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Cigarette and cannabis use in young Swiss men: examination of the bidirectional,
longitudinal associations between frequency of use and descriptive norms

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Abstract

Objective. Although several studies have investigated longitudinal associations between social norms and alcohol use behaviors, less is known about associations between social norms and use of other substances, such as cigarettes and cannabis. The present study aimed to examine the temporal ordering of descriptive norms and cigarette and cannabis use over time.

Method. A sample of 5158 young Swiss men from the Cohort Study on Substance Use Risk Factors (C-SURF) completed baseline and 15-month follow-up questionnaires assessing frequency of use and descriptive norms of cigarette and cannabis use. Bidirectional, longitudinal associations between descriptive norms and cigarette and cannabis use were examined using cross-lagged panel models.

Results. Descriptive norms for cigarette use at baseline predicted increased frequency of use at follow-up, whereas the opposite association, from frequency of cigarette use at baseline to descriptive norms at follow-up, was not significant. For cannabis, associations between descriptive norms and frequency of use were reciprocal. Descriptive norms at baseline predicted an increased frequency of cannabis use at follow-up and frequency of cannabis use at baseline predicted a later increase in descriptive norms.

Conclusions. For cigarette use, findings suggest that descriptive norms shape later cigarette use behaviors. For cannabis use, findings suggest descriptive norms shape cannabis use, but cannabis use also shapes later descriptive norms.

Word count: 210

Keywords: Cigarette, cannabis, descriptive norms, young adults, Cohort Study on Substance Use Risk Factors (C-SURF).

Introduction

Substance use (SU) is a major public health problem because it is a leading cause of young adult mortality and negative health consequences (Kokotailo, 1995; Osgood et al., 1988; Rehm et al., 2006; Toumbourou et al., 2007). A better understanding of the determinants of young adults' SU could help to develop and refine future prevention programs.

Research on social norms has had a substantial influence on the development and implementation of interventions designed to reduce SU. Previous studies have shown that social norms surrounding SU are positively related to SU itself (Neighbors et al., 2006), a finding supporting the idea that normative beliefs about others' behaviors influence our own (Cialdini and Goldstein, 2004). Moreover, since perceived SU social norms are generally higher than actual SU norms (Borsari and Carey, 2003; Cunningham and Selby, 2007), this provides opportunities to lessen misperceptions and thus decrease SU.

Accordingly, social norm-based interventions, e.g. providing information about actual norms, expect that a reduction in perceived SU norms will lead to lower SU (Miller and Prentice, 2016). However, there is no strong evidence that social norm-based interventions are effective at reducing SU, particularly for the use of substances other than alcohol, such as cigarettes and cannabis (e.g. Colby et al., 2012; Copeland et al., 2017; Elliott et al., 2014; Stockings et al., 2016). This raises questions about the causal influence of social norms on smoking and cannabis use.

Associations between social norms and cigarette and cannabis use

A distinction is usually made between descriptive and injunctive norms (Cialdini et al., 1990). Descriptive norms are perceptions of how others behave, e.g. an individual's perception of how most people use a given substance. Injunctive norms are perceptions of how others approve or disapprove of a given behavior. The present study focused on descriptive norms. A large body of research has shown that descriptive norms and SU are positively and significantly associated (e.g. Arbour-Nicitopoulos et al., 2010; Bertholet et al., 2013; Cullum et al., 2010; Neighbors, et al., 2006; Neighbors et al., 2008; Page and Roland, 2004). However, except for research on alcohol, almost all

these studies were cross-sectional, and the few longitudinal studies (e.g. Eisenberg et al., 2014) only tested prospective associations from descriptive norms to later cigarette or cannabis use. To the best of our knowledge, no longitudinal studies have investigated the reverse association (i.e. from cigarette and cannabis use to later descriptive norms) or bidirectional associations. Thus, although positive associations between descriptive norms and cannabis and cigarette use are known, the temporal order is not well researched. A better understanding of this temporal ordering could have important implications for refining existing prevention programs. On the one hand, if descriptive norms are affected by cigarette and cannabis use, rather than influencing its use, the efficacy of interventions aimed at changing descriptive norms in order to change SU behavior may be limited. On the other hand, if cigarette and cannabis use are affected by descriptive norms, rather than influencing them, the efficacy of interventions aimed at changing descriptive norms in order to change SU behavior may be effective. Finally, if descriptive norms and smoking and cannabis use are reciprocally associated over time, then interventions targeting changes in both social norms and SU may be more effective than targeting norms alone.

The present study

Studies on the temporal precedence of descriptive norms or SU have mostly examined alcohol use. They showed reciprocal associations, suggesting that although descriptive norms shape drinking behaviors, they are also shaped by them (Cullum, et al., 2010; Lewis et al., 2015; Neighbors, et al., 2006; Stappenbeck et al., 2010; Wardell and Read, 2013). To the best of our knowledge, no study to date has investigated the bidirectional associations between descriptive norms and cigarette and cannabis use over time, and it is still unclear whether patterns of associations between descriptive norms and cigarette and cannabis use are similar to those for alcohol.

The present study aimed to redress this by investigating the temporal ordering of descriptive norms and cigarette and cannabis use in a representative sample of young Swiss men. We hypothesize reciprocal associations between descriptive norms and cigarette and cannabis use over time, as has been found in studies on alcohol use.

Methods

Study design and participants

The data used in the present study were drawn from the Cohort Study on Substance Use Risk Factors (C-SURF; research protocol number 15/07, approved by Lausanne University Medical School's Ethics Committee for Clinical Research). C-SURF is a longitudinal cohort study designed to investigate the risk and protective factors of SU in young men. In Switzerland, military recruitment is mandatory for all young men; they must report to one of six recruitment centers to undergo an assessment of their eligibility for military or civil service. This offers a unique opportunity to take a quasi-census of Switzerland's population of young men. All the young men reporting to three recruitment centers, i.e. Lausanne (French-speaking), Windisch, and Mels (German-speaking) between August 2010 and November 2011 were invited to participate in the study; 7556 gave their written consent. Military recruitment centers were only used to inform and enroll participants. The C-SURF study was independent of the armed forces. Details of the enrolment procedures and the study in general have been previously described (Gmel, Akre, et al., 2015; Studer et al., 2013). Between September 2010 and March 2012, 5987 men (79.2% response rate) filled out the baseline questionnaire. Of these, 5479 (91.5% retention rate) also completed a first follow-up questionnaire, about fifteen months later, between March 2012 and January 2014. Thus, 501 participants were lost to follow-up, and 321 respondents (5.9% of respondents to both questionnaires) were excluded due to missing values on at least one variable of interest. The final sample for analysis comprised 5158 participants (94.1% of respondents to both baseline and follow-up questionnaires). Questions were translated and back-translated in French and German by native speakers of the C-SURF team. In case of potential differences, the last author and study director (GG) decided on final version after discussion with translators. Analysis of non-response showed that non-respondents at follow-up reported significantly more frequent cigarette ($p < .001$) and cannabis ($p < .001$) use than respondents in the baseline assessment. However, the non-response bias (NRB; see Groves, 2006) was relatively small, (i.e. $NRB = 3.16$ days of cannabis use yearly; $NRB = 9.66$ days of cigarette use yearly), indicating that the analytical sample underestimated the frequency of cannabis and cigarette use by

approximately 10%. The participants' mean age at baseline was 19.98 ($SD = 1.21$) years old and the time lag between completion of the baseline and follow-up questionnaires was 15.88 ($SD = 3.33$) months on average.

Measurements

Cigarette and cannabis use

At baseline and follow-up, frequency of cigarette smoking in the previous 12 months was measured on a 7-point scale and was coded to reflect the number of days of cigarette smoking. Possible answers were: "never" (coded 0), "once a month or less" (coded 6), "two to three days a month" (coded 30), "one to two days a week" (coded 78), "three to four days a week" (coded 182), "five to six days a week" (coded 286), and "every day" (coded 364). At baseline and follow-up, frequency of cannabis use in the previous 12 months was measured on a 6-point scale and was coded to reflect the number of days of cannabis use. Possible answers were: "never" (coded 0), "once a month or less" (coded 6), "two to four times a month" (coded 36), "two to three times a week" (coded 130), "four to five times a week or more often" (coded 234), and "every day or nearly every day" (coded 364).

Descriptive norms

At baseline and follow-up, descriptive norms of cigarette and cannabis use were assessed using questions adapted from previous studies on descriptive norms (e.g. Page and Roland, 2004; Page and Scanlan, 2000). The following item was used: "In your opinion, what percentage of men your age smoke cigarettes [use cannabis]?"

Socio-demographics

Socio-demographic variables included linguistic region (French or German) and highest level of education at baseline (primary schooling, vocational training, post-secondary schooling). Since differences in substance use prevalence exist between Switzerland's linguistic regions (Gmel,

Kuendig, et al., 2015) and between levels of education (Charitonidi et al., 2016), it is important to take these differences into account in any analyses.

Statistical analyses

Descriptive statistics and correlations between variables of interest were examined. Cross-lagged regression models (see Figure 1) were used to investigate temporal precedence between descriptive norms and cigarette or cannabis use variables. These were done separately for cigarette and cannabis use using Mplus 7.11 software (Muthén and Muthén, 1998-2015). These models simultaneously estimated autoregressive (e.g. norms_{baseline} predicting norms_{follow-up}) and cross-lagged associations (norms_{baseline} predicting frequency of use_{follow-up}), as well as cross-sectional correlations (e.g. norms_{baseline} with frequency of use_{baseline}). By controlling for baseline levels of the variables being predicted (i.e. autoregressive paths), such models allow the direction of associations (i.e. cross-lagged associations) between descriptive norms and cigarette or cannabis use to be determined. The inclusion of autoregressive paths allows to partial out the stable portion of the variables being predicted in order to rule out the possibility that the cross-lagged coefficients are simply due to correlations between the predictors and baseline levels of the variables being predicted at follow-up. Thus, a cross-lagged coefficient can be interpreted as the association between a given predictor and the residual variance change in the variable being predicted (Selig and Little, 2012). Cross-lagged regression models do not permit investigators to make strong affirmations about causality, as a consequence of the absence of experimental manipulation and of possible omitted data. However, as mentioned by Newsom (2015), these models allow an investigation of which variable temporally precedes the other, according to Granger causality (Granger, 1969).

As the C-SURF cohort contained a large proportion of cigarette and cannabis non-users, there was a large proportion of zeros in the frequency of use of cigarettes and cannabis. Thus, frequency of use was modeled using a zero-inflated negative binomial regression, whereas linear regression was used to model descriptive norms. Unstandardized coefficients (b) and 95% confidence intervals

(95% CI) were computed for all associations. All models were adjusted for the highest level of education and linguistic region.

Results

At baseline, 2511 (48.7%), 1487 (28.8%), and 1160 (22.5%) men reported primary schooling, vocational training, and post-secondary schooling, respectively, as their highest level of education. There were 2877 (55.8%) French-speaking and 2281 (44.2%) German-speaking participants. A total of 2372 (46.0%) and 1549 (30.0%) men reported smoking cigarettes and using cannabis at least once in the 12 months before baseline assessment, respectively. A total of 2415 (46.8%) and 1625 (31.5%) men reported cigarette smoking and cannabis use at least once in the 12 months before follow-up assessment, respectively. Means, standard deviations, and correlations between all the variables of interest are reported in Supplemental Table A. All variables related to cannabis use were positively and significantly correlated. Most of the variables related to cigarette use were also positively and significantly associated, except associations between: cigarette use frequency_{baseline} and descriptive norms for cigarette use_{follow-up}, and frequency of cigarette use_{follow-up} and descriptive norms for cigarette use_{follow-up}.

Results from cross-lagged models are reported in Figure 1. Frequency of cigarette use_{baseline} was not significantly associated with descriptive norms_{follow-up}. By contrast, descriptive norms for cigarette use_{baseline} were positively and significantly associated with increased cigarette use frequency_{follow-up}. Descriptive norms for cannabis use_{baseline} were positively and significantly associated with increased frequency of use_{follow-up}. Cannabis use frequency_{baseline} was also positively and significantly associated with increased descriptive norms for cannabis use_{follow-up}.

Discussion

The present study investigated the temporal precedence between descriptive norms and cigarette or cannabis use in a sample of young Swiss men. Results showed different patterns of association for cigarette and cannabis outcomes.

Cigarette use

The finding that descriptive norms predicted the later increase in frequency of use of cigarettes, whereas the reverse association was not significant, did not support our hypothesis of reciprocal associations between norms and cigarette use over time. Instead, the association was unidirectional, suggesting that descriptive norms shape or precede cigarette use but are not shaped by cigarette use. This finding is consistent with the prediction of social norms theory, that perceptions and beliefs about others' behaviors influence our own (Cialdini and Goldstein, 2004). In line with promising results from programs focusing on correcting smoking norms, such as mass media campaigns (e.g. Hancock et al., 2002) and interactive social norms programs (e.g. Ott and Doyle, 2005), this finding suggests that future prevention programs could put a greater emphasis on correcting smoking norms. Informing or teaching individuals that smoking is not the norm, in conjunction with other structural measures and individual-focused measures, may improve the efficacy of smoking prevention programs.

Cannabis use

In line with previous longitudinal studies investigating associations between drinking and perceived norms (e.g. Stappenbeck, et al., 2010; Wardell and Read, 2013), results showed that descriptive norms predicted the later increase in frequency of cannabis use, and that frequency of cannabis use predicted the later descriptive norms. This supports our hypothesis that the temporal associations between cannabis use and descriptive norms are reciprocal over time. Consistent with the principle of reciprocal determinism proposed by Bandura (1977), in social learning theory, this suggests that descriptive norms shape cannabis use but are also shaped by cannabis use. As proposed by Wardell and Read (2013), for drinking behaviors, the reciprocal associations observed in the present study suggested that descriptive norms and cannabis use may reinforce each other over time. Perceiving high cannabis use norms may lead to increased cannabis use, which may, in turn, lead to descriptive norms of increased cannabis use, resulting in an escalation of cannabis use over time.

This finding may have important implications for prevention. It suggests that interventions targeting both change in the descriptive norms of cannabis use (e.g. through normative education) and change in cannabis use directly (e.g. informing youths about the negative health consequences of cannabis use, and teaching protective behavioral or adaptive coping strategies) might trigger a virtuous cycle. Correcting normative misperceptions may reduce cannabis use and a reduction in cannabis use may lead to the perception that cannabis use is less normative, and so on.

Limitations.

First, although it provided a better understanding of the temporal associations between descriptive norms and cannabis and cigarette use, this study shed no light on the processes underlying these associations (e.g. conformity, social affiliation, and projection). Further studies are needed to better understand which specific processes should be targeted in social norm interventions. Second, the sample was restricted to young, Swiss, adult men, therefore, further studies should be conducted before generalizing these findings to women and other age groups. Third, the use of single item scales to assess norms may have lower reliability than multiple item scales, therefore, the use of multiple item scales would be recommendable in future studies. Finally, the study focused solely on descriptive norms. Future studies should examine the associations between other aspects of social norms, e.g. injunctive norms and cigarette or cannabis use.

Conclusion.

The present study contributes to understanding the longitudinal associations between descriptive norms and cigarette and cannabis use by showing that descriptive norms shape later cigarette and cannabis use. Accordingly, efforts to develop prevention programs targeting change in social norms in order to change substance use should be continued and enhanced.

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Figure 1.

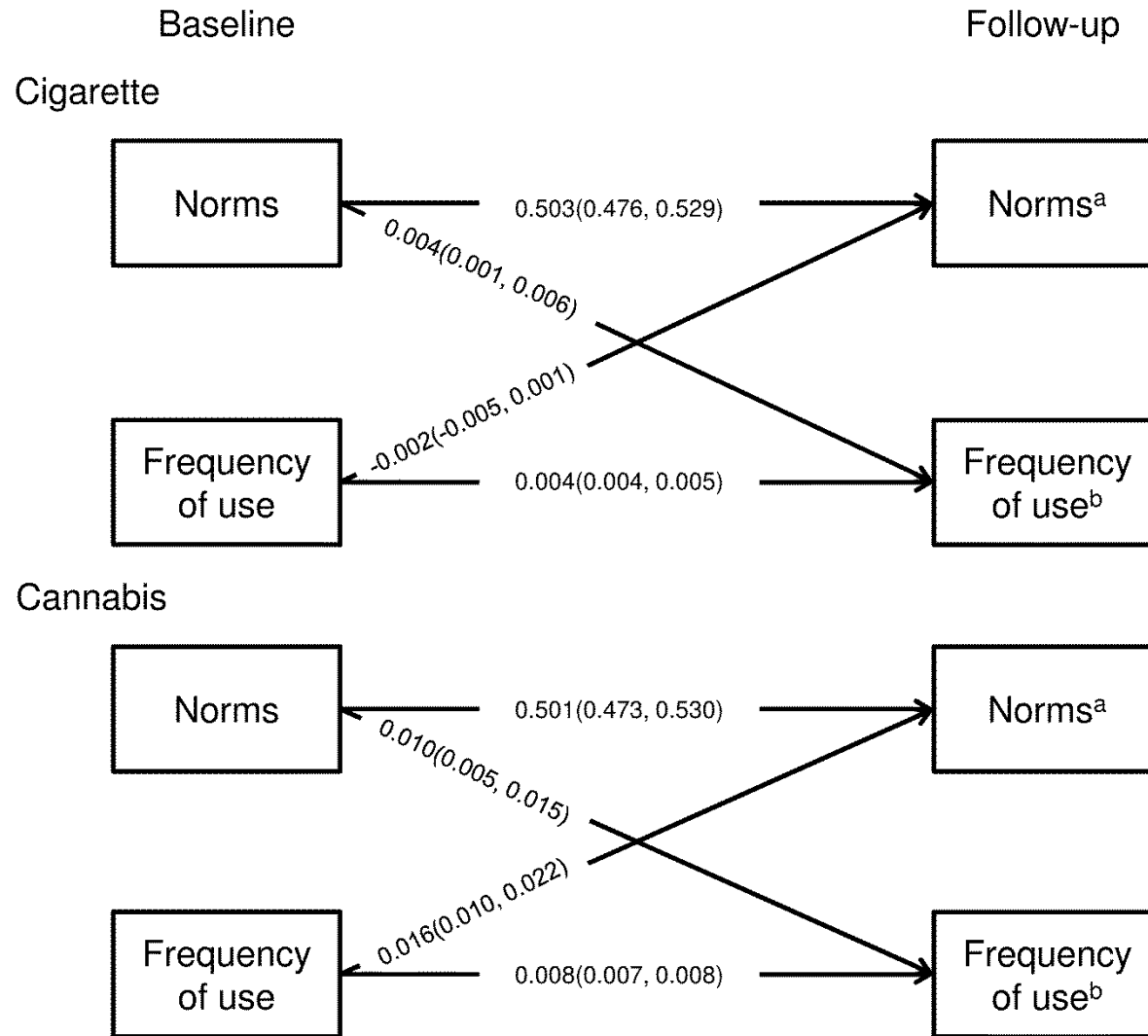


Figure caption.

Figure 1. Cross-lagged panel models of associations between norms and frequency of cigarette use and between norms and frequency of cannabis use, adjusted for age and highest level of education. Unstandardized (95% confidence interval) are displayed. Cross-sectional correlations between norms and frequency of use were omitted from the figure for ease of presentation. ^aLinear regression. ^bZero-inflated negative binomial regression.

Supplemental Table A. Means, standard deviations, and correlations between the variables of interest

	Mean(<i>SD</i>)	Range	Correlations							
			1	2	3	4	5	6	7	
1. Cannabis use baseline	25.10 (78.58) ^a	0 - 364	-							
2. Cigarette use baseline	89.58 (145.45) ^a	0 - 364	.387	-						
3. Norm cannabis baseline	30.86 (19.62)	0 - 100	.176	.144	-					
4. Norm cigarette baseline	52.78 (18.82)	0 - 100	-.002	.035	.549	-				
5. Cannabis use follow-up	23.98 (76.13) ^a	0 - 364	.736	.351	.153	-.002	-			
6. Cigarette use follow-up	96.64 (149.82) ^a	0 - 364	.359	.835	.142	.049	.366	-		
7. Norm cannabis follow-up	30.02 (19.14)	0 - 100	.156	.125	.528	.348	.162	.117	-	
8. Norm cigarette follow-up	52.22 (18.68)	0 - 100	-.020	.011	.366	.522	-.035	.006	.536	

Note. Correlations in bold are significant at $p < .05$. *SD* = Standard deviation. ^anumber of days of use in the previous twelve months.