analogously, the information obtained from sources with no oversight is linked with greater smoking prevalence.

Keywords: adolescents; smoking; tobacco use; nicotine; information sources; health literacy

1 Introduction

While tobacco consumption is a health concern at any age, this is especially true during adolescence since it has a negative impact on adolescents' physical development and behavior [1,2,3]. The ongoing exposure of young people to components of tobacco, such as nicotine, has short- and medium-term negative consequences on the neural network function of the prefrontal cortex [4] and enables brain reward mechanisms for the use of other substances through a gateway effect [5,6]. Similarly, adolescent daily nicotine users experience acute impairments in verbal memory and working memory after smoking cessation [7]. Similarly, adolescent smokers have more frequent upper respiratory tract infections and are most likely to experience delayed lung development [6].

Furthermore, it is much more likely that an adolescent smoker will continue to smoke into adulthood and, at that age, will be more likely to quit smoking [3,8]. Tobacco is the principal preventable cause of death worldwide [9] and contributes to a wide range of diseases affecting various parts of the body and causing a great number of severe health problems, including heart disease, several types of cancer, and respiratory diseases [10].

The global trend in tobacco consumption among young people has declined since the late 20th century [11], including in Spain [12]. In this regard, among the various contributing factors, worldwide initiatives such as the Framework Convention for Tobacco Control [13] have played a significant role. However, nicotine is the second most commonly consumed psychoactive substance by adolescents in Spain [12].

The reasons mentioned in the previous paragraphs justify why the use of tobacco by adolescents has received increasing attention in the scientific literature over the past few decades [14]. We narrowed the study to tobacco use through inhalation, as this practice allows for various modalities, enabling a more detailed analysis of each modality. Specifically, we concentrate on the three primary modes of nicotine consumption among adolescents: traditional cigarettes, electronic cigarettes, and hookah [15], which are also common among Spanish teenagers [12]. Other methods, such as cigars, are comparatively less significant [12]. Currently, there is a notable and widespread decline in cigarette usage, primarily attributed to the diminishing prevalence of tobacco use and, to some extent, a substitution effect resulting from increased usage of electronic cigarettes and hookah [15,16]. Notably, vaping has emerged as the predominant form of nicotine consumed among adolescents in Spain [12].

The effects of perceived information and its sources on smoking behaviors among young people have not been deeply researched in the literature. This is paradoxical considering that health literacy relies on providing trustworthy information and that higher health literacy leads to healthier lifestyles [17,18]. Consequently, there is a need to promote health knowledge among teenagers, emphasizing the significant role that schools play in this regard [19]. Indeed, tobacco use tends to be lower in individuals with higher health literacy, a pattern observed in both adults [18,20,21] and young people [22,23].

However, evidence of success in smoking prevention policies in schools is not conclusive [24]. Likewise, it is well known that mass media interventions have also been employed to prevent smoking through informative campaigns [25]. The opinion on the effectiveness of these campaigns is not unanimous. While [25] suggests that they are successful, the meta-analysis [26] casts doubt on this effect, which, if it exists, is quite limited. In this regard, the WHO advises its member states not to focus solely on health prevention programs based on information dissemination, as information alone does not guarantee a change in attitude toward tobacco [13]. Additional measures are deemed necessary, such as implementing higher taxes on tobacco and derivative products, prohibiting consumption in specific places or at certain ages, monitoring initiated policies [27], and neutralizing advertisements at the point of sale [28]. This reality has been observed in the European Union [29] within a tobacco use prevention context.

Furthermore, [30] observed in a sample of Swiss young men that those who reported having more information about substance consumption had a greater prevalence of substance use, including tobacco. Belzunegui et al. [31] reported similar results with a sample of Spanish adolescents. These authors refer to this finding as the "information paradox." One possible explanation for this issue is that health literacy requires information and that the sources of information are reliable, while not all sources are trustworthy [32,33]. For example, while information from professionals is commonly considered reliable [33], information from peers is less trustworthy [32], as it is subject to other considerations, such as having good time with friends [34], relieving stress [35], and adopting the normative behaviors of peer groups [36,37]. The Internet represents an emerging avenue for accessing health-related information [38]. Despite its significant potential to disseminate valuable healthcare information and its growing utilization by the public, there is a prevailing perception that it is often an unreliable source of healthcare [39].

There is an extensive body of literature exploring the relationships between individual factors (such as gender or personality) and contextual factors (for example, parenting style) and the prevalence of tobacco use [40]. However, studies examining the connection between sources of information and the level of information that adolescents believe possess the prevalence of tobacco use are much less common. This fact motivated this study, which examined the relationship between tobacco use and six widely recognized sources of information that impact health literacy among young people: school, parents, media, peers, siblings, and the internet [19,30,32,33,38,39,41]. Our study is grounded in the distinction that can be made about the level of regulation by public bodies and professional associations that govern the information provided to young people.

Information from the first three sources—school, parents, and media—undergoes oversight by state and semistate organizations, establishing an inherent presumption of reliability. Conversely, the last three sources—peers, siblings, and the internet—lack such regulatory control.

Schools serve as fundamental institutions for educating young people in various fields, encompassing both the sciences and humanities. This education, as outlined in [42], is designed to foster health literacy, positively influencing the health and well-being of youth [22, 23].

Parents, recognized as primary caregivers under the United Nations Convention on the Rights of the Child [43] and Spanish legislation, bear the responsibility for the healthcare of their adolescents. The Spanish Civil Code [44] specifies their duty to ensure well-being. It is logical to interpret that this duty includes providing reliable information regarding tobacco consumption. Certainly, it is imperative that adults' beliefs and knowledge about tobacco use be accurate. However, in general, it is reasonable to assume that the majority of legal guardians believe that tobacco is commonly viewed

as a negative substance and even as one of the most significant threats to public health, as shown by studies worldwide [45], in Europe [46] and in Spain [47].

Conventional media, including television, radio, and the press, operates under strict legislative and ethical codes, whose guiding principles are largely inspired by [13]. This includes campaigns providing information about the consequences of tobacco, such as the ban of tobacco advertising.

In contrast, information shared by friends, siblings, and online individuals lacks supervision, a deficiency apparent in both legislation (e.g., civil and professional ethics codes) and public administration. Consequently, the absence of regulations, especially on the internet, which is currently a main source of healthcare information [48], is tainted by the ease with which unreliable and even malicious information can be encountered [49].

This study assessed the relationship between adolescents' perceived level of information and the source of information on the prevalence of tobacco smoking in three ways: cigarettes, vaping and hookah. By following the above reflections, we differentiate whether the information source originates from outlets monitored by national or supranational laws or, conversely, whether there is limited or no oversight. As a preliminary analysis, we will describe the prevalence of different forms of tobacco consumption, the level of information respondents believe they possess regarding the consequences of substance use, which includes tobacco, and which sources are most relevant in obtaining information.

2 Theoretical framework

The framework used in this work is depicted in Figure 1. The variables of particular interest are those related to the adolescents' information regarding the use of substances by their peers. These variables pertain to both the perceived level of information provided by the adolescent and its source. Thus, we differentiate between monitored sources, on the one hand, and unmonitored sources, on the other hand, through which adolescents acquire information about substance consumption.

Among the explanatory control variables under scrutiny, four pertain to individual characteristics widely acknowledged in the literature, including gender, age, irritability, and the propensity to question authority. Furthermore, we also take into consideration variables associated with the adolescent's environment, such as parental style, peer influence, and religiosity.

[Insert here Figure 1]

2.1 Control variables

2.1.1 Individual factors

The first group of factors to consider when analysing tobacco use comprises those intrinsic to the adolescent [40]. Aside from age and sex, adolescents' temperament [40] plays a decisive role in tobacco use. In this paper, we consider the emotional state of the adolescent [50] and rebelliousness [51].

There is extensive documentation supporting the idea that elevated levels of depression and low moods facilitate tobacco use [52]. Factors such as the presence of anxiety [53] and stress [54,55] also contribute to such usage. In fact, some authors interpret these behaviors as a form of self-medication to cope with certain emotional states [36,56]. Aggressiveness is of particular interest due to its strong association with tobacco, which has a bidirectional relationship. On the one hand, individuals with

higher levels of irritability and impulsivity may turn to tobacco as a way to alleviate these mood states [57,58]. Additionally, adolescent tobacco users are more prone to engage in aggressive and antisocial behaviors [59,60,61].

The presence of clear descriptive rules for adolescents regarding substance use acts as a deterrent for such consumption [3]. Therefore, a teenager's tendency to question rules can encourage tobacco use [51,52,63].

2.1.2 Environmental factors

Given that social control is also a relevant factor in understanding adolescents' relationships with substances [57], supervision and parental control emerge as widely supported variables in the literature [51]. It is well documented that permissive attitudes of parents toward substance use increase the risk of tobacco use during adolescence, while parental disapproval acts as a protective factor [65,66,67,68]. Research indicates that the lack of parental supervision or control, a permissive parenting style, and the absence of consistent boundaries and rules encourage tobacco consumption [40,69,70,71,72,73]. Although parental control discourages tobacco use, it is widely recognized that an authoritarian parenting style can be an enabler [30]; conversely, affectionate and democratic styles may inhibit such use [40,65,66,68,69,70].

Peer influence is the third pillar considered to explain tobacco consumption [34], given the ability of peers to induce subjective norms regarding substance use [3,35]. In fact, as we mentioned in the introduction, several of the most relevant motivations cited by adolescents for tobacco use are situations in which adolescents interact with their peers [38]. Therefore, various studies have also shown that tobacco use has a significant impact on the behaviour of adolescents' friends [3,34,35,67,74].

It is widely recognized that religious practices influence the behaviors and attitudes of adolescents [75], and social capital promotes the transmission of ethical values and, in general, encourages healthier lifestyles and resistance to risky behaviors [2]. The protective effect of religiosity in relation to smoking substances, including tobacco, has been firmly established in various beliefs and cultures [64,76,77,78].

2.2 Information sources

The literature has repeatedly reported that health literacy protects against smoking in young people and teenagers [22,23]. However, neither the information campaigns carried out in educational centres nor those carried out in the mass media necessarily have a significant effect [24,26]. Moreover, reports [30] in Switzerland and [31] in Spain also observe that more information about substance use among adolescents is paradoxically associated with increased tobacco consumption. This is what Belzunegui et al. [31] categorize as the "information paradox," in which greater information about substance use paradoxically goes against inhibiting its use and, therefore, contradicts having greater health literacy. One possible argument for these findings is that health literacy depends on the trustworthiness of the information sources [32,33]. For this reason, [31] emphasizes the importance of conducting a detailed analysis of the relationship between information sources and substance use.

We considered six potential sources of information (school, parents, media, peers, siblings, and the internet) commonly acknowledged for their link with health literacy [19,30,32,33,38,54]. Based on the degree of monitoring by public entities regarding the information these six sources provide, we can categorize them into two groups. The first group, comprising monitored sources, includes

schools, parents, and conventional media. Therefore, we can presume a priori that the information from these sources is reliable and has the objective of inhibiting tobacco use. In contrast, this aspect is not fulfilled in the case of the last three sources where such control does not exist.

As the primary institution for educating young people in various fields, both in the sciences and humanities, schools should strive to promote health literacy on health issues [19]. The significance of education in preventing tobacco consumption is also acknowledged in the document by the WHO [13] and in empirical research [41]. In the case of Tarragona, substance use prevention programs carried out in schools receive support from nearby healthcare centers and are overseen by public institutions and healthcare professionals [79].

According to Article 154 of the Spanish Civil Code [44], which regulates the obligations of parents, "parental authority, as parental responsibility, shall always be exercised in the best interests of sons and daughters, in accordance with their personality, and with respect for their rights, physical and mental integrity (...). It seems logical to interpret that this includes providing reliable information about the impact of tobacco on health. Similarly, Article 172 of the Spanish Civil Code stipulates the potential loss of custody when a child is left abandoned for reasons related to providing truthful information about substance use [80]. This includes ensuring essential care, compulsory schooling, attendance, medical care, and safety. In other words, responsible parental behavior should discourage the child from perceiving substance use as desirable.

Mass media content, encompassing television, radio, and the press, is subject to strict regulation through legislation and professional ethical codes. While the advertising and sponsorship of tobacco on television were banned in 1989 under the European Directive 89/552/EEC [81], the Directive on Tobacco Advertising 2003/33/EC [82] extends this prohibition to cross-border tobacco advertising and sponsorship throughout the EU across various media. This aligns with [13], who recognized the crucial role of advertising intervention in curbing tobacco consumption, meta-analysis [83] and empirical reports [41]. The ban covers print media, radio, and events involving multiple EU countries, such as the Olympics and Formula One races.

Despite these restrictions, public health authorities often leverage these media outlets to caution against the dangers of tobacco [25,26,30]. Moreover, the ethical code of the Spanish College of Journalists safeguards, among other issues, the accuracy of information disseminated in the media [84]. Additionally, in line with the special protection that minors must have toward tobacco exposure, content broadcasted on television during protected hours for children undergoes specific oversight in Spain by the National Commission of Markets and Competition [85].

Three sources of information that are considered to have virtually no control are those obtained from peers and siblings and those obtained from the internet. Their monitoring is practically nonexistent, both at the legislative level (for example, through civil code or professional ethics code) and on the part of public administrations, allowing the messages that adolescents receive to encourage substance consumption.

Preventive discourse about the harms of drugs such as tobacco is based on content related to health and possible long-term damage [86]. In contrast, the perception that peers and siblings can often convey is based on so-called "vitalistic presentism" [87], which is characteristic of adolescents: a way of being and existing in the world that leads them towards the immediate satisfaction of desire while at the same time restricting their ability to perceive the long-term risks of substance use and overestimating the immediate advantages that compensate for those risks. Thus, the information

transmitted by peers and siblings of similar age can influence other aspects associated with smoking, such as allowing for more fun with friends [31], relaxation [35], or providing status and glamour [3,37].

Internet-based media such as blogs, X (formerly Twitter), Facebook, or LinkedIn have enormous potential to provide health-related benefits, such as facilitating communication among professionals, providing information to the public, facilitating the building of peer support networks [88], or enhancing doctor–patient relationships [89]. Thus, in the context of substance use, the internet allows individuals to seek information that can be useful for avoiding substance use [90] as well as for the implementation of online interventions based on information and interaction with professionals [91], peers [92], or both [93].

However, the information circulated on the internet is subject to weak or nonexistent controls [91] and is negatively linked with health literacy according to reports such as [32] since despite the large amount of reliable information, there is also no trustworthy or even malicious information [45]. Its low control also generates problems such as adolescents being exposed to obtaining incorrect and scientifically unfounded information that can give a false sense of literacy [94]; exhibitions that glamorize the use of substances such as tobacco, for example, by peers or influencers [95]; or the possibility of acquiring substances that are legal for adults but not for minors without the need for the controls present in physical stores [95].

3 Materials and methods

3.1 Materials

The present study employed a cross-sectional survey conducted between February and March 2023. The survey aimed to collect data from secondary school students in Tarragona, Spain, using a structured questionnaire. The comprehensive survey, which included 66 variables, went beyond the scope of this study and needed an estimated 15 to 25 minutes for each participant to complete. The study participants consisted of teenagers in their concluding year of compulsory primary education, individuals in one of the two optional years of noncompulsory secondary education, or those enrolled in vocational training courses, covering ages ranging from 15 to 18 years (inclusive).

To execute this research, we obtained permission and assistance from school principals, facilitated by social workers from the Tarragona City Council. Surveys were implemented online in educational centres, where surveyed adolescents were provided with a hyperlink after authorization was obtained from legal guardians and to ensure the willingness of the adolescents to participate. The questionnaire was designed to allow participants to answer questions they deemed appropriate, enabling them to submit an incomplete questionnaire if desired. A social worker was present in the classroom during survey completion to provide support to respondents who needed assistance.

The study utilized a sample of 1307 observations selected from a population of 8000 teenagers. The surveyed adolescents belonged to 24 educational centers, half of whom were public and the other half were private; all the educational institutions in Tarragona were included. Consequently, the response rate was 16.34%, ensuring a margin of error below 3% [96]. Table 1 indicates that out of the total respondents, 608 were female and 669 were male. The age range of the participants varied from 13 to 18 years.

In the sample, 53.56% of the respondents were either 16 years old or younger. The average age of the adolescents was 16.44 years (standard deviation=0.96 years). Regarding the sex distribution, 46.52% were females, and 51.19% were males.

The largest proportion of the responses were from teenagers born in Spain (87.99%). Among the respondents, the overwhelming majority, approximately 95% (1186), lived with at least one parent. Similarly, 67.25% of the respondents reported that both of their parents were born in Spain, while 22.88% reported that. Additionally, 9.87% of the respondents mentioned having one parent born abroad.

This paper specifically addresses certain items from the overall questionnaire that are specifically linked to the theoretical background presented in section 2 and depicted in Figure 1. Table 2 presents the questions and the descriptive statistics of the responses.

The questions pertaining to individual control variables are gender, age, rebelliousness, and irritability. The latter two variables consist of scales comprising 7 and 5 items, respectively. Environmental factors were also measured with psychometric scales. The environmental factors used in the paper were parental support (5 items), parental control (8 items), peer influence (4 items), and religiousness (12 items). Rebelliousness, peer influence and irritability were measured on a 5-point Likert scale, and parental support, parental control and religiosity were measured on a 4-point Likert scale. The questions of all these items and the semantics of the scales are displayed in Table 2.

The questions related to information referred to the consequences of substance consumption. Thus, they included but were not limited to tobacco and/or nicotine. The questions covered the perceived level of information that the teenagers possessed and its source. The perceived information level was assessed by using the single item “Do you consider yourself well informed about the consequences of substance consumption?”. The answers were given on a 5-point Likert scale ranging from 1, “completely disagree”, to 5, “completely agree”. More details can be found in Table 2.

Questions regarding information sources, both supervised (school, parents, and mass media) and nonmonitored (internet, siblings, and peers), were answered dichotomously. It should be emphasized that concerning mass media, classic media such as television newspapers and magazines (in print) should be considered. These are typically consulted by "parents and grandparents." Regarding the internet, we referred to all resources that adolescents voluntarily consult, regardless of the type: social media, YouTube videos, blogs, etc.

The dependent variables were associated with the use of tobacco, including cigarettes, vaping, and hookah, within the past 30 days. For each of these smoking models, the level of usage was encoded using a five-point Likert scale, as presented in Table 2 and Table 3.

[Inset Table 1 here]

[Inset Table 2 here]

3.2 Data analysis

3.2.1 Definition of the variables and measures

All the variables used in this study are defined in Table 3. The individual control variables refer to sex and age, rebelliousness, and irritability. The first environmental variable measure was parental style, which was reflected in the perceived support of the adolescent (parental support) and the

control exerted by the parents (parental control). Additionally, we explore the influence that peers have on adolescents (peer influence) and their religiosity. While sex and age are defined as dichotomous variables, the rest are extracted from the well-known questionnaire developed by Planet Youth [97], which has been used in several studies, such as [98]. Consequently, the construct scales in this questionnaire have undergone extensive validation using various databases, and factors measured by means of scales are quantified as the standardized factor loading of the items in the scale. The most precise definitions of the variables can be found in Table 3.

The information is presented in Table 2. These strains are categorized into two groups. The first group measures the perceived quality of information the adolescent possesses regarding substance use (information level) and the sources from which such information originates (school, parents, mass media, internet, siblings and peers).

The question associated with information level, depicted in Table 2, is initially represented on an ordinal scale with potential values of {1,2,3,4,5}. To answer this question, we quantified the extent of information the adolescent possessed concerning substance use by normalizing the answers to [0,1], as shown in Table 3.

With respect to how adolescents access information about substance use, a distinction can be made between monitored or controlled sources, encompassing schools, parents, and mass media. In this context, "monitoring" pertains to the substantial control that public bodies can exercise over all information disseminated by schools and media concerning substances such as tobacco. As stipulated by the Spanish Civil Code, parents and legal guardians bear the responsibility of ensuring the well-being of their children and acting in their best interest. Consequently, we can deduce that the information parents must convey to their children regarding tobacco use is implicitly contingent on the welfare of the children, albeit with a more lenient approach.

Second, nonmonitored sources, such as the internet, siblings, and friends, were considered. As outlined in the theoretical framework, the regulation of information from these sources is not governed by any legal framework, and oversight by public authorities is practically nonexistent.

For all these questions, an affirmative response is quantified as 1, and a negative response is quantified as 0. Thus, the total number of monitored information sources is calculated, and sources with no supervision are defined as {0,1,2,3}. We subsequently defined the variables linked to exposure to nonregulated sources (NON_MONIT_S) and to those monitored (MONIT_S) as their normalized sum in [0,1], as displayed in Table 3.

While NON_MONIT_S and MONIT_S do not capture the intensity of each specific medium impact on the adolescent, they do indicate the intensity with which the two sets of sources we have differentiated are recognized as being used. A specific set of information sources must have more impact if the adolescent recognizes a greater quantity of them as influential. For example, if the adolescent acknowledges having information about the consequences of tobacco from both school and parents, contact with supposedly monitored and discouraging information about consumption occurs for a longer time than if it comes from only one of them. Moreover, each source adopts a different perspective that can complement another. For instance, in school, information about the consequences of tobacco use comes from professionals, while that provided by parents may originate from closer experiences, such as those related to the experiences of close family members.

Finally, the output variables are quantified as ordinal groups about the smoking frequency indicated in the questionnaire.

[Insert Table 3 here]

3.2.2 Data analysis

The basic descriptive statistics for the study were obtained using a spreadsheet, while subsequent analyses were performed using SPSS 25. Initially, we assessed the scale reliability of the factors rebelliousness, irritability, parental support, parental control, peer influence, and religiousness; the specific items of these factors are presented in Table 2. To determine the scales' reliability, conventional measures such as Cronbach's alpha (α), convergent reliability (CR), and average variance extracted (AVE) were employed. The scales were deemed reliable if α and CR > 0.7 and AVE > 0.5. Additionally, we provided basic descriptive statistics for both the information factors and the output variables.

Next, we conducted a hierarchical regression analysis of the three methods of smoking that we evaluated. Given that all these variables are ordinal and have more than two categories, we employed ordered logistic regressions for adjustment. The hierarchical analysis comprised two stages. In the first stage, individual and environmental variables were considered explanatory factors. In the second phase, we introduced variables related to the information available to the teenagers.

To determine the suitability of introducing information-related variables, we compared the values of Akaike's, Schwartz's, and Hannan–Quinn information criteria for both models—one without information variables and the other considering them. If the inclusion of informative variables resulted in a reduction in the values of the information criterion, it was deemed appropriate.

4 Results

4.1 Descriptive analysis of survey and scale reliability

Table 2 shows that the majority of adolescents had not consumed tobacco or nicotine in any of the studied forms for 30 days. Only a total of 14.99% reported having smoked cigarettes, 21.36% reported using electronic cigarettes, and 15.01% used a hookah. Similarly, those adolescents who, to a greater or lesser extent, acknowledged having consumed tobacco daily in any of the modalities were very much in the minority. Only 6.73% consumed cigarettes daily, 3.3% did so by vaping, and 1.01% did so with a hookah. These prevalences could be slightly higher, as between 3.21% of respondents (in the case of cigarette consumption) and 4.13% (in the case of vaping) did not respond to the question regarding prevalence in smoking modes.

Table 2 shows that adolescents generally feel well informed about substance use. Approximately 36.73% of the respondents mostly agreed with this statement, and 42.08% of the responses indicated complete agreement.

Table 4 shows the number of supervised and nonmonitored sources, as well as the total number of information sources recognized by the respondents. On average, the total number of information sources is 3.40 (SD=1.01), with the most common quantities being 4 (23.18%) and 3 (20.89%). The average number of monitored information sources was 1.97 (SD=0.99), with 3 being the most common quantity (34.51%), followed by 2 (30.07%). The average number of non-supervised sources was 1.44 (SD=0.94), with 1 (34.35%) being the most common, followed by two sources (28.69%). The fact that respondents are more exposed to monitored information sources than information sources with no oversight is confirmed by Student's t test on differences in means of paired samples.

The difference in the average number of supervised vs. nonmonitored sources (0.53, SD=1.01) was significantly different from 0 ($p<0.0001$).

The results in Table 5 indicate that, in general, all the scales are reliable. This conclusion is especially evident for parental control, peer influence, and aggressivity. However, it must also be noted that rebelliousness has an AVE that is slightly lower than 0.5. Thus, the consistency of the scale for rebelliousness must also be accepted because the CR significantly exceeds 0.6 [99].

[Insert Table 4 and Table 5 here]

4.2 Regression analysis of the consumption variables

Tables 6, 7, and 8 present the results of the adjustments for the different methods of tobacco consumption using hierarchical ordered logit regressions. All three categories of tobacco use were adjusted when variables related to information were not considered to yield statistically significant models. The maximum likelihood ratio test of these models indicates that three regressions are significant at a level of <0.01.

For all three assessed forms of tobacco consumption, the inclusion of information variables significantly enhances the obtained adjustments, and the relationship between variables related to information and the intensity of consumption remains unchanged. For all the evaluated modes of nicotine consumption, we found that the perceived level of information provided by the adolescent was not significantly related to the prevalence of nicotine. A greater number of monitored information sources is negatively associated with smoking incidence. Conversely, nonmonitored sources had a positive relationship with smoking incidence in all the evaluated forms.

The pseudo R2 values show a noticeable improvement when introducing information variables. For cigarettes (Table 6), this measure increased from 7.89% to 9.64%; for vaping (Table 7), it increased from 4.45% to 5.93%; and for hookah (Table 8), it increased from 7.72% to 8.95%. Furthermore, the values of all the information criteria used (Akaike, Schwartz, and Hannan-Quinn) decrease in the models that incorporate information variables. Therefore, subsequent analysis of the significance of explanatory factors is performed over the models that include information variables.

Regarding variables related to the information available to the adolescent, we can observe that the information level is not related to the adolescent's tobacco use. However, the extent to which the adolescent derives information from monitored sources or non-supervised sources does have an impact. The relationship between the supervised sources and tobacco use was inhibitory. For cigarettes, OR=0.626 ($p=0.014$); for vaping, OR=0.620 ($p=0.004$); and for hookah, OR=0.596 ($p=0.005$). On the other hand, the tendency to obtain information from uncontrolled channels (the Internet, siblings, and peers) was a risk factor for tobacco use in all the forms analysed. For cigarettes, OR=1.591 ($p=0.018$); for vaping, OR=1.930 ($p<0.001$); and for hookah, OR=1.818 ($p=0.002$).

Among the individual variables, sex was not significantly related to the tendency to consume tobacco in any of the evaluated modalities. Age, although acting as a facilitator of tobacco consumption in all cases (since OR>1 in all cases), was statistically significant only in the case of cigarette consumption (OR=1.401, $p=0.001$). Furthermore, the tendency to question norms can also act as an enabler of adolescents' tobacco consumption, as indicated by an OR > 1 for all three analysed forms. However, we observed statistical significance only for cigarettes (OR=1.177, $p=0.008$).

On the other hand, the irritability of the adolescent acts as a significant facilitator of consumption in all analysed consumption modalities. For cigarettes, OR=1.250 ($p<0.001$); for vaping, OR=1.157 ($p=0.005$); and for hookah, OR=1.293 ($p<0.001$).

Among the environmental variables, neither of the two related to parental style (parental support or parental control) was significantly correlated with the adolescent's tendency to smoke nicotine in any modality. Being involved in a religion, while the OR point estimates showed a protective effect (OR < 1), was statistically significant only for cigarette consumption (OR=0.863, $p=0.019$).

Undoubtedly, the most significant environmental variable is the influence of peers, which acts as a clear enhancer of all tobacco consumption modalities. For cigarettes, OR=1.287; for vaping, OR=1.209; and for hookah, OR=1.217, with $p<0.001$ in all cases.

[Insert Table 6, Table 7 and Table 8 here]

5 Discussion

This study examined the correlation of information variables (perceived amount and sources), that are moderated by four individual variables and four environmental factors on the prevalence on tobacco smoking. Specifically, the modes of consumption studied were cigarettes, electronic cigarettes or vaping, and hookah.

The results concerning the information variables are consistent across all the forms of smoking analysed. On the one hand, the amount of information that adolescents perceive about substance use is not significantly different. This finding contrasts with that of [30,31], who reported that perceiving more information leads to a greater tendency to smoke, as well as that of [22,23], which indicates that greater health literacy is negatively related with tobacco consumption. However, we understand that this does not contradict the analysis conducted, as it reconciles both positions.

On the other hand, information obtained from supervised sources, which are presumably trustworthy, os negatively linked with smoking behaviour. In contrast, the information sources that have not public oversight (peers, the internet, and siblings), are linked with greater smoking prevalence.

The findings of this study have significant implications for shaping tobacco consumption prevention policies among young people, providing crucial insights into the impact of information sources on smoking behaviors. The study reveals that merely increasing information about substance use does not necessarily lead to a decrease in smoking-related behaviors. Instead, the effectiveness of information depends on its source, with regulated sources deemed protective demonstrating a significant mitigating effect on tobacco use among adolescents.

The study advocates for targeted campaigns addressing substance use, especially tobacco, in schools and the media. These regulated information sources prove to be particularly protective, emphasizing the importance of interventions that leverage these platforms to disseminate accurate and impactful information. Conversely, the study underscores the need for authorities to implement interventions to shield adolescents from unregulated information sources, which are associated with higher tobacco prevalence.

The role of the internet in influencing tobacco use is highlighted, with a recognition of its potential to provide useful information as well as misinformation that may encourage tobacco use. The study suggests the importance of educating young people to discern between trustworthy and unreliable

information and equipping them with tools to identify and protect themselves from peer-driven information that promotes tobacco use.

The study contributes to the ongoing debate about controlling minors' access to sensitive content on the internet, proposing an expansion of this discourse to include content that may encourage substance use. It recommends interventions that enable teenagers to access useful health resources while immunizing them against harmful and unreliable information. This twofold approach involves shielding individuals from negative influences and raising awareness among tobacco-using adolescents about the detrimental impacts of advocating for tobacco use on susceptible peers.

Furthermore, the study emphasizes the need for health authorities to monitor and regulate sources of information about substance use, ensuring the dissemination of reliable information. The proposed interventions extend to online platforms, aiming to create a balance between providing useful resources for health and protecting adolescents from harmful influences. Overall, the study suggests a comprehensive approach to shaping policies and interventions that address both the sources and content of information about substance use among young people.

Regarding prevalence, we observed that tobacco use in the last 30 days ranged between 14% (cigarette use) and 20% (vapping) that could be slightly greater when considering that the percentage of nonanswers recorded fluctuates between 3.21% and 4%. According to a survey on substance consumption among Spanish adolescents [12], also referring to the year 2023, the prevalence of cigarette (conventional and electronic) consumption is 21% for individuals aged between 14 and 18 years. In other words, the prevalence recorded in our study is quite consistent with that in a previous report [12].

The most significant individual variable was adolescent irritability, which was evident in all the evaluated smoking modalities, regardless of whether the considered information variables were included. This result could reinforce the interpretation of tobacco use as a form of self-medication to cope with certain emotional states [56]. Additionally, this result aligns with the positive relationship reported in the reviewed literature between tobacco consumption and aggressiveness [57,58,60,61].

Among the environmental variables, the most relevant is the influence that peers have on smoking behaviour. This relationship was significant for tobacco use in all modalities, both in models that included variables related to information and those that did not. The fact that it is a particularly relevant variable is consistent with the results obtained by a significant portion of the reviewed literature [34,35,36,64,67].

We observed that religiosity provides adolescents with significant protection against cigarette use, which is consistent with the findings of various analysed reports [64,76,77,78]. It is also noteworthy that the variables related to parental style (were not significantly related to any of the modes of smoking analysed. While these findings may contradict a significant portion of the reviewed literature, it should also be recognized that these variables have been shown to be less relevant in various studies than factors such as peer influence [67].

Notably, Spain shares prevalence rates of tobacco consumption with Western European states among the adult population, ranging between 20% and 30% [102], and common policies for preventing tobacco consumption [29]. Therefore, the results obtained in this study may be of interest in demographic environments similar to those of Tarragona in European Union countries. On the other hand, the fact that much of Spain's climate allows for adolescent socialization to take place

practically year-round in outdoor spaces is a stimulus for smoking that is not present in other European countries.

The results are more difficult to transpose to countries with tobacco rates very different from those in Spain, either because they are low, as is the case in many African countries, or because they are very high, as in certain Asian countries [100] and/or with prevention policies not governed by European Union directives.

6 Conclusions

This paper explores the connection between information sources and the consequences of substance use and the perceived level of information that adolescents perceive about the issue through a cross-sectional survey conducted in Tarragona (Spain). Our findings illuminate the pivotal role that supervision of these sources plays in shaping adolescent behaviors.

Our research revealed a notable trend: an increased number of supervised information sources exerted a significant negative relationship with tobacco use among adolescents, and a greater prevalence of unsupervised sources was linked with such behaviour. Additionally, the perceived level of information possessed by the adolescent did not significantly relate to the prevalence of any of the evaluated tobacco consumption forms. We believe that these findings have relevant implications for the development of interventions against smoking habits.

7 Limitations of the study

This study has several limitations that can be the subject of further research. In regard to the future implications of our study, we must remain attentive to the constantly evolving landscape of information dissemination. This study is based on a cross sectional survey. Therefore, the insights gleaned from our research should be interpreted with a degree of caution. The critical role that information sources play in shaping adolescent smoking behaviour needs ongoing research, particularly longitudinal studies, to provide a more comprehensive understanding of the phenomena.

It is important to emphasize that Tarragona is an urban center with an economy heavily dependent on the chemical industry and services, particularly tourism, and a migrant population of approximately 20%. Therefore, these findings may be applicable for extrapolation to similar socioenvironments, such as those near Barcelona or Madrid. However, caution is warranted when extending the results to teenagers in rural areas of Spain, where the primary sector plays a more significant role and where the immigrant population is comparatively smaller.

In the survey, adolescents reported binary information on whether they had obtained information from each of the evaluated sources. It would be interesting in future studies to introduce the intensity of exposure for each information source. Furthermore, the questions related to information were generally about the implications of "substance use" and not “tobacco use”. Tobacco is a primary substance consumed by adolescents, and they probably receive more information about it, given that it is a legal substance for adults. The increased accessibility for acquisition is countered by public authorities through stricter regulations and awareness campaigns. It is reasonable to assume that the

correlation between information variables related to substance use and those related to tobacco use is very high, so the former may closely approximate the latter.

Additionally, numerous individual and environmental variables are involved in tobacco consumption because it is practically impossible to capture all those reported in the literature. Therefore, we did not consider variables such as the genetic predisposition of adolescents, their level of self-esteem, the smoking status of parents and siblings, or the adolescent's relationship with their neighbourhood, which various studies have shown to be relevant [40]. Nevertheless, we understand that the considered variables allow for a balance between the parsimony of the estimated regression models and an appropriate number of control variables.

8 References

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10 Ethical issues:

(1) All participants and their legal guardians were informed about the study and the procedure; (2) anonymity of the collected data was ensured at all times; (3) the study was conducted with the authorization and support of the Tarragona City Council through its Committee for Addiction Prevention and the Department of Education of the Generalitat de Catalunya; (5) the study was elaborated in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the University Rovira i Virgili (CEIPSA-2021-PDR-39); and (6) questionnaire completion was voluntary for the children, with prior authorization from the school principal and their legal guardians.

11 Tables and Figures

Figure 1. Framework used in this paper to assess the prevalence of smoking in adolescents

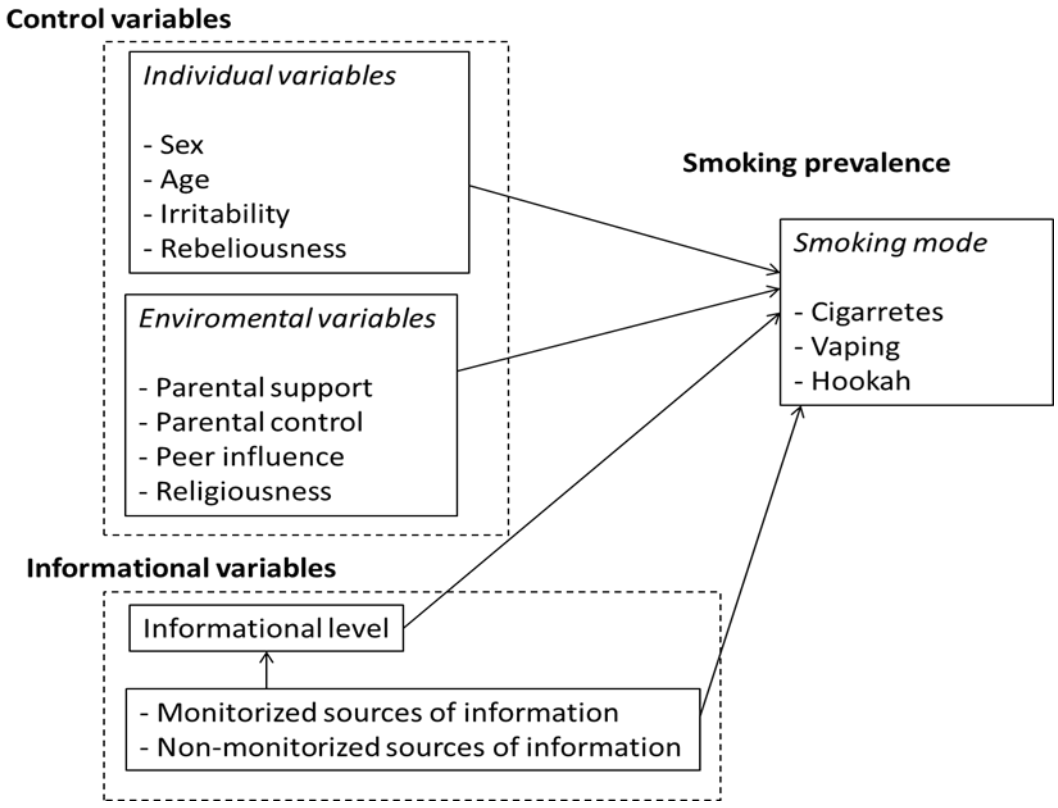

Table 1. Sample profile.

Category	Number of responses	Percentage
Sex		
Female	608	46.52%
Males	669	51.19%
NA	30	2.30%
Age		
>=17 years	573	43.84%
<=16 years	700	53.56%
NA	34	2.60%
(mean=16.44 years and SD=0.96 years)		
The adolescent lives with		
at least 1 parent	1186	90.74%
without parents	75	5.74%
NA	3	0.23%
Place where the adolescent was born		
Spain	1150	87.99%
Abroad	152	11.63%
NA	6	0.46%
Place where both parents were born:		
Spain	879	67.25%
Abroad	299	22.88%
Only one parent in Spain	129	9.87%

Note: NA stands for nonanswered.

Table 2. Proportions of the responses to the survey questions

Input questions						
IQ3: Rebelliousness	(1)	(2)	(3)	(4)	(5)	NA
Rules can be broken.	13.93	19.59	34.89	13.16	8.72	9.72
I follow the rules that I want.	11.09	14.77	22.49	27.85	16.22	7.57
It is hard to trust anything.	4.82	7.35	29.46	29.38	19.59	9.41
None can know what is expected of him/her in life.	4.36	7.19	23.95	30.99	24.87	8.65
You can never be sure of anything in life.	5.59	6.66	18.59	31.60	30.37	7.19
Sometimes, it is necessary to break the rules to succeed.	8.34	9.95	29.92	23.57	20.35	7.88
Following the rules does not guarantee success.	4.82	6.66	26.09	25.33	29.30	7.80
IQ4: Irritability	(1)	(2)	(3)	(4)	(5)	NA
I am often bothered or irritated.	13.01	20.58	26.78	21.73	13.39	4.51
I had felt of anger that cannot controlled.	33.05	26.70	16.45	11.78	7.35	4.67
I have wanted to break things.	42.16	24.18	13.77	8.26	6.89	4.74
I had a fight with someone.	51.26	21.35	13.24	4.13	5.05	4.97
I yelled at someone	49.66	21.35	13.16	5.66	5.05	5.13
IQ5: Parental support	(1)	(2)	(3)	(4)	NA	
I receive care from my parents.	2.83	4.74	18.97	68.32	5.13	
I have received help from my parents.	9.87	18.82	28.62	36.34	6.35	
I can talk about personal matters about important things.	4.59	8.11	24.56	57.54	5.20	
I have advice from my parents regarding my studies.	5.36	10.02	26.01	53.10	5.51	
I have advice from my parents regarding other topics.	3.75	7.57	23.11	59.76	5.81	
IQ6: Parental control	(1)	(2)	(3)	(4)	NA	
My parents consider it important that my studies go well.	0.61	2.75	26.55	65.49	4.59	
My parents state crisp rules in home.	4.21	8.72	41.85	38.41	6.81	
My parents state crisp rules about what I can do outside the house.	4.97	10.41	39.79	37.64	7.19	
My parents state crisp rules about when I have to be home in the evening.	7.27	14.08	36.19	34.28	8.19	
My parents know with whom I am at every moment.	3.52	6.20	23.11	59.07	8.11	
My parents know where I am at every moment.	2.91	4.36	21.96	63.12	7.65	
My parents know my friends.	3.29	6.89	26.32	57.77	5.74	
My parents know the parents of my friends.	10.64	17.29	34.97	29.00	8.11	
IQ7: Peer Influence	(1)	(2)	(3)	(4)	(5)	NA
Sometimes you have to smoke tobacco to be part of your peer group.	83.09	6.35	3.52	1.15	1.76	4.13
Sometimes you have to take alcohol to be part of your peer group.	76.36	9.87	6.12	1.91	1.30	4.44
Sometimes you have to consume cannabis to be part of your peer group.	85.00	4.36	3.29	1.38	1.53	4.44
Sometimes it is necessary to skip classes to be part of your peer group.	80.57	8.26	4.13	0.54	1.84	4.67

IQ8: Religiousness	(1)	(2)	(3)	(4)	NA	
I believe in God.	34.28	14.23	17.60	20.89	13.01	
My faith is important to me.	48.51	15.00	11.32	12.85	12.32	
I pray to God regularly.	59.76	13.24	6.43	7.35	13.24	
I regularly read the sacred texts of my faith.	59.91	14.61	5.66	6.43	13.39	
I regularly attend religious services.	60.75	14.46	5.05	6.20	13.54	
I regularly participate in religious activities other than services.	47.13	11.25	12.55	15.07	14.00	
I can obtain support from God if I need it.	44.61	10.94	14.92	16.99	12.55	
I sought support from God when I needed it.	42.31	18.13	14.08	9.95	15.53	
My best friends are religious.	34.28	16.83	21.04	13.31	14.54	
Most of my acquaintances are religious.	32.13	8.95	16.91	25.02	16.99	
My mother (adoptive/stepmother) is religious.	36.34	11.78	13.77	19.97	18.13	
My father (adoptive/stepfather) is religious.	37.45	10.67	11.56	20.97	19.34	

IQ9: Information level	(1)	(2)	(3)	(4)	(5)	NA
	2.22	3.21	10.48	36.73	42.08	5.28

My information about substance use come from:	Yes	No	NA
IQ10: School	66.26	26.78	6.96
IQ11: Parents/legal guardians	62.36	29.99	7.65
IQ12: Mass media	55.09	37.03	7.88
IQ13: Internet	65.88	27.24	6.89
IQ14: Siblings	23.41	68.25	8.34
IQ15: Peers and friends	44.68	47.13	8.19

Output questions	(0)	(1)	(2)	(3)	(4)	(5)	NA
OQ1: Cigarettes	81.79	5.81	2.45	3.52	1.53	1.68	3.21
OQ2: Vaping	74.52	14.77	3.29	1.61	0.54	1.15	4.13
OQ3: Hookah	80.95	11.02	2.45	0.69	0.08	0.84	3.98

Notes: (a) Information about the input questions IQ1 (sex) and IQ2 (age) is provided in Table 1.
(b) Quantities are presented as percentages.
(c) In the case of rebelliousness (Q3), peer influence (Q7), and information level (Q9): (1) completely disagree, (2) most disagree, (3) neither agree nor disagree, (4) most agree and (5) completely agree.
(d) In the case of irritability (IQ4), (1) almost never; (2) rarely; (3) sometimes; (4) often; and (5) almost always.
(e) In the case of parental support (IQ5), (1) very difficult, (2) difficult, (3) easy, and (4) very easy.
(f) In the case of parental control (IQ6) and religiousness (IQ8), (1) does not apply at all to me, (2) does not apply well to me, (3) applies quite well to me, and (4) applies very well to me.
(g) In the case of cigarettes (OQ1), vaping (OQ2) and hookah (OQ3): (0) Never; (1) Less than 1 cigarette (or its equivalent) in a week; (2) Less than one cigarette (or its equivalent) in a day; (3) between 1 and 5 cigarettes (or its equivalent) in a day; (4) Between 6 and 10 cigarettes (or its equivalent) in a day; and (5) More than 10 cigarettes (or its equivalent) in a day. (d) NA stands for nonanswered.

Table 3. Definition of variables used in regression analyses

Input variables	**Definition**
Individual variables	

(Control variables)	
Sex (FEMALE)	Dichotomous variable taking a value of 1 if the response comes from a girl and 0 otherwise. It comes from IQ1 in Table 2.
Age (AGE)	Dichotomous variable taking a value of 1 if the adolescent is 17 years old or older and 0 otherwise. It comes from IQ2 in Table 2.
Rebelliousness (REBEL)	Standardized factor score of the 7 indicators of the scale IQ3 in Table 2.
Irritability (IRRIT)	Standardized factor score of the 5 indicators of the scale IQ4 in Table 2.
Environment variables *(control variables)*	
Parental support (P_SUPP)	Standardized factor score of the 5 indicators of the scale IQ5 in Table 2.
Parental control (P_CONTR)	Standardized factor score of the 8 indicators of the scale IQ6 in Table 2.
Peers influence (PEER_INFL)	Standardized factor score of the 4 indicators of the scale IQ7 in Table 2.
Religiousness (RELIGION)	Standardized factor score of the 12 indicators of the scale IQ8 in Table 2.
Information variables	
Information level (INF_LEVEL)	Normalized value of IQ9 in Table 2, i.e., INF_LEVEL=(IQ9-1)/4
Normalized number of monitored sources (MONIT_S)	From Table 2, MONIT_S=(IQ10+IQ11+IQ12)/3
Normalized number of non monitored sources (NON_MONIT_S)	From Table 2, NON_MONIT_S=(IQ13+IQ14+IQ15)/3
Output variables	**Definition**
CIGARRETTES, VAPING and HOOKAH	Categorical variables whose intensity is graded as: (0) Never; (1) Less than 1 cigarette (or its equivalent) in a week; (2) Less than one cigarette (or its equivalent) in a day; (3) between 1

	and 5 cigarettes (or its equivalent) in a day; (4) Between 6 and 10 cigarettes (or its equivalent) in a day; and (5) More than 10 cigarettes (or its equivalent) in a day.

Table 4. Number of information sources reported by surveyed people (overall, monitored and nonmonitored)

	Number of sources									
Type of source	zero	one	two	three	four	five	six	NA	mean	SD
(a) Nonmonitored	16.1%	34.4%	28.7%	14%	---	---	---	6.89%	1.44	0.94
(b) Monitored	9.3%	19.2%	30.1%	34.5%	---	---	---	6.96%	1.97	0.99
(c) Overall	4.3%	7.7%	14%	20.9%	23.2%	13.3%	9.8%	6.9%	3.40	1.58
(a)-(b)	6.80%	15.20%	-1.40%	-20.50%					0.53	1.01

Note: (a) The difference in means between monitored and nonmonitored information sources is 0.56 and is significantly different from 0, with $p<0.0001$. (b) NA stands for nonanswered. (c) The mean difference between the number of monitored and nonmonitored information monitoring sources was 0.53 (SD=1.01), and Student's t test was 17.39 ($p<0.001$).

Table 5. Scale reliability measurement of the latent variables

	Cronbach α	Composite Reliability	Average Variance Extracted
Rebelliousness	0.796	0.854	0.459
Irritability	0.833	0.876	0.594
Parental support	0.856	0.904	0.664
Parental control	0.913	0.933	0.608
Peer influence	0.917	0.932	0.812
Religiousness	0.947	0.959	0.657

Table 6. Results of ordered logistic regressions for the consumption of cigarettes in the last 30 days

Individual factors	Odd ratio	p value	95%CI	Odd ratio	p value	95%CI
Sex	0.810	0.077	[0.642, 1.023]	0.807	0.083	[0.634, 1.028]
Age	1.532**	<0.001	[1.230, 1.909]	1.491**	0.001	[1.189, 1.869]
Rebelliousness	1.173**	0.007	[1.044, 1.317]	1.177**	0.008	[1.043, 1.328]
Irritability	1.228**	<0.001	[1.098, 1.373]	1.250**	<0.001	[1.115, 1.401]
Environment	Odd ratio	p value	95%CI	Odd ratio	p value	95%CI
Par. support	1.026	0.643	[0.919, 1.147]	1.063	0.292	[0.949, 1.192]
Parental control	0.909	0.284	[0.764, 1.082]	0.907	0.285	[0.758, 1.085]
Peer influence	1.279**	<0.001	[1.163, 1.407]	1.287**	<0.001	[1.166, 1.419]

Religiousness	0.853*	0.010	[0.756, 0.963]	0.864*	0.019	[0.765, 0.977]
Information	Odd ratio	p value	95%CI	Odd ratio	p value	95%CI
Perceived inf. level	---	---	---	0.796	0.351	[0.493, 1.286]
Nonmonit. sourc.	---	---	---	1.591*	0.018	[1.084, 2.337]
Monit. sources.	---	---	---	0.626*	0.014	[0.431, 0.908]
Pseudo-R2	7.89%			Pseudo-R2		9.64%
Akaike	969.10			Akaike		941.74
Schwatz	1029.72			Schwatz		1016.13
Hannan-Quinn	992.41			Hannan-Quinn		970.37
LR-ratio	80.79**			LR-ratio		91.14**

Note: * and ** denote statistical significance at the 5% and 1% levels, respectively.

Table 7. Results of ordered logistic regressions for vaping in the last 30 days

Individual	Odd ratio	p value	95%CI	Odd ratio	p value	95%CI
Sex	0.855	0.131	[0.698, 1.048]	0.839	0.101	[0.680, 1.035]
Age	1.265*	0.016	[1.045, 1.531]	1.205	0.062	[0.991, 1.465]
Rebelliousness	1.120*	0.029	[1.012, 1.239]	1.086	0.114	[0.980, 1.204]
Irritability	1.154**	0.005	[1.044, 1.275]	1.157**	0.005	[1.045, 1.281]
Environment	Odd ratio	p value	95%CI	Odd ratio	p value	95%CI
Par. support	0.948	0.279	[0.860, 1.044]	0.959	0.413	[0.869, 1.060]
Parental control	0.984	0.846	[0.839, 1.155]	0.997	0.967	[0.846, 1.174]
Peer influence	1.223**	<0.001	[1.117, 1.340]	1.209**	<0.001	[1.100, 1.330]
Religiousness	0.951	0.332	[0.859, 1.053]	0.958	0.408	[0.864, 1.061]
Information	Odd ratio	p value	95%CI	Odd ratio	p value	95%CI
Perceived inf. level	---	---	---	1.012	0.957	[0.659, 1.553]
Nonmonit. sourc.	---	---	---	1.930**	<0.001	[1.385, 2.690]
Monit. sources.	---	---	---	0.620**	0.004	[0.447, 0.860]
Pseudo-R2	4.45%			Pseudo-R2		5.93%
Akaike	1157.01			Akaike		1124.21
Schwatz	1217.63			Schwatz		1198.59
Hannan-Quinn	1180.32			Hannan-Quinn		1152.83
LR-ratio	52.73**			LR-ratio		68.86**

Note: * and ** denote statistical significance at the 5% and 1% levels, respectively.

Table 8. Results of ordered logistic regressions for the consumption of hookah in the last 30 days

Individual	Odd ratio	p value	95%CI	Odd ratio	p value	95%CI
Sex	1.184	0.143	[0.945, 1.484]	1.195	0.138	[0.945, 1.511]
Age	1.218	0.069	[0.985, 1.507]	1.190	0.120	[0.956, 1.480]
Rebelliousness	1.118*	0.049	[1.001, 1.250]	1.083	0.171	[0.966, 1.213]

Irritability	1.272	<0.001	[1.141, 1.418]	1.293**	<0.001	[1.156, 1.446]
Environment	Odd ratio	p value	95%CI	Odd ratio	p value	95%CI
Par. support	1.002	0.968	[0.898, 1.118]	1.019	0.743	[0.910, 1.141]
Parental control	1.050	0.591	[0.878, 1.256]	1.092	0.354	[0.907, 1.315]
Peer influence	1.283**	<0.001	[1.168, 1.410]	1.271**	<0.001	[1.152, 1.402]
Religiousness	0.946	0.331	[0.846, 1.058]	0.949	0.364	[0.847, 1.063]
Information	Odd ratio	p value	95%CI	Odd ratio	p value	95%CI
Perceived inf. level	---	---	---	0.858	0.526	[0.535, 1.376]
Nonmonit. sourc.	---	---	---	1.818**	0.002	[1.257, 2.628]
Monit. sources.	---	---	---	0.596**	0.005	[0.415, 0.856]
Pseudo-R2	7.72%			Pseudo-R2		8.95%
Akaike	834.87			Akaike		805.20
Schwatz	890.82			Schwatz		874.93
Hannan-Quinn	856.39			Hannan-Quinn		832.03
LR-ratio	62.14**			LR-ratio		76.21**

Note: * and ** denote statistical significance at the 5% and 1% levels, respectively.

12 Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as potential conflicts of interest.

13 Author Contributions

The contributions are JdA-S: Conceptualization, methodology, formal analysis, investigation, writing—original draft preparation, writing—review and editing. AB-E: Conceptualization, validation, resources, writing—review and editing, visualization, supervision, funding acquisition. IP-G: Methodology, validation, resources, visualization, supervision, project administration, funding acquisition. AS-A: Conceptualization, formal analysis, investigation, resources, writing—original draft preparation, visualization, supervision, project administration.

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15 Data availability statement

The data used to develop this paper are available upon request to any of the authors.

Full questionnaire in Spanish

Gmail

S A M <ethan.eryn@gmail.com>

[ORCID] Samuel PD Anantadjaya you have new notifications

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Re: My Comment for HELIYON-D-24-17992 [240408-008760]

Heliyon <info@heliyon.com> Mon, Apr 8, 2024 at 11:09 AM
Reply-To: Heliyon <info@heliyon.com>
To: ethan.eryn@gmail.com

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Measuring the impact of information sources about substance consumption on adolescents' smoking behaviour: a cross-sectional evaluation

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Re:My Comment for HELIYON-D-24-17992

郑晖 <zhenghui@cdutcm.edu.cn> Tue, Apr 9, 2024 at 5:56 AM
To: Samuel PD Anantadjaya <ethan.eryn@gmail.com>

Dear Samuel,
Please find the comments below.
1. The level of trustworthiness in media in this case may be questionable due to many distortions and lack of guidance from the experts in the field of tobaccos and nicotine. This will likely affecting the results of the intended trustworthiness in the media. These also affect the results of the parents and adolescence at large particularly if they are smoking in front of others.

2. in your sentences on line 46-55 on page 5 indicates the ironically of the situation about health literacy. Please use these facts to clarify further "Moreover, reports [30] in Switzerland and [31] in Spain also observe that more information about substance use among adolescents is paradoxically associated with increased tobacco consumption. This is what Belzunegui et al. [31] categorize as the "information paradox," in which greater information about substance use paradoxically goes against inhibiting its use and, therefore, contradicts having greater health literacy. One possible argument for these findings is that health literacy depends on the trustworthiness of the information sources [32,33]. For this reason, [31] emphasizes the importance of conducting a detailed analysis of the relationship between information sources and substance use."

3. in your sentences in line 47-52 on page 6 indicates the virtually no control of their peers and siblings. These could then be another factor to influence the smoking habits by adolescence; "Three sources of information that are considered to have virtually no control are those obtained from peers and siblings and those obtained from the internet. Their monitoring is practically nonexistent,
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Regards,
Hui Zheng

---------- Original ----------

From: "Samuel PD Anantadjaya"<em@editorialmanager.com>;
Date: Mon, Apr 8, 2024 02:09 PM
To: "Hui Zheng"<zhenghui@cdutcm.edu.cn>;
Subject: My Comment for HELIYON-D-24-17992

CC: inidengansam@gmail.com

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email: ethan.eryn@gmail.com

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S A M <ethan.eryn@gmail.com>

Re: My Comment for HELIYON-D-24-17992 [240408-008760]

Reviewer Support (ELS) <ReviewerSupport@elsevier.com> Tue, Apr 9, 2024 at 4:21 AM
Reply-To: "Reviewer Support (ELS)" <ReviewerSupport@elsevier.com>
To: ethan.eryn@gmail.com

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Samuel PD Anantadjaya (Reviewer 1)

Reviewer Recommendation Term:	*Accept*
Overall Reviewer Manuscript Rating:	*81*

Custom Review Question(s):	***Response***
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Is the study design, methodology and statistical analysis robust?	*Yes*
Are the conclusions in alignment with the results and discussion?	*Yes*
Is the revised manuscript scientifically sound and have all concerns been addressed?	*Yes*
Are there any new concerns resulting from the revisions?	*No*
Could the manuscript benefit from language editing?	*Yes*
Would you be willing to review a revised version of the manuscript?	*Yes*
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