

1 **Personal and perceived peer use and attitudes towards use of non-prescribed**  
2 **prescription sedatives and sleeping pills among university students in seven**  
3 **European countries**

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70 **Abstract**

71 **Introduction:** The use of non-prescribed prescription sedatives and sleeping pills (NPPSSP) among  
72 university students has been described as an important public health issue. However, the impact of  
73 perceived social norms on students' use and attitudes towards use of NPPSSP is still unclear. Our  
74 aim was to investigate whether perceptions of peer use and approval of use are associated with  
75 students' personal use and approval of NPPSSP use.

76 **Methods:** Cross-sectional data from the Social Norms Intervention for the Prevention of Polydrug  
77 Use (SNIPE) project containing 4,482 university students from seven European countries were  
78 analyzed to investigate self-other discrepancies regarding personal use and attitudes towards  
79 NPPSSP use. Associations between personal and perceived peer use and between personal and  
80 perceived approval of use were examined using multivariable logistic regression.

81 **Results:** The majority (51.0%) of students perceived their peers' NPPSSP use to be higher than  
82 their personal use. 92.6% of students perceived their peers' approval of NPPSSP use to be identical  
83 or higher than their personal approval. Students perceiving that the majority of peers had used  
84 NPPSSP at least once displayed higher odds for personal lifetime use (OR: 1.95, 95% CI: 1.49-  
85 2.55). Perceived peer approval of NPPSSP use was associated with higher odds for personal  
86 approval (OR: 5.49, 95% CI: 4.63-6.51).

87 **Conclusions:** Among European university students, perceiving NPPSSP use and approval of use to  
88 be the norm was positively associated with students' personal NPPSSP use and approval of use,  
89 respectively. Interventions addressing perceived social norms may prevent or reduce NPPSSP use  
90 among university students.

91 **Final trial registration number:** DRKS00004375 on the 'German Clinical Trials Register'.

92 **Keywords:** university students; non-medical use; sedatives; sleeping pills; perceptions; social  
93 norms

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## 103 **1. Introduction**

104 The non-medical use of prescription drugs, particularly among young adults, has been recognized as  
105 an important public health issue worldwide (Martins & Ghandour, 2017). The misuse of several  
106 prescription drugs, such as stimulants, opioids, or tranquilizers, is associated with a high potential  
107 for addiction and other serious physical and psychosocial consequences (United Nations Office on  
108 Drugs and Crime, 2011). However, prescription drugs are often perceived to be safer, and more  
109 socially acceptable than most illicit drugs, because they are produced by pharmaceutical companies  
110 and usually prescribed by physicians (Bodenlos, Malordy, Noonan, Mayrsohn, & Mistler, 2014;  
111 Compton & Volkow, 2006; Hildt, Franke, & Lieb, 2011; Martins & Ghandour, 2017).

112 The non-medical use of prescription drugs among university students may serve as a coping  
113 strategy to manage the demands of university life and to achieve a better work-life balance (Hildt,  
114 Lieb, & Franke, 2014; Jensen, Forlini, Partridge, & Hall, 2016; Maier, Liechti, Herzig, & Schaub,  
115 2013). The phenomenon of taking prescription drugs for the purpose of improving cognitive  
116 performance (e.g., alertness, concentration, or memory) has been termed *pharmacological cognitive*  
117 *enhancement* or *brain doping* (Partridge, Bell, Lucke, Yeates, & Hall, 2011). Further, evidence  
118 indicates that university students use sedatives to improve sleep or relax after stressful days, thus  
119 aiming to improve cognitive performance the next day. This is also referred to as *indirect cognitive*  
120 *enhancement* (Maier, et al., 2013; Maier & Schaub, 2015). Academic performance-enhancing drugs  
121 and sedatives are often used in combination: while performance-enhancing drugs are used to  
122 achieve the highest possible performance level during the day, sedatives are used to aid relaxation  
123 (Maier, et al., 2013).

124 Typically, peers have a significant impact on young adults' behaviors and their attitudes, and people  
125 tend to adapt their personal behavior to match that of their peers (Borsari & Carey, 2001). However,  
126 a growing body of evidence indicates that young people's perceptions of their peers' behaviors  
127 (*descriptive norms*) and attitudes towards behaviors (*injunctive norms*) are often inaccurate  
128 (Berkowitz, 2005; Perkins, 2003). University students tend to falsely believe that their peers behave  
129 or approve of behaviors differently from actual prevailing norms (*misperceptions*) (Berkowitz,  
130 2005; Perkins, 2003), and from their personal behavior and approval of behavior (*self-other*  
131 *discrepancies*) (Borsari & Carey, 2001). Young people generally overestimate how riskily their  
132 peers behave. These misperceptions of other's behavior or attitudes towards behavior represent the  
133 basis for the adaptation of personal behavior and attitude towards the perceived norm (Berkowitz,  
134 2005). Most research on misperceptions of health-related behaviors among university students  
135 originated in the U.S.A. and particularly refers to descriptive norms regarding alcohol consumption  
136 (Borsari & Carey, 2001; Perkins, 2014). In recent years, these findings were replicated in Europe  
137 (McAlaney, Bewick, & Hughes, 2011; McAlaney, et al., 2015). These studies show that

138 exaggerated perceptions of peer alcohol consumption are associated with increased personal alcohol  
139 consumption among university students (Borsari & Carey, 2001; McAlaney, et al., 2011;  
140 McAlaney, et al., 2015; Perkins, 2014). There is further evidence on university students'  
141 misperceptions of their peers' use of tobacco and illicit substances (e.g., marijuana, cocaine,  
142 ecstasy, and amphetamines) (Arbour-Nicitopoulos, Kwan, Lowe, Taman, & Faulkner, 2010;  
143 Bertholet, Faouzi, Studer, Daepfen, & Gmel, 2013; Dempsey, et al., 2016; Helmer, et al., 2014;  
144 Kilmer, et al., 2006; Martens, et al., 2006; Perkins, Meilman, Leichliter, Cashin, & Presley, 1999;  
145 Pischke, et al., 2015), as well as regarding risky sexual behavior (Martens, et al., 2006).  
146 Several studies have examined misperceptions or self-other discrepancies about the non-medical  
147 use of prescription drugs, as well as associations between descriptive norms and personal use,  
148 particularly regarding prescription stimulants (Helmer, et al., 2016; Kilmer, Geisner, Gasser, &  
149 Lindgren, 2015; McCabe, 2008; Sanders, Stogner, Seibert, & Miller, 2014; Silvestri & Correia,  
150 2016), with only one study, to date, investigating prescription sedative use (Sanders, et al., 2014).  
151 Perceived approval among peers for the non-prescribed use of prescription stimulants at the same  
152 university (Helmer, et al., 2016) and perceived approval among close friends, or by the typical  
153 university student or parents (Silvestri & Correia, 2016), were positively associated with personally  
154 approving such substances among university students. The role of perceived injunctive norms  
155 regarding non-medical use of prescription sedatives, however, has not been investigated so far.  
156 The present study aimed to investigate self-other discrepancies regarding the use and attitudes  
157 towards using non-prescribed prescription sedatives and sleeping pills (NPPSSP) in a sample of  
158 university students from seven European countries. We also aimed to investigate if perceptions of  
159 peer use (perceived descriptive norm) and peer approval of use (perceived injunctive norm) were  
160 associated with personal use and approval of NPPSSP use in our study population.  
161 To clarify the terminology employed in this study, NPPSSP is used to describe the non-prescribed  
162 use of sedatives and sleeping pills which are only available by prescription. This does not include  
163 the use of non-prescription products, such as herbal sedatives, which can be acquired without  
164 prescription.

## 165 **2. Material and Methods**

### 166 **2.1 Data**

167 This analysis is based on data from the 'Social Norms Intervention for the prevention of Polydrug  
168 use' (SNIPE) project funded by the European Commission (LS/2009-2010/DPIP/AG). SNIPE was  
169 a cross-national study including students from universities in Belgium, Denmark, Germany, the  
170 Slovak Republic, Spain, Turkey, and the United Kingdom (UK). An overview of the SNIPE study  
171 is provided by Pischke and colleagues (2012). In brief, SNIPE aimed to test the feasibility of a web-

172 based, personalized ‘social norms’-feedback for the prevention of licit and illicit substance use for  
173 European university students. Participants were recruited from one or more designated intervention  
174 and delayed-intervention control universities (21 sites in total) (McAlaney, et al., 2015).  
175 Recruitment methods aimed at increasing students’ registrations on the survey website varied  
176 between countries and included, inter alia, emails, classroom announcements, social media, and  
177 printed flyers. Students who registered on the website received an email including a hyperlink to the  
178 survey webpage. Study participation was voluntary, and participants’ information was  
179 pseudonymized. For the analysis reported in this manuscript, baseline data from both, students at  
180 intervention and students at delayed-intervention control universities, were considered. Statistical  
181 analysis was conducted on an anonymized dataset. For each site participating in the SNIPE project,  
182 ethical approval was obtained from the respective responsible authorities. Participants answered  
183 questions on their personal use of licit (i.e., alcohol, tobacco), and illicit substances (e.g., cocaine,  
184 ecstasy, amphetamines), as well as on their personal use of non-prescribed prescription substances  
185 to improve academic performance and NPPSSP. Further questions related to the students’ personal  
186 attitudes towards use of the aforementioned substances. Moreover, perceptions of peer substance  
187 use and attitudes towards substance use were assessed. Demographic questions, such as on the  
188 participants’ age, sex, migrant status, and living situation (living with or without other students),  
189 were also included.

## 190 **2.2 Measurements**

191 Students’ personal use of NPPSSP was measured by asking how often they used sedatives or  
192 sleeping pills which were not prescribed, followed by a list of registered local trade names of  
193 prescription sedatives and sleeping pills as examples (e.g., diazepam, alprazolam, flunitrazepam,  
194 midazolam, stilnoct). Perceptions of peer NPPSSP use (perceived descriptive norm) were assessed  
195 by asking students how often in the last two months they think most (at least 51%) of the [female in  
196 case of a female respondent/male in case of a male respondent] students at their university have  
197 used sedatives or sleeping pills which were not prescribed, followed by a list of registered local  
198 trade names of prescription sedatives and sleeping pills as examples (e.g., diazepam, alprazolam,  
199 flunitrazepam, midazolam, stilnoct). These questions were tailored to the same sex and university of  
200 the respondents. Response options for both questions were ‘Never in my/their life’, ‘Have used but  
201 not in the last two months’, ‘Once in the last two months’, ‘Twice in the last two months’, ‘Once  
202 every two weeks in the last two months’, ‘Weekly’, ‘Twice a week’, ‘Thrice a week’, ‘Four times a  
203 week’, and ‘Every day or nearly every day’. Furthermore, information about students’ personal  
204 attitude towards NPPSSP use was collected by asking: “Which of the following best describes your  
205 attitude to using each of these substances?”. Concerning students’ perceptions of attitudes towards

206 using NPPSSP among their peers (perceived injunctive norm), respondents were asked: “Which of  
207 the following do you think best describes the attitude of most (at least 51%) of the [female/male]  
208 students at your university to the use of each of these substances?”. Response options for both  
209 questions were ‘Never ok to use’, ‘Ok to use occasionally if it doesn’t interfere with work or study’,  
210 ‘Ok to use frequently if it doesn’t interfere with work or study’, ‘Ok to use occasionally even if it  
211 does interfere with work or study’, and ‘Ok to use frequently if that is what the person wants to do’.  
212 Country, sex, age, year of study, and living situation were considered as potential determinants of  
213 NPPSSP use/attitude towards NPPSSP use.

### 214 **2.3 Statistical analysis**

215 First, frequencies of personal NPPSSP use and attitudes towards NPPSSP use were calculated and  
216 95% bootstrap confidence intervals based on 1,000 bootstrap samples were estimated for each  
217 country, separately. Second, participants’ self-other discrepancies were classified into three groups  
218 to differentiate between students who perceived the NPPSSP use and approval of NPPSSP use of  
219 the majority of their same-sex peers as higher, identical or lower as their personal use and approval  
220 of use. Third, two binary multivariable logistic regression analyses were conducted to examine  
221 associations between perceived and personal NPPSSP use (descriptive norms model), and perceived  
222 and personal attitudes towards NPPSSP use (injunctive norms model). In the descriptive norms  
223 model, country, sex, age, year of study, living situation, perceived NPPSSP use, and personal  
224 attitude towards NPPSSP use were included as independent variables. In the injunctive norms  
225 model, all demographic variables, perceived attitude towards NPPSSP use, and personal NPPSSP  
226 use were included as independent variables. In both models, all variables were entered  
227 simultaneously (enter method). Age was included as a continuous variable, and all other variables  
228 were considered as categorical variables. Categorical variables with more than two categories (i.e.,  
229 country, year of study, living situation) were each converted into a set of dichotomous variables  
230 using dummy coding. Both models were checked for the presence of multicollinearity. Tolerance  
231 (TOL) values for both models ranged from 0.90 to 1.00 indicating absence of multicollinearity  
232 between independent variables. To investigate whether sex or country moderates the associations  
233 between perception and personal NPPSSP use/attitude towards NPPSSP use, the two relevant  
234 interaction terms were added to both regression models. For significant interaction terms ( $p < 0.05$ ),  
235 stratified analyses were conducted. All statistical analyses were performed using SPSS for  
236 windows, version 22.0.

### 237 **3. Results**

238 The SNIPE study included a total of 4,482 university students (71.4% female, mean age: 22.4  
239 years). The Slovak Republic ( $n=1,938$ , 43.2%) contributed the highest number of students, followed

240 by Turkey (n=858, 19.1%), Germany (n=504, 11.2%), Denmark (n=464, 10.4%), Belgium (n=426,  
241 9.5%), Spain (n=185, 4.1%), and the UK (n=107, 2.4%). A detailed description of the sample  
242 characteristics is provided by Helmer et al. (2014). Information on sex and NPPSSP use was  
243 provided by 4,412 students, and 4,284 additionally answered the question regarding their attitude  
244 towards using NPPSSP.

245 Across all participating countries, 9.1% of the students reported having used NPPSSP at least once  
246 in life. Lifetime prevalence rates of NPPSSP use varied from 4.0% of females and 2.3% of males in  
247 Belgium to 12.5% of females and 18.2% of males in the UK. Across all countries, most students  
248 stated that 'it is never okay to use' NPPSSP with rates varying from 56.8% of females in Germany  
249 and 62.5% of males in the UK to 84.7% of females and 91.2% of males in Turkey (Table 1).

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275 **Table 1 Personal NPPSSP use and attitude towards NPPSSP use by country and sex (% and 95% bootstrap CI)**

	Belgium		Denmark		Germany		Slovak Republic	
<i>NPPSSP use (n=4,412)</i>	<i>Male (n=86)</i>	<i>Female (n=321)</i>	<i>Male (n=100)</i>	<i>Female (n=353)</i>	<i>Male (n=207)</i>	<i>Female (n=295)</i>	<i>Male (n=393)</i>	<i>Female (n=1,524)</i>
Used in the last two months	1.2 (0.0-3.8)	1.2 (0.3-2.6)	1.0 (0.0-3.3)	1.7 (0.6-3.3)	2.9 (0.9-5.4)	3.1 (1.2-5.2)	1.5 (0.5-2.9)	2.7 (1.9-3.5)
Used at least once in life	2.3 (0.0-5.8)	4.0 (2.1-6.3)	9.0 (3.6-14.7)	5.9 (3.4-8.6)	11.1 (6.7-15.6)	10.2 (6.6-13.7)	6.4 (3.9-8.9)	11.6 (10.0-13.2)
<i>Attitude towards NPPSSP use (n=4,284)</i>	<i>Male (n=85)</i>	<i>Female (n=316)</i>	<i>Male (n=95)</i>	<i>Female (n=348)</i>	<i>Male (n=203)</i>	<i>Female (n=292)</i>	<i>Male (n=384)</i>	<i>Female (n=1,489)</i>
Never ok to use	83.5 (75.0-91.5)	72.2 (67.1-77.1)	65.3 (55.9-74.0)	75.3 (70.7-79.6)	64.0 (57.1-70.4)	56.8 (51.0-62.6)	83.3 (79.4-86.9)	73.1 (70.8-75.4)
Ok to use if it doesn't interfere with work or study <sup>a</sup>	15.3 (7.9-23.5)	26.2 (21.6-31.6)	28.4 (20.6-37.5)	21.3 (17.3-25.9)	30.0 (23.9-37.0)	38.0 (32.4-43.7)	15.1 (11.7-18.8)	25.6 (23.4-27.8)
Ok to use <sup>b</sup>	1.2 (0.0-3.8)	1.3 (0.3-2.8)	6.3 (2.0-11.8)	3.4 (1.7-5.3)	5.9 (2.7-9.5)	5.1 (2.7-7.9)	1.6 (0.5-3.1)	1.3 (0.8-2.0)

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	Spain		Turkey		UK	
<i>NPPSSP use (n=4,412)</i>	<i>Male (n=52)</i>	<i>Female (n=132)</i>	<i>Male (n=398)</i>	<i>Female (n=446)</i>	<i>Male (n=33)</i>	<i>Female (n=72)</i>
Used in the last two months	1.9 (0.0-6.7)	4.5 (1.5-8.3)	2.0 (0.8-3.5)	2.5 (1.1-3.9)	12.1 (2.9-24.2)	4.2 (0.0-9.2)
Used at least once in life	11.5 (3.8-20.5)	12.1 (6.4-18.2)	5.5 (3.6-7.9)	9.9 (7.2-12.6)	18.2 (6.5-31.4)	12.5 (5.5-21.1)
<i>Attitude towards NPPSSP use (n=4,284)</i>	<i>Male (n=51)</i>	<i>Female (n=126)</i>	<i>Male (n=375)</i>	<i>Female (n=419)</i>	<i>Male (n=32)</i>	<i>Female (n=69)</i>
Never ok to use	64.7 (51.1-78.3)	65.9 (57.6-73.8)	91.2 (88.4-93.9)	84.7 (81.1-88.1)	62.5 (45.7-80.0)	73.9 (62.9-83.8)
Ok to use if it doesn't interfere with work or study <sup>a</sup>	33.3 (20.0-46.9)	31.7 (23.7-39.8)	6.1 (3.9-8.8)	13.6 (10.3-17.1)	34.4 (17.7-51.9)	24.6(15.2-34.8)
Ok to use <sup>b</sup>	2.0 (0.0-6.9)	2.4 (0.0-5.5)	2.7 (1.0-4.5)	1.7 (0.5-3.0)	3.1 (0.0-10.0)	1.4 (0.0-4.6)

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<sup>a</sup> 'Ok to use occasionally if it doesn't interfere with work or study' and 'Ok to use frequently if it doesn't interfere with work or study' were collapsed into 'Ok to use if it doesn't interfere with work or study'.

<sup>b</sup> 'Ok to use occasionally even if it does interfere with work or study' and 'Ok to use frequently if that is what the person wants to do' were combined into 'Ok to use'.

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287 In all countries, except for Denmark (45.4%) and Turkey (43.9%), more than half (54.8%) of the  
 288 students thought that at least 51% of their same sex-peers had used NPPSSP at least once in their  
 289 life. Overall, 51.0% perceived their peers' NPPSSP use to be higher than their personal NPPSSP  
 290 use, 46.0% to be identical, and 3.0% to be lower. With regard to attitudes towards NPPSSP use,  
 291 45.1% perceived that the majority of their peers approved of NPPSSP use. Overall, the majority of  
 292 students perceived that the peer approval towards NPPSSP use was identical (62.9%) or higher  
 293 (29.7%) than their personal approval (Table 2).

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295 **Table 2 Differences between personal NPPSSP use/attitude towards NPPSSP use and**  
 296 **perceived NPPSSP use/ attitude towards NPPSSP use of the majority of peers of the same sex**  
 297 **and university (self-other discrepancies)**

	Lifetime NPPSSP use (%) (n=4,310)	Positive attitude towards NPPSSP use <sup>a</sup> (%) (n=4,178)
Majority of same-sex peers < personal	3.0	7.4
Majority of same-sex peers = personal	46.0	62.9
Majority of same-sex peers > personal	51.0	29.7

298 <sup>a</sup>'Ok to use occasionally if it doesn't interfere with work or study', 'Ok to use frequently if it doesn't interfere with work or study', 'Ok to use  
 299 occasionally even if it does interfere with work or study', and 'Ok to use frequently if that is what the person wants to do'.

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301 After controlling for students' country, sex, age, year of study, living situation, and attitude towards  
 302 NPPSSP use, the perception that the majority of same-sex peers had used NPPSSP at least once in  
 303 their life was significantly associated with a higher likelihood for personal lifetime NPPSSP use  
 304 (OR: 1.95, 95% CI: 1.49-2.55) (Table 3). Moreover, after controlling for all demographic variables  
 305 and NPPSSP use, perceived peer approval of NPPSSP use was associated with higher odds for  
 306 personal approval of NPPSSP use (OR: 5.49, 95% CI: 4.63-6.51) (Table 4).

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319 **Table 3 Associations between personal NPPSSP use and perceived lifetime NPPSSP use of**  
 320 **peers, personal attitude towards NPPSSP use, country, age, sex, year of study, and living**  
 321 **situation – results of a binary logistic regression (descriptive norms model)**

Variables	Ever personally used NPPSSP	
	OR	(95% CI)
<i>Perceived peer NPPSSP use</i>		
Never used NPPSSP (reference)	1.00	
Ever used NPPSSP	1.95	(1.49-2.55)
<i>Personal attitude towards NPPSSP use</i>		
Never ok to use NPPSSP (reference)	1.00	
Ok to use NPPSSP <sup>a</sup>	7.42	(5.81-9.49)
<i>Country</i>		
Slovak Republic (reference)	1.00	
Belgium	0.24	(0.14-0.43)
Denmark	0.32	(0.20-0.52)
Germany	0.47	(0.32-0.70)
Spain	0.70	(0.41-1.22)
Turkey	0.99	(0.70-1.40)
UK	1.01	(0.52-1.94)
Age (in years)	1.04	(1.01-1.07)
<i>Sex</i>		
Female (reference)	1.00	
Male	0.82	(0.63-1.09)
<i>Year of study</i>		
1 <sup>st</sup> (reference)	1.00	
2 <sup>nd</sup>	0.78	(0.57-1.07)
3 <sup>rd</sup>	1.13	(0.83-1.54)
4 <sup>th</sup>	0.89	(0.60-1.31)
5 <sup>th</sup>	0.66	(0.39-1.10)
> 5 <sup>th</sup>	0.70	(0.35-1.41)
<i>Living situation</i>		
With other students (reference)	1.00	
Alone or with partner	2.04	(1.45-2.85)
With parents	1.06	(0.80-1.40)
Other	1.74	(0.94-3.23)

322 <sup>a</sup> 'Ok to use occasionally if it doesn't interfere with work or study', 'Ok to use frequently if it doesn't interfere with work or study', 'Ok to use  
 323 occasionally even if it does interfere with work or study', and 'Ok to use frequently if that is what the person wants to do'.  
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334 **Table 4 Associations between personal attitude towards NPPSSP use and perceived attitude of**  
 335 **peers, personal NPPSSP use, country, age, sex, year of study, and living situation – results of a**  
 336 **binary logistic regression (injunctive norms model)**

Variables	Positive attitude towards NPPSSP use <sup>a</sup>	
	OR	(95% CI)
<i>Perceived peer attitude towards NPPSSP use</i>		
Never ok to use NPPSSP (reference)	1.00	
Ok to use NPPSSP <sup>a</sup>	5.49	(4.63-6.51)
<i>Personal NPPSSP use</i>		
Never used NPPSSP (reference)	1.00	
Ever used NPPSSP	7.03	(5.45-9.06)
<i>Country</i>		
Slovak Republic (reference)	1.00	
Belgium	0.99	(0.74-1.30)
Denmark	2.04	(1.49-2.80)
Germany	2.59	(2.00-3.36)
Spain	1.59	(1.09-2.34)
Turkey	0.54	(0.41-0.71)
UK	1.20	(0.72-1.99)
Age (in years)	0.97	(0.95-0.99)
<i>Sex</i>		
Female (reference)	1.00	
Male	0.84	(0.70-1.02)
<i>Year of study</i>		
1 <sup>st</sup> (reference)	1.00	
2 <sup>nd</sup>	0.84	(0.68-1.04)
3 <sup>rd</sup>	0.99	(0.78-1.24)
4 <sup>th</sup>	1.02	(0.77-1.37)
5 <sup>th</sup>	1.04	(0.73-1.47)
> 5 <sup>th</sup>	0.97	(0.60-1.54)
<i>Living situation</i>		
With other students (reference)	1.00	
Alone or with partner	0.82	(0.64-1.06)
With parents	1.06	(0.87-1.28)
Other	0.63	(0.39-1.02)

337 <sup>a</sup> 'Ok to use occasionally if it doesn't interfere with work or study', 'Ok to use frequently if it doesn't interfere with work or study', 'Ok to use  
 338 occasionally even if it does interfere with work or study', and 'Ok to use frequently if that is what the person wants to do'.  
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340 Interaction terms in the descriptive norms model provided no evidence that the effect of perception  
 341 on personal lifetime NPPSSP use was modified by country or sex. In terms of injunctive norms,  
 342 significant interaction terms suggested that the effect of perception on personal attitude towards  
 343 NPPSSP use was significantly modified by country, but not by sex. A stratified analysis of  
 344 injunctive norms by country showed that the association between perception of peer approval and  
 345 personal approval was significant for all countries, except for the UK (Table 5).

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349 **Table 5 Association between personal attitude towards NPPSSP use and perceived attitude of**  
 350 **peers stratified by country adjusted for personal NPPSSP use, age, sex, year of study, and**  
 351 **living situation**

Country	Positive attitude towards NPPSSP use <sup>a</sup>	
	OR	(95% CI)
Slovak Republic	6.02	(4.64-7.81)
Belgium	2.79	(1.60-4.87)
Denmark	16.40	(9.37-28.73)
Germany	4.11	(2.69-6.29)
Spain	3.52	(1.66-7.47)
Turkey	6.41	(3.80-10.80)
UK	1.79	(0.52-6.10)

352 <sup>a</sup> ‘Ok to use occasionally if it doesn't interfere with work or study’, ‘Ok to use frequently if it doesn't interfere with work or study’, ‘Ok to use  
 353 occasionally even if it does interfere with work or study’, and ‘Ok to use frequently if that is what the person wants to do’.

#### 354 **4. Discussion**

355 In the present study with European students, we investigated self-other discrepancies regarding the  
 356 use and attitudes towards the use of NPPSSP. In addition, we evaluated whether perceptions of peer  
 357 use (perceived descriptive norm) and peer approval of use (perceived injunctive norm) were  
 358 associated with personal use and approval of NPPSSP use. In our study, students on average  
 359 perceived the NPPSSP use of their peers to be higher than their personal use and attitudes towards  
 360 the use to be identical or more positive than their personal attitudes. Both, perceived descriptive and  
 361 injunctive norms of peers, were associated with students' personal use and attitudes towards the use  
 362 of NPPSSP, respectively.

363 To date, there are few studies on the use of NPPSSP among students. The only study that examined  
 364 perceptions with respect to prescription sedatives by Sanders and colleagues (2014) found that  
 365 65.7% of students perceived the recreational use of prescription sedatives to be the norm among  
 366 their peers despite only 2.6% of the sample reporting recreational use of these substances during the  
 367 last month. More than a third of participants overestimated (26.3%) or extremely overestimated  
 368 (10.2%) their peers' use, and recreational users of prescription sedatives were more likely to  
 369 overestimate their peers' use of these substances (Sanders, et al., 2014). These findings are in line  
 370 with our study. The results reported by Sanders and colleagues (2014), however, are based on  
 371 bivariate analyses and thus did not account for further potential determinants of students' personal  
 372 prescription sedative use, such as sex or age.

373 Our study extends the limited evidence regarding the association of perceived descriptive norms of  
 374 peers with university students' personal use of NPPSSP. Indeed, our study adds to the existing  
 375 evidence by revealing self-other discrepancies regarding NPPSSP use in a large sample of  
 376 university students from various universities across Europe. Across all countries participating in the  
 377 SNIPE study, the majority of students perceived their peers' use to be higher than their personal

378 use. Furthermore, we demonstrated associations between perceived peer use and students' personal  
379 use while controlling for other potential determinants of NPPSSP use ensuring further  
380 methodological rigor to our study.

381 The present study is the first to demonstrate discrepancies between personal and perceived peer  
382 injunctive norms regarding NPPSSP use by investigating self-other discrepancies and associations  
383 between perceived injunctive norms and students' personal approval of NPPSSP use. To date,  
384 associations between perceived injunctive norms and personal approval of using non-prescribed  
385 prescription substances have only been investigated for stimulants (Helmer, et al., 2016; Silvestri &  
386 Correia, 2016), not for sedatives or sleeping pills. Silvestri and Correia (2016), analyzing data from  
387 959 U.S. undergraduate students, found that students' personal approval of non-medical  
388 prescription stimulant use was positively correlated with perceived approval among what students  
389 perceived to be a typical university student, close friends, as well as parents. However, the  
390 correlations between perceived parental and close friend approval with personal approval were  
391 moderate in strength with weak associations between perceived typical student approval and  
392 personal approval. This suggests that more proximal referent groups, rather than students' broader  
393 group affiliations, could be important in determining personal approval of stimulant use. Another  
394 study by Helmer and colleagues (2016), also using data from the SNIPE study, found that 38.7% of  
395 students perceived their peers to be more approving of using non-prescribed prescription stimulants  
396 to improve their academic performance than themselves. Their multivariable analysis also revealed  
397 an association between perceived peer and personal approval of using these substances. In our  
398 study, an association between perceived injunctive norms of peers and students' personal approval  
399 of using NPPSSP was found for all countries participating in the SNIPE project, except for the UK,  
400 with its comparatively small sample size.

401 The findings of this study align with previous observations that university students' exaggerated  
402 perceptions of peer norms also exist for prescription substances which are less commonly used and  
403 socially accepted than, for example alcohol, tobacco, or cannabis (Helmer, et al., 2016; Kilmer, et  
404 al., 2015; McCabe, 2008; Perkins, et al., 1999; Sanders, et al., 2014; Silvestri & Correia, 2016).  
405 Increased interest in the non-medical use of prescription drugs to the public and the media  
406 (Partridge, et al., 2011) may create the impression that approving and using these substances is  
407 much more common than it is in reality (McCabe, 2008; Sanders, et al., 2014). Perceiving  
408 prescription drugs to be safer, and socially acceptable because of their production by  
409 pharmaceutical companies and their prescription by physicians (Bodenlos, et al., 2014; Compton &  
410 Volkow, 2006; Hildt, et al., 2011; Martins & Ghandour, 2017) may also explain exaggerated peer  
411 norms.

412 The identification of perceived descriptive and injunctive norms of peers as significant predictors of  
413 students' NPPSSP use and approval of use provides empirical arguments for the important role of  
414 social norms for personal behaviors and approval of behaviors. In line with social norms theory  
415 (Berkowitz, 2005; Perkins, 2003), our findings may indicate that exaggerated perceptions of  
416 descriptive norms of peers may increase students' willingness to use NPPSSP themselves.  
417 Moreover, exaggerated perceptions of injunctive norms of peers may also lead to an increased  
418 approval of using NPPSSP in order to match personal attitudes to the perceived peer norms. Social  
419 norms interventions that challenge perceptions of descriptive and injunctive peer norms through, for  
420 example, mass media campaigns, social marketing strategies or the provision of online personalized  
421 feedback (McAlaney, et al., 2011; Perkins, 2003), may be a viable approach to prevent or reduce  
422 NPPSSP use among European university students.

423 There are certain limitations to the present study. The analyses are based on self-reported data  
424 collected via a confidential online survey. This is a commonly used survey technique in substance  
425 use research among university students to minimize the risk of socially desirable response behavior  
426 (Kypri, Gallagher, & Cashell-Smith, 2004). However, in general, an under- or overestimation of  
427 NPPSSP use and approval of use due to social expectation bias cannot be ruled out. Moreover,  
428 possible misunderstandings of the survey questions by survey participants, i.e., also considering the  
429 use of drugs which are available without a prescription, may have led to an overestimation of  
430 NPPSSP use and approval of use. However, since only registered local trade names of prescription  
431 sedatives and sleeping pills were provided as examples in the survey questionnaire, and given that  
432 use and approval rates of NPPSSP are in line with those for other illicit substances asked for in the  
433 SNIPE study (Helmer, et al., 2014), the risk of having misunderstood the survey questions can be  
434 considered low. On the other hand, the survey questions regarding NPPSSP may have led to an  
435 underestimation of use and approval rates since only a selection of registered local trade names of  
436 prescription sedatives and sleeping pills (e.g., diazepam, alprazolam, flunitrazepam, midazolam,  
437 stilnoct) were included. Furthermore, it is to be noted that individual email addresses were collected  
438 for the intervention provided within the study and students may have perceived that they can be  
439 identified. In addition, the number of participating students differed between countries, ranging  
440 from 107 individuals in the UK to 1,938 in the Slovak Republic. Therefore, selection bias may have  
441 differentially affected the sample composition in different countries. Finally, since the analyses are  
442 based on cross-sectional survey data, no causal relationships between perceived descriptive and  
443 injunctive norms and personal behavior and attitudes towards behavior can be deduced.

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## 446 **5. Conclusions**

447 This study suggests that European university students perceive the use of NPPSSP among their  
448 peers to be higher than their personal use and peer attitudes towards the use to be identical or more  
449 positive than their personal attitudes. Furthermore, both perceived descriptive and injunctive norms  
450 of peers were shown to be associated with students' personal use and attitudes towards the use of  
451 NPPSSP, respectively. Social norms interventions may be useful to change exaggerated perceptions  
452 regarding the use and attitudes towards NPPSSP use and may prevent or reduce NPPSSP use  
453 among European university students.

454 **Declarations of interest:** none

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