

Does shyness interact with peer group affiliation in predicting substance use in adolescence?

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Declaration: This study was conducted for the requirements of a Master's Thesis at Université Laval, under the direction of Michel Boivin and Richard E. Bélanger.

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Abstract

Background and objectives. Cigarette use and binge drinking are risky behaviors emerging during adolescence. Although many beneficial factors are well documented, studies linking shyness to substance use are somehow conflicting, which may be due to the contribution of moderators. Therefore, the present study has two objectives: (a) to prospectively analyze the association between shyness and substance use during adolescence; and (b) to test the moderating role of peer group affiliation on the relationship between shyness and substance use.

Method. Participants are 1447 adolescents from the Quebec Longitudinal Study of Child Development, a representative cohort of single-birth children born between 1997 and 1998 in the province of Quebec, Canada. Shyness was assessed at age 12 years. Peer group affiliation, as well as past year cigarette use and binge drinking were assessed at age 15 years. Logistic regressions were used to analyze the data. All analyses were carried out using weighted data accounting for the complex multistage sample design. **Results.** Results show that shyness negatively predicts the use of tobacco and the occurrence of binge drinking while controlling for confounding variables. However, shyness does not interact with peer group affiliation in predicting substance use. **Conclusion.** This is the first study that confirms the presence of a negative relationship between shyness and substance use during adolescence over a three-year period. Results suggest that shyness could exert a beneficial effect against substance use notwithstanding the adolescent's social context.

Keywords: Shyness; Peer group affiliation; Cigarette use; Binge drinking; Longitudinal

Introduction

Tobacco is the first preventable cause of death in the world, killing six million people each year (World Health Organisation, 2011). Among daily tobacco smoking adults in the USA, 88% had already started smoking by the age of 18 (United States Department of Health Human Services, 2012). On the other hand, alcohol is involved in 36% of fatalities among the 15- to 20-year olds (Sleet, Ballesteros, & Borse, 2010). In 2013, blood alcohol concentration among USA drivers was ≥ 0.08 g/dL in 17% of the 16- to 20-year olds involved in fatal car crashes (National Highway Traffic Safety Administration, 2014). Moreover, binge drinking (i.e. at least five alcoholic drinks on a single occasion) in adolescence is associated with suicide attempts (Schilling, Aseltine, Glanovsky, James, & Jacobs, 2009). In 2013, 6.2% of adolescents in the USA reported current binge drinking (Substance Abuse and Mental Health Services Administration, 2013). Such figures indicate that a clearer understanding of cigarette use and binge drinking precursors among youth is still necessary. Although much research focuses on risk factors, it is also deemed important to evaluate beneficial factors for the purposes of substance use prevention.

Many variables negatively predict substance use in adolescents, i.e. operate as potential beneficial factors (e.g. Hemphill et al., 2011). One of them is shyness, described as “the propensity to respond with heightened anxiety, self-consciousness, and reticence in a variety of social contexts” (Jones, Briggs, & Smith, 1986, p. 630). Shyness is a narrower construct than introversion and neuroticism, i.e. whereas measures of introversion and neuroticism might assess shyness, the opposite is unlikely (Briggs, 1988). Similarly, shyness is not merely a milder form of social anxiety, but rather a precursor or a contributor to social anxiety. More specifically, as a temperamental predisposition, shyness could contribute to the development of cognitive biases

and internalising coping, which in turn could lead to social anxiety (Findlay, Coplan, & Bowker, 2009; Weeks, Ooi, & Coplan, 2016).

The evidence linking shyness to substance use during adolescence is both inconsistent and scarce. In cross-sectional studies, shyness does not seem to be associated with smoking during adolescence (Allen, Page, Moore, & Hewitt, 1994; Piko, Varga, & Mellor, 2016). However, it is negatively associated with binge drinking (Piko et al., 2016). Moreover, shy adolescents are less likely to present an alcohol use disorder (Burstein, Ameli-Grillon, & Merikangas, 2011). Only two longitudinal studies thus far have examined the relation between shyness and substance use in adolescence. In the context of the Woodlawn Study, Fleming, Kellam, et Brown (1982) found that shyness in first grade negatively predicted cigarette and alcohol initiation during adolescence, especially in females (Fleming et al., 1982). Yet, in another USA cohort, shyness in grades four and five was found to be a poor predictor of substance use initiation in the following year (Bush & Iannotti, 1992).

Inconsistencies in previous studies may be due to a lack of consideration for the potential moderating effect of other variables. Regarding the moderating role of gender, shyness is negatively associated with both alcohol and tobacco use in girls (Page, 1989; Varga & Piko, 2015), but only with alcohol use in boys of the same age group (Varga & Piko, 2015). Similarly, contextual factors could play a moderating role, i.e. shyness might exert a beneficial effect against substance use in some contexts, while in other contexts, this beneficial effect might be absent. One such context could be the presence or absence of a group of friends.

Shyness could exert a beneficial effect against substance use in the presence of a group of friends, while being a risk factor in the absence of such a group. Firstly, among adolescents with a group of friends, shy individuals could present a lower risk to use substances than non-shy

individuals. While being shy may not imply having fewer friends, it could impede the quality of one's friendships (Ponti & Tani, 2015). A lower quality of friendships could reduce the frequency of social contacts, thus the number of occasions to use and share substances. In addition, shy adolescents could affiliate with friends who are also shy, as is the case for socially anxious youth (Van Zalk, Van Zalk, Kerr, & Stattin, 2011); in turn, these shy friends could be less favorable to substance use. Secondly, among adolescents without a group of friends, shy individuals could present a greater risk to use substances than non-shy individuals. Shyness is associated with peer rejection and peer victimization (Doey, Coplan, & Kingsbury, 2014), which is a risk factor for substance use (e.g. Kelly et al., 2015; Tharp-Taylor, Haviland, & D'Amico, 2009). Without the protection of a group of friends, shy adolescents could experience more victimisation than their non-shy counterparts, which could motivate them to use substances in order to alleviate their negative feelings.

The objectives of the present study were (a) to prospectively analyze the association between shyness and cigarette use / binge drinking in a representative, contemporary longitudinal cohort of adolescents born in Quebec (Canada); and (b) to test the moderating role of peer group affiliation on the relationship between shyness and cigarette use / binge drinking during adolescence. The two substances were tested separately as their relationship with shyness tends to differ based on current knowledge. Moreover, because boys and girls could react differently to the influence of their group of friends (Marschall-Lévesque, Castellanos-Ryan, Vitaro, & Séguin, 2014), the moderating role of gender was tested as well. We hypothesised that a prospective negative relationship between shyness and substance use would be found. We also hypothesised that this relationship would be stronger for adolescents with a group of friends than for adolescents without such a group.

To ensure the validity of the results, confounders (i.e. control variables) were considered in the analyses. In the present study, most confounders were selected as they are associated with both shyness and substance use in the literature. In this regard, shyness and substance use are positively associated with depressive symptoms (Kaminer, Connor, & Curry, 2007; Murberg, 2009), victimization (Kelly et al., 2015; Woodhouse, Dykas, & Cassidy, 2012) and anxiety (Burstein et al., 2011; Wu et al., 2010), but negatively associated with the socioeconomic status (Hanson & Chen, 2007; Miller & Coll, 2007). Sensation seeking is negatively associated with shyness (Crozier & Birdsey, 2003), but positively associated with substance use (Doran et al., 2011; Stautz & Cooper, 2013). Other variables predicting substance use in adolescence were also used as confounders in the present study, although their possible relation to shyness had not been previously reported. More specifically, substance use during adolescence is negatively associated with attachment to school (Chen, Wu, Chang, & Yen, 2014; Dever et al., 2012) and the quality of the parent-child relationship (Harakeh, Scholte, Vermulst, de Vries, & Engels, 2004; Ryan, Jorm, & Lubman, 2010). Substance use during this period is also negatively associated with having immigrant parents (Haug, Schaub, Salis Gross, John, & Meyer, 2013; Sarasa-Renedo et al., 2015), while it is positively associated with having a blended family or single-parent family (Brown & Rinelli, 2010). Finally, substance use in adolescents is positively associated with alcohol use (Handley & Chassin, 2013) and cigarette use (Sullivan, Bottorff, & Reid, 2011) in the mother.

Method

Participants and Procedures

Participants came from the *Quebec Longitudinal Study of Child Development (QLSCD)*, a representative cohort of single-birth children born between 1997 and 1998 in Quebec, Canada,

and selected through a region-based stratified sampling design. The extensive sampling procedure has been described elsewhere (Jetté & Des Groseillers, 2000). At the baseline, 2120 families participated in the survey. The current study uses data collected at age 12 years ($n = 1415$), 13 years ($n = 1312$) and 15 years ($n = 1466$). Among 15-year-old participants, 19 were excluded due to a diagnosis of autism or mental retardation ($n = 16$), or to aberrant data on substance use variables ($n = 3$). Among the remaining 1447 participants, those whose data informed about past-year cigarette use ($n = 1416$) and binge drinking ($n = 1419$) were included in the analysis. Participating adolescents completed a computerized questionnaire while a self-reported questionnaire and an interviewer-administered questionnaire were completed by their parents. The QLSCD protocol was approved by the ethic committees of *Institut de la statistique du Québec* and the CHU Sainte-Justine Research Center.

Measures

Outcomes. Past-year cigarette use and binge drinking were reported by the adolescent at the age of 15. The following questions were used: (i) “during the last 12 months, did you smoke at least one cigarette?” (“yes” or “no”) and (ii) “during the last 12 months, how many times did you have at least five drinks in a single occasion?” The latter question was dichotomized (i.e. zero time versus at least one time) to allow comparisons with cigarette use. Cigarette use and binge drinking were selected at 15 years because few participants had ever used substances at 13 years (early substance use was not the scope of this study). Data on substance use were not available after the age of 15.

Predictors. Shyness was self-assessed by the adolescent at the age of 12. Shyness was selected at 12 years because this age coincides with the beginning of high school and allowed to predict substance use over a long period of time (i.e. three years). Shyness was assessed using

the Asendorpf's three-degree scale of shyness (Asendorpf, 1993), namely "I readily approach children I don't know" (reversed), "I am shy with children I don't know", and "I take a long time to warm up to children I don't know". To each statement, three optional answers were available, i.e. "never or not true", "sometimes or somewhat true" and "often or very true". The answer to the first item was transposed. A variable was then derived by calculation from these statements according to a scale from zero to 10. This continuous variable of shyness was used in the analysis. Moreover, in order to provide a graphical representation of the variation in substance use according to shyness, this variable was transformed into a categorical variable: mild shyness (score ≤ 3), moderate shyness ($3 < \text{score} < 7$) and severe shyness (score ≥ 7). Peer group affiliation was reported by the adolescent at the age of 15 by answering to the question: "Some people have a group of friends with whom they spend time, do activities or stroll. Do you belong to such a group?" ("yes" or "no"). Data for this variable were not available at any other age.

Confounding variables. Among the control variables, two were treated as dichotomous: (a) the family structure at the age of twelve (parent-reported): "intact family (both parents living together)" vs. "blended or single-parent family"; and (b) the parents' immigration status at birth (parent-reported): "no immigrant parent" vs. "at least one parent being an immigrant". The answer to two variables offered three options: (a) maternal alcohol use when the child was 13 years old (parent-reported): "less than once a week", "once a week or more", or "every day"; and (b) maternal cigarette use when the child was 13 years old (parent-reported): "never", "sometimes", or "every day". All other covariates were computed variables (from zero to 10) derived from categorical statements: (a) a positive relationship with the parents (child-reported at 15 years) (Lempers, Clark-Lempers, & Simons, 1989); (b) a negative relationship with the parents (child-reported at 15 years) (Lempers et al., 1989); (c) depressive symptoms

(child-reported at 12 years) (Kovacs, 1992) ; (d) sensation seeking (child-reported at 15 years) (Woicik, Stewart, Pihl, & Conrod, 2009); (e) attachment to school (child-reported at 12 years) (Hill & Werner, 2006); (f) victimization (child-reported at 12 years) (Ladd & Kochenderfer-Ladd, 2002); and (g) anxiety (child report at 12 years) (Boyle et al., 1987). Finally, the socioeconomic status when the child was 12 years (parent-reported) was a continuous covariate whose value was between -3 and 3. It summarized the parents' occupation, their education and the family household income (Wilms & Shields, 1996). All confounders (except the parents' immigration status) were selected as close as possible to the assessment of the independent variable (i.e. 12 years old); however, some confounders were only available at 13 or 15 years. This methodological choice allowed to control for the long-term effect of the confounders.

Statistical Analysis

A three-step logistic regression that was similar for each type of substance was used to analyze the data. As a first step, shyness (values between zero and 10) was entered into the model. At the second step, peer group affiliation and gender were added, in addition to the two-way and three-way interactions. As a third and last step, confounding variables were added. Between each of the three steps, non-significant predictors ($p > 0.05$) were retrieved. All analyses were carried out using weighted data accounting for the complex multistage sample design. Participants whose data did not inform about the use of the target substance were excluded from the analysis. The remaining missing data, including on the shyness variable, were handled using 10 multiple imputations. All variables had less than 15% of missing data, except for maternal cigarette use (32%) and maternal alcohol use (31%). Both original and weighted / imputed results are reported. Logistic regression and imputations were performed using Mplus Version 7.3 (Muthén & Muthén, 2012). Descriptive analyses were performed with SPSS 23.

Results

Descriptive Statistics

Table 1 summarizes the participants' characteristics before and after data transformation. Among the 15-year-old participants who were included in the study ($n = 1447$), the vast majority (97.2%-98.7%) provided data on substance use variables. In the past year, 17.2% of females and 13.4% of males had smoked at least one cigarette, while 43.0% of females and 40.4% of males had had five drinks or more at least once. As a visual support, Figures 1 and 2 present variations in substance use according to three degrees of shyness: mild, moderate and severe (the number of participants in each category is based on imputed and weighted data).

Logistic Regressions

The results of the three-step logistic regressions are presented in Table 2. As shown, in the first step, shyness significantly predicted both cigarette use ($\beta = -.10, p = .015$) and binge drinking ($\beta = -0.13, p < .001$). At step two, both peer group affiliation and gender were added to the model, as well as the two-way and three-way interactions. After introducing the latter parameters, shyness remained a significant predictor of both cigarette use ($\beta = -0.09, p = .019$) and binge drinking ($\beta = -0.13, p < .001$). Peer group affiliation also significantly predicted cigarette use ($\beta = 0.46, p = .019$) and binge drinking ($\beta = 0.55, p < .001$). Gender, as well as the two-way and three-way interactions were not significant for either substance use. In step three, the confounding variables were added. Still, shyness was a significant predictor of cigarette use ($\beta = -0.11, p = .008$) and binge drinking ($\beta = -0.11, p = .001$). Similarly, peer group affiliation predicted cigarette use ($\beta = 0.41, p = .044$) and binge drinking ($\beta = .50, p = .001$).

Discussion

The two objectives of the present study were (a) to prospectively assess the association between shyness and cigarette use / binge drinking in a contemporary longitudinal cohort of adolescents, and (b) to test the moderating role of peer group affiliation on the relationship between shyness and cigarette use / binge drinking during adolescence. Our results indicate that shyness at the age of 12 negatively predicted cigarette use and binge drinking at age 15. These predictive associations remained significant even after adjusting for covariates. However, there was no interaction between shyness and peer group affiliation in predicting substance use.

Present results related to shyness and substance use are partially conflicting with previous findings. One longitudinal study (Fleming et al., 1982), which was conducted with African-Americans from a lower socio-economic background, reported that shyness in first grade negatively predicted initiation to cigarette use and alcohol use during adolescence. On the contrary, another study conducted in the USA (Bush & Iannotti, 1992) reported no prospective association between shyness and substance use over a one year period.

Contrary to our expectations, shyness did not interact with peer group affiliation to predict cigarette use or binge drinking. This suggests that shyness may exert a beneficial effect against substance use notwithstanding the adolescent social context. For adolescents with a group of friends, a lower quality of friendships, or shyness in friends, could explain the reduced risk of substance use. For adolescents without a group of friends, shyness could represent a barrier to approach peers in order to acquire substances.

Importantly, peer group affiliation was positively associated with cigarette use and binge drinking. It has long been recognized that friends may help to create the rationale to use substances, as well as provide substances and facilitate access to social settings where use of

substances occurs (Oetting & Beauvais, 1986). Friends can also exert their influence through normative and overt pressure. Normative pressure is mainly determined by the perceived approval of substance use and substance use behaviors by the subject's friends. It plays a more important role than overt pressure, i.e. the direct persuasion of friends to conform to their behavior (Hoffman, Sussman, Unger, & Valente, 2006; Simons-Morton & Farhat, 2010). Although friends' characteristics could not be assessed in the present study, affiliation with deviant peers could represent an even greater risk for substance use (Marschall-Lévesque et al., 2014). Finally, an inverse causal association between peer group affiliation and substance use might also exist, since conforming to peers' expectations regarding alcohol use (e.g. getting drunk) could contribute to having more friends (Balsa, Homer, French, & Norton, 2011).

This study has several strengths. First, a three-year interval separated the assessment of shyness and substance use. Secondly, it used data from a representative sample of adolescents living in a Canadian province (i.e. Quebec). Thirdly, the most relevant confounding variables were controlled for, ensuring the validity of the findings. However, some limitations should be kept in mind in the interpretation of the results. First, while the moderating role of peer group affiliation was tested, quantitative and qualitative aspects of friendships that may play a role in the relationship between shyness and substance use during adolescence were not evaluated, e.g. the number of friends or the quality of friendships (Ponti & Tani, 2015). Secondly, only two measures of substance use were used (i.e. past-year cigarette use and binge drinking), which may not cover other important aspects of the relationship between shyness and substance use. Thirdly, it was not possible to document the evolution of shyness between 12 and 15 years since this variable was not assessed after the age of 13. Despite these limitations, the present results indicate that shyness could exert a beneficial effect against substance use during adolescence.

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Table 1
Descriptive statistics

Variables	Females		Variables	Males	
	Original data (<i>N</i> = 759)	Weighted data (<i>N</i> = 715)		Original data (<i>N</i> = 688)	Weighted data (<i>N</i> = 723)
Past-year cigarette use			Past-year cigarette use		
Yes	16.5%	17.2%	Yes	13.5%	13.4%
No	83.5%	82.8%	No	86.5%	86.6%
Data availability (%)	747 (98.4%)	704 (98.5%)	Data availability (%)	669 (97.2%)	701 (97.0%)
Past-year binge drinking			Past-year binge drinking		
Yes	44.3%	43.0%	Yes	41.3%	40.4%
No	55.7%	57.0%	No	58.7%	59.6%
Data availability (%)	749 (98.7%)	705 (98.6%)	Data availability (%)	670 (97.4%)	700 (96.8%)
Variables	Original data (<i>N</i> = 759)	Imputed and weighted data (<i>N</i> = 715)	Variables	Original data (<i>N</i> = 688)	Imputed and Weighted data (<i>N</i> = 723)
Shyness			Shyness		
Mean (SD)	4.3 (2.3)	4.4	Mean (SD)	4.0 (2.3)	4.1
Data availability (%)	655 (86.3%)		Data availability (%)	579 (84.2%)	
Group of friends			Group of friends		
Yes	75.5%	75.0%	Yes	67.7%	69.8%
No	24.5%	25.0%	No	32.3%	30.2%
Data availability (%)	748 (98.6%)		Data availability (%)	672 (97.7%)	
Positive parent-child relationship			Positive parent-child relationship		
Mean (SD)	7.1 (2.4)	7.0	Mean (SD)	7.1 (2.3)	7.0
Data availability (%)	748 (98.6%)		Data availability (%)	670 (97.4%)	

Negative parent-child relationship			Negative parent-child relationship		
Mean (SD)	1.9 (1.4)	1.9	Mean (SD)	1.9 (1.6)	2.0
Data availability (%)	748 (98.6%)		Data availability (%)	670 (97.4%)	
Depression			Depression		
Mean (SD)	1.3 (1.4)	1.4	Mean (SD)	1.3 (1.5)	1.4
Data availability (%)	655 (86.3%)		Data availability (%)	579 (84.2%)	
Sensation seeking			Sensation seeking		
Mean (SD)	6.1 (2.4)	6.0	Mean (SD)	6.8 (2.4)	6.7
Data availability (%)	750 (98.8%)		Data availability (%)	672 (97.7%)	
Attachment to school			Attachment to school		
Mean (SD)	7.9 (1.9)	7.8	Mean (SD)	7.1 (2.1)	7.1
Data availability (%)	654 (86.2%)		Data availability (%)	578 (84.0%)	
Victimization			Victimization		
Mean (SD)	2.3 (2.0)	2.3	Mean (SD)	2.9 (2.2)	2.9
Data availability (%)	654 (86.2%)		Data availability (%)	577 (83.9%)	
Anxiety			Anxiety		
Mean (SD)	3.1 (2.3)	3.1	Mean (SD)	2.1 (2.1)	2.2
Data availability (%)	655 (86.3%)		Data availability (%)	579 (84.2%)	
Socioeconomic Status			Socioeconomic Status		
Mean (SD)	0.0 (1.0)	-0.1	Mean (SD)	0.0 (1.0)	-0.1
Data availability (%)	660 (87.0%)		Data availability (%)	605 (87.9%)	
Family structure			Family structure		
Intact	66.0%	64.3%	Intact	64.2%	64.7%
Not intact	34.0%	35.7%	Not intact	35.8%	35.3%
Data availability (%)	658 (86.7%)		Data availability (%)	603 (87.6%)	
Parents immigration status			Parents immigration status		
Immigrant parent ($n \geq 1$)	13.6%	18.2%	Immigrant parent ($n \geq 1$)	12.7%	18.1%

No immigrant parent	86.4%	81.8%	No immigrant parent	87.3%	81.9%
Data availability (%)	720 (94.9%)		Data availability (%)	646 (93.9%)	
Mother's cigarette use			Mother's cigarette use		
Not at all	80.5%	78.7%	Not at all	78.7%	76.3%
Sometimes	3.7%	3.9%	Sometimes	4.4%	4.4%
Every day	15.7%	17.4%	Every day	16.9%	19.3%
Data availability (%)	534 (70.4%)		Data availability (%)	450 (65.4%)	
Mother's alcohol use			Mother's alcohol use		
< 1/week	50.0%	53.0%	< 1/week	46.0%	50.7%
≥ 1/week	48.5%	45.2%	≥ 1/week	51.2%	47.0%
Every day	1.5%	1.8%	Every day	2.8%	2.3%
Data availability (%)	542 (71.4%)		Data availability (%)	459 (66.7%)	

Table 2

Logistic regressions for past-year cigarette use and binge drinking

Steps and predictor variables	<i>B</i>	<i>SE</i>	<i>p</i>	<i>OR</i>	95% CI
Past-year cigarette use					
Step 1					
Shyness	-0.10	0.04	0.015	0.91	[0.84, 0.98]
Step 2					
Shyness	-0.09	0.04	0.019	0.91	[0.84, 0.99]
Group of friends	0.46	0.20	0.019	1.58	[1.08, 2.31]
Step 3					
Shyness	-0.11	0.04	0.008	0.90	[0.83, 0.97]
Group of friends	0.41	0.21	0.044	1.51	[1.01, 2.27]
Positive parent-child relationship	-0.11	0.04	0.002	0.89	[0.83, 0.96]
Negative parent-child relationship	0.15	0.05	0.006	1.16	[1.04, 1.29]
Attachment to school	-0.11	0.05	0.016	0.89	[0.82, 0.98]
Family Structure	0.86	0.20	0.000	2.35	[1.59, 3.48]
Mother's cigarette use	0.35	0.13	0.006	1.41	[1.10, 1.81]
Past year binge drinking					
Step 1					
Shyness	-0.13	0.03	0.000	0.88	[0.83, 0.93]
Step 2					
Shyness	-0.13	0.03	0.000	0.88	[0.83, 0.93]
Group of friends	0.55	0.14	0.000	1.73	[1.32, 2.26]
Step 3					
Shyness	-0.11	0.03	0.001	0.90	[0.84, 0.96]
Group of friends	0.50	0.14	0.001	1.64	[1.24, 2.18]
Positive parent-child relationship	-0.16	0.03	0.000	0.85	[0.81, 0.90]
Sensation seeking	0.19	0.03	0.000	1.21	[1.14, 1.28]
Family structure	0.33	0.15	0.023	1.39	[1.05, 1.86]
Parents immigration status	-0.80	0.22	0.000	0.45	[0.29, 0.69]
Mother's alcohol use	0.40	0.16	0.011	1.49	[1.09, 2.04]
SES	-0.20	0.07	0.006	0.82	[0.71, 0.94]

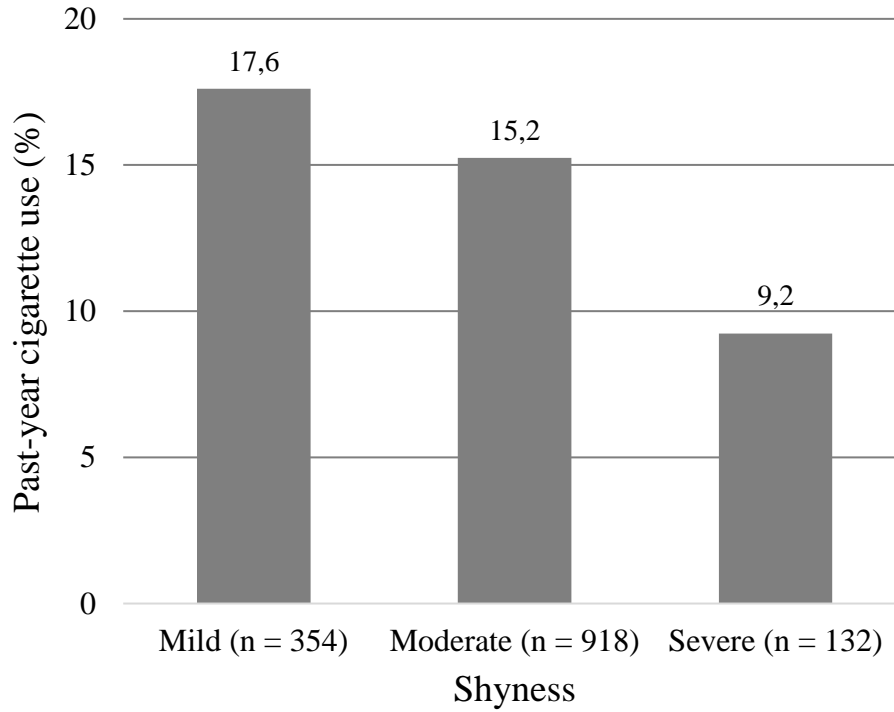


Figure 1. Past year cigarette use (%) according to shyness degree

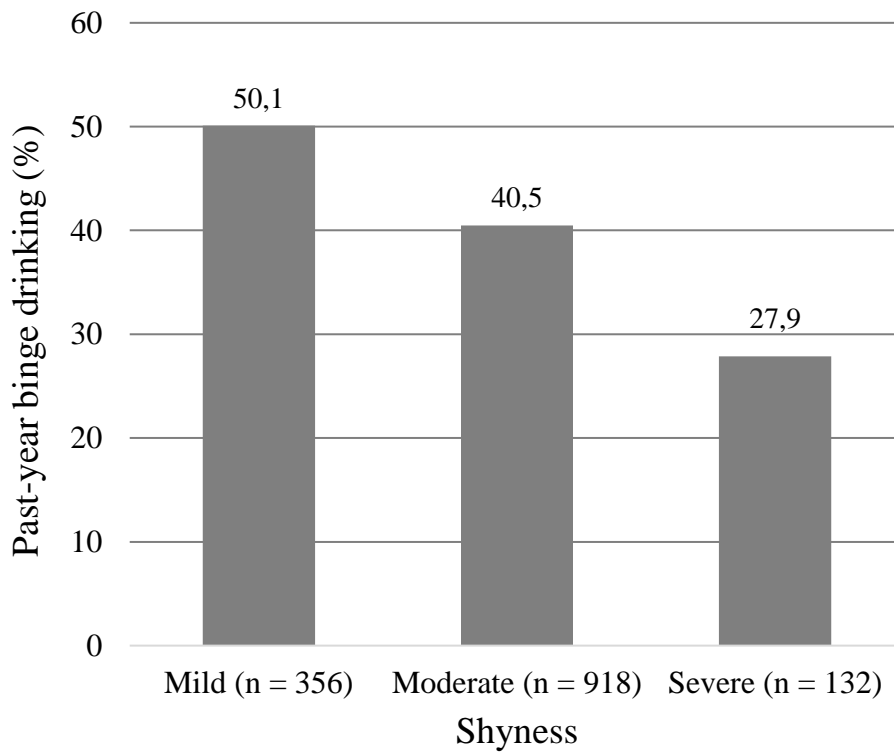


Figure 2. Past year binge drinking (%) according to shyness degree