

Prevalence and Risk Factors of Substance Use among Urban Adolescents: Questionnaire Study

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Aim. To examine the prevalence and possible interconnections among the frequencies of consuming various psychoactive substances in Zagreb adolescents. Also, to assess risk factors associated with the use of tobacco, alcohol, and marijuana.

Method. We applied an anonymous, multi-dimensional, self-reporting questionnaire on a representative sample of 2,404 elementary and high school students (total age range, 13-23 years) from Zagreb, Croatia. The questionnaire was designed to explore the extent to which examinees consumed various psychoactive substances, as well as to assess their attitudes and knowledge about the substances. The socio-demographic data were collected on all examinees, their hierarchy of values, family relations, adjustment to school, relationships with peers, and high-risk and delinquent behavior. We analyzed the interconnections among the frequencies of consuming various psychoactive substances, and assessed the factors possibly predictive of substance use.

Results. Almost 90% of all examinees experimented with alcohol at least once, 80% with tobacco, 39% with marijuana, and 9% with Ecstasy. Thirty-six percent consumed alcohol and 11% marijuana several times a month, whereas 28% smoked tobacco daily. Although there was no statistically significant difference according to sex in experimenting with psychoactive substances, day-to-day abuse was significantly more frequent among young men than women. About 43% of our examinees believed consuming marijuana should become legally permitted, 37% were against this policy, and 21% were undecided on this issue. Our results showed a high degree of interconnection among the frequencies of consuming tobacco, alcohol, and marijuana. We also found that the best predictive factors for consumption of these three substances were a history of high-risk and delinquent behavior, troubled adjustment to school, domination of hedonistic values, and poor family relations. Regression analysis and pondering for ratios of particular predictors of psychoactive substances use gave values for coefficients of multiple regression as follows: $R=0.548$ ($R^2=0.300$; $p<0.001$) for tobacco, $R=0.575$ ($R^2=0.330$; $p<0.001$) for alcohol, and $R=0.608$ ($R^2=0.370$; $p<0.001$) for marijuana. Knowledge about the consequences of consuming psychoactive substances positively correlated with the frequency of consuming tobacco ($r=0.213$, $p<0.001$), alcohol ($r=0.226$, $p<0.001$), and marijuana ($r=0.320$, $p<0.001$).

Conclusion. Most adolescents had personal experience with psychoactive substance abuse, mostly alcohol, tobacco, and marijuana, but only a smaller proportion became regular consumers. The frequency of substance consumption implied a generalized tendency towards substance abuse among Zagreb adolescents. Our findings could serve as empirical basis for the re-evaluation of the current drug prevention programs and programs aimed at preventing other forms of risk behavior among children and adolescents.

Key words: adolescent; alcohol drinking; Croatia; marijuana smoking; risk factors; substance-related disorders; tobacco

The World Health Organization defines addiction as the state of physiological or psychological addiction to any psychoactive substance (1). The state is characterized by changes in behavior and other psychological reactions, always including the compulsive need for occasional or regular substance use, guided by the pleasant psychological effect of the substance or avoiding the symptoms of abstinence.

Addictive behavior is a major medical, psychological, and societal problem, especially in view of the increasing incidence and availability of drugs.

Although most epidemiological studies depicted an increasing trend in drug abuse incidence among adolescents, only a small proportion explored causation and tried to explain the nature of addictive behavior or possible predictive factors (2-7). There is no

professional consensus, or at least a widely accepted and coherent theoretical model, which would integrate various risk or etiological factors, and explain the etiology of addiction, especially in more serious cases. Acknowledgement of risk and protective factors, as well as their inter-relations, enables definition of risk groups and development of effective prevention programs.

Oetting and Donnermeyer (8) argued that drug abuse was a multidimensional phenomenon in which physicians, sociologists, psychologists, legalists, and other experts deal with different aspects of the problem, but without inter-disciplinary integration or a coherent theory. Development of evidence-based models, which would enable understanding and predicting the behavior of addicts, is of crucial importance for the effectiveness of prevention programs. Theories and models of addiction are divided into several groups, depending on factors they study and emphasize. Medical and biological models explore neurophysiological and metabolic aspects of drug abuse and addictive behavior, relying on medications for therapy (8). Psychosocial and genetic models emphasize the importance of the individual psychological structure, taking into account environmental and hereditary factors, as well as the social context and interactions.

Studies of twin children of alcoholics suggested the importance of genetic factors in the etiology of alcoholism, since there was a larger proportion of alcoholics among identical than fraternal twins (9). Furthermore, an above average proportion of children of alcoholics become alcoholics themselves, even if they are adopted into non-drinking families as newborns (9,10). Different studies assessed the role of individual characteristics in etiology of alcoholism, such as sex (5,11,12), age, nationality and race (4, 13,14). Most of these studies showed that consumption of psychoactive substances was generally more frequent among men and adolescents. Recent research has also addressed the connection between the likelihood of psychoactive substances abuse and certain psychological characteristics (10,15-17), psychopathological dimensions (18), personal hierarchy of values (19), attitudes toward psychoactive substances (20), motivation for illicit drug abuse (5,21,22), expectations from drug abuse (23), risk and deviant behavior (13,24,25), and religious beliefs (26). Many studies explored the influence of different social factors on the onset and persistence of addictive behavior, most frequently relationships with parents (25,27-30), other possible addicts in the adolescent's family (28), peer pressure (23,31-33), and different variables related to schooling (6,34). Additionally, another possible approach to assessing possible risk factors is the environmental approach, where other risk factors are taken into account, such as material wealth (14), geopolitical region, societal attitude towards substance use, or availability of psychoactive substances (35).

Integrating all the findings from the literature, we can only conclude that the abuse of psychoactive substances is a complex problem and that both the inclination toward "experimenting" with psychoactive substances and regular consumption result from the

simultaneous impact of various interconnected factors. In other words, none of the etiological factors seems to be decisive in a way that they would determine the individual's experiences with psychoactive substances independently of other factors. The only way to understand and manipulate addictive behavior of an individual or a group is through the overall context of psychoactive substances abuse.

Studies assessing specific forms of addictive behavior show that there is an etiological correlation and interconnection among abuses of different psychoactive substances (36-38). In our study, we aimed to assess the nature and interconnection of risk factors for abuse of the most frequently consumed substances among Zagreb adolescents: tobacco, alcohol, and marijuana.

Participants and Methods

Sample

Our study included all elementary (a total of 101) and high schools (a total of 72) in the city of Zagreb, comprising students from the 8th grade elementary school to the senior (4th) year of high school (total age range, 13-23 years). We did not include schools for children with special needs. When defining the age span, we aimed at the span broad enough to comprise the dynamics of the addressed issue and narrow enough to permit the use of a single research instrument.

Our population numbered a total of 53,500 students (8,469 elementary school and 45,031 high school students). For technical reasons, our unit of sampling was a class, and not an individual. We estimated that our sample needed to comprise 100 classes (about 5% of the population). In this case, standard error of proportion does not exceed 1%. The sample was stratified by age and type of high school (gymnasium, 4-year vocational, 3-year vocational, and art school). Inside the stratus, classes were randomly chosen to participate in the study. We expected the whole sample to comprise 2,584 students. However, due to the variations in class size and the fact that some students were absent at the time of examination (1 or 2 students per class on average), the final sample size was 2,404 students (4.5% of the population) (Table 1).

In our sample, 762 individuals (32%) represented gymnasium students, 801 (33%) 4-year vocational, 413 (17%) 3-year vocational, and 67 (3%) artistic high school students. The remaining 15% of the sample were 8th-grade elementary school students. This distribution is in concordance with that of the whole population. Since we stratified our sample according to the type of high school, where the distribution according to gender is not in agreement with the general distribution in the adolescent population, our sample had a higher proportion of young men than expected (52% men vs 48% women).

All relevant data pertaining to the examined population were obtained from the Zagreb City Council for Education and Sports.

Questionnaire

We developed a self-report questionnaire and tested the understandability and metric characteristics of each particle and the questionnaire as a whole in a pilot study (about 200 examinees, covering the needed age span). Based on the pilot study results, the questionnaire was additionally adjusted quantitatively,

Table 1. Demographical structure of the sample

Student's grade	No. (%) of examinees			Age (median, range; years)
	girls	boys	total	
Elementary school (8th)	184	177	361 (15.0)	14 (13-16)
High-school				
1st	238	335	573 (23.8)	15 (14-17)
2nd	329	233	562 (23.4)	16 (15-18)
3rd	193	344	537 (22.3)	17 (15-20)
4th	206	165	371 (15.4)	18 (16-23)
Total	1,150 (47.8)	1,254 (52.2)	2,404 (100.0)	16 (13-23)

contextually, and terminologically, and administered on the whole sample of students in April and May of 2001. The final version of the questionnaire was completely anonymous and contained the groups of variables as follows.

Measures of Substance Abuse. We assessed the frequency of consuming tobacco, alcohol, marijuana, hashish, LSD, heroin, cocaine, methadone, Ecstasy, amphetamines, sedatives, and inhalants. We asked our examinees whether they had ever had the experience of consuming the psychoactive substance in question (possible answers: no; once; more than once) and whether they consumed it during the preceding month (possible answers: no; once; more than once; daily). The answers to the first question were used to measure the so-called experimental abuse, and the second question served to assess the frequency of regular consumption.

In correlational analysis, we used indexes of consumption, which were calculated as the sum of indicators of experimental and regular consumption of the particular substance. Values for individual indexes ranged from 0 ("no experience ever") to 8 ("everyday consumption"), where a higher value indicated a more frequent consumption of a psychoactive substance.

Socio-demographic Variables. Examinees were asked to provide data on their sex, age, economical status of their families, education level and employment status of their parents, wholeness of the family, birth order, and the number of siblings.

Family Relations. Questions in this section aimed to estimate the length of time parents spent with their adolescent children, parents' strictness, harmony between parents and adolescents, and concord between parents. Students graded these four measures of intrafamilial relations on a scale from 1 (very bad) to 5 (excellent), and the final result was obtained from these grades.

Substance Use by Other Members of the Family. We assessed the consumption frequency for tobacco, alcohol, and illicit substances among examinees' family members, using a 5-step scale (1 = does not consume at all; 5 = very often).

Adjustment to School. This aspect was assessed through the data about the grade average (Croatian grade range is 1 to 5, where a higher number indicates a better grade), amount of study time (in hours), grade repetition (never; once; or several times), punishments for inadequate behavior (never; once; or several times), and number of unexcused class absence hours. The scales for these five measures were transformed into a single uniform measurement scale, and the total sum was used as a measure of adjustment to school.

Satisfaction with Teachers and Social Interactions at School. Examinees graded their satisfaction with social interactions at school (schoolmates, classmates, and teachers). We used three 5-step scales (1 for terrible; 5 for excellent), and used the total sum as the measure of satisfaction with the social interactions.

Risk and Deviant Behavior. We used a scale consisting of 12 particles, which included the history of running away from home, endangerment of public safety, destruction of public property, breaking and entry, theft, selling stolen goods, participation in a fight, gambling, binge drinking, dangerous car or motorcycle riding, police arrest, early onset of sexual activity, and promiscuity. Examinees described their taking part in the listed behaviors by checking one of the three offered answers: never, once, or more than once. The sum of all scale particles was taken as the measure of risk and delinquent behavior.

Attitude toward Marijuana. We used six semantic differential rating scales, with the end-result on the scale from -3 (extremely negative attitude) to +3 (extremely positive attitude). We also asked our examinees about their attitude toward the legalization of marijuana, where legalization was defined as the legally permitted production, sale, and possession of marijuana (offered answers: pro; against; and I don't know).

Hierarchy of Values. This part of the questionnaire was composed of 26 particles, examining the importance that health, family, school, sports, spirituality/religiousness, altruism, and hedonism bear to our examinees. The importance was represented on the scale from 1 (completely irrelevant) to 5 (very important).

Examinees' Perception of Harms Associated with Consumption of Marijuana and Hashish to Realization of Personal Values. This was assessed for each value examined in the previous set of questions. On the 1-5 scale, examinees were asked to as-

sess the influence of marijuana use on fulfillment and realization of these values, with 1 indicating "makes it much easier", 3 "no effect", and 5 "makes it much harder". Our final measure of examinees' perception of harm inflicted by drug abuse was the average of grades given to all 26 values.

Knowledge on the Consequences of Illicit Drug Abuse. Examinees were asked to qualify 20 statements as "true", "false", or "I'm not sure". The total number of correct answers was used as the measure of knowledge.

Students were asked to fill out the questionnaire during a single school class, with previous instructions and supervision of trained administrators. We guaranteed anonymity to all students in word and in writing. Students were free to quit the test at any time without any explanation or sanctions. All investigators were college graduates with majors in humanities, not known to the examinees, and adequately paid for their work. All examinees voluntarily and benevolently filled out the questionnaires in full and handed them in to the investigators, making our response rate 100%.

Statistics

Statistical analysis was performed with the SPSS Statistical Package for Windows, version 10.0 (SPSS Inc, Chicago, IL, USA). Descriptive statistics of the collected data was done using standard statistical parameters: percentages, means, and standard deviations. Correlation between particular predictive variables was calculated using the Pearson coefficient of correlation. Multivariate technique of hierarchy regression analysis was used to calculate the multiple correlations between the predictive and criteria variables, the latter being abuse of tobacco, alcohol, and marijuana. This analysis reveals the highest possible correlation (expressed as R – the coefficient of multiple correlation) in mathematically optimized combination of the used predictors and the criteria variables. It takes into account intercorrelations between predictors and eliminates redundancy in the process of prediction. Particular predictors (or groups of predictors) are successively one by one included into the analysis, and the influence of each of them on the change of the criteria variable is assessed separately. Multiple correlation squared (R^2) shows the percentage of the explained variance, ie, the total variability of the results in a particular criterion.

Results

Baseline Characteristics of Psychoactive Substance Abuse

Lifetime (Experimental) Use of Different Psychoactive Substances. Lifetime use of each substance was assessed by a separate question. The percentages of unanswered questions for the whole sample ranged from 0.6% for tobacco to 2.4% for sedatives.

The two psychoactive substances most frequently experimented with were alcohol and tobacco, which most students consumed at least once in elementary school, and almost all students in high school (Table 2). Thirty-nine percent of all examinees and more than a half (54%) of seniors in high school consumed marijuana at least once. The percentages were much lower for other illicit drugs (Table 2).

Regular Abuse of Psychoactive Substances. Regular abuse was assessed from the reported frequency of consumption during the preceding month. All questions were multiple-choice, and the results are shown for the four most frequently abused substances (Table 3). About a half of our examinees did not smoke tobacco at all in the preceding month, and by our definition were considered abstinent. However, almost a third (28%) were day-to-day tobacco smokers. The lowest was the proportion of occasional smokers of tobacco (22%). On the other hand, most of our examinees (59%) consumed alcohol occasion-

Table 2. Frequency of abuse of particular psychoactive substance at least once in a lifetime among Zagreb adolescents

Psychoactive substance	No. (%) of examinees					
	elementary school	high school				Total (n=2,404)
	8th grade (n=361)	1st class (n=573)	2nd class (n=562)	3rd class (n=537)	4th class (n=371)	
Tobacco	244 (67.6)	452 (78.9)	460 (81.9)	461 (85.8)	299 (80.6)	1,916 (79.7)
Alcohol	286 (79.2)	505 (88.2)	521 (92.7)	493 (91.8)	351 (94.6)	2,156 (89.7)
Marijuana	51 (14.1)	214 (37.4)	218 (38.8)	256 (47.7)	198 (53.4)	937 (39.0)
Ecstasy	4 (1.1)	45 (7.9)	46 (8.2)	76 (14.2)	42 (11.3)	212 (8.8)
"Speed"	4 (1.1)	34 (5.9)	36 (6.4)	38 (7.1)	28 (7.5)	140 (5.8)
LSD	3 (0.8)	28 (4.9)	46 (8.2)	44 (8.2)	35 (9.4)	156 (6.5)
Heroin	2 (0.6)	7 (1.2)	14 (2.5)	8 (1.5)	6 (1.6)	37 (1.5)
Cocaine	2 (0.6)	11 (1.9)	16 (2.8)	22 (4.1)	16 (4.3)	67 (2.8)
Sedatives	9 (2.5)	45 (7.9)	41 (7.3)	40 (7.4)	38 (10.2)	173 (7.2)
Inhalants	24 (6.5)	61 (10.6)	62 (11.0)	47(8.8)	18 (4.9)	212 (8.8)

*Percentages were calculated using the number of valid answers. The percentage of the missing data for the whole sample varied between 0.6% for tobacco and 2.4% for sedatives.

ally ("once" or "several times" a month), and only 3% consumed alcohol daily. As far as marijuana was concerned, 81% of our examinees were abstainers, about 16% smoked occasionally, and 2% smoked marijuana on a daily basis. The vast majority of our examinees (95%) claimed not to have consumed Ecstasy during the preceding month, and about 3% were occasional users.

When we compared the data of the so-called experimental use and regular abuse of psychoactive substances, we found that most adolescents lost interest and became abstainers after the experimental phase of abuse, especially when illicit drugs were in question (Tables 2 and 3). On the other hand, it was also clear that the more adolescents "experiment", the larger the proportion of the occasional and regular abusers.

Interesting findings were obtained from the comparison of regular consumption trends for the three most frequently abused substances. Whereas the examinees polarized between the extremes of day-to-day smokers of tobacco and non-smokers (abstain-

ers), with a relatively small proportion of occasional smokers, this ratio was much different for alcohol and marijuana, where most consumers were occasional and only a few percent day-to-day consumers (Table 3).

Sex Distribution. In regard to distribution according to sex, we analyzed the three most frequently consumed substances: tobacco, alcohol, and marijuana (Table 4). These were the only psychoactive substances where the frequency was high enough to permit such an analysis. In tobacco smoking, there was no difference in any of the consumption frequency categories. In the once-a-month consumption, the young women consumed alcohol more frequently than the young men (women/men ratio = 1/0.9; chi-square = 4.126; $p < 0.05$), whereas there was no statistically significant difference in the consumption of marijuana. When comparing the several-times-a-month consumption of both alcohol and marijuana, the young men's frequency of consumption was significantly higher (for alcohol - women/men ratio = 1/1.3; chi-square = 15.241; $p < 0.001$; for marijuana - women/men ratio = 1/1.7; chi-square = 14.377; $p < 0.001$). The domination of the young men in the frequency of consumption was even more evident in the day-to-day consumption (for alcohol - women/men ratio = 1/6.3; chi-square = 36.665; $p < 0.001$; for marijuana - women/men ratio = 1:4.0; chi-square = 19.502; $p < 0.001$).

Age of First Experience. The average age at first experience with psychoactive substances was calculated from the data on high school seniors, with the

Table 3. Frequency of consumption of particular psychoactive substances among our adolescents during the month preceding the survey (n = 2,404)

Psychoactive substance	No. (%) of examinees				
	never	once	more than once	every day	no answer
Tobacco	1,189 (49.5)	144 (6.0)	369 (15.3)	674 (28.0)	28 (1.2)
Alcohol	884 (36.8)	626 (26.0)	797 (33.2)	72 (3.0)	25 (1.0)
Marijuana	1,936 (80.5)	166 (6.9)	217 (9.0)	54 (2.2)	31 (1.3)
Ecstasy	2,286 (95.1)	39 (1.6)	28 (1.2)	10 (0.4)	41 (1.7)

Table 4. Differences in consumption of tobacco, alcohol, and marijuana during the month preceding the survey, according to examinee's sex

Substance	No. (%)* of young women	No. (%)* of young men	women:men (%)	Chi-square
Tobacco:				
once	75 (6.6)	69 (5.5)	1:0.8	0.976
several times	189 (16.6)	179 (14.6)	1:0.9	1.856
every day	307 (27.0)	365 (29.7)	1:1.1	2.190
Alcohol:				
once	322 (28.3)	303 (22.6)	1:0.9	4.126 [†]
several times	338 (29.7)	459 (37.3)	1:1.3	15.241 [‡]
every day	9 (0.8)	62 (5.0)	1:6.3	36.665 [‡]
Marijuana:				
once	70 (6.1)	96 (7.8)	1:1.3	2.603
several times	78 (6.8)	139 (11.4)	1:1.7	14.377 [‡]
every day	10 (0.9)	44 (3.6)	1:4.0	19.502 [‡]

*%w, %m - calculated using the total number of the young women and men in the sample.

[†] $p < 0.05$.

[‡] $p < 0.001$.

presumption that they were more or less out of the so-called experimental phase.

The average age at first alcohol consumption was 13.2 years, tobacco 13.6, and marijuana 15.7 years. In terms of generations according to the Croatian schooling system, this means that the first experience with alcohol and tobacco usually happened during elementary school, and with marijuana during the first year of high school.

To determine generational differences among our examinees, we selected the adolescents who had their first experience with an illicit drug before the age of 15 (early consumers). Elementary school students were excluded from this analysis, since they were younger than the designated age. We found that the percentage of early consumers among the high school seniors was 8%, among juniors and sophomores 14%, and among freshmen 25%.

Adolescents' Attitudes toward Soft Drugs. We asked our examinees what their position was on legalization of marijuana in Croatia. Answers of adolescents who admitted to experimenting with illicit drugs (mostly marijuana) were presented separately from those who claimed not to have had any experiences with such substances (Table 5). Overall, about 43% thought that marijuana should be legalized in Croatia, 36% were opposed to the idea, whereas a high percentage (21%) of the adolescents were undecided on the issue. Personal experiences with the substance in question obviously also influenced the attitude toward possible legalization: 61% of those who had experimented with marijuana vs 27% of those who had not thought it should be legalized.

Table 5. Examinees' attitudes toward legalization of marijuana

Personal history of experimenting with illicit substances	No. (%) of examinees			
	pro	against	don't know	no answer
Yes	591 (61.2)	199 (20.6)	172 (17.8)	4 (0.4)
No	363 (27.1)	657 (49.0)	310 (23.1)	11 (0.8)
Unknown	64 (66.0)	20 (20.6)	11 (11.3)	2 (2.1)
Total	1,018 (42.3)	876 (36.4)	493 (20.5)	17 (0.7)

Predicting Abuse of Psychoactive Substances among Adolescents

In assessing risk and protective factors, we started the analysis with several reductions. The criteria variables were consumption of tobacco, alcohol, and marijuana. In correlational analyses we used the indexes of consumption, which were calculated as the sum of indicators of experimental and regular consumption of the particular substance. Values for individual indexes varied from 0 ("no experience ever") to 8 ("everyday consumption"). Such indexes are known to have a higher correlation with the predictors than the separate measures of consumption. The arithmetic mean and standard deviation of the consumption index were 3.94 ± 3.14 for tobacco, 3.77 ± 2.17 for alcohol, and 1.38 ± 2.14 for marijuana. Similarly, where statistically justified and possible, we summarized particular variables from the groups of predictors, e.g., we calculated a unified measure for quality of family relations, adjustment to school, lean-

ing towards risk and deviant behavior, and hierarchy of values. The distribution normality was assessed with the Kolmogorov-Smirnov test, with the statistically significant positive asymmetry of the results for the consummation index and intrafamilial relations ($p < 0.01$).

Correlations among Abuse of Psychoactive Substances and Particular Groups of Predictive Variables. For each potential predictive factor we calculated the Pearson correlation coefficient with indexes of consumption for tobacco, alcohol, and marijuana. Our results showed that the structure and hierarchy of the predictors were very similar for all three substances (Table 6). On the other hand, variables that were not predictive of consuming a particular psychoactive substance usually did not correlate significantly with the consumption of the other two substances.

The highest degree of correlation with the three substances was found for risk and deviant behavior ($r = 0.397, 0.485, \text{ and } 0.501$, respectively for tobacco, alcohol, and marijuana; $p < 0.01$) (Table 6). All the three coefficients are of a positive sign, indicating that a higher frequency of risk and deviant behavior positively correlates with the frequency of consuming a particular substance. The next most powerful predictive factors were poor adjustment to school ($r = 0.346, 0.272, \text{ and } 0.397$, respectively for tobacco, alcohol, and marijuana; $p < 0.01$) and the domination of hedonism in the adolescent's hierarchy of values ($r = 0.275, 0.302, \text{ and } 0.253$, respectively for tobacco, alcohol, and marijuana; $p < 0.01$).

Another important predictor was the adolescent's perception of the influence that the consumption of soft drugs had on the fulfillment of personal values ($r = -0.248, -0.284, \text{ and } -0.361$, respectively for tobacco, alcohol, and marijuana; $p < 0.01$), indicating that the adolescents who consumed psychoactive substances more frequently thought they were less harmful. Also, the consumption of the three substances increased with age ($r = 0.226, 0.248, \text{ and } 0.217$, respectively for tobacco, alcohol, and marijuana; $p < 0.01$) and was more frequent in adolescents with poor family relationships ($r = 0.192, 0.178, \text{ and } 0.190$, respectively for tobacco, alcohol, and marijuana; $p < 0.01$) and adjustment to school ($r = 0.175, 0.190, \text{ and } 0.164$, respectively for tobacco, alcohol, and marijuana; $p < 0.01$). The use of all three substances positively correlated with parents' consumption of tobacco and alcohol ($r = 0.137, 0.177, \text{ and } 0.130$, respectively for tobacco, alcohol, and marijuana; $p < 0.01$). Psychoactive substances were less popular among adolescents in whose hierarchy of values health, sports, education, spiritual growth, religiousness, and self-actualization were highly ranked. The abuse of alcohol and marijuana was also more frequent among young men than women, whereas the difference between the sexes in regard to smoking tobacco was not statistically significant.

Our analysis showed that the following factors were not predictive of the frequency of consumption of tobacco, alcohol, and marijuana: the marital status of parents and wholeness of the family (although there was a tendency towards a more frequent sub-

Table 6. Pearson's correlation coefficients of predictive factors with use of alcohol, tobacco, and marijuana among Zagreb adolescents

Predictive factors	Pearson's correlation coefficients		
	index of alcohol consumption*	index of tobacco consumption	index of marijuana consumption
Sex (the young men consume more frequently than women)	0.107 [†]	0.004	0.155 [†]
Older age	0.248 [†]	0.226 [†]	0.217 [†]
Increased importance of hedonistic values	0.302 [†]	0.275 [†]	0.253 [†]
Increased importance of health and sports	-0.135 [†]	-0.208 [†]	-0.186 [†]
Increased importance of self-actualization	-0.143 [†]	-0.081 [†]	-0.154 [†]
Increased importance of spiritual values	-0.140 [†]	-0.095 [†]	-0.190 [†]
Perception of harmfulness abuse of soft drugs might have on the realization of the hierarchy of values	-0.284 [†]	-0.248 [†]	-0.361 [†]
Poor family relations	0.178 [†]	0.192 [†]	0.190 [†]
More frequent abuse of psychoactive substances in the family	0.177 [†]	0.137 [†]	0.130 [†]
Poorer adjustment to school	0.272 [†]	0.346 [†]	0.397 [†]
Poorer relationships with teachers and peers	0.190 [†]	0.175 [†]	0.164 [†]
More prominent leaning toward risk and deviant behavior	0.485 [†]	0.397 [†]	0.501 [†]

*Calculated as the sum of indicators of experimental and regular consumption of the particular substance. Higher value indicates a more frequent consumption.

[†]Statistically significant ($p < 0.001$).

stance use among adolescents whose parents were divorced, but with no statistically significant difference), self-appreciation, quality of relationships with peers, number of close friends, financial status of parents (we only noticed a slight tendency toward more frequent consumption among adolescents from extremely wealthy, as well as extremely poor families), number of members in the family, order of birth, and type of high school.

Interrelations of Predictors. We assessed the structure and hierarchy of the relevant predictors. We then investigated the directions and intensities of interrelations between the predictive variables. The strongest interrelation between the particular predictors was the one between the poor adjustment to school and the tendency toward risk and deviant behavior ($r = 0.423$; $p < 0.001$). Young men had a lower grade average and were more likely to engage in risk and deviant behavior than young women ($r = 0.283$ and $r = 0.378$, respectively; $p < 0.001$ for both). These predictors also correlated with the high ranking of the hedonistic elements in the adolescents' hierarchy of values. A separate cluster comprised values that promoted health, sports, self-actualization, and spiritual growth (interrelation about 0.250), but were independent of hedonistic values.

Our results also showed that the adolescent's positive assessment of family relations was related to a high validation of health and sports ($r = 0.150$; $p < 0.001$), self-actualization ($r = 0.130$; $p < 0.001$), spiritual growth ($r = 0.149$; $p < 0.001$), better adjustment to school ($r = 0.138$; $p < 0.001$), less frequent engagement in risk and deviant behavior ($r = -0.147$; $p < 0.001$), and lower frequency of other family members' consumption of psychoactive substances ($r = -0.179$; $p < 0.001$). Another finding we considered valuable was that of the interrelation between a high sense of self-actualization and good adjustment to school ($r = 0.158$; $p < 0.001$) on the one hand, and lesser tendency toward risk and deviant behavior ($r = -0.187$; $p < 0.001$) on the other. Other interrelations between the particular predictors were not statistically significant and/or were not relevant for the interpretation of the results of the regression analysis.

Hierarchical Multiple Regression Analysis of Predictive Variables. We used hierarchy multiple regression analysis to investigate the possibility of predicting substance abuse by simultaneously using the predictors which were at the disposal in a particular individual case. The order (hierarchy) of including the particular predictors into the analysis was defined under the scope of the socialization theories (8,13,29). We started with the demographical data (sex and age), since these variables are independent of any sociological influences (Table 7). The second group of variables introduced into the analysis was descriptive of the hierarchy of values, which is influenced by the complex process of the socialization. Next, we added the group of predictors pertaining to the influence of family relations, and the last two groups of predictive variables were those pertaining to adjustment to school and risk and deviant behavior. We ran three independent analyses, where the criteria variables were consumption of alcohol, tobacco, and marijuana. Multivariate regression analysis was performed on the sample of 1,878 examinees (those who answered all questions included into the analysis). Additional tests showed that the excluded examinees did not significantly differ from the examinees that provided all the relevant data, except for the lower grade average and a higher proportion of the male students among those who did not answer to all questions.

The results of the hierarchical multiple regression analysis showed that roughly one-third of the variability of the criteria variables could be explained by the inclusion of all predictive variables ($R^2 = 0.330$, 0.300, and 0.370, respectively for alcohol, tobacco, and marijuana) (Table 7). The successive inclusion of the variables showed that each of the seven predictive groups had its unique value, contributing significantly to the prediction of the abuse of all three psychoactive substances (Table 7).

Interconnections between Consuming Different Psychoactive Substances. Although our preliminary results indicated a high degree of interrelation among analyzed psychoactive substances (Tables 6 and 7), a more exact analysis of these interrelations was needed. Pearson's correlation coefficient for indexes of alcohol and tobacco consumption was $r = 0.524$

Table 7. Results of three hierarchy multiple regression analyses for the consumption of alcohol, tobacco, and marijuana. In each successive step of the analysis, a new predictor was added to the predictors from the earlier step

Step No.	Earlier predictors	New predictor [‡]	Index of alcohol consumption ^{*†}		Index of tobacco consumption [†]		Index of marijuana consumption [†]	
			R [§]	R	R	R ²	R	R ²
1	–	A	0.266	7.1	0.226	5.1	0.262	6.8
2	A	B	0.421	10.7	0.397	10.6	0.416	10.5
3	A, B	C	0.457	3.1	0.424	2.3	0.486	6.3
4	A, B, C	D	0.469	1.1	0.441	1.4	0.498	1.2
5	A, B, C, D	E	0.483	1.3	0.447	0.5	0.501	0.3
6	A, B, C, D, E	F	0.497	1.4	0.500	5.0	0.549	5.1
7	A, B, C, D, E, F	G	0.575	8.4	0.548	5.0	0.608	6.8
Total	% of the explained variance			33.0		29.7		37.0

*Calculated as the sum of indicators of experimental and regular consumption of the particular substance. Higher value indicates a more frequent consumption.

†Correlation coefficients at all 7 steps were statistically significant $p < 0.001$.

‡A – demographical variables (sex and age); B – personal hierarchy of values (hedonistic, health, sports, self-actualization, spiritual values); C – perception of influence abuse of soft drugs might have on the realization of the hierarchy of values; D – satisfaction with intrafamilial relations; E – abuse of psychoactive substances among other members of the family; F – adjustment to school and satisfaction with relationship with teachers and peers; G – leaning toward risk and deviant behavior.

§Multiple correlation coefficient based on the so far included predictors (ie, all predictors used in the particular step of the analysis).

||Percentage of variance explained by the inclusion of the new predictor (indicates whether the new predictor gives the solution for the so far not explained part of the variability).

($p < 0.001$), for alcohol and marijuana $r = 0.438$ ($p < 0.001$), and for tobacco and marijuana $r = 0.539$ ($p < 0.001$).

A positive attitude toward marijuana was connected with a more frequent use of marijuana ($r = 0.595$, $p < 0.001$), but also of alcohol ($r = 0.381$, $p < 0.001$) and tobacco ($r = 0.402$, $p < 0.001$). The same was true for the views on the legalization issue, which also positively correlated with the consumption of all three analyzed psychoactive substances: marijuana ($r = 0.384$, $p < 0.001$), alcohol ($r = 0.253$, $p < 0.001$), and tobacco ($r = 0.275$, $p < 0.001$). These results were in favor of a strong psychological affinity between alcohol, tobacco, and marijuana consumption. Further, although they did not directly prove, they did suggest the existence of a relatively well-defined chronology and interaction among particular psychoactive substances (Fig. 1). Of those examinees who were not regular consumers of alcohol or tobacco, only 9% experimented with marijuana in their lifetime, and even less (6%) with harder illicit substances (most frequently hashish, LSD, or Ecstasy). Regular consumers of alcohol who did not smoke tobacco experimented with illicit drugs more than the previous group (24% with marijuana and 12% with other illicit substances), whereas examinees who regularly smoked tobacco but did not consume alcohol

regularly experimented with illicit drugs even more often (46% with marijuana and 22% with harder illicit drugs). Further, 67% of examinees who regularly consumed both alcohol and tobacco experimented with marijuana, and 36% with harder drugs. Finally, 62% of adolescents who regularly consumed alcohol, tobacco, and marijuana also experimented with harder illicit drugs.

Adolescents' Knowledge on Consequences of Abusing Psychoactive Substances. Our results indicated a positive correlation between the frequency of drug abuse and knowledge of the consequences. Those examinees who did have a history of consuming illicit drugs were better informed than abstainers on the effects of particular substances, consuming rituals, and prices of drugs, as well as on the consequences of abuse to the user's health. The correlations between examinees' total knowledge and the consumption of alcohol, tobacco, and marijuana were all statistically significant at $p < 0.001$ ($r = 0.226$, 0.213, and 0.320, respectively).

Discussion

Our results undoubtedly reflect a high degree of psychoactive substance abuse among adolescents in the Croatian capital, where almost a quarter of the

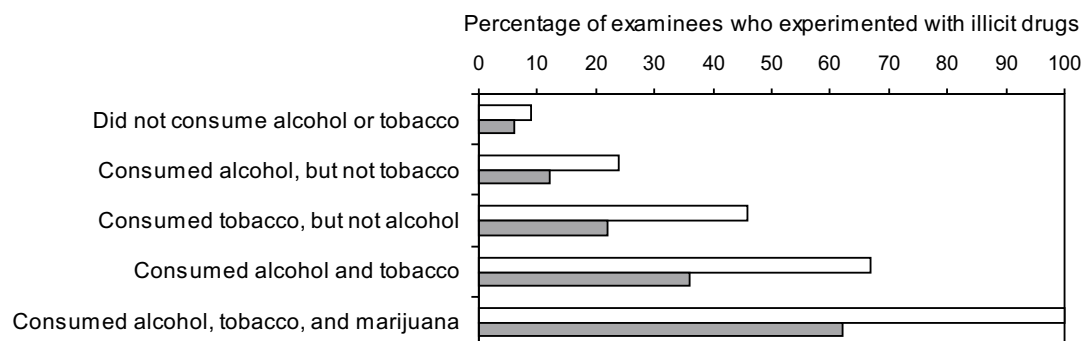


Figure 1. Association of abuse of several psychoactive substances among adolescents in Zagreb, Croatia. Open bars – examinees who experimented with marijuana only; gray bars – examinees who experimented with illicit substances other than marijuana.

Croatian population lives. Most adolescents experimented with alcohol and tobacco as early as elementary school, and one-third smoked tobacco daily and consumed alcohol occasionally, but regularly. Half of them experimented with illicit drugs, usually marijuana. When compared with a similar survey undertaken in Zagreb in 1998, these findings show a slight incline in the prevalence of use of almost all psychoactive substances among the adolescents (2). The prevalence found now is much higher than those found at the national level two (40) or three years ago (2). However, it is possible that these differences are partly due to differences in methodology, especially sampling. In the experimental and occasional use, the young women are now almost as active as men, but regular abuse is still more frequent among the young men (2,13,15,21,32,34,39-41). Judging from the frequency of use of the particular illicit substance and the attitudes toward marijuana and its legalization, this illicit drug is in adolescents' perception much closer to alcohol and tobacco than to other illicit drugs.

Another sign of a higher level of receptiveness of today's youth toward illicit substances is the ever younger age at first experience with particular substances. We can only speculate as to what influence this will have on today's adolescents' behavior and attitudes in the future, but we can hardly be optimistic. Several recent studies have found that the younger the age at which the first contact with the substance occurred, the higher the possibility that the user is going to become an addict in the full sense of the word (12). Still, one reason for optimism is the fact that a large proportion of adolescents never experiment with illicit substances, or only have a few experimental episodes and ultimately become abstainers.

We believe our results support the theory of the commonness of the etiological factors for abuse of psychoactive substances, or at least of alcohol, tobacco, and marijuana. The occurrence of one of these psychoactive substances in the population is regularly accompanied by the occurrence of the other two. In our study, all three psychoactive substances had a very similar structure and hierarchy of predictors in the context of demographical and psycho-social aspects of adjustment. Finally, the emotional attitude toward marijuana and the attitude toward the possibility of its legalization are well reflected in consumption of not only marijuana, but also alcohol and tobacco.

Although we believe that the basic etiological factors of abuse are common for most psychoactive drugs, we do not decline the specificities in patterns and motivation for use of each particular substance. The high but not complete degree of covariance suggests that some adolescents show a general tendency toward consumption of psychoactive drugs, but the final choice of the drug most frequently consumed comes from the combination of the general and specific motives. Worldwide, many authors reported on the similar structure and interconnections among predictors of abuse of different psychoactive substances (3,21,32,34,42). In addition, our results suggest a relatively regular chronological pattern of "experiment-

ing" with particular substances. Independently of the specificities and the degree of abuse, almost all consumers who participated in our study first experimented with alcohol and tobacco. Those who showed no interest in legal addictive substances also showed no interest in the illicit drugs, and this is especially true for the so-called hard drugs. In other words, adolescent's early "experimenting" with alcohol and tobacco puts him or her at a higher risk of becoming an addict. This also offers a unique opportunity for the early action through the prevention programs. Congruent with this concept of a generalized tendency toward consuming psychoactive substances is also the assumption that the early prevention of alcohol and tobacco abuse would reduce (in a later phase) adolescent' leaning toward other psychoactive substances.

The analysis of potential predictors showed that the general circumstances of living (ie, the wholeness of the family, as well as its numerosness and financial status, employment status of parents, order of birth, or type of high school) played no significant role in the adolescent's attitude toward and involvement with psychoactive substances. This is congruous with the results from studies conducted elsewhere (34,43). However, some variables from this circle become predictive when they reach the extremes (ie, both parents deceased, extremely wealthy or extremely poor families). The strongest predictors in our analysis were leaning towards risk and socially deviant behavior, as well as the dominance of hedonistic elements in the adolescents' hierarchy of values. Substance abuse was also accompanied by some sort of a problematic relationship at school or in the family, and inclination toward negating or lessening the damaging effects of drug abuse.

On the other hand, the low risk of drug abuse correlated with harmonious family relationships, successful adjustment to school, and orientation toward health, sports, spiritual values, and self-actualization. Drug abuse was more frequent in older adolescents than in younger ones, and more frequent among the young men than women. The combination of all the relevant predictors explains for about one-third of the variability in the measures of consumption of alcohol, tobacco, and marijuana. Even though our sample reflected only the urban population of adolescents, the structure and hierarchy of the relevant predictors outlined in our study matches that found on the national level (34,42,43), and is even in congruence with studies dealing with other ethnic groups, even races (6,15-17,24,25,32). It seems that the tendency toward consumption of psychoactive substances, in its essence, surpasses not only specificities of the particular substance or patterns of consumption, but also the national and ethnical boundaries.

We found that age and sex were valuable parameters predictive of drug abuse in adolescents. Their connection with drug abuse should be considered in the context of psycho-social specificities of age-groups or sexes in general, whether genetically determined or acquired (e.g., submissiveness to peer pressure, or tendency towards risk behavior).

If we try to define the role of the primary family in the etiology of adolescent's drug abuse, the key question is whether the adolescent's frustration with family relations is the cause or the effect of his or her drug abuse. From the contents of adolescents' complaints (e.g., parents don't pay enough attention to him or her, they are too permissive in the upbringing, parents themselves have poor relationships), it is obvious that some family issues had existed before the drug problem aroused. Namely, the typical parental reaction when they find out about their child's drug problem is to become more controlling and strict, as well as to put their own conflicts temporarily aside. We are going to assume that the primary family of a drug addict is more likely to be dysfunctional (even before the onset of the drug problem) than the primary family of the abstinent. Any adolescent coming from a dysfunctional family will be prone to numerous adjustment deficits, such as the emotional deprivation and insufficient mechanisms of self-control.

The hierarchy of values is a relatively stable intra-psychological category, which is mostly formed during childhood and early adolescence, ie, before the interest for drugs is likely to develop. Therefore, we argue that the hedonistic orientation has an indirect stimulating influence on leaning toward drug abuse, whereas orientation toward health, sports, spiritual values, and self-actualization an indirect inhibiting influence. We also believe that a child's "choice" of values is influenced by the quality of life in the primary family. We interpret the problems with adjustment to school and leaning toward deviant behavior, together with drug abuse, as a logical consequence of the adolescent's immaturity when it comes to the adjustment process (whether or not caused by the family issues), and the specific hierarchy of values.

We still need to discuss the tendency to deny the harmfulness of drugs, better knowledgeableness, and more positive attitude toward drugs, which is all more prominent in the adolescents who consume psychoactive substances than in the abstainers. We believe that all these three aspects are the consequence of a conscious decision to abuse psychoactive substances, while their function is to justify and sustain this decision. We argue that the adolescents in the pre-experimental phase have no intrinsic interest in the information about psychoactive substances, nor a clearly articulated attitude toward drug abuse. The adolescents who decide to use drugs gather information spontaneously through their actions and drug abuse rituals, whereas abstainers remain ignorant of these matters. Further, we see no reason why the adolescents would glorify psychoactive substances, bend their own perceptions, and ignore valid information on drugs harmfulness, before they experience the psychological effects of the substances. On the other hand, the abstainers who refuse to experiment with drugs without knowing much about it are also in a sense acting irrationally. Generally, we gather that irrationality is one of the main characteristics of the adolescents' attitudes toward abuse of psychoactive substances.

In summary, it seems that the drug abusers' unfortunate life stories begin in primary families, with

poor family relationships and poor parents' balancing between controlling and spending time with the adolescent. Such a constellation contributes to the emotional deprivation, making it harder for children to develop their full potential and skills necessary for adjustment out of the family (school, peers). Also, such a child develops a hedonistic (egoistic) hierarchy of values, and the aversion toward conventional (pro-social) values. Socially insufficient and consumption-driven, having no intrinsic inhibitions against deviant patterns of adjustment, these children are easily joining "bad company" on the streets. They neglect their schooling, and gain affirmation among peers through drug abuse and deviant behavior, which partly solves their problem of the chronic emotional deprivation. Their attitudes toward drug abuse and perception of drug harmfulness are formed by the psychological gain that the psychoactive substance provides, while rational arguments and facts get pushed aside.

Children who grew up in the more fortunate family circumstances have at least three reasons to refuse drugs: a realistically lesser need for what drugs have to offer, protective hierarchy of values, and consideration of their parents, with whom they nurture a harmonious relationships.

In order to complete the etiological scheme, we should assume the feedback influence, ie, interactions among the variables. For example, drug abuse logically has a negative feedback influence on the consumer's general psychological status, his or her relationships with parents, friends, and adjustment to school, whereas its feedback influence on the deviant behavior will be positive.

The described trends and the context of drug abuse can partially be credited to the 1991-1995 war in Croatia and transitional economy. The war chaos and government's inability to adequately deal with the aggressive and well-organized drug-crime resulted in a relatively steep increase in availability of various illicit drugs (40). On the other hand, we do not believe that the war influenced the adolescents in a sense that they became more interested in psychoactive substances, but rather that this trend is the consequence of the global social and economic changes, present in most democratic countries (e.g., the erosion of the traditional hierarchy of values and blooming of the consuming mentality). Supportive of this thesis is the fact that the trends regarding drug consumption, which are visible in Croatia, also exist in many European countries which had neither the war nor transition economy (3,21,32,34,39,41).

There are some limitations to our study. First, the collected data were self-reported, relying on the examinees' truthfulness and insight into themselves. Further, the survey did not include adolescents who are not a part of a regular schooling system. We do not know the exact number of these adolescents, much less their habits or attitudes towards psychoactive substance abuse. Another limitation that prevents us from gaining the general overview of drug abuse among the Zagreb adolescents is the fact that we excluded from the study all adolescents who attended schools with special programs. Also, the correlation

analysis we used does not enable us to draw unambiguous conclusions on causality, ie, cause-effect relations.

Still, our results imply certain suggestions for improving the programs for prevention of addiction. First, the concept of the general tendency toward consuming psychoactive substances makes room for a strong critique of the programs of partial prevention, which are focused only on preventing abuse of a particular substance. Such programs isolate related phenomena (e.g., inclination toward tobacco, alcohol, and marijuana), spend much time, money, and energy, but rarely reaching the core of the problem. Also, the maximum efficacy of such programs is limited only to a single psychoactive substance. Our results are in favor of an integral program that would include prevention of not only abuse of all psychoactive substances, but also other forms of risk and deviant behavior. Such a program should take advantage of the relatedness among the phenomenon in question, and focus on the common causes of deviant behavior, with possible "collateral subprograms" dealing with specificities of a particular phenomenon.

Since most addicts begin their "careers" with abuse of alcohol and tobacco early during adolescence, it seems logical to focus the programs of prevention on reduction of smoking and alcohol drinking among young adolescents, hoping it will also reduce the inclination toward other psychoactive substances, ie, even more serious forms of drug abuse. We dare to argue that the drug battle is either won or lost on the elementary school level, through young adolescents' attitudes toward tobacco and alcohol. Further, since our results show that knowledge does not correlate with the adolescent's likelihood of experimenting with drugs or becoming an addict, we need to pose the seemingly absurd question: "Should education be excluded from prevention programs?". Not necessarily. We believe that knowledge and subsequent attitudes, combined with a timely intervention, can make for an important motive for abstinence. The intervention should "artificially" cause young adolescents to become interested in the drug issue, and systematically educate them before they reach the age when they are at high risk for drug abuse, since they are most prone to rational influences before drugs become an issue of their personal experience and interest.

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