



Validation and adaptation of the Serbian adaptation of the Marijuana Effect Expectancies Questionnaire among adolescents

Validacija i adaptacija srpske verzije upitnika *Marijuana Effect Expectancies Questionnaire* među adolescentima

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Abstract

Background/Aim. Expectancies about the effects of cannabis have been related to the onset and frequency of its consumption. One of the most used instruments to measure cannabis effect expectancies is the Marijuana Effect Expectancy Questionnaire (MEEQ). The aim of this study was to determine the psychometric properties of the Serbian adaptation of the MEEQ among secondary school pupils. **Methods.** The retrospective study included 1,642 secondary school pupils (52.3% female) from the South Bačka District, Vojvodina, Serbia. In addition to the MEEQ, the Cannabis Use Intention Questionnaire (CUIQ) was also used, as well as a self-report measure of cannabis use. **Results.** The original six-factor MEEQ model showed the best fit indices with the following factors: Cognitive and Behavioral Impairment, Relaxation and Tension Reduction, Social and Sexual Facilitation, Perceptual and Cognitive Enhancement, Global Negative Effects, and Craving and Physical Effects. All MEEQ scales showed positive and expected correlations with the CUIQ scales, among which the highest correlation was with the Attitudes toward Consumption scale. Correlations with self-report cannabis use were significant for all MEEQ scales, except for Cognitive and Behavioral Impairment. **Conclusion.** The results suggested good psychometric properties of the Serbian adaptation of the MEEQ. The results also confirmed the originally proposed factor structure, good reliabilities of the scales' scores based on internal consistency, as well as convergent and criterion validity.

Key words:

adolescent; serbia; substance-related disorders; surveys and questionnaires; validation study.

Apstrakt

Uvod/Cilj. Očekivanja o dejstvu kanabisa povezana su sa početkom i učestalošću njegovog korišćenja. Jedan od najčešće korišćenih instrumenata za merenje očekivanog dejstva kanabisa je Upitnik očekivanih efekata upotrebe marihuane (*Marijuana Effect Expectancy Questionnaire – MEEQ*). Cilj rada bio je da se utvrde psihometrijska svojstva srpske adaptacije MEEQ za primenu kod učenika srednjih škola. **Metode.** U retrospektivnu studiju uključeno je 1 642 učenika srednjih škola (52,3% ženskog pola) iz Južnobackog okruga, Vojvodina, Srbija. Uz MEEQ, korišćen je i Upitnik o nameri upotrebe kanabisa (*Cannabis Use Intention Questionnaire – CUIQ*), kao i mera samoprocene upotrebe kanabisa. **Rezultati.** Originalni šestofaktorski model MEEQ pokazao je najbolje fit indekse sa sledećim faktorima: Kognitivno oštećenje i poremećaj ponašanja, Relaksacija i smanjenje napetosti, Socijalna i seksualna facilitacija, Perceptualno i kognitivno poboljšanje, Globalni negativni efekti i Žudnja i fizički efekti. Sve MEEQ skale pokazale su pozitivne i očekivane korelacije sa CUIQ skalama, među kojima je najviša korelacija bila sa skalom Pozitivni stavovi prema konzumaciji. Korelacije sa samoprocenom upotrebe kanabisa bile su značajne za sve MEEQ skale, osim za Kognitivno oštećenje i poremećaj ponašanja. **Zaključak.** Rezultati su ukazali na dobre psihometrijske karakteristike srpske adaptacije MEEQ. Rezultati su takođe potvrdili i originalno predloženu faktorsku strukturu, dobru pouzdanost skorova na skalama zasnovanu na internoj konzistenciji, kao i konvergentnu i kriterijumsku validnost.

Ključne reči:

adolescenti; srbija; poremećaji izazvani supstancama; ankete i upitnici; istraživanje, validaciono.

Introduction

Adolescence is a period of changes not only in hormones and the body but also in social roles in peer and other interpersonal relationships, which coincides with an increase in mental health problems^{1,2}. In this vulnerable period of life, there is an increase in risk-taking behaviors, including substance misuse^{3,4}. These behaviors are often established during youth, extend into adulthood, increase the risk of adult harm, and are interrelated^{5,6}. Recent literature indicates small negative associations between cognitive functioning and cannabis use⁷. In addition, cannabis use during adolescence, especially heavy use and earlier age at onset of cannabis use, is associated with poorer educational outcomes and mood disorders, particularly depressive symptoms, and should be considered when assessing suicide risk⁸⁻¹¹.

According to the World Health Organization (WHO), cannabis is the most commonly used illicit drug globally¹². Within the WHO European Region, an estimated 9 million people aged 15–24 years (19.1% of this age group) used cannabis in 2020¹³. European School Survey Project on Alcohol and Other Drugs (ESPAD) data also reveals that, on average, 16% of students reported having used cannabis at least once in their lifetime, and in Serbia, the reported number was 2.9–7.3%¹⁴. Moreover, the data from the latest Serbian National Health Survey show that cannabis was used by 1.2% of the population in the previous 12 months, significantly more common in the 18 to 34 age group (2.4%), among men (1.6%), urban residents (1.5%), residents of higher education (1.8%), and those belonging to the wealthiest households (2.1%)¹⁵.

There are various reasons and expectations for cannabis use, and according to extended expectancy theory¹⁶, drug effect expectancies are shown to be related to the actual use of drugs¹⁷. Individuals learn, through observation and experimentation, and get beliefs, both positive and negative, about how a drug will affect them. One of the most frequently used questionnaires created to assess cannabis effect expectancies is the Marijuana Effect Expectancies Questionnaire (MEEQ). It was based on expectancy theory, extended to drug use, and it was designed to allow completion by both cannabis users and adolescents who have never used cannabis¹⁷. The MEEQ assesses six domains of marijuana effect expectancies, which could be divided into positive expectations [Relaxation and Tension Reduction (RTR), Social and Sexual Facilitation (SSF), and Perceptual and Cognitive Enhancement (PCE)], negative expectations [Cognitive and Behavioral Impairment (CBI) and Global Negative Effects (GNE)], and neutral expectations [Craving and Physical Effects (CPE)]. For instance, one will use it to feel relaxed and reduce stress, which is an important motivator to initiate and maintain drug use. However, others will expect adverse effects, such as impaired cognition, which can inhibit the initiation and continuation of drug use behaviors. Therefore, adolescents use illicit drugs when they hold strong positive and weak negative expectancies for these behaviors¹⁸. Moreover, non-users endorsed more GNE than infrequent and frequent users¹⁹.

Among six MEEQ scales, non-users scored lower on RTR and CPE, while they showed higher scores on GNE compared to past- and present-users among United States

male inpatients²⁰. In the study of Hayaki et al.²¹ on adult women who use marijuana, the main positive predictor of frequency and severity of marijuana use was RTR. At the same time, CBI was a negative predictor of the frequency of marijuana use, and GNE was a predictor of the severity of marijuana use. Furthermore, non-users of marijuana had significantly higher expectations for GNE from marijuana and lower expectations for CPE than quitters, infrequent users, and frequent users. On the other hand, frequent marijuana users reported significantly lower expectations for CBI from marijuana than quitters and non-users²².

However, there are inconsistent results regarding the factor structure of the MEEQ. Aarons et al.²² offered composite scores of negative and positive effects, indicating the hierarchical structure of the MEEQ. GNE composite captures CBI and GNE scales, while the rest of the scales formed Global Positive Effects (GPE). The hierarchical model proposed by Hayaki et al.²³ was used. They suggested that the higher-order negative expectancy factor should include CBI, CPE, and GNE, while the remaining three scales should constitute a positive expectancy factor. However, these composites are not formed by empirical evidence. Some research on French-speaking adolescents suggested a four-factor structure based on exploratory factor analysis²⁴. Although in the Confirmatory Factor Analysis (CFA) study²⁵, the four-factor solution had a better model fit compared to the six-factor solution, both model fits are below the recommended cut-off criteria for fit indices, indicating poor model fit for both solutions. Thus, we could conclude that the four-factor structure is not the common use of the MEEQ.

To the best of our knowledge, there is no validated Serbian adaptation of the MEEQ. Therefore, the aim of this study was to examine the psychometric properties of the Serbian adaptation of the MEEQ among secondary school pupils. More precisely, factor structure was tested *via* CFA, and the internal reliability was tested *via* alpha and omega coefficients. In addition, convergent validity was tested *via* average variance extraction and correlation with the Cannabis Use Intention (CUI) Questionnaire (CUIQ) scales, which measure similar constructs. Furthermore, criterion validity was tested through correlations with self-report cannabis use. We expect to confirm the originally proposed factor structure, as well as convergent and criterion validity.

Methods

Participants and procedure

The sample consisted of 1,642 secondary school children (52.3% female) from the territory of the South Bačka District, Vojvodina, Serbia, aged 15–19 years [mean value (M) = 16.40, standard deviation (SD) = 1.02], of which 59.8% attended a four-year vocational school, 23.8% gymnasium, and 16.4% a three-year vocational school. Google Form was used to administer instruments from September 15 to December 15, 2021. Class teachers shared the link with their students *via* the Google Classroom platform. Secondary school

children who did not want to complete the online questionnaire did not participate in this research.

Instruments

The MEEQ is the 48-item measure of six expectancy domains on the following subscales: CBI, RTR, SSF, PCE, GNE, and CPE. Each item is scored on a 5-point Likert scale (from 1 = 'strongly disagree' to 5 = 'strongly agree'), with scales containing 6–10 items.

The Serbian adaptation of the MEEQ was made in line with the report of the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) Task Force for Translation and Cultural Adaptation²⁶. This procedure included several steps: 1) preparation – consent to use the MEEQ and translate it into Serbian was obtained from the copyright holder, Prof. Dr. Sandra Brown; 2) forward translation – the translation process, after preparation, included forward translations from English to Serbian by two health professionals who were native speakers of Serbian and fluent in the English language; 3) reconciliation – a comparison and merging of forward translation versions into a single translation was made at a consensus meeting; 4) back translation – a professional translator translated the Serbian language back to the original English language; 5) harmonization – the forward translations were similar to and consistent with the original version; 6) cognitive debriefing – the Serbian version was then piloted on a group of 40 participants, pupils of Secondary Medical School "April 7th", Novi Sad, Serbia, who filled in the questionnaire, to check the comprehensibility of the items. All items were clear, and only minor linguistic modifications were made; 7) proofreading – a final review of the translation to correct grammatical, printing, or other errors was done by the research team members; 8) final report – at the end of the process, all steps were documented as a part of the doctoral thesis of one of the team members.

CUIQ^{27, 28} operationalized four scales: Attitudes toward consumption (ATC), measured with two sets of four items that assess expected outcomes of cannabis consumption as well as the desirability of these outcomes ($\alpha = 0.93$); Subjective norms, measured with two sets of three items that assess how significant others would view the consumption of marijuana as well as their motivation to comply with them ($\alpha = 0.70$); Self-efficacy to abstinence, a five-item scale which assesses beliefs about the extent to which the person feels capable of not using cannabis in different circumstances ($\alpha = 0.95$); CUI, a three-item scale which assesses the perceived likelihood to consume marijuana ($\alpha = 0.95$). Each item is scored on a 5-point Likert scale (from 1 = 'not at all' to 5 = 'very much').

ESPAD¹⁴ measures the cannabis lifetime use, cannabis use in the last year, and cannabis use in the last month (0; 1–2 times; 3–5 times; 6–9 times; 10–19 times; 20–39; 40 or more).

Data analysis

First, CFA was used in R package "lavaan"²⁹ in order to test several proposed models of the MEEQ. Due to multivariable normality violation, a diagonally weighted least

squares (DWLS) estimator was used. Model fit was evaluated using several fit indices: the Chi-square test, comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). Although there are no absolute standards, the determination of model fit requires consideration of a range of fit indices that may evidence a good fit (e.g., RMSEA and SRMR < 0.06, TLI and CFI > 0.95) or an acceptable fit (e.g., RMSEA < 0.08, TLI and CFI > 0.90)³⁰. Second, descriptive statistics and reliability were calculated in R package 'psych'³¹. Reliability was calculated as Cronbach's α and Guttman split-half coefficients (with values ≥ 0.70 indicating satisfactory reliability) and as McDonald's ω (with values ≥ 0.41 indicating satisfactory, ≥ 0.61 moderate, and ≥ 0.81 high reliability)³². Additionally, the average variance extracted (AVE)³³ was calculated as a measure of convergent validity, with values higher than 0.50 indicating good convergent validity. Third, convergent validity was estimated *via* Pearson's correlations with CUIQ scales, and criterion validity was assessed *via* correlations with cannabis use.

Ethical aspects

The research was approved by the Ethics Committee of the Institute of Public Health of Vojvodina, Serbia (No. 01-1184/2, issued on July 22, 2021). School principals who agreed to participate in the study informed the Parent Councils. According to the Patient Rights Law of the Republic of Serbia, public health research involving a child who has reached the age of 15 and is capable of reasoning and which does not produce direct benefit or risk to the child may be approved if the research aims to contribute to a better understanding of the state of health of this population, with the written consent of the child or his/her legal representative³⁴. In line with that, participants were fully informed about the objectives and methods of the study orally by the teachers who shared the link with them at the very beginning of the online questionnaire. They had a right to make an independent decision as to whether or not they wanted to participate in a study dealing with issues that were relevant to them. The respondents expressed their consent by answering the first mandatory question on whether they agreed to participate, and those who marked 'yes' were considered to participate in the study. They could withdraw at any time before submitting the online form.

Results

Results of CFA showed that the originally proposed six-factor model had good fit indices (Table 1). However, item 26, which belongs to two factors, had remarkably low loading on the second factor (-0.39) and loading over 1 on the fourth factor (1.13); hence, it was omitted from the second factor. Similarly, item 33 had remarkably low loading on the first factor (0.31) compared to loading on the sixth factor (0.53); hence, it was omitted from the first factor. Omitting those two items from factors where loadings were lower and keeping them only on factors where their loadings were high resulted again in good model fit indices. Loading was in a range from 0.41 to 0.87 (Figure 1). Correlations between factors were high, which

Table 1

Model fit indices of proposed MEEQ models

Models	DWLS $\chi^2(df)$	CFI	TLI	RMSEA (90% CI)	SRMR
Original six-factor model	7,049.66 (1,063)	0.987	0.986	0.059 (0.058–0.060)	0.062
Original six-factor model without double items	7,145.35 (1,065)	0.987	0.986	0.059 (0.058–0.061)	0.062
Hierarchical model	8,465.81 (1,073)	0.984	0.983	0.065 (0.064–0.067)	0.068
Two-factor model	9,938.21 (1,079)	0.981	0.980	0.071 (0.070–0.072)	0.073

MEEQ – Marijuana Effect Expectancy Questionnaire; DWLS – diagonally weighted least squares; CFI – Comparative fit index; TLI – Tucker-Lewis Index; RMSEA – root mean square error of approximation; CI – confidence interval; SRMR – standardized root mean square residual.

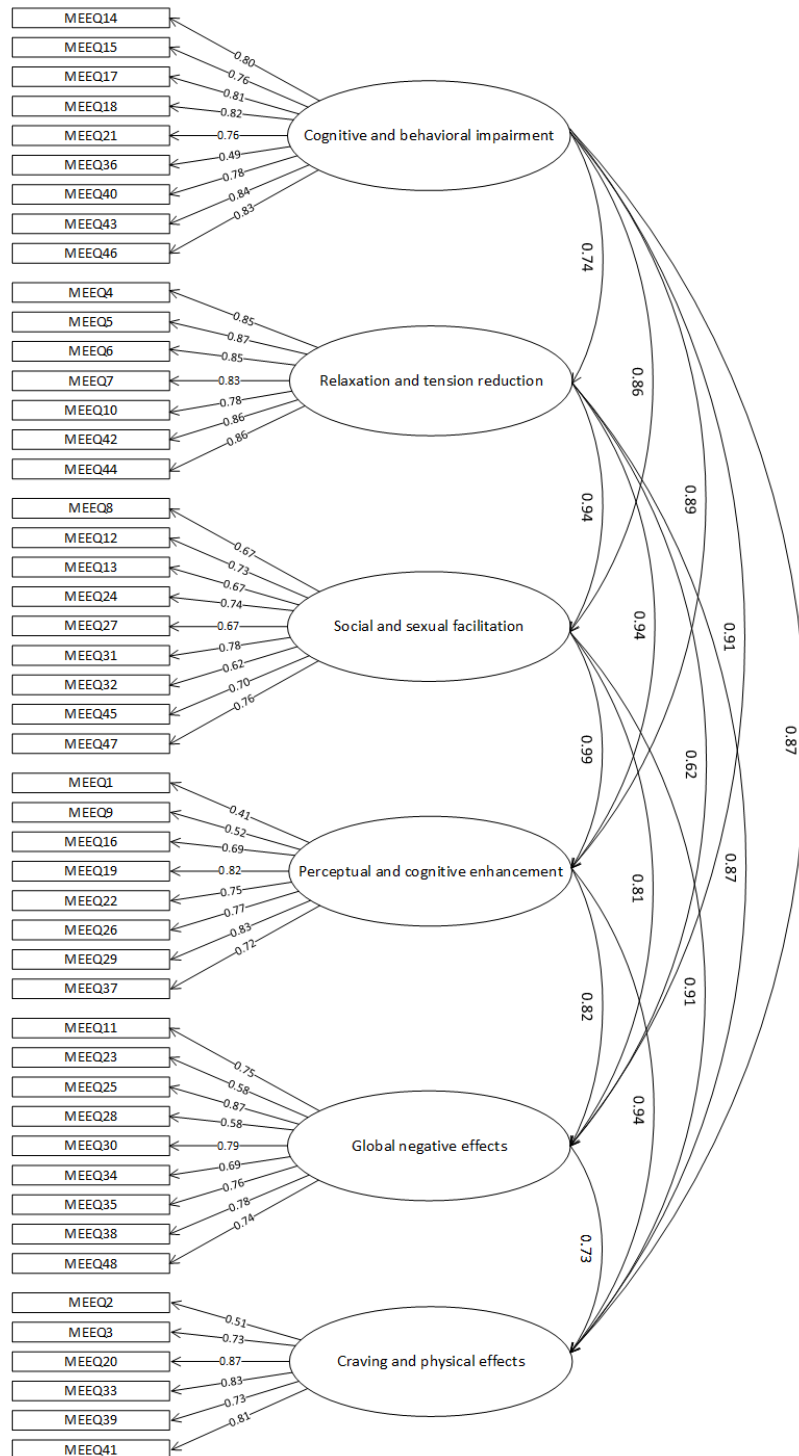


Fig. 1 – Parameters of the six-factor model of the MEEQ. MEEQ – Marijuana Effect Expectancy Questionnaire.

could indicate that the hierarchical factor structure was more suitable. Although the hierarchical model proposed by Hayaki et al.²³ with two higher-order factors showed good model fit, it was significantly worse than the proposed six-factor model ($\Delta\chi^2(8) = 1,320.5; p < 0.001$) and more importantly, loadings of the third and the fourth factors on a higher-order factor of positive expectancy were over 1. Finally, a two-factor model was tested, with positive and negative expectancy factors, but it showed a worse model fit compared to the proposed six-factor model ($\Delta\chi^2(14) = 2,792.9; p < 0.001$). Thus, the six-factor model with items 26 and 33 only loaded on one factor showed the best model fit indices (Table 1) and parameters (Figure 1).

Alpha, split-half, and omega reliabilities for each scale indicated good reliability, and AVE indicated good convergent validity of the scale scores (Table 2).

Convergent and criterion validity correlations

All MEEQ scales correlated substantially with ATC from the CUIQ, with the highest correlation between RTR and ATC (Table 3). Furthermore, all MEEQ scales showed higher correlations with the Subjective norms and Self-efficacy to abstinence scales from the CUIQ. The correlations between the MEEQ and CUI scales from CUIQ were lower, and the only nonsignificant correlation was between GNE and CUI. Among all MEEQ scales, GNE showed the lowest correlations with CUIQ scales. Correlations with cannabis use were significant for all MEEQ scales, except for CBI. The CPE scale had the highest correlations with cannabis use, while the GNE scale showed only negative correlations.

Discussion

This research aims to explore the psychometric properties of the Serbian adaptation of the MEEQ among secondary school pupils. Among all tested models, results supported the original six-factor structure¹⁷. More importantly, a six-factor solution showed better model fit compared to the hierarchical solution often used in research. It should also be noted that although negative and positive expectancy factors were used in previous research²³, no study has yet tested the hierarchical factor structure. Thus, we raised concerns about the interpretation of the higher-order factor of the MEEQ. In addition, results showed that items 26 and 33 should be loaded only on one factor because this solution provided no overestimated loadings.

All six MEEQ scales demonstrated good Cronbach's α coefficient, ranging from 0.88 (PCE scale) to 0.94 (RTR scale). Internal reliability was generally good and similar to previous studies^{21, 24}. McDonald's ω coefficient, considered a more sensible index of internal consistency and with less risk of overestimation or underestimation of reliability³⁵, has shown high values for MEEQ scales, between 0.88 and 0.95.

Convergent validity was tested through correlation with CUIQ, with the highest correlation between RTR (MEEQ) and ATC (CUIQ). Adolescents with greater positive expectancies of RTR were more likely to report a positive attitude toward substance use. On the other hand, GNE (MEEQ) showed the lowest correlations with CUIQ scales.

Criterion validity was evaluated through correlations with self-reported cannabis use. The correlations were

Table 2

Descriptive statistics and reliabilities for MEEQ scales

Scale	M	SD	α	Split-half	McDonald's ω	AVE
Cognitive and behavioral impairment	2.86	1.20	0.92	0.87	0.95	0.60
Relaxation and tension reduction	3.09	1.34	0.94	0.88	0.95	0.71
Social and sexual facilitation	2.69	1.07	0.90	0.89	0.91	0.50
Perceptual and cognitive enhancement	2.81	1.07	0.88	0.86	0.89	0.51
Global negative effects	2.65	1.09	0.91	0.90	0.90	0.54
Craving and physical effects	2.97	1.18	0.89	0.87	0.88	0.57

MEEQ – Marijuana Effect Expectancy Questionnaire; M – mean; SD – standard deviation; AVE – average variance extracted.

Table 3

Correlations between MEEQ and CUIQ scales and cannabis use

MEEQ	CUIQ				ESPAD – cannabis use		
	Attitudes toward consumption	Subjective norms	Self-efficacy to abstinence	Cannabis use intention	Lifetime	In the past 12 months	In the last 30 days
Cognitive and behavioral impairment	0.48	0.36	0.45	0.15	0.03	0.05	0.04
Relaxation and tension reduction	0.74	0.41	0.43	0.35	0.25	0.24	0.21
Social and sexual facilitation	0.69	0.44	0.40	0.33	0.15	0.16	0.17
Perceptual and cognitive enhancement	0.67	0.42	0.42	0.31	0.13	0.14	0.13
Global negative effects	0.31	0.29	0.38	0.01	-0.17	-0.16	-0.11
Craving and physical effects	0.65	0.42	0.46	0.36	0.35	0.35	0.27

MEEQ – Marijuana Effect Expectancy Questionnaire; CUIQ – Cannabis Use Intention Questionnaire; ESPAD – European School Survey Project on Alcohol and Other Drugs.

Note: All correlations ≥ 0.13 are significant at $p < 0.001$.

significant for all MEEQ scales except for the CBI scale. This is not in line with previous studies^{22, 21} in which the CBI scale was negatively associated with the frequency of marijuana use. One explanation is that the participants in our study were younger than participants in the previous studies because the period of cannabis use in our sample was shorter.

Furthermore, the highest and most positive correlation was found between cannabis use and the CPE scale, followed by the RTR, which is in line with previous studies²⁰⁻²². It should be noted that some authors suggested the CPE scale as a part of the negative expectancy factor²³. However, the CPE scale showed a positive correlation with marijuana use. The results are more in line with the decision by Aarons et al.²² that this scale should not be a part of the higher-order GNE dimension but of the GPE dimension. However, as we already stated, hierarchical structure is questionable. According to the findings of Buckner and Schmidt¹⁹, the users who especially value marijuana's physical and craving effects characteristics (hunger, craving for things and snacks, laughter, dry mouth) are likely to become more frequent users. These results showed that, at least in community youth, the frequency of marijuana use is more associated with positive expectancies compared to negative ones. Regarding the RTR scale, other research pointed out that it predicted not only frequency but also severity of marijuana use, and this scale emerged as a robust belief in adults 18–24 years old²¹.

The only negative correlation was found between marijuana use and the GNE scale, indicating that maybe only this scale contains clearly negative expectations and effects of marijuana use, compared to others that are also considered indicators of negative consequences of marijuana use. Therefore, the GNE scale assesses expectations that may include clinical severity indicators that only appear in more serious cases²¹.

There are several limitations of this study. First, the study includes a convenient sample comprised solely of

secondary school pupils from mostly urban areas of Serbia. Thus, the generalization of the results is limited to adolescents but not to the general population of Serbia. Second, self-report data on marijuana use among adolescents could be biased or under social desirability response despite the anonymity. Third, all measures were self-reported, which can influence the correlations among them, i.e., correlations can be higher than expected because of the same method used (self-report). We tested common method variance *via* Harman's single factor method³⁶, and results of joint principal component analysis on all included items in the study showed that the first component included 32.51% of shared variance. Since this is smaller than the recommended cut-off of 50% of shared variance, we can conclude that common method variance did not affect the results. However, in line with good practices, we recommend using a multitrait-multimethod design to validate further the MEEQ. Fourth, only reliability based on internal consistency was tested as well as congruent and criterion validity. Future studies should include testing of test-retest reliability as well as discriminant validity. Fifth, given that participants completed questionnaires online, a person's motivation to answer carefully may be decreased.

Conclusion

Despite the limitations of this study, the presented results provide important information regarding the psychometric properties of the Serbian adaptation of the Marijuana Effect Expectancy Questionnaire and confirm the originally proposed factor structure and convergent validity as well as good internal reliability. The relations with the criterion variable were rather small, but results indicated that the Global Negative Effects scale may be a protective factor in the initiation of marijuana use during adolescence. To sum up, the results of this study add further to the cross-cultural validity and use of the Marijuana Effect Expectancy Questionnaire.

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