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ADOLESCENT DRUG USE, RELATIONAL VARIABLES AND PERSONALITY FACTORS

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SUMMARY

Objective: *An ongoing issue in the study of adolescent drug use is the impact of family and the peer group on the problem of adolescent substance use. The present study has examined relative effects of these contexts as well as personality variables on drug use outcomes.*

Method: *A test battery measuring various psychological variables was administered to a representative sample of 1652 secondary school students (grades 9 and 11), 876 male(mean age=17,61, SD=0.99) and 789 female (mean age=16.73, SD=1.31). Data about relationship to parents and association with deviant peers were collected, personality dimensions such as Neuroticism and Sensation Seeking were measured. Regressional and discriminant analyses were conducted, then a decision tree model was created.*

Results: *Sensation seeking arose as the most significant predictor of substance use. Fatheradolescent relationship had the highest predictive value primarily in male sensation seekers. Peer effects were stronger in comparison to parental influences. In adolescent boys, contact with deviant friends and sensation seeking constituted two independent pathways to drug use.*

Conclusions: *Our study highlights the necessity to give consideration to sensationseeking in prevention initiatives during adolescence, as well as the need for education of parents about parenting techniques recommended during adolescence.*

Key words: *adolescents - drug use*

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INTRODUCTION

Adolescence is a critical life period with high risk of substance use, a behavior that may lead to later deliquency, academic failure, and risky sexual activity (Van Ryzin et al. 2014, Randolph 2004). Research initiatives addressing adolescent substance use emphasize some factors of the social context, such as parental monitoring and the parent–adolescent relationship. There is also a growing body of evidence that personality and temperament act as determinants of substance use vulnerability (Quinn & Harden 2013)

Family is a crucial context of socialization and adjustment. Parents are role models for both health/risk behavior and health-related value formation (Chen et al. 2010, Loke & Wong 2010, Pergamit et al. 2001) Some of the family-related variables including family cohesion, low family conflict, regular engagement in family activities and rituals have been confirmed as protective factors (van der Vorst et al. 2006, Rankin & Kern 1994), as they increase the likelihood for parents to transfer their health-related values and prosocial norms to their children (Kincaid et al. 2011). Secure attachment to parents, family connectedness and parent-child communication ameliorate the risks of ineffective coping (Ryan et al. 2010, Johnson et al. 2011, De Haan et al. 2012). Parental monitoring techniques in relation to nonpunitive and supportive family relationships (Johnson et al. 2011) may also effectively reduce the risks for substance use involvement (Chapple et al. 2005, Yabiku et al. 2010). Some authors found support for significance of maternal impact (Costa et al. 2019), others have confirmed the role of fathers' attitudes (Weymouth et al. 2017), especially paternal control (Henry et al. 2018).

Socializing with drug using friends is among the strongest predictors of substance use (Fujimoto & Valente 2012, Marschall-Levesque et al. 2014, Monahan et al. 2014), with a moderate to strong effect size (Jaccard et al. 2005), that is even stronger than parental influences (Hoffmann & Su 1998). Peer contacts may not be stable over time, meaning most risk during early and middle adolescence (Steinberg & Monahan 2007, Sumter et al. 2009, Kelly et al. 2012). A number of risk mechanisms within peer groups have been described, among them peer selection, peer pressure and conformity (Hoeve et al. 2009, Urberg et al. 2003, Lundborg 2006, Simons-Morton & Chen 2006, Loke & Mak 2013). Social influence theory proposed that adolescents who regularly contact deviant peers are also more likely to abuse drugs (Lai et al. 2013). Deviant peers may subject their new friends to „deviancy training" (Lipsey et al. 2006, Goodman et al. 2016) by modeling and promoting antisocial behavior, simultaneously applying pressure (Teunissen et al. 2012, Bot et al. 2005, Deutsch et al. 2014). Furthermore, social selection theory posits

that deviant tendencies of adolescents may lead them to seek similar, deviant friends (Richmond et al. 2012). Some researchers however have suggested that parental and peer effects on substance use may not be separate but interrelated (Lee et al. 2004, Van Ryzin et al. 2014).

Individual personality factors can act as additional mediators between the family context and drug use (Horan & Widom 2015, Lansford et al. 2010, Oshri et al. 2011). Numerous research initiatives have found links between some personality factors and drug use habits, aiming to identify personality factor profiles of substance users. Sensation seeking and neuroticism have repeatedly been established as vulnerability factors (Herman-Stahl et al. 2006, Atherton et al. 2014, N'Goran et al. 2014, Maier et al. 2015, Quinn & Harden 2013, Dever et al. 2012, Pedersen et al. 2012). Sensation seeking is the tendency to seek stimulating new experiences, including risky situations (Zuckerman & Link 1968), and it has been associated with increased substance use during adolescence and young adulthood (Romer et al. 2010, Quinn & Harden 2013, Pedersen et al. 2012, Cyders & Smith 2008). High sensation seekers may be sensitive to positive reinforcements such as drugs (Woicik et al. 2019), and they can seek more risky or more unstructured leisure activities (Trainor et al. 2010, Wilson et al. 2010). Neuroticism is another, temperament-based risk factor of stress vulnerability, indicating a basic tendency of emotional instability (Jeronimus et al. 2014, Guenole et al. 2008). As stress is serious susceptibility factor of drug use (Gurley & Satcher 2003), Neuroticism influences substance use both directly (Kotov et al. 2010) and through coping motives (Kuntsche et al. 2006). Higher Neuroticism means more risk by experiencing more frequent changes in emotional states and an increased negative emotionality. Additionally, some authors have proposed that the forementioned personality traits and environmental factors can themselves be interrelated (Ersche et al. 2012), with change of influencing variables during the course of development (Ellis et al. 2011). For the most part, personality traits linked with Neuroticism have been consistently associated with substance use (Grekin et al. 2006, Fridberg et al. 2011).

In recent years, there has been an increasing need to study parental and peer influences as well as personality variables simultaneously and to incorporate them in comprehensive statistical models. This approach can specify the significant variables related to substance use outcomes, their differential effects and interrelations. Regarding interactions between parental and peer effects, van Ryzin et al (2012) found that family factors, such as relationship quality, indirectly predicted adolescent substance use through reduced deviant peer associations. In contrast, Bares et al. (2011) reported that when peer influences were added to an outcome model of drug use, family influences were reduced. For interactions between personality factors and variables of the social context, Oshri et al. (2011) has found that some personality traits (ego undercontrol and ego resiliency) acted as mediators of the link between parental maltreatment and adolescent cannabis consumption. Further studies have examined individual characteristics (e.g., depression) as mediating mechanisms in the association of child maltreatment with substance use (Horan & Widom 2015, Lansford et al. 2010, Lo & Cheng 2007). Nevertheless, whether Sensation seeking and/or Neuroticism can be similar mediators of drug use is still to be clarified. It also remains a debated topic whether parental influences are more direct or indirect and whether certain parenting styles can be associated with adolescents' choice of more deviant peers.

As former research is still inconclusive, our study had a the aim to include various risk factors into a complex analysis of substance use outcomes. For this purpose, we have used classical regressional and discriminant analyses, and we have applied a decision tree model, a powerful method of classification of non-linear complex relationships. We have also considered a gap in present research regarding parental factors, as there were only a few studies addressing maternal and paternal impact separately (Weymouth et al. 2017, Henry et al. 2018). Gender differences of drug use pathways were additionally taken into account, as gender may be a moderator variable, with boys and girls having different motivations for drug experimentation (Simoes et al. 2012, Anderson et al. 2011, Aspy et al. 2014).

METHOD

The main purpose of the present study was to test relative effects of parental and peer influences as well as personality variables on substance use during adolescence.

Our sample consisted of 1652 students, 876 male (mean age=17.61, SD=0.99) and 789 female (mean age=16.73, SD=1.31) students of secondary schools in Hungary (see Table 1), from grades 11. Students have been recruited from all of twenty counties in Hungary, representatively to population in Hungary. Students filled out the questionnaire in a school setting.

Ethical approval was obtained from the Human Subjects Research Ethics Committee of our University. Written permission to conduct the survey was also obtained from school directors. An information sheet explaining the aims of the study was provided to school principals, and also a declaration of informed consent was obtained from the parents of the subjects. The participants were ensured about confidentiality, anonimity, and data use exclusively for research purposes.

Measures

Our main dependent variables were prevalence of drug use (the answer to the question of „Have you ever used drugs?") frequency of drug use on a 5-point scale (response options: no drug use, once, 2-3 times, 4-10 times, more than 10 times). Our independent variables included gender, personality indices of Neuroticism and Sensation seeking as well as indices of relationship with father, mother and peers as well as contact with deviant friends.

Inventory of Parent and Peer Attachment (IPPA, Armsden & Greenberg 1987). This measure is focused on the quality of parent and peer attachment in late adolescence and young adulthood and is based on Bowlby's attachment theory. It originally consists of 25 statements for the three domains of mother, father and peer attachment. Participants respond on a 5-point Likert-type scale from „almost always true" to „almost never true". In the original version, there were three subscales for each domain: trust, communication and alienation, and a total score could be calculated. In the present study, relationship to mother and father were measured by 10-10 items of the IPPA, for which a total index score was obtained. (Reliability coefficients in the present study were Cronbach alpha = 0.874 for mother attachment and Cronbach alpha = 0.783 for father attachment).

Relationship to peers was measured by 6 items compiled by the expert team. In this part, subjects indicated the number of male and female friends, easiness/difficulties to form friendships, and subjective quality of communication with male and female friends. A principal component was obtained from these variables, with all component scores being higher (in absolute value) than 0.55 and with explained variance of 40.00%.

Also, an index of deviant peer contact was composed, based on the Adolescent Delinquency Questionnaire (Huizinga & Elliott 1986). The six items addressed association with friends who have been 1. deliberately destroying things; 2. acting aggressively; 3. smoking and drinking alcohol; 4. hanging out from school; 5. staying out for night without parents' permission; 6. having early sexual activity). A Cronbach-alpha of 0.519 was calculated for this index.

The Ten-Item Personality Inventory (TIPI, Gosling et al. 2003) is a widely used brief measure of the five major domains of personality. It includes two items for each of the Big Five dimensions, namely Extraversion, Agreeableness, Conscientiousness, Openness to experience and Emotional Stability. Items can be scored on a 7-point Likert-type scales ranging from 1 (strongly disagree) to 7 (strongly agree). While the complete measure was administered, for the present study, only the Neuroticism score was used.

The Brief Sensation Seeking Scale (BSSS) was created by Hoyle et al (2002) and is intended for adolescents and young adults. It consists of eight items and four dimensions, each being represented by two items. Experience seeking means seeking of experiences through the mind and senses; boredom susceptility means aversion to routine; thrill and adventure seeking, represents a desire to get involved in dangerous sport activities, and disinhibition, a tendency to behave in a socially or sexually extreme way. Responses can range between „strongly disagree" and „strongly agree". Cronbach alpha of the scale was 0.795.

Drug use was measured with 10 items. One of the items examined the initiation to drug use („Have you ever used drugs?"), and a second item addressed frequency of drug use. Participants were asked to indicate the approximate number of times when they consumed drugs on a 4-point scale between 1 (once) and 4 (more than 10 times). Other items were related to consumption of various drug types, however analysis of these data was not included in the present study.

RESULTS

Descriptive statistics

Descriptive statistics of the variables included in the present study are listed in Table 1, whereas Table 2 presents mean and standard deviation scores. In both tables, we have indicated with lowercase letters if significant differences between substance users (subjects who have been initiated into drug use) and non-users have appeared. Both tables indicated that in case of both genders, substance users had worse relationship with both of their parents, along with better relationship with peers. Additionally, substance useres had more deviant friends and higher level of Sensation seeking as well as Neuroticism than non-substance users.

Discriminant analysis

The Wilks' Lambda of our discriminant analysis (λ (df=4.1452) =0.88, Sig. <0.001) indicated 11.2 % of explained variance (Canonical correlation = 0.334). Sensation seeking and deviant friends emerged as the risk variables for drug use, whereas positive relationship with father and female gender turned out to be protective factors (Table 3).

The classifications based on these independent variables have correctly identified 66.9% of drug-users, but misclassified 35.0% of non-users as users. Altogether, 65.5% of original grouped cases correctly classified.

Decision Tree

CRT decision tree divides the data into subsamples that are as homogeneous as possible, with respect to the dependent variable (Lahrmann 2018). A subsample (which is called a node) with all cases having the same value for the dependent variable is a fully homogeneous, pure" node (IBM 2010). The tree is a binary tree, which means that each parent node splits into two child nodes.

Table 1. Descriptive statistics of the present sample

		Male			Female			All sample		
		Non-users Col %	Substance users Col %	All Col %	Non-users Col %	Substance users Col %	All Col %	Non-users Col %	Substance users Col %	All Col %
Age (Binned)	<= 17.0	60.0_a	52.1_b	57.4	66.7_a	46.6_b	62.9	63.5	50.2	60.0
	17.1-18.0	26.4_a	27.7_a	26.8	23.2_a	33.6_b	25.1	24.7	29.7	26.0
	18.1+	13.6_a	20.2_b	15.8	10.1_a	19.9_b	11.9	11.8	20.1	13.9
Relationship to mother (Binned)	<= 4.10	36.2_a	49.6_b	40.5	31.1_a	52.8_b	35.1	33.6	50.7	37.9
	4.11-4.60	36.4_a	31.6_a	34.9	24.3_a	22.5_a	24.0	30.1	28.5	29.7
	4.61+	27.4_a	18.8_b	24.6	44.6_a	24.6_b	40.9	36.3	20.8	32.4
Relationship to father (Binned)	<= 3.40	30.7_a	38.8_b	33.3	34.6_a	51.9_b	37.7	32.7	43.2	35.3
	3.41-4.00	35.7_a	37.6_a	36.3	31.2_a	25.6_a	30.2	33.4	33.6	33.4
	4.01+	33.6_a	23.6_b	30.4	34.2_a	22.5_b	32.1	33.9	23.3	31.2
Neuroticism (Binned)	<= 3.00	52.2_a	44.4_b	49.8	42.6_a	26.0_b	39.5	47.2	38.0	44.9
	3.01-4.00	26.6_a	27.0_a	26.8	22.9_a	33.6_b	24.9	24.7	29.3	25.9
	4.01+	21.2_a	28.5_b	23.5	34.5_a	40.4_a	35.6	28.1	32.7	29.3
Sensation seeking (Binned)	<= 2.63	38.2_a	15.7_b	31.2	48.9_a	23.1_b	44.1	43.8	18.3	37.3
	2.64-3.38	36.8_a	36.2_a	36.6	27.5_a	34.0_a	28.7	32.0	35.4	32.9
	3.39+	25.0_a	48.1_b	32.2	23.6_a	42.9_b	27.2	24.2	46.3	29.8
Deviant friends (Binned)	<= 0.33	64.9_a	46.1_b	59.0	74.1_a	53.8_b	70.3	69.7	48.8	64.4
	0.34-0.50	20.1_a	29.4_b	23.0	17.9_a	19.3_a	18.1	18.9	25.8	20.7
	0.51+	15.0_a	24.5_b	18.0	8.1_a	26.9_b	11.6	11.4	25.4	14.9
Relationship to peers(Binned)	<= -0.28	30.1_a	25.1_a	28.5	38.6_a	39.3_a	38.7	34.5	30.1	33.4
	-0.270-0.67	35.4_a	28.1_b	33.1	34.5_a	37.2_a	35.0	34.9	31.4	34.0
	0.68+	34.5_a	46.8_b	38.4	26.9_a	23.4_a	26.3	30.6	38.5	32.6

Note: Values in the same row and subtable not sharing the same subscript are significantly different at p<0.05 in the two-sided test of equality for column proportions. Cells with no subscript are not included in the test. Tests assume equal variances.[1]; 1. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction

Table 2. Group comparisons between substance users and non-users

	Male						Female						All sample					
	Non-users		Substance users		All		Non-users		Substance users		All		Non-users		Substance users		All	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Relationship to mother	4.23_a	0.60	4.07_b	0.66	4.18	0.63	4.31_a	0.74	3.93_b	0.88	4.24	0.78	4.27	0.68	4.02	0.74	4.21	0.70
Relationship to father	3.71_a	0.62	3.53_b	0.66	3.65	0.63	3.62_a	0.73	3.36_b	0.83	3.58	0.75	3.67	0.68	3.48	0.72	3.62	0.69
Deviant friends	0.38_a	0.21	0.46_b	0.19	0.40	0.21	0.32_a	0.19	0.44_b	0.21	0.34	0.20	0.35	0.20	0.46	0.20	0.37	0.21
Neuroticism	3.24_a	1.35	3.47_b	1.38	3.31	1.36	3.62_a	1.44	4.00_b	1.39	3.69	1.44	3.43	1.41	3.66	1.41	3.49	1.41
Sensation seeking	2.91_a	0.81	3.38_b	0.73	3.05	0.81	2.75_a	0.82	3.26_b	0.85	2.85	0.85	2.83	0.81	3.34	0.78	2.95	0.83
Relationship to peers	0.08_a	0.96	0.23_b	0.97	0.13	0.96	-0.14_a	1.03	-0.15_a	1.01	-0.14	1.02	-0.03	1.00	0.09	1.00	0.00	1.00

Note: Values in the same row and subtable not sharing the same subscript are significantly different at p<0.05 in the two-sided test of equality for column means. Cells with no subscript are not included in the test. Tests assume equal variances.[1]; 1. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

Table 3. Discriminant analyses

		Wilks' Lambda	Exact F Statistic	df1	df2	Sig.	Coefficient
1	Sensation seeking	0.92	120.82	1	1455	0.000	0.63
2	Deviant friends	0.90	75.86	2	1454	0.000	0.37
3	Gender	0.89	57.47	3	1453	0.000	-0.36
4	Relationship with father	0.88	45.72	4	1452	0.000	-0.24

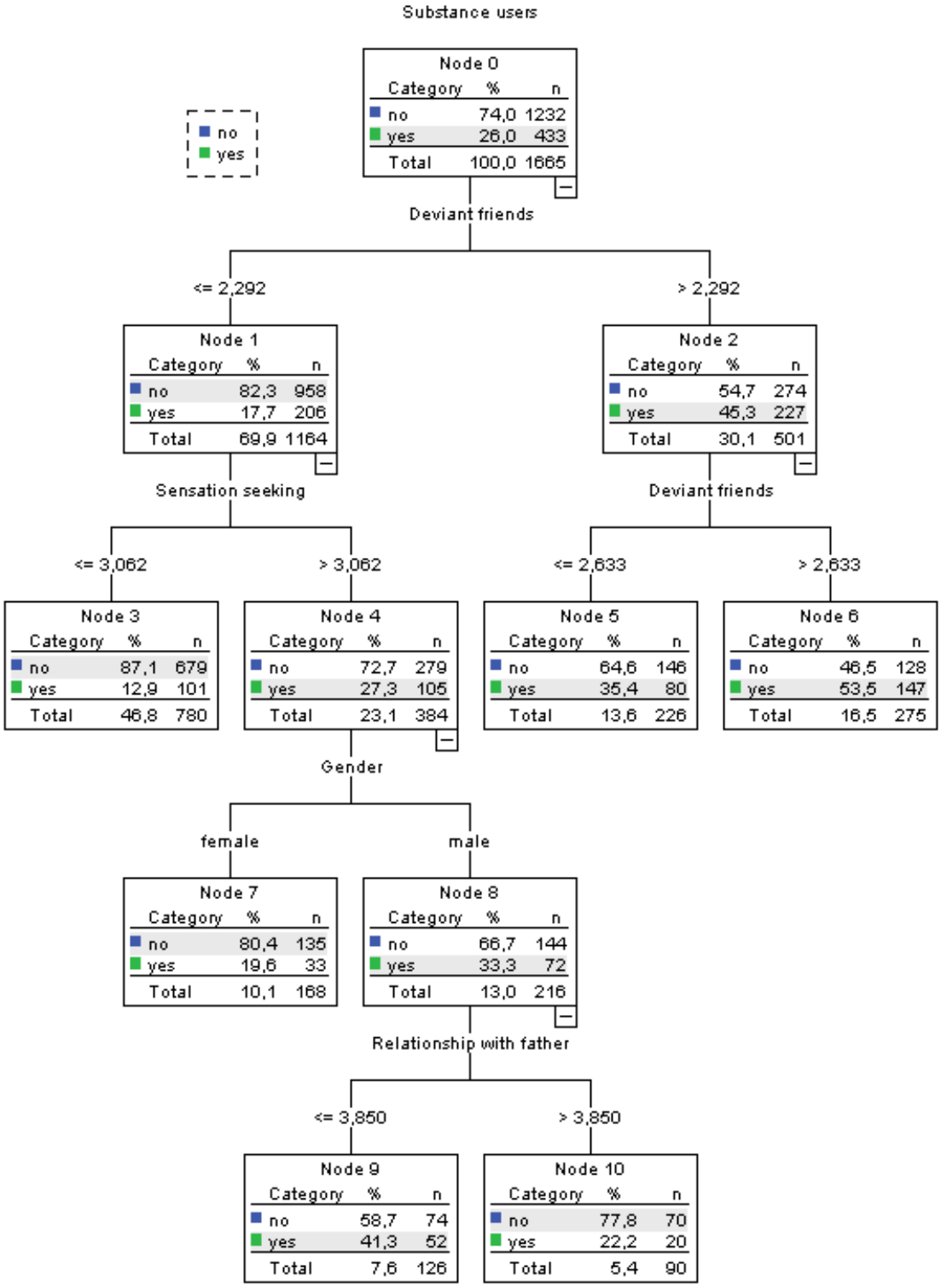

Figure 1. Prediction of drug use initiation

Splitting is based on maximazing Gini Impurity function, and utilizing the Goodness of Split Improvement measure. The Goodness of Split Improvement function is shown below (IBM, 2010):

$$\Delta i(\tau, j, s) := i(\tau) - [p_L i(\tau_L) + p_R i(\tau_R)]$$

Impurity is decreased from the parent node to the child node by choosing the variable split that maximizes the change in impurity (IBM 2010). The decision tree is good for discovering possible interactions between the predictor variables (Lahrmann 2018).

The decision tree analyses were conducted using tenfold cross-validation, using 10% of the sample as a minimum number of cases in the parent node and 5% as the child node. The same criteria were applied by Machuca, Vettore, Krasuska, Baker, & Robinson (2017) and Zhang & Singer (1999).

As suggested by Li and Schwartz (2011), we reported the full rather than the pruned tree, as pruning may omit small but important groups. As drug use is characteristic of minority only (25% of sample have ever used drugs), we were interested in smaller target groups as well.

First, we have built a model on prediction of drug use initiation (Figure 1) Deviant friends, sensation seeking, male gender and bad relationship with father have indicated risk for substance use. The cross-validation method has indicated 4% increase in error rate, decreasing the variance between nodes from 51.4% to 47.3%. Small standard errors (Resubstitution: 0.022; Cross-validation: 0.020) have ensured the validity of our model.

In our prediction model we have built in a three-times bigger misclassification cost for the miss of drug user than for the false alarm of predicting a non-user as a user (as proportion of users was three times bigger than proportion of non-users). The classifications revealed that 64.4% of drug-users have correctly been identified, but 28.2% of non-users have falsely been categorized as users, yielding an overall percentage of correct classification at 69.8%.

For our first model, focused on the prediction of drug use initiation, results have indicated that having highly deviant friends undoubtably increases the risk for substance use. In the total sample, around 25% of high-schoolers have been initiated into drug use, and this rate increased up to 53.5% among those with deviant friends. However among adolescents without deviant friends, there was another risk group: male sensation seekers in bad relationship with their fathers. In this group, drug prevalence was 41.3%.

In our sceond model, the frequency of drug use was predicted from the set of independent variables (Figure 2). In these statistics, only subjects already initiated into drug use were included. This decision model resulted in only one predictor: deviant friends. The crossvalidation increased error rate by 4% (from 56.1% to 59.7%). The standard errors for both resubstitution and cross-validation became 0.0.25. The overall percentage of correctly identified cases (based on the model) was 43.9%.

CONCLUSIONS

Our study aimed to incorporate family, peer and personality-related variables in a comprehensive model, studying their differential and simultaneous effects. Most notably, the present research has confirmed the importance of sensation seeking in predicting risk behavior (Yanowitzky 2005), indicating that this temperamental trait affects adolescent drug use directly and through interactions with family and peer relationships (Oetting & Donnermeyer 1998, Hersh & Hussong 2009).

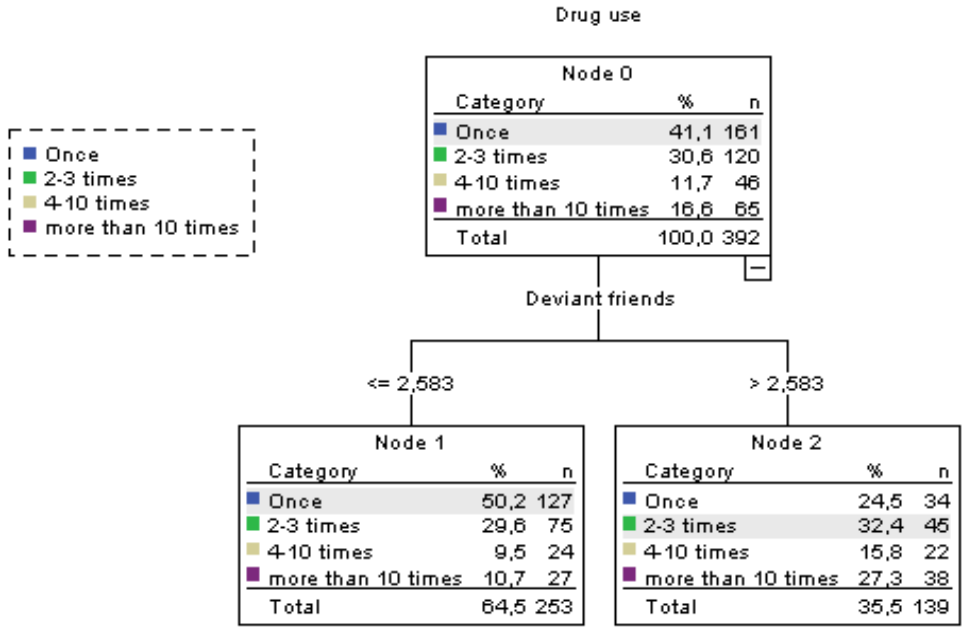

Figure 2. Prediction of drug use frequency

Sensation seeking can be associated with problem behaviors and antisocial peer contact as a result of lowered negative consequence perception, intense adventure seeking and boredom avoidance (Romer & Hennessy 2007, Yanovitzky 2005, Bergen et al. 2007). Additionally, this factor may evoke a need for intense social contact together with an urge to experience unusual situations, which may put the individual at risk for association with deviant communities in which a high level of stimulation is likely to be present and tolerable. As a consequence, deviant behavior – including drug use –may be normalized and a reinforced form of fulfilling a need for novel experiences (Beardslee et al 2018, Thomas 2015). Our data about direct and indirect effects of sensation seeking are in full accordance with former studies describing the developmental dynamics of this trait (Simons-Morton et al 2001, Epstein et al 2016, Scalese 2014)

This temperamental trait, which is at least moderately heritable, can be viewed as an endophenotype, and carries a remarkable risk for antisocial behaviors beginning from adolescence, or even before this period. In contrast, a similar link was not established for Neuroticism, despite that a number of former studies have found association between this Big Five trait and drug experimentation. As an explanation, we agree with recent studies that externalizing behavior during adolescence has more predictive power regarding drug use in comparison to the Big Five (Mann et al. 2017), so that there might be only a weak link between Neuroticism and deviant behavior. It is far more likely that some specific clusters of Big Five traits can underly substance use, rather than a single trait.

Some predictive power of the parent-child relationship variable was also demonstrated by the present study. This indicates that parental influence is likely to remain present during adolescence, despite that this is a period when the peer context becomes extremely significant. Our study therefore provides even more evidence about the modifying effect of parental bond on the trajectory and expression of sensation seeking (Martins et al 2015), together with its power in counteracting and buffering substance use habits. This conclusion particularly applies to male substance users in whom the quality of the father-child relationship is a significant, indirect protective factor. Our results clearly show that deviant outcomes can be to some degree ameliorated by the father-child relationship quality, which definitely involves the limit-setting activity of the fathers (Stephenson and Helme 2006). The parent-child bond can provide a safe background with positive models of coping and leisure activities; it can also be a context for prosocial rules and norms, thereby reducing the duration of unstructured time with peers (Van Ryzin et al 2012). Based on the present data, it may be important primarily for male adolescents to have prosocial models in their household from their fathers, to form good alternatives to deviant group activities.

In addition to confirming former data on significance of relationship factors and their interrelatedness with sensation seeking, our research supports the usefulness of comprehensive models in prediction of adolescent drug use. Such evidence-based models can highlight targets of prevention in health psychology. The present study emphasizes the necessity to involve sensation-seeking youth in prosocial, but stimulating initiatives, in line with some promising evidence that sensation seeking can also be linked to engagement in complex and creative leisure activities (Roberti 2004) within a stable socioeconomic background (Hansen & Breivik 2001). Besides, there is need for education programmes for parents about tje significance of their continued parental involvement in children's lives during the adolescent period, particularly in lives of sensation seeking youth. Though the exact nature of parental behaviors preventing drug use involvement remains still unclear, future research could provide a deeper understanding of this issue. It might also be a fruitful direction to clarify the preventive function of maternal and paternal roles separately in interaction with the gender of their children.

It must be mentioned that our study has several limitations. First, a cross-sectional design was used, so the direction of causality cannot be doubtlessly stated. Second, though we have used standard measures for which there cross-cultural adaptation data were available, in our country there is not so broad experience with application of some questionnaires used by the present research. The Ten Item Personality Inventory might have been too short - with only two items measuring Neuroticism - to provide a fully adequate index of this trait with its interrelationships; which could have biased the results. Additionally, we have used self-report measures for operationalization of deviant peer contact, that can lead to some social desirability bias.

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Contribution of individual authors:

Zsuzsanna Mirnics:Zsuzsanna Kövi: design of the study, data collection, preparation of first draft of the article, statistical analyses.

Zsuzsanna Kövi, Zsuzsanna Tanyi & Ferenc Grezsa: collection, literature searches and analyses, interpretation of dana.

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