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

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69

70 **Abstract**

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

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

87 **Conclusions:** Among European university students, perceiving NPSSP use and approval of use to
88 be the norm was positively associated with students' personal NPSSP use and approval of use,
89 respectively. Interventions addressing perceived social norms may prevent or reduce NPSSP 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 for
107 addiction and other serious physical and psychosocial consequences (United Nations Office on Drugs
108 and Crime, 2011). However, prescription drugs are often perceived to be safer, and more socially
109 acceptable than most illicit drugs, because they are produced by pharmaceutical companies and
110 usually prescribed by physicians (Bodenlos, Malordy, Noonan, Mayrsohn, & Mistler, 2014; Compton
111 & 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 strategy
113 to manage the demands of university life and to achieve a better work-life balance (Hildt, Lieb, &
114 Franke, 2014; Jensen, Forlini, Partridge, & Hall, 2016; Maier, Liechti, Herzig, & Schaub, 2013). The
115 phenomenon of taking prescription drugs for the purpose of improving cognitive performance (e.g.,
116 alertness, concentration, or memory) has been termed *pharmacological cognitive enhancement* or
117 *brain doping* (Partridge, Bell, Lucke, Yeates, & Hall, 2011). Further, evidence indicates that
118 university students use sedatives to improve sleep or relax after stressful days, thus aiming to improve
119 cognitive performance the next day. This is also referred to as *indirect cognitive enhancement* (Maier,
120 et al., 2013; Maier & Schaub, 2015). Academic performance-enhancing drugs and sedatives are often
121 used in combination: while performance-enhancing drugs are used to achieve the highest possible
122 performance level during the day, sedatives are used to aid relaxation (Maier, et al., 2013).

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

138 students (Borsari & Carey, 2001; McAlaney, et al., 2011; McAlaney, et al., 2015; Perkins, 2014).
139 There is further evidence on university students' misperceptions of their peers' use of tobacco and
140 illicit substances (e.g., marijuana, cocaine, ecstasy, and amphetamines) (Arbour-Nicitopoulos, Kwan,
141 Lowe, Taman, & Faulkner, 2010; Bertholet, Faouzi, Studer, Daeppen, & Gmel, 2013; Dempsey, et
142 al., 2016; Helmer, et al., 2014; Kilmer, et al., 2006; Martens, et al., 2006; Perkins, Meilman,
143 Leichliter, Cashin, & Presley, 1999; Pischke, et al., 2015), as well as regarding risky sexual behavior
144 (Martens, et al., 2006).

145 Several studies have examined misperceptions or self-other discrepancies about the non-medical use
146 of prescription drugs, as well as associations between descriptive norms and personal use, particularly
147 regarding prescription stimulants (Helmer, et al., 2016; Kilmer, Geisner, Gasser, & Lindgren, 2015;
148 McCabe, 2008; Sanders, Stogner, Seibert, & Miller, 2014; Silvestri & Correia, 2016), with only one
149 study, to date, investigating sedative use (Sanders, et al., 2014). Perceived approval among peers for
150 the use of non-prescribed stimulants at the same university (Helmer, et al., 2016) and perceived
151 approval among close friends, or by the typical university student or parents (Silvestri & Correia,
152 2016), were positively associated with personally approving such substances among university
153 students. The role of perceived injunctive norms regarding non-medical use of sedatives, however,
154 has not been investigated so far.

155 The present study aimed to investigate self-other discrepancies regarding the use and attitudes
156 towards using non-prescribed sedatives and sleeping pills (NPSSP) in a sample of university students
157 from seven European countries. We also aimed to investigate if perceptions of peer use (perceived
158 descriptive norm) and peer approval of use (perceived injunctive norm) were associated with personal
159 use and approval of NPSSP use in our study population.

160 **2. Material and Methods**

161 **2.1 Data**

162 This analysis is based on data from the 'Social Norms Intervention for the prevention of Polydrug
163 use' (SNIPE) project funded by the European Commission (LS/2009-2010/DPIP/AG). SNIPE was a
164 cross-national study including students from universities in Belgium, Denmark, Germany, the Slovak
165 Republic, Spain, Turkey, and the United Kingdom (UK). An overview of the SNIPE study is provided
166 by Pischke and colleagues (2012). In brief, SNIPE aimed to test the feasibility of a web-based,
167 personalized 'social norms'-feedback for the prevention of licit and illicit substance use for European
168 university students. Participants were recruited from one or more designated intervention and
169 delayed-intervention control universities (21 sites in total) (McAlaney, et al., 2015). Recruitment
170 methods aimed at increasing students' registrations on the survey website varied between countries
171 and included, inter alia, emails, classroom announcements, social media, and printed flyers. Students

172 who registered on the website received an email including a hyperlink to the survey webpage. Study
173 participation was voluntary, and participants' information was pseudonymized. For the analysis
174 reported in this manuscript, baseline data from both, students at intervention and students at delayed-
175 intervention control universities, were considered. Statistical analysis was conducted on an
176 anonymized dataset. For each site participating in the SNIPE project, ethical approval was obtained
177 from the respective responsible authorities. Participants answered questions on their personal use of
178 licit (i.e., alcohol, tobacco), and illicit substances (e.g., cocaine, ecstasy, amphetamines), as well as
179 on their personal use of substances to improve academic performance and NPSSP. Further questions
180 related to the students' personal attitudes towards use of the aforementioned substances. Moreover,
181 perceptions of peer substance use and attitudes towards substance use were assessed. Demographic
182 questions, such as on the participants' age, sex, migrant status, and living situation (living with or
183 without other students), were also included.

184 **2.2 Measurements**

185 Students' personal use of NPSSP was measured by asking how often they used sedatives or sleeping
186 pills which were not prescribed, followed by a list of active ingredients as examples for NPSSP (e.g.,
187 diazepam, alprazolam, flunitrazepam, midazolam, stilnoct). Perceptions of peer NPSSP use
188 (perceived descriptive norm) were assessed by asking students how often in the last two months they
189 think most (at least 51%) of the [female in case of a female respondent/male in case of a male
190 respondent] students at their university have used sedatives or sleeping pills which were not
191 prescribed, followed by a list of active ingredients as examples for NPSSP (e.g., diazepam,
192 alprazolam, flunitrazepam, midazolam, stilnoct). These questions were tailored to the same sex and
193 university of the respondents. Response options for both questions were 'Never in my/their life',
194 'Have used but not in the last two months', 'Once in the last two months', 'Twice in the last two
195 months', 'Once every two weeks in the last two months', 'Weekly', 'Twice a week', 'Thrice a week',
196 'Four times a week', and 'Every day or nearly every day'. Furthermore, information about students'
197 personal attitude towards NPSSP use was collected by asking: "Which of the following best describes
198 your attitude to using each of these substances?". Concerning students' perceptions of attitudes
199 towards using NPSSP among their peers (perceived injunctive norm), respondents were asked:
200 "Which of the following do you think best describes the attitude of most (at least 51%) of the
201 [female/male] students at your university to the use of each of these substances?". Response options
202 for both questions were 'Never ok to use', 'Ok to use occasionally if it doesn't interfere with work or
203 study', 'Ok to use frequently if it doesn't interfere with work or study', 'Ok to use occasionally even
204 if it does interfere with work or study', and 'Ok to use frequently if that is what the person wants to

205 do'. Country, sex, age, year of study, and living situation were considered as potential determinants
206 of NPSSP use/attitude towards NPSSP use.

207 **2.3 Statistical analysis**

208 First, frequencies of personal NPSSP use and attitudes towards NPSSP use were calculated and 95%
209 bootstrap confidence intervals based on 1,000 bootstrap samples were estimated for each country,
210 separately. Second, participants' self-other discrepancies were classified into three groups to
211 differentiate between students who perceived the NPSSP use and approval of NPSSP use of the
212 majority of their same-sex peers as higher, identical or lower as their personal use and approval of
213 use. Third, two binary multivariable logistic regression analyses were conducted to examine
214 associations between perceived and personal NPSSP use (descriptive norms model), and perceived
215 and personal attitudes towards NPSSP use (injunctive norms model). In the descriptive norms model,
216 country, sex, age, year of study, living situation, perceived NPSSP use, and personal attitude towards
217 NPSSP use were included as independent variables. In the injunctive norms model, all demographic
218 variables, perceived attitude towards NPSSP use, and personal NPSSP use were included as
219 independent variables. All variables were entered simultaneously (enter method).

220 Age was included as a continuous variable, and all other variables were considered as categorical
221 variables. Both models were checked for the presence of multicollinearity. Tolerance (TOL) values
222 for both models ranged from 0.90 to 1.00 indicating absence of multicollinearity between independent
223 variables. To investigate whether sex or country moderates the associations between perception and
224 personal NPSSP use/attitude towards NPSSP use, the two relevant interaction terms were added to
225 both regression models. For significant interaction terms ($p < 0.05$), stratified analyses were
226 conducted. All statistical analyses were performed using SPSS for windows, version 22.0.

227 **3. Results**

228 The SNIPE study included a total of 4,482 university students (71.4% female, mean age: 22.4 years).
229 The Slovak Republic ($n=1,938$, 43.2%) contributed the highest number of students, followed by
230 Turkey ($n=858$, 19.1%), Germany ($n=504$, 11.2%), Denmark ($n=464$, 10.4%), Belgium ($n=426$,
231 9.5%), Spain ($n=185$, 4.1%), and the UK ($n=107$, 2.4%). A detailed description of the sample
232 characteristics is provided by Helmer et al. (2014). Information on sex and NPSSP use was provided
233 by 4,412 students, and 4,284 additionally answered the question regarding their attitude towards using
234 NPSSP.

235 Across all participating countries, 9.1% of the students reported having used NPSSP at least once in
236 life. Lifetime prevalence rates of NPSSP use varied from 4.0% of females and 2.3% of males in
237 Belgium to 12.5% of females and 18.2% of males in the UK. Across all countries, most students

238 stated that 'it is never okay to use' NPSSP with rates varying from 56.8% of females in Germany and
239 62.5% of males in the UK to 84.7% of females and 91.2% of males in Turkey (Table 1).

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

	Belgium		Denmark		Germany		Slovak Republic	
<i>NPSSP 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 NPSSP 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 ^a	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 ^b	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)

	Spain		Turkey		UK	
<i>NPSSP 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 NPSSP 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 ^a	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 ^b	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)

243 ^a '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
244 doesn't interfere with work or study'.

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

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

	Lifetime NPSSSP use (%) (n=4,310)	Positive attitude towards NPSSP use ^a (%) (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

^a 'okay to use' and 'okay to use if it doesn't interfere with work or study'

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

Table 3 Associations between personal NPSSP use and perceived lifetime NPSSP use of peers, personal attitude of NPSSP use, country, age, sex, year of study, and living situation – results of a binary logistic regression

Variables	Ever personally used NPSSP	
	OR	(95% CI)
Perceived peer behavior: never used NPSSP (reference)	1.00	
Perceived peer behavior: ever used NPSSP	1.95	(1.49-2.55)
Never ok to use NPSSP (reference)	1.00	
Ok to use NPSSP	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 st (reference)	1.00	
2 nd	0.78	(0.57-1.07)
3 rd	1.13	(0.83-1.54)
4 th	0.89	(0.60-1.31)
5 th	0.66	(0.39-1.10)
> 5 th	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)

1 **Table 4 Associations between personal attitude towards NPSSP use and perceived attitude of**
 2 **peers, personal NPSSP use, country, age, sex, year of study, and living situation – results of a**
 3 **binary logistic regression**

Variables	Positive attitude towards NPSSP use ^a	
	OR	(95% CI)
Perceived peer attitude towards NPSSP use: never ok to use (reference)	1.00	
Perceived peer attitude towards NPSSP use: ok to use	5.49	(4.63-6.51)
Never used NPSSP (reference)	1.00	
Ever used NPSSP	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 st (reference)	1.00	
2 nd	0.84	(0.68-1.04)
3 rd	0.99	(0.78-1.24)
4 th	1.02	(0.77-1.37)
5 th	1.04	(0.73-1.47)
> 5 th	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)

4 ^a 'okay to use' and 'okay to use if it doesn't interfere with work or study'

5
6

7 Interaction terms in the descriptive norms model provided no evidence that the effect of perception
 8 on personal lifetime NPSSP use was modified by country or sex. In terms of injunctive norms,
 9 significant interaction terms suggested that the effect of perception on personal attitude towards
 10 NPSSP use was significantly modified by country, but not by sex. A stratified analysis of injunctive
 11 norms by country showed that the association between perception of peer approval and personal
 12 approval was significant for all countries, except for the UK (Table 5).

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16 **Table 5 Association between personal attitude towards NPSSP use and perceived attitude of**
 17 **peers stratified by country (OR and 95% CI) adjusted for personal NPSSP use, age, sex, year**
 18 **of study, and living situation**

Country	Positive attitude towards NPSSP use ^a	
	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)

19 ^a 'okay to use' and 'okay to use if it doesn't interfere with work or study'

20 **4. Discussion**

21 In the present study with European students, we investigated self-other discrepancies regarding the
 22 use and attitudes towards the use of NPSSP. In addition, we evaluated whether perceptions of peer
 23 use (perceived descriptive norm) and peer approval of use (perceived injunctive norm) were
 24 associated with personal use and approval of NPSSP use. In our study, students on average perceived
 25 the NPSSP use of their peers to be higher than their personal use and attitudes towards the use to be
 26 identical or more positive than their personal attitudes. Both, perceived descriptive and injunctive
 27 norms of peers, were associated with students' personal use and attitudes towards the use of NPSSP,
 28 respectively.

29 To date, there are few studies on the use of non-prescribed sedatives and sleeping pills among
 30 students. The only study that examined perceptions with respect to sedatives by Sanders and
 31 colleagues (2014) found that 65.7% of students perceived the recreational non-medical use of
 32 prescription sedatives to be the norm among their peers despite only 2.6% of the sample reporting
 33 recreational use of these substances during the last month. More than a third of participants
 34 overestimated (26.3%) or extremely overestimated (10.2%) their peers' use, and recreational users of
 35 prescription sedatives were more likely to overestimate their peers' use of these substances (Sanders,
 36 et al., 2014). These findings are in line with our study. The results reported by Sanders and colleagues
 37 (2014), however, are based on bivariate analyses and thus did not account for further potential
 38 determinants of students' personal sedative use, such as sex or age.

39 Our study extends the limited evidence regarding the association of perceived descriptive norms of
 40 peers with university students' personal use of NPSSP. Indeed, our study adds to the existing evidence
 41 by revealing self-other discrepancies regarding NPSSP use in a large sample of university students
 42 from various universities across Europe. Across all countries participating in the SNIPE study, the
 43 majority of students perceived their peers' use to be higher than their personal use. Furthermore, we

44 demonstrated associations between perceived peer use and students' personal use while controlling
45 for other potential determinants of NPSSP use ensuring further methodological rigor to our study.

46 The present study is the first to demonstrate discrepancies between personal and perceived peer
47 injunctive norms regarding NPSSP use by investigating self-other discrepancies and associations
48 between perceived injunctive norms and students' personal approval of NPSSP use. To date,
49 associations between perceived injunctive norms and personal approval of using non-prescribed
50 substances have only been investigated for stimulants (Helmer, et al., 2016; Silvestri & Correia,
51 2016), not for sedatives or sleeping pills. Silvestri and Correia (2016), analyzing data from 959 U.S.
52 undergraduate students, found that students' personal approval of non-medical prescription stimulant
53 use was positively correlated with perceived approval among what students perceived to be a typical
54 university student, close friends, as well as parents. However, the correlations between perceived
55 parental and close friend approval with personal approval were moderate in strength with weak
56 associations between perceived typical student approval and personal approval. This suggests that
57 more proximal referent groups, rather than students' broader group affiliations, could be important in
58 determining personal approval of stimulant use. Another study by Helmer and colleagues (2016), also
59 using data from the SNIPE study, found that 38.7% of students perceived their peers to be more
60 approving of using non-prescribed stimulants to improve their academic performance than
61 themselves. Their multivariable analysis also revealed an association between perceived peer and
62 personal approval of using these substances. In our study, an association between perceived injunctive
63 norms of peers and students' personal approval of using NPSSP was found for all countries
64 participating in the SNIPE project, except for the UK, with its comparatively small sample size.

65 The findings of this study align with previous observations that university students' exaggerated
66 perceptions of peer norms also exist for prescription substances which are less commonly used and
67 socially accepted than, for example alcohol, tobacco, or cannabis (Helmer, et al., 2016; Kilmer, et al.,
68 2015; McCabe, 2008; Perkins, et al., 1999; Sanders, et al., 2014; Silvestri & Correia, 2016). Increased
69 interest in the non-medical use of prescription drugs to the public and the media (Partridge, et al.,
70 2011) may create the impression that approving and using these substances is much more common
71 than it is in reality (McCabe, 2008; Sanders, et al., 2014). Perceiving prescription drugs to be safer,
72 and socially acceptable because of their production by pharmaceutical companies and their
73 prescription by physicians (Bodenlos, et al., 2014; Compton & Volkow, 2006; Hildt, et al., 2011;
74 Martins & Ghandour, 2017) may also explain exaggerated peer norms.

75 The identification of perceived descriptive and injunctive norms of peers as significant predictors of
76 students' NPSSP use and approval of use provides empirical arguments for the important role of
77 social norms for personal behaviors and approval of behaviors. In line with social norms theory
78 (Berkowitz, 2005; Perkins, 2003), our findings may indicate that exaggerated perceptions of

79 descriptive norms of peers may increase students' willingness to use NPSSP themselves. Moreover,
80 exaggerated perceptions of injunctive norms of peers may also lead to an increased approval of using
81 NPSSP in order to match personal attitudes to the perceived peer norms. Social norms interventions
82 that challenge perceptions of descriptive and injunctive peer norms through, for example, mass media
83 campaigns, social marketing strategies or the provision of online personalized feedback (McAlaney,
84 et al., 2011; Perkins, 2003), may be a viable approach to prevent or reduce NPSSP use among
85 European university students.

86 There are certain limitations to the present study. The analyses are based on self-reported data
87 collected via a confidential online survey. This is a commonly used survey technique in substance
88 use research among university students to minimize the risk of socially desirable response behavior
89 (Kypri, Gallagher, & Cashell-Smith, 2004). However, in general, an under- or overestimation of
90 NPSSP use and approval of use due to social expectation bias cannot be ruled out. Moreover, it is
91 also possible that herbal products that are available without prescription have also been understood
92 as non-prescription by participating students. Even if only registered local trade names have been
93 provided to narrow down the scope, possible misunderstandings may have led to an over reporting
94 bias.

95 Furthermore, it is to be noted that individual email addresses were collected for the intervention
96 provided within the study and students may have perceived that they can be identified. The SNIPE
97 questionnaire included only a selection of active ingredients (e.g., diazepam, alprazolam,
98 flunitrazepam, midazolam, stilnoct) as examples for NPSSP which likewise may have led to an
99 underestimation of use and approval rates. In addition, the number of participating students differed
100 between countries, ranging from 107 individuals in the UK to 1,938 in the Slovak Republic.
101 Therefore, selection bias may have differentially affected the sample composition in different
102 countries. Finally, since the analyses are based on cross-sectional survey data, no causal relationships
103 between perceived descriptive and injunctive norms and personal behavior and attitudes towards
104 behavior can be deduced.

105 **5. Conclusions**

106 This study suggests that European university students perceive the use of NPSSP among their peers
107 to be higher than their personal use and peer attitudes towards the use to be identical or more positive
108 than their personal attitudes. Furthermore, both perceived descriptive and injunctive norms of peers
109 were shown to be associated with students' personal use and attitudes towards the use of NPSSP,
110 respectively. Social norms interventions may be useful to change exaggerated perceptions regarding
111 the use and attitudes towards NPSSP use and may prevent or reduce NPSSP use among European
112 university students.

113 **Declarations of interest:** none

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