A School-based, Multi-Component Intervention To Prevent Adolescent Tobacco and Cannabis Use: a Prospective Pilot Study from Hungary

Abstract

Background: Schools represent a key setting for substance use prevention during adolescence. Multi-component school-based programs aim to influence knowledge, attitudes, and social norms simultaneously, yet evidence regarding their effectiveness remains inconsistent.
Objective: This prospective pilot study aimed to assess the feasibility, acceptability, and indicative effects of a multi-component school-based intervention targeting tobacco and cannabinoid use among adolescents.
Methods: A prospective observational design was applied in a Hungarian secondary school. Anonymous self-report questionnaires were administered before, during, and after the intervention (n=417, n=497, and n=631, respectively). Outcome indicators included lifetime and 30-day prevalence of tobacco and cannabinoid use, knowledge, attitudes, and participation in individual program components.
Results: Participation rates differed substantially across intervention components, with peer-led and digitally mediated elements attracting higher engagement. Students who participated in peer group activities or prevention quizzes reported significantly lower rates of cannabinoid experimentation ($p<0.05$). No significant reduction in overall substance use prevalence was observed over time.
Conclusion: The pilot intervention proved feasible and acceptable within the school environment and successfully reached adolescents who had already experimented with tobacco or cannabinoids. While no clear reduction in prevalence was detected, the program enhanced transparency of substance use patterns and provided valuable insights for refining school-based prevention strategies.

Keywords: tobacco use, cannabinoids, adolescent substance use, school-based prevention, youth smoking prevention, multi-component intervention

Introduction

A significant proportion of adult smokers begin smoking during adolescence [1]. In light of this, it is concerning that, according to the 2016 Hungarian Youth Tobacco Survey, 25.5% of Hungarian adolescents used some form of tobacco product in the past 30 days [2]. Compared to adult smoking patterns, adolescent tobacco use is characterized by poly-use of different products [1] and a high tendency for progression [3]. Those who experiment with tobacco are at risk of quickly becoming regular users, and in some cases, consumption may increase exponentially [4]. In this context, it is crucial that preventive interventions target not only those who have already started smoking but also non-smoking adolescents – whether in medical settings [5], family environments, or schools [6]. During the academic year, adolescents spend the majority of their weekdays at school. Therefore, it is assumed that school-based health promotion programs may positively influence their health behaviors. However, the evidence regarding the effectiveness of school-based smoking prevention interventions is mixed and often contradictory [7,8]. Several studies suggest that such programs are relatively ineffective, while others report promising outcomes [9]. It is noteworthy that studies of lower methodological quality tend to report more positive results than higher-quality trials [7]. Moreover, meta-analytical approaches to this field are limited due to significant heterogeneity in intervention content, target groups, implementation methods, and durations [7,8]. With respect to long-term effects, the evidence base remains sparse [7,9]. Some studies even propose that such programs may merely delay the onset of smoking rather than prevent it altogether [10,11]. Nevertheless, delaying initiation may contribute to earlier and more successful cessation efforts, thereby reducing adult smoking prevalence and smoking-related mortality [12].

A Cochrane review of school-based tobacco prevention programs categorizes interventions into three major types [13]. Information-based interventions presume that adolescents who start smoking lack appropriate knowledge, and that education alone may prevent initiation [13]. Skill-building interventions are based on the assumption that underdeveloped personal and social competencies contribute to substance use; therefore, enhancing these skills may improve resistance to tobacco use [13]. Social influence interventions aim to raise awareness and develop coping strategies for environmental influences (e.g., peer pressure, family models, media portrayals) while clarifying prevailing social norms [13]. According to the review, skill-building and social influence models - particularly in combination - appear to outperform purely informational approaches [13]. Nonetheless, another meta-analysis questions these conclusions due to inconsistent results in randomized controlled trials [7]. In addition, multimodal programs, which integrate school, community, and family-level health promotion, remain relatively rare in both practice and literature [13].

The present study focuses on a pilot program that facilitates deeper understanding of preventive processes. The goal was to create a supportive school environment in which multiple forms of prevention could reinforce each other. The pilot phase was essential to ensure safe and scalable implementation in other educational institutions. The intervention's multi-component structure combined information dissemination, attitude shaping, and skill development. The program's preventive effect was not linear, but rather systemic—shaped by the interplay of community norms, student interactions, and credible information sources. Such an approach is particularly relevant in adolescence, a developmental period defined by strong social dynamics [13]. As the program employed a multi-component model, identifying direct causal relationships was not the primary objective. Instead, the focus was placed on constructing a complex preventive environment. The authors intentionally refrained from isolating the effect of individual elements—this was a deliberate methodological decision. Although the program was implemented in Hungary, the accessibility of tobacco and cannabinoid products, adolescents' digital socialization, and the pervasive influence of peer norms are global trends. Thus, the insights derived from this program may hold international relevance.

Methods

Design and Sampling

This study was conducted as a prospective observational pilot study in a Hungarian secondary and vocational art school. The primary aim was to assess feasibility, acceptability, and indicative trends rather than to establish causal effects. Data collection took place at three time points: prior to the intervention, during implementation, and after completion. The pilot design provided an opportunity to implement the program in an adapted, low-risk manner, free from planning flaws, while also laying

the groundwork for a subsequent large-scale controlled investigation. The intervention was conducted in a Hungarian secondary and art high school, where students completed questionnaires on three occasions: before the program, during its implementation, and after its conclusion. Parental informed consent was obtained through a written statement distributed in advance, covering participation in the program, data collection, and the use of anonymized, aggregated data for analysis. Participation in the survey was entirely voluntary.

The study was approved by the Regional and Institutional Human Biomedical Research Ethics Committee of the Albert Szent-Györgyi Clinical Centre, University of Szeged (ethical approval number: 4058, 83/2017-SZTE). During data processing, questionnaires containing implausible or incorrectly completed responses were excluded. Although an attempt was made to code the questionnaires to allow for the individual but anonymous tracking of students over time, the majority of adolescents failed to complete the codes correctly, resulting in the inability to conduct individual-level analysis. Consequently, we compared substance use patterns and changes in relevant predictors between different school grades, which may provide useful insights for planning grade-specific prevention programs. Additionally, participation rates in specific program elements were analyzed based on the second and third rounds of data collection.

Although the sample size does not allow for statistical generalisation, it provides valuable insights into the attitudes, responses, and real-life dynamics of the school environment. The first round of data collection took place before the program began, during which 417 valid questionnaires were completed by students, representing 49% of the total student population. During the implementation phase, 497 students completed the questionnaire, accounting for 58% of the school's enrolment. The final round of data collection occurred in the last year of the program, achieving the highest response rate of 74%, with 631 valid responses.

To enable longitudinal tracking, we focused on two school cohorts that participated in the prevention program and all three waves of data collection. These were referred to as Group "A" and Group "B". Students in Group A were in 9th grade at baseline, 10th grade during the program, and 11th grade at the final follow-up. This group comprised 175 respondents at the first measurement point, 134 at the second, and 157 at the third. Group B consisted of students one academic year senior to Group A. They were in 10th grade at baseline, 11th grade during the intervention, and 12th grade at the final measurement. The number of valid questionnaires completed in Group B was 51 at baseline, 137 during the program, and 178 at follow-up. To ensure the integrity of the follow-up analysis, only those students who participated in the program and completed all three surveys were included in the longitudinal comparison.

Instrument

Data were collected using a structured, anonymous self-administered questionnaire. The instrument was adapted from the Hungarian version of the Global Youth Tobacco Survey (GYTS), originally developed for cigarette use, and extended to cover a broader range of tobacco products and cannabinoids. Content validity was ensured through expert review by public health and behavioral science professionals involved in adolescent substance use prevention. Face validity was assessed during a pilot administration, confirming comprehensibility and age-appropriateness of the items. Key constructs included lifetime and 30-day substance use prevalence, knowledge regarding health risks, attitudes toward peer influence, and participation in program components. Internal consistency was considered acceptable for the attitudinal items (Cronbach's alpha >0.70).

This pilot intervention was designed to allow for the refinement of both content and methodology. To this end, we monitored changes in two widely used outcome indicators in school-based prevention studies: lifetime and 30-day prevalence of tobacco and cannabinoid use. Lifetime prevalence was defined as any instance of trying a tobacco product or cannabinoid at least once. The 30-day prevalence captured whether students had consumed such substances at least once in the past month. Importantly, we categorised tobacco use to include both combustion-based products (e.g. cigarettes, cigars, waterpipes, IQOS) and smokeless forms (e.g. snus, chewing tobacco, nasal snuff), as well as nicotine delivery devices that mimic smoking behaviour (e.g. e-cigarettes, e-pipes, e-pens, and heated stones). The cannabinoid category included both natural (e.g. marijuana) and synthetic cannabinoids (e.g. herbal blends).

In addition to these behavioural indicators, the study also focused on specific predictors, namely students' knowledge and attitudes regarding tobacco and cannabinoid use. To assess these, we adapted selected items from the Hungarian version of the Global Youth Tobacco Survey, originally

developed for cigarette use, to encompass the broader category of tobacco products and cannabinoids. Specifically, non-users were asked to indicate their perception of harm: "Do you think using tobacco products harms your health?" and "Do you think using marijuana or synthetic cannabinoids (herbal) harms your health?" The response options, based on the original GYTS, were: "Definitely not," "Probably not," "Probably yes," "Definitely yes," and "Don't know." For analytical purposes, responses were dichotomised: "Definitely yes" was considered a protective factor, while all other responses indicated uncertainty or risk.

Similarly, attitudes toward peer influence were measured with two parallel items: "If one of your best friends offered you a tobacco product, would you accept it?" and "If one of your best friends offered you marijuana or herbal, would you accept it?" Again, only the response "Definitely not" was coded as a protective factor, while all other options were grouped as risk-related. During the second and third data collection waves, participants were also asked about their involvement in the various program components ("Which programs did you participate in?"). Eight options were provided: quiz on tobacco and cannabinoids, school health consultation, participation in the peer-led prevention club (as community service), poster-based campaigns, health education sessions delivered by university students, guest lecture by a lung-transplanted ex-smoker, discussions with teachers, and the school's annual "Smoke-Free Day". Students could select multiple components.

Only the responses of those who had participated in the prevention program across all three years (i.e., the previously defined Group A and Group B) were included in the participation analysis. Participation rates in the program elements were statistically compared to the defined outcome indicators of monthly and lifetime prevalence.

Study Procedure

The intervention consisted of multiple prevention components implemented within the school environment, including peer-led activities, educational sessions, voluntary health consultations, and interactive events. Questionnaires were administered in classroom settings under teacher supervision at each measurement point. The prevention program consisted of the following elements. Students could participate in a quiz related to the use of tobacco products and cannabinoids, in which they competed for various prizes. They were encouraged to approach the school physician and the school nurse with their questions, and their attention was explicitly drawn to this opportunity. In addition, during the school health screening, the level of exhaled carbon monoxide was measured. In cases of elevated values, minimal intervention was provided in accordance with the Hungarian national guideline for smoking cessation support [5,14]. In order to strengthen non-smoking community norms, a school-based "student prevention group" was organized. Within this group, students implemented peer-led prevention programs under professional supervision. One such initiative involved placing prevention posters in various locations around the school.

Furthermore, students could participate in health education sessions delivered by pre-trained university health educators. These sessions went beyond mere information transfer; they also focused on skills development and addressing social influences. Additionally, students were exposed to real-life stories about the consequences of smoking, either through video presentations or through guest lectures delivered by a former smoker who had undergone lung transplantation. Efforts were also made to engage the school's teachers in the program. Teachers were given the opportunity to gain knowledge related to the prevention of tobacco and cannabinoid use. Subsequently, we emphasized that students should feel comfortable turning to them with their questions.

Finally, during the school's annual Health Day, a dedicated "Smoke-Free Day" was organized. On this occasion, students could enhance their knowledge related to smoking, cannabinoid use, and cessation through interactive activities at various booths. Within the content of the program components, the focus of information dissemination was primarily on the short-term effects of smoking—as opposed to long-term consequences—which were often perceived by students as abstract [5]. In addition, we promoted age-appropriate smoking cessation support tools, such as the national quitline, websites, mobile applications, and Facebook and Instagram pages designed to support quitting [5,15].

For students who were not receptive to cessation, the emphasis was placed on general health promotion [16]. During the program, special attention was given to critically discussing new types of so-called "harm reduction" tobacco products (e.g., e-cigarettes, heated tobacco products, snus). The goal was to help students understand the associated risks, misleading marketing strategies, and the

process of social normalization. The discussions often included students sharing their own examples, which created an opportunity for applying a psychoeducational approach.

Statistics

For the comparison of nominal variables, the Chi-square test was used. In cases where the minimum expected count of 5 per cell was not met in 2×2 contingency tables, Fisher's exact test was applied. For comparisons between nominal and metric variables, the independent samples t-test was employed. Where the assumption of homogeneity of variance was violated, the Welch test was used. For variables derived from categorical response options, means and standard deviations were calculated based on numerical coding of response categories, consistent with common practice in exploratory and pilot studies. Data analysis was carried out using the SPSS software package, with a significance level set at 5% ($p < 0.05$).

Results

Demographic Characteristics

During the study period, the gender distribution of the school's student body ranged between 27–28% adolescent males and 72–73% adolescent females. It is worth highlighting the considerable overrepresentation of females within the student population. Accordingly, during the first wave of data collection, 22% of the respondents were male and 78% were female; in the second and third waves, the proportions were 26% male and 74% female. The overall average age in the school ranged between 16 and 17 years. The mean age in the first year was 16.18± 1.05, while in the final year it was 16.51± 1.08.

Changes in Tobacco and Cannabinoid Use Patterns

Tobacco and cannabinoid use patterns across the three-year data collection period are summarised in Table 1. During the first questionnaire survey, conducted prior to the launch of the prevention program, 48% of respondents reported having tried some form of tobacco product in their lifetime. This overall lifetime prevalence increased continuously during the study, reaching 56% at the second data collection point and 58% at the third. Accordingly, a rising trend can be observed in the lifetime prevalence of the various tobacco products. The program may have contributed to more honest student responses, making previously underestimated usage rates visible. The increased prevalence data can thus be interpreted as a result of raising awareness of hidden usage patterns.

Newer and alternative product categories showed particularly pronounced increases in lifetime experimentation during the study period (Table 1). It should be emphasised that the prevention program merely responded to the emergence of these new types of products and did not promote their use. Students typically experimented with multiple types of tobacco products, and this also showed an increasing trend. At the time of the first data collection, students tried an average of 2.43 ± 1.21 types of tobacco products, which increased to 2.82 ± 1.31 by the third data collection.

While lifetime tobacco experimentation increased over time, recent (past-30-day) tobacco use remained comparatively stable (Table 1). In contrast to cigarette use, which remained between 19–20%, an increase was observed in the monthly use of alternative tobacco products. A notable increase was also recorded in the monthly prevalence of new types of products; for example, the monthly use of electronic cigarettes rose from 1% to 6%. Students typically used several types of tobacco products in the past 30 days, with this trend also increasing — from an average of 1.22 ± 1.21 to 1.62 ± 1.41 products.

Across the study period, natural cannabinoids predominated both in lifetime experience and recent use. Lifetime cannabinoid experience showed a moderate increase over time, whereas recent (past-30-day) use remained relatively stable. Concurrent use of natural and synthetic cannabinoids appeared uncommon (Table 1).

Table 2 summarises the lifetime and monthly prevalence of tobacco and cannabinoid use by school grade. Reviewing the data collected prior to the prevention program, a clear pattern emerges: the prevalence of tobacco and cannabinoid use increases with grade level. It is particularly noteworthy that, in the case of tobacco products, there is a marked increase in prevalence between 9th and 10th grade, followed by a slower progression between 10th and 12th grade. As for cannabinoid use, a gradual increase in prevalence can be observed. A similar trend is evident in the second and third rounds of data collection as well.

When examining the two cohorts that were followed across all three data collections, both lifetime and recent use indicators increased over time for tobacco products and cannabinoids. Overall, participation in the three-year program was not associated with a clear reduction in prevalence indicators, which may partly reflect increased honesty in self-reporting across repeated assessments (Table 2).

Changes in the Examined Predictors

The changes in the examined predictors over the three-year data collection period are summarised in Table 3. First, we present students' knowledge regarding the health risks of tobacco use. Most non-smoking students consistently reported high certainty regarding the health risks of tobacco use across the study period (Table 3). When examining the baseline data by grade level before the launch of the program, an increasing trend was observed between 9th and 11th grade, followed by a decrease between 11th and 12th grade. A similar pattern of increase can be observed in Group "A," which started the prevention program in the 9th grade, while in Group "B," which began the pilot program in the 10th grade, an increase followed by a decline can be seen.

Next, we present the findings regarding knowledge about cannabinoid use. It is worth emphasising that students showed significantly more uncertainty concerning the health risks associated with cannabinoid use. It is worth highlighting that students expressed significantly more uncertainty regarding the health impacts of cannabinoid use. At the first data collection point, 69% of students who had not used cannabinoids were certain that cannabinoid consumption is harmful to health. This proportion increased only slightly in the second and third data collection waves, respectively, essentially stagnating. When analysing baseline data by grade level, a slight increase in certainty can be observed between 9th and 10th grade, while from 10th to 12th grade, students became increasingly uncertain about the harms of cannabinoid use. A similar pattern is reflected in the data for Group "A," where an initial increase was followed by a slight decline. In Group "B," a continuous decrease was observed in the proportion of students who were confident about the harmfulness of cannabinoids.

Subsequently, we provide insight into students' attitudes toward rejecting tobacco and cannabinoid products. Refusal attitudes toward tobacco and cannabinoids showed no substantial improvement over time and varied by grade and cohort patterns (Table 3). This proportion essentially stagnated in the second and third data collections. When analysing the baseline data collected before the launch of the program, a decrease can be observed between 9th and 11th grade, followed by a slight increase between 11th and 12th grade in terms of rejecting tobacco products. A much more moderate decline is observable in Group "A," which started the prevention program in 9th grade, while an increase is evident in Group "B," which began the pilot program in 10th grade. Among students who did not use cannabinoids, a stagnation was observed in terms of rejecting cannabinoids across the three data collections. At the time of the first data collection, a marked initial decrease is visible between 9th and 10th grade, followed by a steady increase between 10th and 12th grade in the rejection of cannabinoids. In the case of Group "A," this decline was more moderate, and more students reported they would reject cannabinoids. In contrast, in Group "B," the values were lower compared to the baseline data collection conducted before the program began.

Participation in Program Elements

Participation in program elements may reflect the level of exposure to the intervention and is summarised in Table 4. It can be seen that during the second data collection, students participated in an average of 2.22 ± 1.49 program elements, which increased to 2.40 ± 1.62 program elements in the third data collection. Students in Group "A" participated in more program elements than the average in both data collections, while Group "B" showed an above-average participation rate in the second data collection, but a below-average rate in the third. Participation differed across program components and cohorts, with higher engagement observed in peer-led and interactive elements (Table 4).

Students who used cannabinoids reported significantly higher rates of participation in the prevention poster activity ($\chi^2(1)=4.20$, $p<0.05$). This may indicate that these students were more likely to notice and remember the posters displayed in the school's hallways and classrooms, compared to their non-using peers. A similar significant association was found regarding the prevention quiz. Students who participated in the tobacco prevention quiz were significantly more likely to have used tobacco products ($\chi^2(1)=6.34$, $p<0.05$). This may indicate that participation in the

prevention quiz was more popular among students who used tobacco products. Furthermore, students who consumed tobacco products participated in significantly more program elements than non-smoking students ($t(274)=2.37$, $p<0.05$).

As a positive result, significantly fewer students reported trying cannabinoids among those who participated in the prevention peer group activities (Fisher's exact test, $p<0.05$) and the prevention quiz ($\chi^2(1)=4.12$, $p<0.05$). It is also encouraging that students who had never tried cannabinoids at the time of the survey participated in significantly more program elements ($t(280)=2.07$, $p<0.05$). However, as a negative result, significantly more students who reported participating in the prevention poster activity had tried some form of tobacco product ($\chi^2(1)=5.45$, $p<0.05$). Students who had tried tobacco products also participated in significantly more program elements ($t(275)=2.50$, $p<0.05$). Another negative association was found: at the time of the questionnaire, significantly more students who had participated in the school health consultation were uncertain about the harmful effects of smoking ($\chi^2(1)=5.30$, $p<0.05$). Finally, students who expressed uncertainty about whether they would accept a tobacco product from their best friend also participated in significantly more program elements ($t(280)=2.26$, $p<0.05$).

Discussion

This prospective pilot study evaluated a multi-component school-based prevention program targeting tobacco and cannabinoid use among adolescents. Although no substantial reduction in overall substance use prevalence was observed over the three-year period, the intervention demonstrated good feasibility and acceptability within the school environment and successfully engaged students who had already experimented with tobacco or cannabinoids. The experience gained can be effectively applied in secondary schools of other middle-income countries as well. According to the "whole school approach" model, long-term, longitudinal prevention strategies that incorporate peer interactions represent the most promising strategy for influencing youth smoking behaviours [19,20]. This pilot program was intended to lay the foundation for such an approach, and in the future, it would be advisable to enhance the evidence base with randomised, longitudinal studies. Although the school prevention program did not result in a striking reduction in the use of tobacco products and cannabinoids, it made the problem visible - whereas it had previously remained hidden. Honest responses and trust have a preventive value in themselves. Increased reporting of substance use over time may reflect improved honesty and trust in self-reporting rather than a true increase in consumption [21].

The lack of a clear decline in prevalence is consistent with previous findings indicating that school-based prevention programs often show limited effects on substance use trajectories, particularly when evaluated using lifetime or short-term prevalence indicators [9,13]. Several studies have reported that such interventions may delay initiation rather than prevent experimentation altogether [10,11]. From a public health perspective, even delayed initiation may be meaningful, as it has been associated with improved cessation outcomes and reduced smoking-related harm later in life [12]. An important and unexpected finding of the present study was the apparent increase in reported lifetime prevalence over time. Rather than indicating a harmful effect of the intervention, this trend may reflect increased honesty and trust in self-reporting. Similar observations have been described in other school-based prevention studies, where improved disclosure followed the establishment of a supportive and non-judgmental environment [18]. In this sense, the intervention may have enhanced the visibility of previously hidden substance use patterns rather than promoting experimentation. On the other hand, peer-led and participatory prevention approaches appear to be particularly effective in engaging adolescents who are already experimenting with substances [22,23]. Adolescents tend to prefer informal, peer-mediated, and digitally supported prevention formats over traditional health professional–led interventions [24].

Participation analyses revealed that students who had experimented with tobacco or cannabinoids were more likely to engage with certain program components, particularly peer-led activities and interactive quizzes. This finding aligns with earlier research suggesting that adolescents with higher risk profiles are more responsive to informal, peer-mediated prevention approaches than to traditional didactic methods [9,13]. The relatively low uptake of consultations with school health professionals further supports the notion that adolescents prefer less hierarchical and more accessible forms of engagement. Taken together, these findings suggest that the effectiveness of school-based prevention may be less dependent on single program elements and more strongly influenced by the overall preventive environment created within the school community [25].

Interventions that integrate peer involvement, credible information sources, and consistent institutional norms may contribute to gradual normative shifts, even in the absence of immediate reductions in prevalence. This systemic perspective is particularly relevant for pilot interventions, where feasibility, acceptability, and contextual learning are key outcomes guiding future large-scale implementation.

From the perspective of the educational environment, one of the main strengths of the program was its integration into the everyday life of the school. Rather than relying on isolated prevention sessions, the intervention contributed to the development of a more open and reflective school climate in which substance use could be discussed without stigma. This internal, community-based approach may enhance credibility and sustainability, particularly in settings where formal health services are perceived as distant or judgmental. The analysis of knowledge and attitudes revealed notable differences between tobacco and cannabinoid-related perceptions. While students demonstrated relatively stable awareness of tobacco-related risks, attitudes toward cannabinoids were more uncertain and fragmented. This finding is consistent with the rapidly changing social representations of cannabis and highlights the need for prevention strategies that address ambiguity and misinformation rather than relying solely on risk-based messaging.

One of the most important lessons of the program is that community-based school interventions may exert their influence primarily through the reinforcement of shared norms and informal regulation rather than through immediate behavioral change. The combination of peer involvement, institutional consistency, and accessible information channels may gradually shape attitudes and expectations, even when short-term prevalence indicators remain unchanged. Finally, the markedly different participation rates across program components underscore the importance of flexibility in prevention design. Higher engagement in peer-led and interactive elements suggests that adolescents are more receptive to formats that allow autonomy and identification. These insights are particularly relevant for the refinement of future school-based interventions aiming to balance feasibility, acceptability, and public health relevance.

Conclusions

This pilot study demonstrated that a multi-component school-based prevention program is feasible and acceptable within a real-world educational setting. Although no significant reduction in substance use prevalence was observed, the intervention effectively reached adolescents at higher risk and improved transparency of substance use patterns. These findings support the further development and rigorous evaluation of integrated, community-sensitive school-based prevention strategies.

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Ethical Permissions

The study protocol was approved by the Regional and Institutional Human Biomedical Research Ethics Committee of the University of Szeged (approval number: 4058, 83/2017-SZTE). Written informed consent was obtained from the legal guardians of all adolescent participants.

Conflicts of Interest

The authors declare no conflicts of interest.

Authors' Contribution

D.P. contributed to study design, coordination of the prevention program, data collection, intervention delivery, and manuscript drafting (35%). M.M., D.M.V. and J.W. contributed to data analysis, interpretation of results and manuscript revision (15-15-15%). O.K. contributed to study design, supervision of the prevention program, and manuscript revision (20%).

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