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Übersichtsarbeit

The Swiss Cohort Study on Substance Use Risk Factors – Findings of two Waves

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Abstract: *Aim:* To summarize published findings in peer-reviewed journals of the first two waves of the Swiss Cohort Study on Substance Use Risk Factors (C-SURF), a longitudinal study assessing risk and protective factors of 5,987 young men during the phase of emerging adulthood (20 years at baseline, followed-up 15 months later). *Methods:* Included were 33 studies published until November 2014 focusing on substance use. *Results:* Substance use in early adulthood is a prevalent and stable behavior. The 12-month prevalence of nonmedical use of prescription drugs (10.6 %) lies between that of cannabis (36.4 %) and other illicit drugs such as ecstasy (3.7 %) and cocaine (3.2 %). Although peer pressure in the form of misconduct is associated with increased substance use, other aspects such as peer involvement in social activities may have beneficial effects. Regular sport activities are associated with reduced substance use, with the exception of alcohol use. Young men are susceptible to structural conditions such as the price of alcohol beverages or the density of on-premise alcohol outlets. Particularly alcohol use in public settings such as bars, discos or in parks (compared with private settings such as the home) is associated with alcohol-related harm, including injuries or violence. Being a single parent versus nuclear family has no effect on alcohol use, but active parenting does. Besides parenting, religiousness is an important protective factor for both legal and illegal substance use. Merely informing young men about the risks of substance use may not be an effective preventive measure. At-risk users of licit and illicit substances are more health literate, e. g., for example, they seek out more information on the internet than non-at-risk-users or abstainers. *Discussion:* There are a number of risk and protective substance use factors, but their associations with substance use do not necessarily agree with those found outside Europe. In the United States, for example, heavy alcohol use in this age group commonly takes place in private settings, whereas in Switzerland it more often takes place in public settings. Other behaviors, such as the nonmedical use of prescription drugs, appear to be similar to those found overseas, which may show the need for targeted preventive actions. C-SURF findings point to the necessity of establishing European studies to identify factors for designing specific preventive actions.

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Introduction

Substance use among adolescents and young adults remains one of Europe's most entrenched and costly health problems (Rehm et al., 2004). It is the leading cause of mortality among adolescents and young adults worldwide, accounting for an estimated 35.3 % of all deaths in 15–29-year-old men in the developed world (Rehm, Taylor, & Room, 2006; Toumbourou et al., 2007). Licit and illicit drug use at young ages is associated with various high-risk behaviors like violence, injuries, suicide, school dropout, risky sexual behaviors, and various adverse physical and mental health outcomes (Jessor & Jessor, 1977; Kokotailo, 1995; Kuntsche & Gmel, 2013; Perkins, 2002).

During emerging adulthood, individuals face a number of normative developmental tasks from the domains of physical and cognitive development, identity, affiliation, and achievement. Substance use and associated problems often increase during this phase and may precipitate future problems (Gotham, Sher, & Wood, 2003; Schulenberg & Maggs, 2002). Hence, the period of emerging adulthood offers an important vantage point for examining both increasing and decreasing alcohol and drug use, and it represents a critical period for taking preventive actions. Many young substance abusers "mature out" in their twenties when they adopt the roles and responsibilities of adulthood. Nevertheless, a significant proportion continues or even increases their substance use. Few longitudinal studies have addressed this critical phase between the late teen years and emerging adulthood.

To date, our knowledge about substance use among emerging adults stems from general population samples not restricted to smaller areas such as individual cities, counties, or states; the main source is North America. Prominent examples are the Monitoring the Future Study (Terry-McElrath & O'Malley, 2011), the National Longitudinal Study of Adolescent Health (Chen & Jacobson, 2012), and the National Longitudinal Survey of Youth (Quinn & Harden, 2013). A review of studies following up adolescents into early adulthood discovered 54 studies from 10 cohorts; a majority of the studies, however, revealed problems with bias and confounding (McCambridge, McAlaney, & Rowe, 2011). About half of the studies were from the United States. The authors concluded that there is an urgent need for high-quality long-term prospective cohort studies. Research in the United States has often focused on young college students, and the non-representativeness of many of these studies has been criticized (Chen & Jacobson, 2012). One of the strengths of Swiss Cohort Study on Substance Use Risk Factors (C-SURF) is that it enrolls its sample during mandatory Army recruitment, eliminating any preinclusion bias (such as e. g., college students with a higher education level, coming from relatively rich families, etc.).

Outside the United States there have been a number of highly publicized general population cohort studies of emerging adulthood. Examples are the Christchurch Health and Development Study (Goodwin, Fergusson, & Horwood, 2004) or the Dunedin Multidisciplinary Health and Development Study (Ramrakha et al., 2013) in New Zealand as well as a study of 44 schools in Victoria, Australia (Degenhardt et al., 2013). Surprisingly, however, there have been few general population cohort studies in Europe on the development of substance use between late adolescence and early adulthood. Most of longitudinal research in Europe on substance use and mental health was done on adolescents, used small sample sizes or convenience samples, involved only a particular region in a single country, used clinical samples with preselected, often disabled populations (e. g., patients of specialist mental healthcare and addiction services). Large-scale, representative studies mainly come from Britain, such as the British National Child Development Study (Takizawa, Maughan, & Arseneault, 2014) or the British Birth Cohort study (Viner & Taylor, 2007), which used samples of all births during one week. Some large-scale cohort studies following adolescents up into early adulthood have also emerged from Norway (Rossow & Kuntsche, 2013), France (Bowes, Chollet, Fombonne, Galéra, & Melchior, 2013), Germany (Behrendt, Wittchen, Höfler, Lieb, & Beesdo, 2009), The Netherlands (Prince van Leeuwen et al., 2014), and Switzerland (Rössler, Hengartner, Angst, & Ajdacic-Gross, 2012), but they used samples from a narrower area, e. g., such as the city of Munich or Zurich.

More common were studies such as the Swedish Conscript Study (SCS; Romelsjö, Allebeck, Andréasson, & Leifman, 2012), which assessed data taken at a single point in time and followed people up through national registers such as mortality registers; other examples are from e. g., England (Hayes et al., 2011), Finland (Virtanen et al., 2011), Spain (Herrero, Domingo-Salvany, Brugal, & Torrens, 2011), Sweden (Nyhlén, Fridell, Hesse, & Krantz, 2011), Denmark (Arendt, Munk-Jorgensen, Sher, & Jensen, 2011), and Germany (Holtmann et al., 2011). Follow-up based on registry data with only a single assessment of substance use patterns at baseline, however, does not allow us to look at any changes in consumption pattern and development over time. In the review of Mcambridge et al. (2011) nine of the 21 European studies included were reports of SCS.

In conclusion, very few representative, general population cohort studies on substance use trajectories have been conducted in Europe. The Swiss Cohort Study on Substance Use Risk Factors (C-SURF) tries to fill these gaps and to overcome the limitations mentioned (see webpage http://www.csurf.ch). In this paper we further analyze separately the published findings of C-SURF from either the baseline assessment when participants were around 19–20 years old or from the first follow-up 15 months later. We focus on (1) studies on substance use with (2) a narrower look of an emerging problem, namely nonmedical use of prescription drugs (NMPDU), (3) early experiences with substances as particular risk factors, and (4) aspects that may be of importance for prevention.

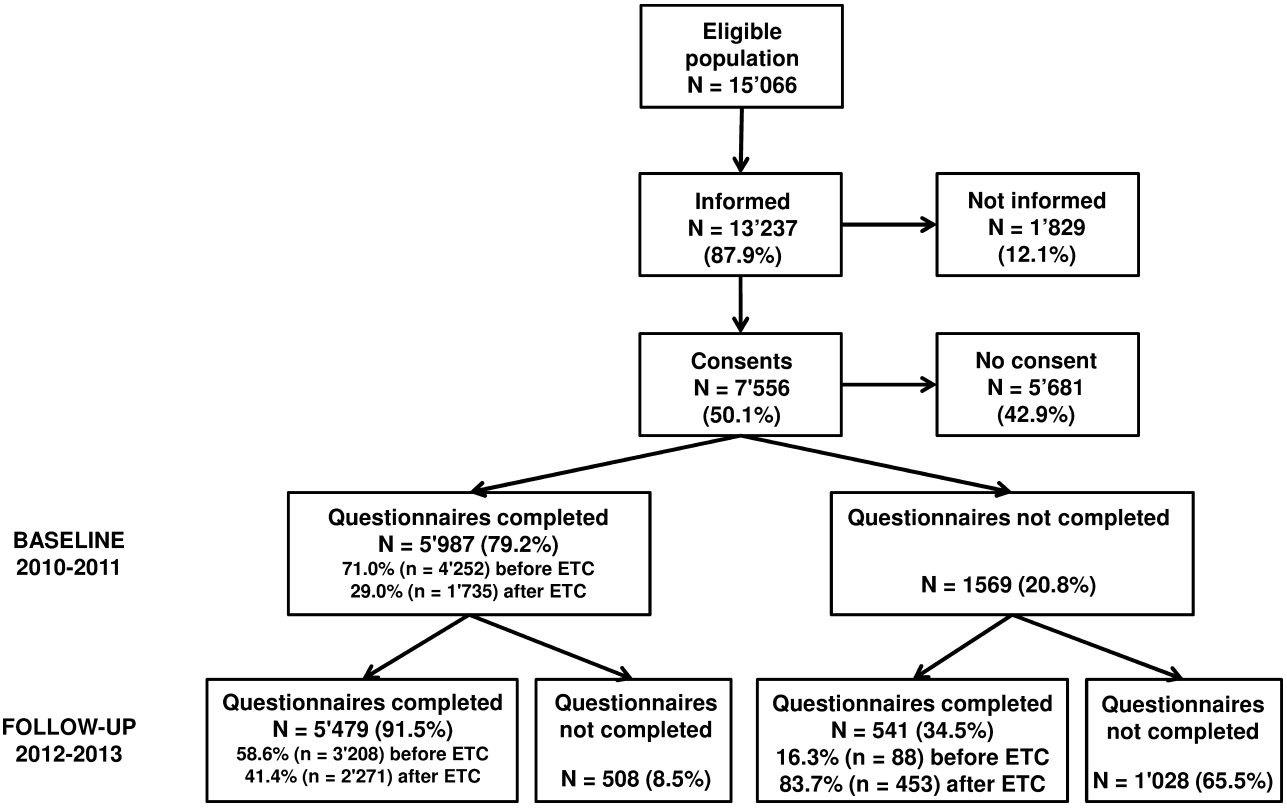

Figure 1. Flowchart of participant inclusion at baseline and follow-up.

Methods

Study Selection

We reviewed C-SURF data on substance use with a special focus on NMPDU, first substance use, and potential risk and protective factors, taken from 33 journal manuscripts up until November 2014. For the selection and validation of instruments we refer to several other publications.

Design and Sample

Switzerland has a mandatory Army recruitment process, meaning virtually all men around the age of 20 years are processed to determine their eligibility for military or civil service. Three out of six recruitment centers covering 21 of the 26 Swiss cantons were used to enrolll men in the study between August 23, 2010, and November 15, 2011 (with data collection lasting up to March 5, 2012). These were the centers for which permission for enrolment had been received from the Army. One center covered all French-speaking conscripts, another center was the largest center for German-speaking conscripts, and the third covered smaller, rural cantons. For language reasons we could not include the Italian-speaking conscripts. Missing also are recruits form the largest city in Switzerland (Zurich), though the sample does include the major cities in the German- and French-speaking parts (Basel, Lausanne, Geneva) and therefore represents rural and urban regions of both linguistic regions in Switzerland. Recruitment centers were used only to enroll individuals in the study. Questionnaires were sent privately to the participants' addresses, and confidentiality was assured. The study protocol (Protocol No 15/07) was approved by the Lausanne University Medical School's Clinical Research Ethics Committee.

Figure 1 shows the participation at baseline and follow-up around 15 months later. 15,066 Swiss men showed up at the Army recruitment centres and were eligible for study inclusion. Two points are worth mentioning: First, a prerequisite of the arrangement with the Army was that enrolment should not influence army procedures. Therefore, 1,829 were not informed about the study. 5,987 individuals participated at baseline and 5,479 (91.5 %) also at follow-up (between March 7, 2012 and January 6, 2014). Additionally, 541 participants with informed consent who did not participate at baseline could be convinced to participate at follow-up. Table 1 provides an overview of sample characteristics at baseline. Second, we conducted so-called encouraging telephone calls (ETC) with consenters who did not participate after standard reminders. Interviewers were trained by experts to use aspects of motivational interviewing (for details, see Studer, Baggio et al., 2013).

During Army enrollment everybody was asked to fill out a short 5-minute questionnaire on substance use; 94 % completed it. This short questionnaire enabled us to

Table 1
Sample charachteristics of C-SURF

	French-speaking ($N = 3316$)			German-speaking ($N = 2671$)		
	N	%	*N* missing	*N*	%	*N* missing
Age (*M*, *SD*)	20.29	1.28	0	19.65	1.10	0
Highest completed level of education			0			18
Secondary education	1213	36.6		1660	62.6	
Basic vocational education	62	1.9		43	1.6	
Secondary vocational / technical education	891	26.9		583	22.0	
Community colleges	183	5.5		77	2.9	
Vocational High school	251	7.6		90	3.4	
High school	621	18.7		186	7.0	
Bachelor	91	2.7		10	0.4	
Other	4	0.1		4	0.2	
Civil status			30			22
Single	3099	94.3		2531	95.5	
Living with a partner	164	5.0		97	3.7	
Divorced or separated	2	0.1		1	<0.1	
Married	21	0.6		20	0.8	
Number of children			27			17
0 children	3264	99.2		2636	99.3	
1 child	21	0.6		14	0.5	
2 or more children	4	0.1		4	0.2	
Partner pregnancy			30			18
Yes	55	1.7		14	0.5	
No	3231	98.3		2639	99.5	
Financial independence			31			20
Cover all life expenses	749	22.8		676	25.5	
Cover part of life expenses	1465	44.6		1069	40.3	
Other sources cover life expenses	1071	32.6		906	34.2	

compare (1) consenters versus nonconsenters and (2) early responders (before ETC) and late responders (after ETC). Although there were some differences between consenters and nonconsenters, these differences were generally small (Studer, Mohler-Kuo et al., 2013). Similarly, differences between early responders and late responders were small, whereby the substance use patterns of late responders lay between those of early responders and nonresponders (Studer, Baggio et al., 2013).

Results

Prevalence Rates of Addictive Behaviors

Substance use was highly prevalent among the young men in this age group. In the past 12 months less than 10 % had abstained from alcohol, while more than 40 % showed risky single-occasion drinking (RSOD also called "binge drinking") at least monthly. More than 30 % smoked daily (Dermota et al., 2013), about 10 % used smokeless tobacco at least once a month (Fischer, Clair, Studer, Cornuz, & Gmel, 2014), and 4.9 % used E-cigarettes (Douptcheva, Gmel, Studer, Deline, & Etter, 2013).

Cannabis is the most common illicit drug with a 12-months prevalence of 36.4 %, and almost 20 % had used cannabis at least twice a week (Dermota et al., 2013). Baggio, Deline, Studer, Mohler-Kuo et al. (2014) showed that the route of administration of cannabis was associated with heavy use and use disorder symptoms. Users who do not mix cannabis with tobacco are more often moderate users and less often screened with use disorders, whereas users of water pipes (bongs) showed both heavy use and use disorders. Cannabis dependence longitudinally predicted negative health consequences (Baggio, N'Goran et al., 2014). Frequent simultaneous use (i.e., happening in the same instant; to be distinguished from concurrent, i.e. happening over the same period of time such as in the past 12 months) of alcohol and cannabis or tobacco and cannabis was associated with increased dependence rates, when one substance triggered the simultaneous use of another substance (Baggio, Studer, Deline, N'Goran et al., 2014).

The most common illicit drugs after cannabis were ecstasy, with a 12-month prevalence of 3.7 %, and cocaine

(3.2 %). Other illicit drugs (15 drug classes were measured) had 12-month prevalence rates below 3 % (Baggio, Studer, Mohler-Kuo, Daeppen, & Gmel, 2013). So-called "smart drugs" (cognitive enhancers) had a 12-month prevalence of 3 % (Deline et al., 2014). Substance use behaviors remained relatively stable (Baggio, Studer, N'Goran et al., 2014) between baseline and follow-up (participants being around 20 and 21.5 years old, respectively).

NMPDU: An Emerging Public Health Problem?

NMPDU involves the use of prescription drugs without a prescription or in ways not recommended by a physician. Its use can be due to self-medication or recreational use (e. g., experimentation, "getting high"). NMPDU had a 12-month prevalence of 10.5 % (N'Goran et al., 2014), with opioid analgesics (6.5 %), sedatives (2.9 %), anxiolytics (2.6 %), and stimulants (1.9 %) being most commonly used. NMPDU not only proved to be a sign of self-medication with poor mental or physical health, but it also induced poor mental health at follow-up among individuals without poor mental health at baseline (N'Goran et al., 2014). NMPDU was associated with particular personality profiles, namely, individuals scoring high on the aggression/hostility personality scale, with an attention deficit hyperactivity symptomatology or scoring high on the personality subscale of anxiety/neuroticism (N'Goran et al., 2015). The associations of NMPDU with poor mental health were commonly stronger than those of illicit street drugs (Baggio, Studer, Mohler-Kuo, Daeppen, & Gmel, 2014). The simultaneous intake of NMPD with alcohol aggravated a number of physical, social and mental health problems (Baggio, Deline, Studer, N'Goran et al., 2014).

Age of Onset and Experienced Effects at First Use

In C-SURF, besides initial use (which may mean just tasting), stronger definitions were used, such as age at daily smoking, first drunkenness, and first time getting high on cannabis. Besides cannabis-only users (level 1), there seems to be two classes of illicit drug users: level 2 drug users (hallucinogens: magic mushrooms, other hallucinogens, salvia divinorum; uppers: ecstasy, cocaine, speed, amphetamines/methamphetamines; and inhaled drugs: poppers, solvents), and level 3 drug users (ketamine, GHB/GBL, heroin, research chemicals, crystal meth, and spice). There was little progression from cannabis use only to level 2 drug use or from level 2 drug use to level 3 drug use. Moreover, the age of onset of intensive use of legal drugs and cannabis showed different cut-offs for the use of these drug classes. For example, although generally the earlier the onset of cannabis use, the higher the prevalence of other illicit drug use, the prevalence of level 2 drugs use particularly increased in individuals who had started cannabis use between the ages of 13 and 15 years (compared with 16–18 years, 19 years or older). With regard to level 3 drug use, its prevalence increased sharply when cannabis was first used before the age of 13 years (Baggio, Studer, Mohler-Kuo et al., 2013). The same was found for the onset of daily smoking or first drunkenness.

From a longitudinal perspective, the earlier the age of onset of cannabis use, the more likely the existence of poor mental health and depression (Henchoz, N'Goran et al., 2014). This association was mediated through increased use of tobacco, alcohol, and cannabis among early-onset users. There were also a number of factors associated with the rare late onset (after 20 years of age) of cannabis use (Haug, Nunez, Becker, Gmel, & Schaub, 2014) such as lower parental knowledge of peers and their whereabouts, depression, parental divorce, or sensation seeking. Late drinking onset (after the age of 20) was associated with more harm than for alcohol users who had started earlier but did not engage in RSOD (Dupuis et al., 2014).

Besides the age of onset, the subjective experience users made at their first-time use was important. Baggio, Henchoz et al. (2014) showed that more pleasant experiences at first cannabis use were associated with the use of similar (level 2) drugs provoking stimulating and entactogen effects. Yet, if first-time-use effects were less pleasant, continuing drug users were more likely to move on to level 3 drugs with more depressant effects. Similarly, the effects of first-time tobacco smoking could be empirically distinguished based on positive and negative effects: Experiencing positive effects at first-time tobacco smoking was associated with a higher likelihood of continued smoking and heavy smoking, in agreement with the valence model (Baggio, Studer, Deline et al., 2013). However, also negative effects were associated with continued smoking and dependence, particularly "dizziness" when starting smoking, in agreement with the sensitivity model. The positive effects of first tobacco use were also associated with more positive experiences at first cannabis use, which may reinforce the maintenance of both cannabis and tobacco use as well as the heavier use of and dependence on both substances (Baggio, Studer, Deline, Mohler-Kuo et al., 2014).

Risk and Protective Factors

Peer Pressure and Drinking Motives

The perception that more people of the same age group drink, smoke, and take drugs than is actually the case was associated with one's own heavier use (Bertholet, Faouzi, Studer, Daeppen, & Gmel, 2013). Besides the norm perception, C-SURF uses subscales (Baggio, Studer, Daeppen, & Gmel, 2013) of the Peer Pressure Inventory (PPI; Brown, Clasen, & Eicher, 1986) and a short form of the Drinking Motives Questionnaire Revised (DMQ-R SF;

Kuntsche & Kuntsche, 2009). Research on peer pressure commonly looked only at the negative aspects of peer pressure, i.e., "misconduct" with "deviant peers" (use of substances, unsafe sex, and delinquent behaviors), and neglected that there may be positive aspects of peer influences, such as peer involvement (involvement in peer social activities) and peer conformity, i.e., conformity with peer norms such as dressing or musical tastes. Studer, Baggio et al. (2014) observed that the positive effect, i.e., increased drinking, was mainly found for misconduct and was mediated through drinking motives of enhancement and coping. Peer involvement (i.e., involvement in peer social activities) and peer conformity (i.e., conformity with peer norms such as dressing or musical tastes) had a negative effect on drinking, mediated through enhancement, conformity, and coping motives. Coping motives acted more strongly during the work week, whereas enhancement motives were particularly relevant for drinking on the weekend (Studer, Baggio, Mohler-Kuo et al., 2014).

Do Physical Activity and Exercising Sport Prevent Substance Use?

In C-SURF, the level of physical activity was estimated using the short form of the International Physical Activity Questionnaire (IPAQ; Gauthier, Lariviere, & Young, 2009) and exercising sports by an additional single-item scale. In fact, physical activity did not generally have a protective effect for cannabis and tobacco use, whereas sports and exercise did (Henchoz, Dupuis et al., 2014). The frequency of sports activity showed dose-response effects with cannabis and tobacco use, but not with alcohol use. From a longitudinal perspective, those maintaining regular (almost daily) sports activities or taking them up at follow-up generally had lower nicotine dependence and less cannabis use disorders than did those who resisted regular sport activities at both data collection points or lapsed in regular sports activities at follow-up (Henchoz, Baggio et al., 2014). A cross-lagged panel analysis showed that regular exercise had a beneficial prospective effect on substance use disorders. Mental and physical health showed reciprocal effects, i.e., baseline mental and physical health predicted regular exercise at follow-up, whereas regular exercise at baseline also predicted better mental and physical health at follow-up (Henchoz, Baggio et al., 2014).

Structural Measures, Economic and Physical Availability

Structural measures such as price increases and availability restrictions (e.g., density of alcohol outlets) are commonly seen as the most effective means of reducing substance use (Babor et al., 2003). Participants in C-SURF were given a hypothetical alcohol purchase task, adapted from Murphy and MacKillop (2006). Briefly, a scenario of alcohol use was given, and then participants were asked how many drinks they would purchase and imbibe at 11 different prices. Alcohol users, including those with alcohol use disorders (AUD), generally proved to be price sensitive (Bertholet, Murphy, Daeppen, Gmel, & Gaume, 2015). However, sensitivity to prices decreased slightly as drinking behavior became more problematic. For an increase in price by 1 Swiss franc, for example, there was a decrease in the number of drinks by 10.8% for people without AUD, 10.5% for those with mild AUD, and 9.9% for those with severe AUD.

A multilevel analysis linked the individual level of drinking with the outlet density of communities (Astudillo, Kuendig, Centeno-Gil, Wicki, & Gmel, 2014). The density of on-premises outlets (bars or clubs where alcohol is sold for direct consumption), but not off-premise outlets (where alcohol is sold for consumption elsewhere), was associated with RSOD (having 6 drinks or more on a single occasion). Effects sizes were higher in regions with higher alcohol use of the general population.

"Superordinate" Instances

C-SURF showed that it was less important whether the family is a two- or a single-parent family. Having a negative family history (e.g., alcohol-dependent parents) was a risk factor (Steiner, Schori, & Gmel, 2014), and active parenting (knowing the whereabouts of children and setting rules) had a beneficial effect on RSOD, volume of drinking, and alcohol dependence.

Religiosity and spirituality are often neglected protective factors. Gmel et al. (2013) showed that being religious (believing in God) has a more beneficial effect on the use and misuse of almost all substances than just belonging to a religious denomination. The associations remained, despite the adjustment for potentially relevant parenting variables.

Giving Information and Feedback

For C-SURF participants, health literacy (i.e., searching for information on substance on the internet, a good understanding of information on health) was higher for substance users (alcohol, tobacco, cannabis) than for abstainers, and higher for at-risk users than for users not at risk (Dermota et al., 2013). A randomized clinical trial embedded in C-SURF using brief motivational interventions showed a small beneficial effect in favor of the intervention (Gaume et al., 2014).

Drinking Locations

A large portion of the total alcohol use among young Swiss men occurred in public locations, such as at bars, pubs, discos, festivals and other special events (Kuntsche & Gmel, 2013). In particular, drinking in bars/pubs, discos/nightclubs and outdoor places (but not at home or in

restaurants) was associated with alcohol-related risks. Increasing alcohol use in these settings was longitudinally associated with the increase in harm (Studer, Baggio et al., 2015).

Bähler et al. (2014) further showed that, even when adjusting for the alcohol use of individuals, those who drank predominantly in public locations had higher risks for severe alcohol-related consequences. Complementing these findings, Dey, Gmel, Studer, Dermota, and Mohler-Kuo (2014) found that drinkers preferring beer were more likely to show risky drinking patterns than people with a mixed choice of beverages. In contrast, drinkers preferring wine were more likely to display low-risk consumption of alcohol and less likely to experience negative alcohol-related consequences. Beer is typically more affordable and more often consumed in high-risk public settings (e. g., bars) than wine, which is typically enjoyed at home or in low-risk public settings (e. g., restaurants).

Discussion

C-SURF is one of the rare European longitudinal studies in emerging adulthood with a large sample size of a wider geographic region, and the sample is relatively unbiased due to the mandatory conscription. The lack of such studies was criticized in recent reviews (Marshall, 2014; McCambridge et al., 2011). Switzerland, with its different linguistic regions and related cultures, can serve as a role model for other European countries. Furthermore, C-SURF data are made freely available to researchers all over the world. The C-SURF team encourages researchers to use these data for hypothesis testing as well as for comparative research seeking to identify similarities across and differences between countries, which will also be helpful to identify preventive actions. Research possibilities (e. g., instruments used) as well as access to the C-SURF data are documented on the C-SURF website (www.c-surf.ch).

C-SURF showed that substance use can in fact be reliably measured. The consistency in responses over a period of 1.5 years makes deliberate false responses unlikely. Individuals must be very consistent "cheaters" to recall their false responses over a period of 15 months. This confirms the common view that substance use can be reliably measured (Del Boca & Darkes, 2003; Midanik, 1988). Such consistency also means that 20-year-olds commonly did not progress to heavier drug use. This means that, for example, users of only alcohol commonly did not add tobacco, or that users of legal substances commonly did not add illicit drugs, or that users of level 2 drugs (e. g., cannabis, hallucinogens, uppers, and inhaled drugs) did not add level 3 drugs (e. g., ketamine, GHB/GBL, heroin, research chemicals, crystal meth) to their use spectrum. This indicates that primary prevention approaches, i. e., approaches to preventing the onset of drug use must start earlier. In fact, the increase in the use of level 2 and level 3 drugs was found mainly for very early onset before the age of 13 (level 3 drugs) and before the age of 15 (level 2 drugs) for cannabis as well as alcohol and tobacco. This suggests that cannabis does not necessarily act as a gateway drug, but that there is a common liability of very early substance use misbehavior associated with the progression toward the use of other drugs, particularly level 3 drugs. Therefore, conspicuous substance use behaviors in early adolescence should be a major focus of preventive actions. Common liability, already apparent as neurobehavioral disinhibition in childhood, has been shown to be predictive of later substance use disorders (Tarter et al., 2003), and there are personality-targeted interventions that can be applied before the onset of natural substance use and that have shown their effectiveness (Conrod, O'Leary-Barrett, Newton et al., 2013).

C-SURF also showed that NMPDU must be added in research on substance use in Europe. NMPDU is a growing problem in many countries (Casati, Sedefov, & Pfeiffer-Gerschel, 2012). Present findings suggests that it is added to the use spectrum of illicit drugs with similar predisposing personality factors as for illicit drugs, but may have even stronger effects on physical, social, and mental health problems.

Findings from outside of Europe cannot always be applied to European cultures. For example, in contrast to North America, where alcohol is primarily consumed by young people in private settings (e. g., at parties or at friends' home; for a review of the studies, see Kuntsche & Gmel, 2013), something that is likely related to the higher purchasing age limit in North America, a large share of the overall alcohol use among young Swiss men occurred in public locations such as bars, pubs, discos, at festivals and other special events. Even when adjusting for the alcohol use of individuals, those who drank predominantly in public locations had higher risks for severe alcohol-related consequences. This may mean that not only one's own alcohol use, but also the fact of being in a setting with other heavy alcohol users bears an additional risk. These findings point the way toward prevention programs targeting public drinking places (e. g., soliciting trained streetworkers), which may be further supported by the enforcement of regulations such as responsible beverage serving practices (Graham, Jelley, & Purcell, 2005) or structural measures targeting availability and price. There is evidence – mainly from the United States – that increasing the legal drinking age limit does have beneficial effects on consumption and harm (Crost & Guerrero, 2012), though its political feasibility can be doubted in many European settings: Increasing the legal drinking age might just displace alcohol use to more private, less-controlled settings. C-SURF findings showed that late drinking onset (after the age of 20) was associated with more harm than for alcohol users who started earlier, but did not engage in RSOD. This could mean that early socialization to moderate alcohol use, both in the family and elsewhere (Barnes, 1990), need not *per se* have negative consequences.

Prevention often works best where preventive activities are not directly noticeable, e. g., in the family or at church. Family is considered to be linked to many risk and

protective factors of substance use (Ryan, Jorm, & Lubman, 2010; Stone, Becker, Huber, & Catalano, 2012). Astonishingly, McCambridge et al. (2011) noted that only few longitudinal studies in this age group had addressed family influences. C-SURF confirmed reviews that having a negative family history (e. g., alcohol dependent parents) is a risk factor, and that active parenting (knowing the whereabouts of children and setting rules) is a protective factor of heavy drinking including dependence (Stone et al., 2012). Interestingly, parental effects played only a minor role in explaining the beneficial effects of religiousness on substance use. Thus, it is not a family background in a more (or less) religious environment, but the individual preoccupation with religious norms and beliefs that enforces less substance use. The identification of protective factors, beside faith in God, may be of importance also for non-religious-oriented prevention initiatives. Such factors may be traced to religious people taking more comfort in relaxation and meditation (lower arousal levels) than in sensation-seeking activities (higher arousal levels), having particular strategies for coping with stress, or having peer groups in which certain norms and values not related with substance use are enforced.

Peers have an important impact on substance use. Descriptive norms, i. e., the perception that more people of the same age group drink, smoke, and take drugs than is actually the case, were associated with own heavier use. Beside the norm perception, peer pressure and drinking motives were recently incorporated into prevention programs, such as resistance training or changing drinking motives (see Studer, Baggio et al., 2014b, for an overview). Research on peer pressure commonly looks only at the negative aspects of peer pressure (see the recent review of Leung, Toumbourou, & Hemphill, 2011), i. e., misconduct with "deviant peers" (use of substances, unsafe sex, and delinquent behaviors). C-SURF findings showed that peer involvement (i. e., involvement in peer social activities) and peer conformity (i. e., conformity with peer norms such as dressing or musical tastes) had beneficial effects mediated through enhancement, conformity, and coping motives. Peer involvement may mean having more friends who take care and disapprove of individuals' misbehaviors. Spending time with such friends may also provide an alternative to coping with negative affect states, e. g., using more adaptive emotion-regulation strategies instead of drinking too much. Coping motives acted more strongly during the work week, whereas enhancement motives were particularly relevant to weekend drinking (Studer, Baggio, Mohler-Kuo et al., 2014), suggesting that drinking for coping may be dealt with by developing more adaptive coping strategies, whereas heavy weekend drinking may be targeted by providing alternatives to enhance emotional states other than by drinking on weekends.

Sport may provide such an alternative activity to substance use or visiting a peer group supporting the values of a healthy life within a team to achieve common goals. C-SURF found a positive impact on substance use behavior, and recently also non-substance-related addictions such as problematic video game use (Henchoz et al., 2015), with the exception of alcohol use, which is probably too widely spread in Swiss society. A recent review also found no beneficial effects of sports on alcohol use; findings for illicit substances were mixed (Kwan, Bobko, Faulkner, Donnelly, & Cairney, 2014).

There is some controversy over the question whether informing people about risks of substance use has a preventive effect. On the one hand, it is assumed that educative approaches based mainly on providing information are ineffective (Babor et al., 2003). On the other hand, brief interventions providing mainly mere information are considered to be effective (Bertholet, Daeppen, Wietlisbach, Fleming, & Burnand, 2005). C-SURF revealed a significant but small effect in reducing alcohol use in the intervention group compared with the control group in an embedded brief-intervention controlled trial (Gaume et al., 2014). The peculiarity of the study was that 18 counselors delivered the intervention, and their motivational skills were measured. The study showed important differences among the characteristics and behaviors of the counselors, which raises the possibility that the effects of brief motivational interventions may depend on the training of the counselors and the implementation of motivational skills. On the other hand, providing information, say, on the internet, may not be protective for substance use, because particularly heavy users use this information more often than nonusers or non-heavy-users.

Although C-SURF is one of the rare European longitudinal studies with a representative sample and low attrition covering a wider geographical area, the sample design using military conscription comes with two major weaknesses. First, conscription is mandatory only for men and not for women. Second, most substance use patterns have been already formed by the age of 20 years and remain rather stable over the 15 months until the first follow-up. Thus, important factors influencing the substance use are retrospective measures. The major aim, however, is to investigate the development of substance use and other non-substance-related addictions *during* emerging adulthood. Thus, at least two further waves, when the young men turn 25 and 30 years, respectively, are planned. This should provide more evidence for prevention in this critical period of emerging adulthood.

Implications for Practice

Substance use is changing in emerging adulthood. Many users mature out, but some even increase their use. Substance use and corresponding risk and protective factors also have a cultural and societal component. Therefore it is important to study these risk and protective factors in emerging adulthood in different societies to shape preventive actions according to specific needs, instead of adopting findings from other cultures such as the United States, where most

publications come from, but where the societal and cultural background is different.

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Declaration of Interests

The authors declare that there is no conflict of interest relating to this article.

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