Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Eidgenössisches Departement des Innern EDI
Bundesamt für Gesundheit BAG
Tabakpräventionsfonds

Schlussbericht für Tabakpräventionsprojekte und -programme
(bitte nicht handschriftlich ausfüllen)

Projektname	A Tobacco Brief Motivational Intervention among Conscripts (ATOMIC)	
Projektstart	01.04.2008	
Projektende	30.06.2010	
Beitragsempfängerin / Beitragsempfänger	Name Strasse / Nr. PLZ / Ort	CHUV – Service d'alcoologie Herrn Gerhard Gmel Mont-Paisible 16 1011 Lausanne
Kontaktperson	Gerhard Gmel	
Verfügungsnummer	08.001190	
Verfügungssumme	471'234.—CHF	

Lausanne, 31.01.2012 Gerhard GMEL

Bitte beachten Sie die Erläuterungen zum Schlussbericht und zur Schlussabrechnung. Sie befinden sich auf der Website des TPF.

Version 2010

Content

1 Summary of final report

The present project implemented the possibility for receiving a brief motivational intervention (BMI) for tobacco and cannabis smokers in the army recruitment center of Lausanne. BMI consisted of one 20-30 minute session intended to reinforce one's motivation to change behavior, modeled after motivational interviewing spirit and techniques. It was made available to all smokers, but additionally addressed alcohol and multiple substance use and abuse. MI postulates a central role for "change talk", i.e. talk about behavior change. During the BMI counselors were encouraged to elicit "change talk" among the young men. An individual focus for each intervention was negotiated between the young men and the counselor. The main aim, however, was to deal with problem behaviors (that often cluster) among young adults, thus addressing only a single behavior would ignore other concurrent problem behaviors. The negotiation of the intervention focus was used as the general starting point of the intervention. The present intervention was therefore one of the first implementations of BMI worldwide for multiple substance use, although primarily tobacco and cannabis smokers were invited to participate.

In Switzerland, there is a lack of knowledge regarding the training of counselors to provide brief interventions in a motivational interviewing style. Therefore, extensive training concepts were developed as part of the project, and partly (as a side effect of the project) already used in the curriculum of medical students. Because the intervention included more than one substance, the training concepts for counselors were not focused on one particular substance and can therefore be used for BMI interventions focusing on tobacco, cannabis, alcohol or other drugs).

BMI has been widely used, most commonly in highly selective populations, such as university or other school students, emergency patients or patients of general practitioners. Hence, it is usually not available to major portions of the population; it is effective, but has only a minor impact on public health because it reaches only a small portion of the population. The intervention would have to become available to large segments of the population to become relevant in a public health sense. The advantage of implementing BMI in army recruitment centers is that it reaches about 98% of all men aged 19 to 20 years. In Lausanne virtually all francophone men have to go through the recruitment procedures. BMI was offered the young men on a voluntary basis, either at the time of conscription, or 6 months later. The army recruitment procedures create a rather hectic setting; therefore, because of restrictions imposed by the army, not all men going through it during the trial could be invited. Of the 4,767 that were eligible for BMI, 1,052 actually took the offer. Thus, there was apparently a need for young men to talk about their substance use problems. Some conscripts could not be accommodated because of restrictions of time and interview space. We included 853 individuals, of whom 392 were randomized into the intervention group and 461 served as controls in order to evaluate the effectiveness of the intervention. The controls were to receive BMI six months later. A booster session (administered to a random half of those receiving the intervention) was evaluated for potential increased effectiveness. One of the clear results of this project was that the booster session did not increase effectiveness; to be more cost-effective, it can be dropped in future.

The intervention proved to be effective in the overall sample by significantly reducing the number of cigarettes smoked and the number of days with cannabis use. Crossover effects on alcohol use tended to be positive (i.e. reduce consumption), but were not significant. An interesting finding was that the intervention

often had stronger effects on substances that were not the focus of the alcohol or cannabis interventions (e.g. number of cigarettes smoked, changes from daily use to occasional use and smoking cessation). This suggests that BMI works less well on the heaviest users of a substance. It is important to note that “focus” does not mean that other substances were not discussed during BMI, but that they were not concentrated on as much. In future BMI, more mention of treatment that is more intensive should be considered and the focus of the change talk should be widened to include other substances that are not necessarily chosen as a primary problem by the conscript. In summary, the intervention in the army recruitment center in (French-speaking) Lausanne proved effective, was highly accepted by the young men and should be extended to include other centers in the German-speaking sector and in Ticino. Material to train counselors to provide these brief motivational interventions has been developed; it can be used in different recruitment centers as well as in other settings that are frequented by young men. The transferability to women of this age has yet to be tested.

2 Evaluation of Results

Aims (Aims/milestones as detailed in application Pt 4. / 4.1)	Achieved	Partly achieved	Not achieved	Commentaries
Project staff is hired and trained	X			Complex assessment of candidates for counselling and research assistance over multiple days. Training of final candidates (see report milestone 1), including: - Triage of 120 applications - 10 applicants remained; - Individual discussions with candidates, including role plays with standardized patients over 3 days, but also with "real" conscripts in the army setting; - 2 days workshops for research assistants and psychologists for screening and assessment procedures, and supervised tests in the army setting; - Selection of 2 research assistants, and 5 psychologists for field phase.
Manuals for training of staff and documentation of BMI training including simulated patients are finalized	X			In addition to the provided material (see report "Formation des intervenants à l'intervention brève tabac, CTA – 2009"), a DVD was produced with examples for training sessions (cf. report Milestone 2), and experience with this procedures were integrated into the curriculum of training medical students in using BMI
First six months of administering BMI in the recruitment centre and first 3 months of booster sessions are completed	X			The expected participation rate was slightly lower, counter measures such as incentives and change motivation strategies to enhance participation were set into operation (see report milestone 3)
BMI in the recruitment are completed and first six months of follow-up are completed	X			The expected participation rate of 1000 men was originally achieved, but some could not participate mainly because of tasks that they had to follow for the army procedures. A sample size of 856 individuals was reached at baseline, and of those 697 were followed up after 6 months (see report milestone 4).
Fieldwork is completed (Follow-up and all boosters are completed)	X			Of the 392 included cases, 192 (random half) received a booster session. Among cases 145 with booster sessions and 168 without booster sessions were followed up after 6 months, and 384 of the 461 controls. To all controls a BMI after 6 months was suggested and provided to all those who still wanted it.
Finalization of Report and scientific articles	X			Final report and the promised 4 scientific articles have been written (see Appendix).
Press conference in collaboration with the army and other tobacco prevention agencies to communicate results.		X		Upon acceptation of this report, publication strategies, press conferences and/or press releases will be developed in collaboration with the army. First contacts and negotiations are established a plan for communication has been developed.

For this report we follow the structure as suggested by the Impact Model (Wirkmodel) of www.tabak-praevention.ch / Rubrik Wirkungsmanagement*).*

2.1 The Roots

2.1.1 Context

During the transition from adolescence to adulthood individuals are confronted with a number of normative developmental tasks, e.g., in the domains of physical and cognitive development, identity, affiliation and achievement. This process involves major individual and contextual changes in every domain of life; at the same time, tobacco and drug use, heavy drinking, and associated problems often increase during this transition, and may shape the course of future tobacco, alcohol and other drug-related problems (Gotham et al., 2003; Schulenberg and Maggs, 2002). This stage of life in young males is a unique and important vantage point for examining increasing changes in tobacco, alcohol and other drug use, as well as an important window in which to take preventive actions. A major research domain has been the university (Hingson et al., 2002; O'Malley and Johnston, 2002; Perkins, 2002; Vik et al., 2000), but one disadvantage of student surveys is that the population is highly selective (i.e. more highly educated than are their counterparts of comparable age).

Another promising area for researching transitions from adolescence to young adulthood among men is the army, especially in countries with mandatory conscription. In Switzerland, virtually all non-institutionalized men are called at the age of 19, thus this sample of conscripts is most representative of the young male Swiss population. Surveys of conscripts exist in many European countries, e.g., Norway (Heir and Eide, 1997), Finland (Marttunen et al., 1997), Russia (Palkin, 2005), Italy (Siliquini et al., 2001), France (Arvers and Choquet, 1999), and elsewhere (Bray et al., 1991; Chong et al., 2004; Nguyen et al., 2004). To our knowledge, however, taking advantage of easy access to large samples of young men for designing preventive actions in general, and on substance and tobacco use in particular has not often occurred. There were a few large trials conducted in the army, but they focused mainly on physical problems related directly to military service, e.g., reduction of back (Larsen et al., 2002) or lower limb (Withnall et al., 2006) problems, or bacterial and viral contamination (Goldhammer et al., 2006). The present intervention “A Tobacco Brief Motivational Intervention among Conscripts (ATOMIC) uses this area for an unbiased access to a full cohort of young men to implement preventive actions on tobacco and cannabis smoking and other substance use, mainly alcohol.

Preventive measures aimed at substance use reduction, such as routine military drug testing or tobacco bans during basic training, have been shown to be effective (Bachman et al., 1999). However, most of the research on legal and illegal substances among conscripts ends with obvious claims that “intervention is needed” (e.g. Bianchi and Popper, 2000; Bray et al., 1991; Schei and Sogaard, 1994). Typically, they do not describe the possible ways to implement or test substance use interventions during the recruitment process.

Recent research has shown that less invasive techniques such as Brief Motivational Interventions (BMI) can work as well as structural measures, such as smoking bans or tax increases to effectively reduce substance use (Bertholet et al., 2005; Bien et al., 1993; Dunn et al., 2001). The efficacy of brief and minimal tobacco cessation interventions in the general adult population has been shown in some meta-analyses (Fiore et al., 2000; Kottke et al., 1988; Law and Tang, 1995; Silagy and Stead, 2001). Promising results of smoking reduction and cessation have been shown among adolescents and young adults (Colby et al., 1998; Colby et al., 2005; Horn et al., 2007; Kentala et al., 1999). On the other hand, the authors of a recent meta-analysis stated that despite the fact that intensive behavioral interventions result in substantial increases in smoking abstinence compared with controls, there is still insufficient evidence to draw strong conclusions regarding

the efficacy of minimal clinical intervention in general adult populations (Mottillo et al., 2009). A Cochrane review on tobacco cessation interventions for young people concluded that trials of brief interventions would still be useful, particularly as these are often only used as control conditions for more complex interventions (Grimshaw and Stanton, 2006). There are some positive findings that brief interventions can reduce tobacco use, but the evidence is inconclusive on adolescents.

In clinical practice, there are still barriers to addressing tobacco use in youths, including a lack of clear clinical practice guidelines and training, perception of poor effectiveness of interventions and low self-efficacy in delivering effective intervention, and lack of reimbursement. Clinicians may feel overwhelmed during brief clinical encounters in dealing with complex social behaviors such as tobacco use. They may screen and identify tobacco users, but are hesitant about how to proceed with behavior-change counseling (Pbert et al., 2003). The present intervention, ATOMIC, therefore used well-trained psychologists to deliver brief interventions, and the project developed materials to train counselors to conduct for future interventions.

Most BMI studies have addressed a single risky behavior like alcohol or tobacco use. This narrow approach has been criticized, because many individuals at risk for one of these behaviors are much more susceptible to other associated risk categories (Saitz et al., 2006). Concurrent use of multiple substances by adolescents and young adults is well documented in epidemiological surveys in Switzerland (Gmel et al., 2004; Narring et al., 2004; Schmid et al., 2007). Currently there is limited research on interventions aimed at multiple risk behaviors (Coups et al., 2004; Goldstein et al., 2004; McCambridge et al., 2010). To our knowledge, there are only a few international, controlled intervention studies among young people that simultaneously target alcohol, tobacco and illicit drug use (McCambridge and Strang, 2003; McCambridge and Strang, 2004). In these, the authors found reductions in use of the three substances, as well as carry-over effects for substances such as cannabis, even when the focus of the intervention was on another substance, such as tobacco. Similar findings of reduced tobacco, alcohol and drug use were found in a convenience trial in Japan (Suzuki et al., 2003). In a recent unpublished study, Babor and colleagues also showed that BMI targeting alcohol use had cross-effects in reducing tobacco use (personal communication Tom Babor; 15.05.2007). The ATOMIC intervention targeted smokers, but was designed to also take into account the multi-risk behaviors of young adults.

BMI often has focused on a single intervention session. However, it appears that it is even more efficacious when accompanied by a booster session (Longabaugh et al., 2001; Mello et al., 2005). There is some evidence that success of BMI for tobacco use increases with the intensity of the intervention and with the number of (booster) sessions (Fiore et al., 2000; Kottke et al., 1988; Miller and Wood, 2003). A booster session was therefore administered to half of those receiving an intervention to test its additional impact.

2.1.2 Structure

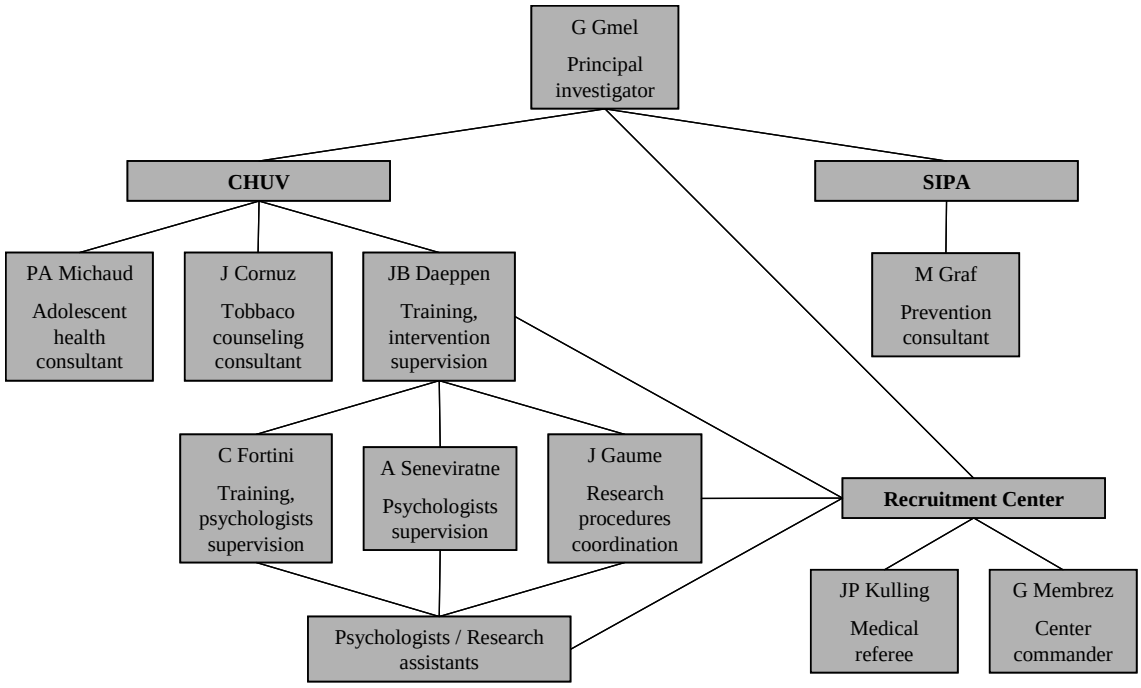
The project had several interconnected key players (see Figure 1) who have expertise in various domains: adolescents and young adults, clinical counseling and treatment of substance use problems (Prof. Michaud); tobacco research and prevention (Prof. Cornuz); delivery of effective BMI (Prof. Daeppen and colleagues); and substance use prevention for adolescents and young adults outside the clinical setting (Michel Graf). At the time, collaboration with the Swiss Institute for the Prevention of Alcohol and Drug Problems (SIPA) now named Addiction Info Switzerland (AIS)), facilitated the exchange of prevention materials for distribution in the army and the data analyses, and will involve AIS in the development of a communication process for disseminating results. AIS is particularly adept at communicating research findings both to the general

public and to the prevention community. Gerhard Gmel, the Principal Investigator, worked part-time simultaneously in the projects at the Lausanne University Hospital (CHUV) and AIS, in order to maximize his time on the research. He maintained and solidified the connection between the key players in the CHUV and the AIS.

Administrative issues and general data collection procedures were supervised and coordinated by Jacques Gaume. He was responsible for the administrative aspects of counselor and research assistant coordination in collaboration with the army, as well as for overseeing organizational aspects related to randomization, administration of booster sessions and telephone follow-ups. Christiana Fortini and Alicia Seneviratne are well-trained, long-term specialists in administering BMI, and supervised all aspects related to providing BMI. All are currently working at the Alcohol Treatment Center (Service d'alcoologie), headed by Prof. Daeppen. He was responsible for facilitating the exchange between CHUV collaborators and headed the group responsible for the training and coaching of counselors. He was the major contact person for networking with the army to facilitate and maintain optimal delivery of BMI in the army setting.

The project was in close collaboration with army personnel, especially the head of the recruitment center's medical department (Dr. Kulling) and the recruitment center commander (Lt. Col. Membrez).

Figure 1: Interconnectedness of study partners and collaborators



2.1.3 Income

Comparative International Youth surveys such as the European School Project on Alcohol and Drugs (ESPAD) (Hibell et al., 2009) have shown that the use of legal substances such as alcohol and tobacco is higher in Europe than in the US (in the comparable Monitoring The Future (MTF) study), showing the need for increased preventive actions in Europe. Switzerland is among the middle-ranking European countries in alcohol and tobacco use by youths and is among the leading countries in cannabis use. Substance use is one of the leading factors in mortality and morbidity among young people in most developed societies, where alcohol use alone is responsible for 30.6% of deaths among those aged 15 to 29 (Toumbourou et al., 2007).

Longitudinal cohort studies showed that using substances early in life increases the risk of progression to more frequent and problematic use in later life, including dependence (Coffey et al., 2000; Grant et al., 2006; Toumbourou and Catalano, 2005). This is particularly true for tobacco users (Chen, 2003; DiFranza et al., 2002; Russell, 1990), and calls for early intervention on smokers.

Recruits in Switzerland often use more alcohol, tobacco and cannabis than their peers in the general population (Bieri Buscho and Forrer, 2002; Daeppen et al., 2005). Gmel et al. (2010) showed that 68.7% of the present target group of army conscripts had at least one of the following risky substance use behaviors:

- Alcohol: Risky single occasion drinking (RSOD; 6+ drinks on an occasion) at least twice per month or usual consumption of more than 20 drinks per week (58.1%) where one drink contains approximately 10g of ethanol)
- Tobacco: daily smoking (36.6%)
- Cannabis: at least twice weekly (17.2 %)

Prevalence rates were higher for substance use in general, but not for at-risk use in particular. Almost one in three (32.5%) of the recruits engaged in more than one of three risky behaviors; the young men who are at risk may benefit from brief interventions.

2.1.4 Input

The Tobacco Prevention Funds founded the project with 471,234 CHF. Real costs of the project were estimated to be 1,045,782 CHF. Besides infrastructure, most of the self-financed work “in kind” was provided through the supervision and managing of BMI counselors (C Fortini, A Seneviratne, JB Daeppen), production of training materials, and through project management (G Gmel, JB Daeppen, J Cornuz, PA Michaud) and data analysis (G Gmel, M Faouzi, J Gaume).

2.2 Design: the log

Only men of Swiss nationality are recruited for conscription; Swiss women can join the military service on a voluntary basis, but were not included in the research. An important advantage of the study is that virtually all non-institutionalized men are called for conscription at age 19; there should be minimal social status bias, eliminating the issue of differential access to intervention that would favor the higher socio-economic strata.

2.2.1 Primary outcome aims

I. *Development of training material for brief intervention providers*
II. *Increase in tobacco and cannabis smoking cessation rates with intensity of intervention 6 months after baseline (from second control group to BMI + booster, see below)*

2.2.2 Secondary outcome aims

New recommendations of the WHO tend to show a potential for secondary preventive measures that target consumption reduction as well as abstinence (World Health Organization (WHO), 2002). Reduction or maintenance of occasional smoking also seems to be a precursor of higher abstinence rates later (Colby et al., 2005; Horn et al., 2007; Sargent et al., 1998). Positive BMI effects on intermediate outcomes, such as increased motivation for change, have also been shown among adolescents and young adults and appear to be a good predictor of later cessation (Colby et al., 1998; Nieman et al., 2005).

i. *Significant decrease in number of cigarettes (or days with cannabis use) smoked 6 months after baseline with increasing intensity of intervention*
ii. *Among non-daily smokers, progression from occasional tobacco smoking to daily smoking less likely 6 months after baseline with increasing intensity of intervention*
iii. *Beneficial effects: reductions in at-risk alcohol and cannabis use (crossover effects) 6 months after baseline*

A positive gradation was expected for all outcomes between the three conditions associated with increasing intensity of intervention, from (control group 1, with no intervention, assessment and telephone counseling promised 6 months later) to BMI without booster group to BMI plus booster group.

The project originally contained two control groups for the evaluation of the effects of intervention and respective booster sessions: Control group 1 (voluntarily receiving BMI but randomized to a waiting list with assessment only at baseline and BMI proposed at follow-up) and Control group 2 (no BMI or assessment, only a short screening questionnaire). Group 2 was randomly selected from all participants who did not show up for an intervention. Two control groups were included in order to evaluate possible effects of regression to the mean and to distinguish them from recipients of minimal interventions. Table 1 gives an overview of the substance use characteristics of both of these groups.

As shown in Table 1, those showing up for an intervention more often are smokers, cannabis and alcohol users, particularly at risk-binge drinkers. This might be expected since individuals volunteering for an intervention are more likely to acknowledge problems with their personal substance use. Control group 2 (screening only, no intervention) was inserted because of methodological questions related to brief intervention studies. Since they differed in their willingness to receive BMI and in their levels of substance use, this group will not be included in the present report that focuses on intervention effectiveness. Instead, Control group 1 (intervention and more comprehensive substance use assessment) will be used. Methodological studies that include Control group 2 are planned or still in progress.

Table 1: Comparison of the two control groups

Scale level	Variables	Controls screening only (n=439)	Controls with additional assessment (n=461)	Test value	p-value
Smoking					
1	% past 6 months smoking, total sample	46.2	54.4	6.056	.014
1	% at risk (daily) smoking, total sample	32.6	37.3	2.217	0.136
1	% at risk (daily) smoking, smokers only	70.4	68.5	.194	0.695
0	number of cigarettes per smoking day, total sample	4.9	5.8	3.402	.065
0	number of cigarettes per smoking day, smokers only	10.6	10.7	.028	.868
Cannabis use					
1	% cannabis use past 6 months, total sample	37.8	44.3	3.850	0.05
1	at risk (> once a week) use	14.6	18.9	2.969	0.085
1	at risk (> once a week) use, cannabis users only	38.6	42.6	.635	0.426
0	number of days with cannabis use per months, total sample	3.4	3.9	1.218	.270
0	number of days with cannabis use per months, cannabis users only	8.9	8.9	.000	.991
Alcohol					
1	% drinkers past 6 months, total sample	88.4	95.9	17.457	<0.001
1	% risk volume (> 14 drinks/week), total sample	8.2	9.6	.531	0.466
1	% risk volume (> 14 drinks/week), drinkers only	9.3	10.0	.123	0.726
1	% risk binge (> once a month), total population	47.4	55.5	5.830	0.016
1	% risk binge (> once a month), drinkers only	53.8	57.7	1.257	0.262
1	% at risk (either volume or binge), total population	47.4	56.0	6.474	0.011
1	% at risk (either volume or binge), drinkers only	53.8	58.2	1.569	0.21
0	number of drinks per week, total population	7.8	9.8	4.720	.030
0	number of drinks per week, drinkers only	8.9	10.2	1.959	.162
0	number of binge occasions per months, total sample	2.6	3.0	3.239	.072
0	number of binge occasions per month, drinkers only	3.0	3.2	.632	.427
Socio-demography					
education					
1	mandatory school (9 years of schooling)	49.7	41.2	7.662	.022
	apprenticeship, professional school	31.4	33.8		
	high school preparing for eligibility for universities	18.9	24.9		
residency					
1	% rural (vs urban)	51.1	55.1	1.412	0.235
age					
0	Age	20.0	20.0	.005	.945

Remarks: *Scale levels for variables coded 1 are categorical variables, with test-values being Chi-squared values, scale levels coded 0 are continuous interval-scaled variables and tests are mean comparisons of continuous variables with test-values being F-values (ANOVA)*
Values are means for continues variables and percentages for categorical variables

2.2.3 Activities to reach aims

Switzerland has a mandatory two-day army recruitment process for all males at age 19, and virtually all conscripts complete the physical, medical and cognitive assessments to determine eligibility for service in the military. In Lausanne, around 190 individuals pass the recruitment procedures on these two days (over about 46 weeks of conscription) and theoretically total about 8,700 per year. (In the year of the present study there were slightly fewer passing the recruitment procedures, see below.) Groups of 30 conscripts each were assigned by the army to follow the various medical, physical, and psychological assessments in different sequences. We arranged time during the 3 hours of medical examinations, to conduct ATOMIC 3 times a

day (6 times per week) on these groups of 30 conscripts each. Conscripts had ample time to participate in our activities during the medical examination, since the actual examination takes about 1.5 hours and the rest is waiting time. The three-hour examination slot was used for: proposing voluntarily participation in the study; randomly assigning intervention and control groups; conducting detailed assessments of substance use, substance use history and related problems in the groups; and for delivering BMI to the treatment group. Written informed consent was obtained from all intervention participants.

While waiting for the medical decision later in the recruitment process, those not receiving intervention were asked to fill out a short screening questionnaire on substance use. Every individual was asked for consent to be followed up via telephone, and Control group 2 was randomly selected from those who agreed. Generally, the CONSORT statement for clinical trials was adhered to.

2.2.4 Inclusion protocol

Figure 2 below demonstrates sampling during one year of conscription (8,419 conscripts over 46 weeks). Smokers were invited to receive tobacco (or cannabis) use BMI, which also addresses additional (mainly alcohol) substance use. We did not propose randomization among all conscripts but only among those interested in receiving BMI, for the following reason: Randomization of individuals not willing to participate in BMI sessions would increase the internal, but not the external validity of the design and would probably result in many refusals at baseline or at follow-up. It is unlikely that in reality those not willing to receive BMI will be amenable to any counseling. Also, recent research in an emergency department study on brief alcohol counseling demonstrated that BMI mainly had an effect on those who (during the counseling session) felt themselves to be more capable of changing, were also more likely to decrease alcohol consumption at follow-up (Gaume et al., 2008).

Interested persons were randomly assigned to either the assessment and intervention condition, or the assessment and offer for counseling after 6 months by telephone (waiting list) condition. Originally we expected at least four individuals per group to volunteer for BMI (i.e. 24 per week or 1,032 per year). Each assessment took about 15 minutes, while BMI took about 20 minutes. This allowed sufficient time for two interviewers to conduct four assessments and two BMIs during each 3-hour period of medical examination.

In reality, one of every six conscripts was not available to be invited for BMI participation because of various army logistics and requirements. Every sixth group of 30 had psychological tests after the scheduled time for our study. Army psychologists were concerned that BMI might inadvertently influence the results of their testing; therefore, the conscripts in every sixth group were ineligible (on a random basis) and their loss was unlikely to result in any systematic bias. Several other groups could not be invited due to changes in the army schedules.

In the end, among the 8,419 conscripts present in recruitment center during study inclusion, 1,640 had left the center before meeting our research staff, 2,012 were ineligible due to army constraints as explained above, and 4,767 were eligible and proposed participation in the study. Of those, 1,052 (22.1%) were interested in participating and in receiving BMI. Some of these were consequently lost, due to priority military assessment (N=157), and lack of time or space in which to conduct assessment and BMI (N=21). Twenty-one more were excluded because they refused to be contacted 6 months later for follow-up. This resulted in 853 conscripts randomized into intervention (N=392) and control (N=461) groups. The imbalance occurred because on some days more individuals came to get an intervention than could be accommodated, due to

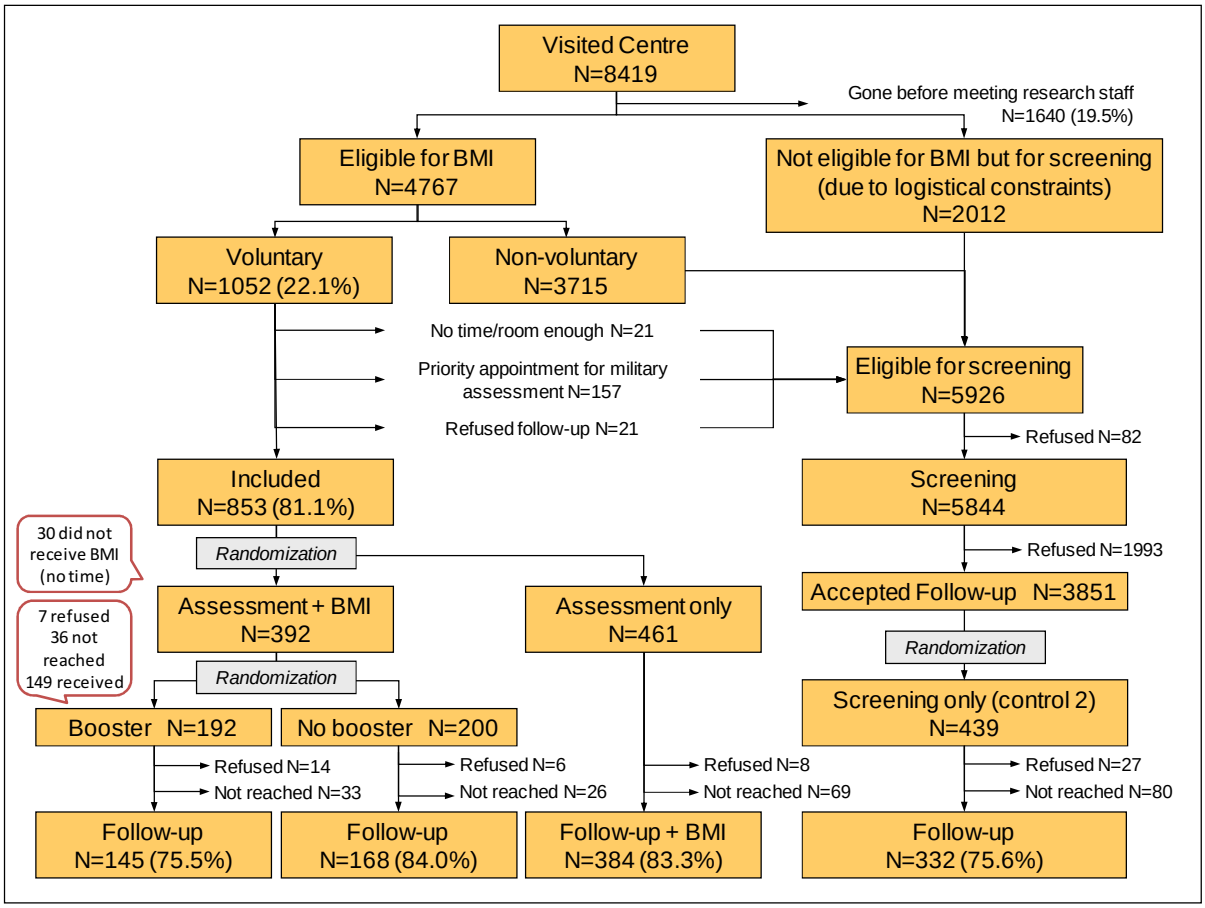
time and place restrictions, e.g. only one individual out of three could be randomly selected to receive an intervention, and the remaining two were assigned to be controls.

For those randomized into the experimental BMI group, the intervention was conducted immediately following the assessment, and was done in a separate room outside the medical examination waiting room in order to provide confidentiality between counselor and conscript.

All young men not eligible for BMI, not volunteering to receive it, or not included in the BMI or control group were asked to fill out a short screening questionnaire (N=5,926). Only 82 refused and the other 5,844 complied. All of these were asked to provide informed consent to be followed up six months later. Among the 3,851 (65,9%) consenting, we randomly selected a posteriori each week a number equal to those in each study group (intervention and control) to create a second control group consisting of those receiving neither assessment nor BMI.

After 3 months, a booster session of BMI was delivered by telephone to a randomized half (n=192) of those who received BMI at baseline. After 6 months, follow-up interviews were conducted via telephone. With an average attrition rate of 20.4%, the final sample size at follow-up consisted of one intervention group with booster (N=145), one intervention group without booster (N=143), one control group volunteering for BMI but receiving assessment only (N=384), and one control group completing the screening only (N=332).

Figure 2: Flow-chart of sampling and randomization to treatment and control groups



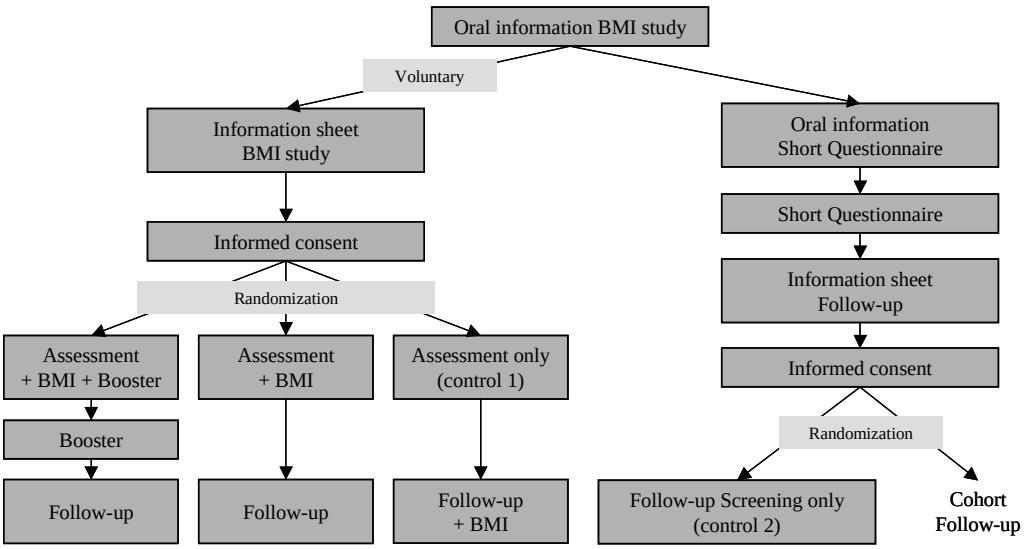
2.2.5 Randomization procedures

Randomization to the assessment only or to the BMI-plus-assessment groups was done *a priori* before conscripts entered the army, precluding the possibility that counselors might influence randomization based on apparent or visible criteria (e.g. feeling sympathy, judging manner of dress, etc.). Assignment to each condition was provided on generated "Randomization sheets" for each three-hour medical examination block via a computerized randomization algorithm. Counselors got a sheet for every block of 30 recruits that assigned each of them to the assessment only or to the BMI-plus-assessment group. Then, counselors merely had to consult this list to identify those actually enrolling for counseling. This randomization could be done in advance because each of the 30 individuals in each block already had a number from 1 to 30 that was assigned by the army. Since the research group did not know *a priori*, who received which number, they remained blinded to the selection of any particular conscript.

2.2.6 Process of informing conscript, and obtaining consent

Figure 3 outlines the course of informing conscripts, obtaining consent, and randomization. At the beginning of each three-hour medical examination block, all 30 conscripts were given oral general information regarding the study and the possibility of receiving counseling on smoking, and possibly other substance use. Those voluntarily participating in the BMI study received a detailed information sheet to read, and were asked to consider their further involvement for about 20 minutes. Then they were asked for written consent to participate and to provide their names and addresses to be contacted for follow-up. It was pointed out that recording personal data relinquishes total anonymity but still preserves the guaranteed confidentiality.

Figure 3: Flow-chart of information and informed consent



Conscripts not enrolling for BMI received general oral information and were asked to fill out a short screening questionnaire on substance use and demography. Following this, individuals received a detailed information sheet regarding the follow-up study 6 months later. They were asked to carefully read this information and take time to think about it. They were then asked for written consent to be contacted by telephone later. Cohort data on those who declined participation in the follow-up were stored anonymously and used only for comparing baseline measures to non-responses, and for analyzing sample selectivity and the potential for imperfect randomization. The remaining conscripts were asked to provide their names and addresses and it

was again pointed out that recording personal data relinquishes total anonymity but still preserves the confidentiality that is guaranteed. Those who consented to follow-up were then eligible to be controls without assessment or BMI (control group 2). Two of these from each group were randomly chosen for follow-up interviews *a posteriori* using a computerized randomization algorithm.

2.2.7 Booster sessions

Booster sessions were conducted by phone on half of the initial experimental group. For each participant, the booster session was conducted by the same counselor who provided the baseline BMI. These counselors could not be blinded to the objectives of the study, since they had to refer to the objectives set during the intervention session to build on the initial BMI. MI style was used either to reinforce changes that had been made, or to reiterate the aims of BMI in a non-judgmental way. Booster sessions took place around 3 months following BMI and lasted about 15-20 minutes.

2.2.8 Trial follow-up

Two psychologists who did not provide the BMI conducted follow-up telephone interviews 6 months after baseline assessment. They were blinded to baseline data (short questionnaire, assessment and randomization status (i.e. BMI + booster, BMI, or control)) and were trained to conduct the telephone interviews using the follow-up questionnaire. They were guided by computer-assisted telephone interviewing; at the end of the questionnaire a prompt on the monitor popped up and informed them, whether or not an additional BMI had to be conducted (per the waiting list). They asked the participants whether they still wanted to get counseling and forwarded the answer to the two counselors. This protocol guaranteed blinding to an individual's condition or group assignment for data collection at follow-up.

2.2.9 Realization of the process

Two psychologists were hired and received additional training (see below subchapter "treetop") in providing BMI.

Twelve students were recruited as research assistants to work in groups of two during the field phase to administer the assessments and short questionnaires. They were selected for their individual skills in applying research procedures, such as data collection using standardized questionnaires and obtaining informed consent.

Two additional psychologists were hired to conduct computer-assisted telephone interviewing (CATI). They were selected for their individual skills in conducting research interviews. Two-day training was provided and was comprised of a presentation of research procedures, a presentation of the CATI program, and role-plays to improve CATI practice and to prepare for any anticipated "tricky" situations.

One psychologist (Jacques Gaume), familiar with questionnaire interviewing and BMI in comparable settings (i.e., those with variable, sometimes hectic interactions between medical examiners and patients as found in emergency departments or primary care), supervised continuously and guided the research assistants in the assessment and short questionnaire procedures and oversaw all organizational and administrative tasks.

2.3 Realization: the treetop

2.3.1 Development of an intervention protocol

The experimental condition consisted of a brief motivational intervention (BMI), intended to reinforce motivation to change behavior. Rollnick and colleagues (Miller and Rollnick, 1991; Rollnick et al., 1992) developed a model of brief motivational interviewing in the context of a study using a 30–40 minute brief intervention with male, heavy drinkers in a hospital setting. McCambridge & Strang (2003) adapted this model recently for young people using various substances. The intervention outlined in our study is inspired by the latter but was performed in a shorter form. It involves exploring the use of tobacco, potentially other substances, and related hazardous behaviors before focusing on one or more aspects of them (Seneviratne et al., 2007). The first aim of this BMI is to introduce a behavior change perspective and talk about it in a non-judgmental, empathic and collaborative manner. An open discussion around smoking (tobacco, but also cannabis) and its repercussions on different life areas can heighten the conscript's awareness of the importance to change this behavior now or in the future, and can lead to successful behavior change. An example for a BMI on alcohol is available at http://www.alcoologie.ch/alc_home/alc_formation/alc-video_imb_multisubstances.htm

Conducting a BMI included different strategies from which the interviewer could choose during the intervention. These strategies are outlined below, and focus mainly on the primary topic of this study, tobacco.

1. First contact: Establish a collaborative rapport, so as to enable elicitation of multiple substance use.
2. Set the framework for the intervention: Ensure confidentiality; specify the duration of the intervention.
3. Ask permission: Ask permission to talk about smoking behaviors.
4. Gather information: With an open question, ask the conscript to talk about his tobacco use/eventual other related substance use; focus on areas that the conscript considers problematic.
5. Decisional balance: Explore pros and cons of tobacco use/eventual other related substance use.
6. Summarize change talk and values: Reflect and affirm change talk (desire, ability, reasons and need for change); enhance values and objectives that might be incompatible with present tobacco use/eventual other related substance use.
7. Evoke and explore possible behavior change: Explore importance, confidence and readiness to change; explore consequences of change on relationships (family and friends), professional life (training and early work experiences) and health (risk of accident or health problems).
8. Evoke commitment and eventually identify a change plan for the future: Identify how the conscript's tobaccos/eventual other related substance use could better fit in with his values and objectives: evoke commitment to a change plan.
9. End the session: Support the conscript's self-efficacy; affirm the conscript and his change plan.

In a first step, we pilot tested our intervention with four conscripts and performed a qualitative analysis of these intervention.

- Number 1 smoked occasionally on weekends usually accompanied with alcohol. He did not feel addicted to tobacco, but wanted to stop totally because of price and impact on health. He set an objective not to smoke on the next weekend.
- Number 2 smoked regularly and felt extremely dependent. He had already tried to stop smoking but found it difficult to remain abstinent, mostly due to social influence and stress. He explored in detail

the pros and cons of smoking and possible change and was reinforced in his attempts to stop smoking.

- Number 3 had never smoked and saw many disadvantages in smoking. Counselor explored pros and cons of smoking and not smoking and then reinforced him in his choice to not start the habit.
- Number 4 smoked large daily amounts of cigarettes and felt extremely addicted. He expressed strong motivation to stop smoking due to the smoking-related death of a close relative and concern for his own physical condition. He tried stopping several times but relapsed. Counselor reinforced his motivation to change and his objective to first reduce smoking on weekdays and at conscript request also recommended potential resources like psycho-medical consultations and web-based programs.

From the pilot tests we concluded that interested individuals are those who are highly concerned over smoking issues. Counselors could encourage and lead already motivated conscripts to stop and reevaluate their tobacco smoking and prospects for possible change. Counselors could reinforce those who had already attempted cessation (and relapsed) to persevere. For non- or infrequent smokers, reinforcement of improvement or even maintenance has proved to be a feasible goal.

2.3.2 Counselors training (see Milestone 1 report for details)

Two half-time psychologists were recruited to provide BMI. They delivered all BMI (i.e. in person in the army, by telephone for booster sessions after three months and waiting list controls after six months).

Since prior experience has shown that the success of BMI largely depends on the quality of the counselors, we used the following strategies to select them. An advertisement was posted on the websites of the CHUV and of the Swiss Psychologists Society. Among the 120 applications, we chose the best 10 for a practical assessment. This assessment was comprised of a meeting with one of our psychologists (Alicia Seneviratne) and a role-play with a standardized patient as proposed by Miller and colleagues (Miller et al., 2005). The meeting with the psychologist was to test listening skills. Applicants met with the psychologist first to reduce anxiety about the consecutive steps (e.g. using role-play). They were asked to explore some of the psychologist life domains and to summarize it in the end of the meeting. The second task was a counseling session with a standardized patient (i.e. an actor playing the role of an actual patient). The scenario was a tobacco counseling session with a young man at the army conscription centre. The role-plays were tape-recorded for coding using the Motivational Interviewing Treatment Integrity (MITI) (Moyers et al., 2005), an instrument created to monitor counselor adherence to MI techniques and spirit. Psychologists (AS) feedback, as well those of the standardized patients gave useful and consistent information that highlighted four interesting candidates. One week later, all 10 applicants were seen again in a more administrative-oriented job interview, exploring motivation, time and skills for the position. These interviews confirmed the pre-selection and allowed a decision about which of the two best candidates to hire.

The two selected psychologists were then trained to conduct MI and BMI. They received a two-day training in tobacco counseling, observed tobacco counseling in the hospital, observed BMI in the army conscription centre (end of another BMI research project), viewed video examples, made additional role-plays with standardized patients under supervision, conducted BMI with voluntary young men in the army conscription centre, and read manuals and articles related to MI and BMI. One month after the project started in the army, they received a specific MI training during which they went into further details about the spirit, principles and tools of MI, through exercises aimed at improving performance using an active, empathic listening style to avoid confrontation, as described elsewhere (Baer et al., 2004).

Counselors received supervision throughout the whole project. To guarantee high and constant quality of BMI delivery, the process included weekly individual supervision in which difficulties and challenges were discussed, and a monthly joint supervision with two senior psychologists. Audiotapes of the interventions were reviewed and trainees were given feedback on various aspects of BMI (e.g., MI spirit, reflective listening techniques, eliciting change talk, etc.).

2.3.3 Measures – questionnaire measures used for effect evaluation

To estimate the change between baseline and the follow-up, all questions referred to the timeframe of "in the last 6 months".

Smoking

The first question asked whether one smoked, even occasionally. Responses allowed a distinction to be made between regular (daily), occasional (non-daily), former smoking, or never smoking.

Smokers in the past 6 months were asked about the quantity of cigarettes used. Regular smokers were asked about their daily number of cigarettes, and occasional smokers about the number of cigarettes on days when they smoked. Since this information on quantity may differ for occasional smokers becoming regular smokers and vice versa, we also evaluated the change in number of cigarettes among consistent regular smokers at both baseline and at follow-up. At-risk smoking was defined as daily smoking.

Cannabis use

Cannabis use questions started with lifetime use. Among lifetime users frequency of use in the past 6 months was asked with response formats "never", "once a month or less often" (coded with a frequency of 0.5 days per month), "2-3 times a month" (coded 2.5 days per month), "2-3 times a week" (coded 10 days a month), and "4 times or more often a week" (coded 20 days a month). Changes in use days were estimated for the total sample (with non-users coded 0) and among consistent (both at baseline and at follow-up) cannabis users. At-risk cannabis use was defined as at least twice per week.

Alcohol use

For volume of usual alcohol use a quantity-frequency instrument was applied, again with a time frame of six months. Frequency of alcohol use (in days) was asked for weekly alcohol users with an open-ended question, while non-weekly users were given the closed-ended option: 2-3 times a month (coded 0.58 days per week, i.e. 2.5*12 months/52 weeks), and once a month or less often (coded 0.12 days a week). Quantity was asked with an open-ended question for the number of standard drinks consumed on days when drinking. Pictures of standard drinks were provided, showing standard drinks containing around 10-12 grams of pure alcohol). Number of days was multiplied with the usual number of drinks on drinking days. Volume of at-risk drinking was defined as more than 21 drinks per week.

Binge drinking was asked with an open-ended question about the monthly number of occasions drinking at least 6 standard drinks on an occasion. At risk for binge drinking was defined as having at least 2 such occasions per month.

Other variables and socio-demographics

Years of age, last finished school level and whether respondents live in rural or urban areas was measured. For all three above substances, users of the corresponding substance were asked on 10-point scales about their self-perceived importance to change the use of the substance, their readiness to change, and the self-perception of being able to change (Bertholet et al., 2009a; Bertholet et al., 2009b; Williams et al., 2007).

3 Results: the fruits

3.1 Development of intensive training material – Outcome I

A draft course to train counselors in administering brief motivational sessions on substance use with a focus on tobacco use has been developed. The documentation of how counselors were chosen (starting with a first assessment centre of 10 applicants), then further trained and supervised has been written (see Formation des intervenants à l'intervention brève tabac, 2009). In addition a DVD is provided showing the examples that were used during the courses.

Currently the *Service d'alcoologie* is developing a training programme for medical students in MI spirit and techniques. The experiences and consolidated findings of the training sessions for ATOMIC have influenced this course for medical students. Both projects provided mutual stimulation for each of them that will lead to a joint book publication on training for brief motivational interviewing.

3.2 Evaluation of effectiveness of intervention

There are different ways possible to analyze effectiveness:

a) Comparison of follow-up data only: this is justified if there is baseline equivalence of comparison groups. This was only used for the 1:1 matched dataset (see point "adequate control group" below)
b) Analysis of difference values between baseline and follow-up: this is useful for continuous data, because difference values often are less skewed and therefore are easier applicable to standard ordinary least square regressions. The analysis permits the adjustment of variables in the case of baseline non-equivalence. One problem of difference values is the analysis of dichotomous outcomes (e.g., being a smoker or not). In the case of a 0/1 coding scheme, differences take the values of -1, 0, 1, which cannot longer be analyzed with e.g. binary logistic regressions. Moreover, the value 0 has two meanings, namely, e.g. for smoking, to remain a nonsmoker or to remain a smoker. Analysis of differences for dichotomous outcome measure here used the comparison of changers, i.e. in the smoking example whether there have been more changing to the good (becoming non-smoker) or for the worse (becoming a smoker). Such analysis discards the large majority of those who have not changed (in the smoking example: consistent smokers and consistent nonsmokers).
c) Analysis of follow-up data by adjusting for baseline measures: This is directly comparable for both dichotomous and continuous outcomes, where logistic regressions for dichotomous and ordinary least square regressions for continuous outcomes will be used. In change score analysis, a dichotomous measure would have three values and therefore needs special treatment in regression models (see above).
d) For continuous variables we also used logarithmic transforms as a sensitivity analysis, because in some subgroup analysis cell sizes were rather small and results and confidence intervals may therefore be affected by skewed distributions of the dependent analysis (e.g. few cases with very high number of cigarettes smoked). Analysis of log-transformed variables resulted in the same direction of effects, but significance levels were commonly even higher (more insignificant). We therefore report only results of non-transformed analyses, which have more natural interpretations

(e.g. mean difference in number of cigarettes smoked instead of the mean difference of logarithmized number of cigarettes smoked).

Adequate control group

Another question concerns the adequacy of a control group. Recruits came to get an intervention based on different preconditions. However, the study was introduced as an intervention on smoking; those with other problematic substance use, or with multiple problematic substance use behaviors were also invited. The focus of the BMI was negotiated during the counseling session between the "patient" and the counselor. The intervention focus was recorded after the session. However, the background for why recruits wanted to enroll in the study is unknown for the controls. Therefore it is impossible to determine what are adequate controls for a session focusing on tobacco intervention versus a session focusing on cannabis use.

The effectiveness of a tobacco-focused intervention among otherwise moderate users of other substances may be underestimated if, for example, many controls were coming with a more severe multi-substance set of problems. Therefore two sets of analysis were done. First, all controls were used**,** even in subsets of cases (e.g. for those with a specific substance-focused interventions, or for those having received a booster session).

Second, in an additional set of analyses from the pool of controls, a single individual was matched to each case (1:1 matching) based on baseline substance use patterns and socio-demographics (all variables in Table 1). Optimal matching was done using the algorithm provided in the NCSS software package (Hintze, 2007), which resulted either in perfect matches or in matches that came closest to the corresponding case, according to the Mahalanobis distance. The analysis of 1:1 matched data is slightly different: conditional logistic regression was used for dichotomous outcomes and paired t-tests for continuous measures. Only follow-up data were used. Adjustment was not needed since pairs of cases and controls were constructed in a way that they were comparable (and if optimal controls were available they were exactly the same) and therefore baseline equivalent.

3.2.1 Baseline equivalence and attrition

As can be seen in table 2, there were almost no significant differences in substance use, and the non-significant comparisons had high p-values commonly exceeding 0.2 (except p=0.145 for confidence in being able to change smoking). Controls and cases were different for living environment (residency). Controls came more often from rural regions (55.1% among controls versus 47.0% among cases). There was also a notable difference in cannabis use. Control cannabis recruits were more often weekly users (44.7%) and used it on more days per month (8.9 days), compared with cases (32.8%, 7.0 days).

Table 2: Baseline comparison of cases and controls

		Scale level	Controls (n=461)	Cases (n=362)	Test value	p-value
Smoking	% past 6 months smoking, total sample	1	54.5	54.4	0.000	0.994
	% at risk (daily) smoking, total sample	1	37.3	37.9	0.025	0.875
	% at risk (daily) smoking, smokers only	1	68.5	69.5	0.053	0.817
	number of cigarettes per smoking day, total sample	0	5.4	5.8	0.636	0.425
	number of cigarettes per smoking day, smokers only	0	10.7	9.9	1.284	0.258
	importance to change, smokers only	0	5.0	5.1	0.410	0.522
	readiness to change, smokers only	0	4.9	5.1	0.753	0.386
	confidence being able to change, smokers only	0	6.5	6.9	2.120	0.146
Cannabis use	% Cannabis user past 6 months, total sample	1	44.3	48.1	1.188	0.276
	at risk (> once a week) use	1	18.9	15.8	1.373	0.241
	at risk (> once a week) use, cannabis users only	1	42.7	32.8	3.894	0.048
	number of days with cannabis use per months, total sample	0	3.9	3.4	1.205	0.273
	number of days with cannabis use per months, cannabis users only	0	8.9	7.0	3.939	0.048
	importance to change, cannabis users only	0	3.4	3.8	0.865	0.353
	readiness to change, cannabis users only	0	4.7	4.4	0.351	0.554
	confidence being able to change, cannabis users only	0	7.0	6.7	0.787	0.376
Alcohol	% drinkers past 6 months, total sample	1	95.9	96.7	0.379	0.538
	% risk volume (> 14 drinks/week), total sample	1	9.2	9.2	<0.001	0.996
	% risk volume (> 14 drinks/week), drinkers only	1	9.7	9.6	0.001	0.969
	% risk binge (> once a month), total sample	1	55.5	55.0	0.026	0.873
	% risk binge (> once a month), drinkers only	1	57.7	56.9	0.060	0.806
	% at risk (either volume or binge), total sample	1	57.1	55.3	0.264	0.607
	% at risk (either volume or binge), drinkers only	1	59.4	57.2	0.388	0.533
	number of drinks per week, total sample	0	9.5	9.6	0.034	0.853
	number of drinks per week, drinkers only	0	9.9	10.0	0.008	0.929
	number of binge occasions per months, total sample	0	3.0	2.9	0.142	0.706
	number of binge occasions per month, drinkers only	0	3.2	3.0	0.193	0.661
	importance to change, drinkers only	0	2.3	2.4	0.693	0.406
	readiness to change, drinkers only	0	4.0	4.1	0.213	0.644
	confidence being able to change, drinkers only	0	7.7	7.5	0.325	0.569
Socio-demography						
Education	mandatory school (9 years of schooling)	1	41.2	40.1	3.804	0.149
	apprenticeship, professional school		33.8	29.3		
	high school preparing for eligibility for universities		24.9	30.7		
residency	% rural (vs urban)	1	55.1	47.0	5.374	0.020
age	age	0	20.0	20.2	2.283	0.131

Remarks: *Scale levels for variables coded 1 are for categorical variables, with test-values being Chi-squared values, scale levels coded 0 are variable means and tests are mean comparisons of continuous variables with test-values being F-values (ANOVA)*
Values are means for continues variables and percentages for categorical variables

Attrition due to lost to follow-up was not different (chi^2 = 1.89, df = 1; p = 0.169; not tabulated in Table 3) with 16.7% of lost controls at follow-up and 20.4% of cases (Table 2). Multinomial logistic regressions for categorical variables and analysis of variance for continuous variables was used. Tests of interaction (attrition*case/control) were used to test differential attrition for all variables.

Table 3: Differential effects of sample attrition on cases and controls, baseline measures

							Multivariate tests (logistic regression or AONOVA)			
			Controls		***Cases***		***Test attrition versus non-attrition***		***Test Interaction***	
	Scale level		**Attritions**	**Non-attritions**	**Attritions**	**Non-attritions**	**Test value**	**p-value**	**Test value**	**p-value**
Attrition		N	77.0	384.0	74.0	288.0				
		%	16.7	83.3	20.4	79.6				
Smoking	1	% past 6 months smoking, total sample	50.7	55.2	59.5	53.1	1.201	0.464	0.643	0.226
	1	% at risk (daily) smoking, total sample	33.8	38.0	44.6	36.1	1.203	0.481	0.584	0.148
	1	% at risk (daily) smoking, smokers only	66.7	68.9	75.0	68.0	1.106	0.786	0.406	0.640
	0	number of cigarettes per day, total sample	5.5	5.9	5.9	5.2	0.060	0.810	0.570	0.450
	0	number of cigarettes per day, smokers only	11.0	10.7	10.1	9.9	0.077	0.781	0.005	0.941
	0	importance to change, smokers only	4.4	5.1	5.2	5.1	0.960	0.327	1.290	0.256
	0	readiness to change, smokers only	4.0	5.0	5.0	5.1	2.260	0.133	1.700	0.194
	0	confidence being able to change, smokers only	6.3	6.5	6.4	7.0	1.630	0.203	0.330	0.564
Cannabis use	1	% cannabis user past 6 months, total sample	42.9	44.5	55.4	46.2	1.070	0.787	0.645	0.228
	1	at risk (> once a week) use	19.5	18.8	23.0	13.9	0.954	0.881	0.567	0.210
	1	at risk (> once a week) use, cannabis users only	45.5	42.1	41.5	30.1	0.873	0.722	0.696	0.495
	0	number of days with cannabis use per months, total sample	4.3	3.9	5.3	2.8	4.740	0.030	2.390	0.123
	0	number of days with cannabis use per months, cannabis users only	10.0	8.7	9.6	6.2	3.986	0.047	0.803	0.371
	0	importance to change, cannabis users only	2.6	3.6	3.3	3.9	3.690	0.056	0.320	0.574
	0	readiness to change, cannabis users only	4.0	4.9	4.0	4.6	2.120	0.147	0.110	0.742
	0	confidence being able to change, cannabis users only	5.9	7.3	6.8	6.6	1.880	0.171	2.910	0.089

							Multivariate tests (logistic regression or AONOVA)			
			Controls		*Cases*		*Test attrition versus non-attrition*		*Test Interaction*	
	Scale level		**Attritions**	**Non-attritions**	**Attritions**	**Non-attritions**	**Test value**	**p-value**	**Test value**	**p-value**
Alcohol	1	% drinkers past 6 months, total sample	96.1	95.8	98.7	96.2	0.927	0.906	0.372	0.423
	1	% risk volume (> 14 drinks/week), total sample	12.0	8.7	9.6	9.2	0.696	0.366	1.365	0.605
	1	% risk volume (> 14 drinks/week), drinkers only	12.5	9.1	9.7	9.5	0.698	0.370	1.401	0.575
	1	% risk binge (> once a month), total sample	57.1	55.2	67.6	51.7	0.924	0.755	0.557	0.116
	1	% risk binge (> once a month), drinkers only	59.5	57.4	68.5	53.8	0.918	0.741	0.583	0.157
	1	% at risk (either volume or binge), total sample	57.1	57.1	67.6	52.1	0.997	0.990	0.524	0.083
	1	% at risk (either volume or binge), drinkers only	59.5	59.4	68.5	54.2	0.997	0.990	0.546	0.113
	0	number of drinks per week, total sample	9.6	9.4	10.9	9.3	0.490	0.486	0.350	0.556
	0	number of drinks per week, drinkers only	10.0	9.9	11.0	9.7	0.334	0.564	0.246	0.620
	0	number of binge occasions per week, total sample	3.6	2.9	3.5	2.8	3.750	0.053	0.020	0.887
	0	number of binge occasions per week, drinkers only	3.7	3.1	3.6	2.9	3.405	0.065	<0.001	0.996
	0	importance to change, drinkers only	2.6	2.3	2.3	2.5	0.410	0.523	1.490	0.223
	0	readiness to change, drinkers only	4.5	3.9	4.2	4.1	1.560	0.212	0.530	0.469
	0	confidence being able to change, drinkers only	7.6	7.7	7.6	7.5	<0.001	0.972	0.010	0.933
Socio-demography										
education	1	mandatory school (9 years of schooling)	29.9	43.0	25.7	42.4	3.659	0.160	1.505	0.471
		aprenticeship, professional school	24.7	30.5	27.0	24.0				
		high scool preparing for eligibility for universities	45.5	26.6	47.3	33.7				
residency		% rural (vs urban)	49.4	56.3	44.6	47.6	1.320	0.268	0.854	0.664
age	0	age	20.3	20.0	20.2	20.2	1.370	0.242	1.644	0.200

Remarks: *Scale level coded 1 are for categorical variables, with test-values being Chi-squared (loglikelihood-ratio test), scale level coded 0 are mean comparisons of continuous variables with ANOVA and test-values being F-values*

Values are means for continues variables and percentages for categorical variables

There were few significant differences in attrition between those dropping out of the study and those remaining in the study at follow-up. These differences were significant for frequency of cannabis use, i.e. days of cannabis use in the past month (total sample: p = 0.030; cannabis users only: p = 0.047). Nearly significant differences were also found for binge drinking days (total sample: p = 0.056; alcohol users only: p = 0.065). Results indicate that those dropping out were more often frequent or heavy users at baseline. However, the interaction was not significant, meaning that although attritions differed from non-attritions, it did not differ between cases and controls, i.e. the drop-out rate was the same among both groups, therefore comparisons of cases and controls at follow-up should not be biased.

Table 2 and Table 3 also show that drinking was widespread in this age group. More than 96% used alcohol in the past six months. In order to keep these tables from becoming overloaded, further analyses of drinking status was omitted, as was the differentiation of analyses regarding alcohol for the total sample and the drinkers only sample. All analyses of alcohol measures were performed on the total sample. Additionally, Tables 2 and 3 show that those at risk for volume of drinking (more than 21 drinks per week) were almost all at risk for binge (twice or more per month) drinking. Hence, looking at the combined risk did not add much to the analysis of being at risk for binge drinking. More precisely, in this age group those at risk for volume of drinking are also at risk for binge drinking. However, the opposite is not true; binge drinkers are not necessarily at risk for volume of drinking. Therefore the analysis of combined risk was omitted further on.

3.2.2 Effectiveness of intervention for tobacco smoking (Primary outcome II, secondary outcome i)

Table 4 shows effects of the intervention versus the total sample of controls. The values in the columns for controls and cases are either the means of continuous variables or the ratio for changers for dichotomous outcomes. For example, among controls there were 22 non-smokers at baseline who became smokers at follow-up and 31 smokers at baseline who became non-smokers at follow-up, which results in an ratio of 0.71 (22/31). Ratios smaller than one are positive in the sense that more smokers became non-smokers than vice versa. This was true for both cases and controls, although the ratio was smaller for cases (=0.45), i.e. the positive effect was stronger for cases than it was for controls. This effect can be tested with logistic regressions, where the unadjusted odds ratio is the ratio of the two ratios (i.e. 0.45/0.71 = 0.63). An odds ratio smaller than one indicates a positive effect in the intervention group, compared to controls.

An alternative test is to regress follow-up values of smoking status on the intervention (=0 for controls, 1 for cases). The corresponding odds ratio was 0.84, again favoring the intervention. The alternative test has the advantage that it can be run on all individuals, whereas the “difference test” can be done on changers only (0 coded for “positive” changers to non-smoking, and 1 for “negative” changers to smoking).

Table 4: Effectiveness of Intervention on Smoking outcomes analysed with a) difference measures between baseline and follow-up, and b) follow-up measures, adjusted for baseline measures

Baseline to follow-up differences					**Difference measures**				**Regression on follow-up values adjusted for baseline values**			
			controls*	**cases***	**unadjusted**		**adjusted**		**baseline adjustment only**		**fully baseline adjusted****	
		scale level	**odds of changers/ means**	**odds of changers/ means**	**OR / t-value**	**p-value**	**OR / t-value**	**p**	**OR / t-value**	**p**	**OR / t-value**	**p-value**
Smoking	past 6 months smoking, total sample	1	0.71	0.45	0.63	.351	.640	.399	0.84	.459	0.84	.486
	at risk smoking (daily), total sample	1	1.35	0.79	0.58	.291	.724	.565	0.71	.208	0.74	.272
	number of cigarettes, total sample	0	0.38	-0.04	-1.04	.301	-1.043	.298	-1.31	.191	-1.23	.220
	number of cigarettes among consistent regular smokers	0	0.74	-0.26	-1.18	.240	-1.240	.216	-1.80	.073	-1.59	.113

Remarks: *Scale level coded 1 are for categorical variables, with test-values being Odds Ratios (OR) from logistic regressions, scale level coded 0 are linear regressions on continuous variables with test-values being t-values for the coefficient of the regression on the intervention (coded 1= cases and 0=controls)*

values are means for continues variables and percentages for categorical variables

** for categorical variables , values are odds for changers ; example for past 6 months smoking controls: there were 22 who became smokers, but 31 stopped smoking; 22/31=0.71*

italics: tendency of results towards a negative impact of the intervention

bold: significant at p < 0.05

***adjustment for age, education and residency*

For continuous values, the columns for cases and controls represent the change in number of cigarettes between baseline and follow-up. For example, the total sample of controls increased the number of cigarettes on average by 0.38 cigarettes, whereas the total sample of cases reduced it by 0.04 cigarettes (among consistent daily smokers, the controls increased smoking by 0.74 cigarettes on average, whereas cases decreased smoking by 0.26 cigarettes). The effect can be tested directly, either on difference measures between baseline and follow-up or on the number of cigarettes at follow-up adjusted for the baseline number of cigarettes.

For both types of analysis, unadjusted and adjusted (for socio-demographic differences between cases and controls) models were run.

In general, the direction of effects did not change for type of analysis (regression of difference measures or regression of follow-up measures adjusted for baseline measures) or for adjusted and unadjusted models. This is the most common finding for the following results as well. Since the analysis of follow-up measures adjusted for baseline measures is more comparable between dichotomous and continuous measures, we will present it in following chapters.

For all smoking measures there was a small positive effect of the intervention (i.e. fewer people became smokers, and fewer individuals became at-risk users, or they showed stronger reductions in the number of cigarettes). However, none of these changes reached statistical significance.

The effectiveness of booster sessions can be found in Table 5, and shows that a booster session had no additional impact on the effectiveness of brief motivational interventions (BMI) for tobacco outcomes.

Table 5: Comparison of effects for interventions with and without booster sessions on tobacco outcomes

					Regression on follow-up values adjusted for baseline values			
					baseline adjustment only		**fully baseline adjusted****	
		scale level	**non booster (n=143)***	**booster (n=145)***	**OR /t-value**	**p**	**OR /t-value**	**p**
Smoking	past 6 months smoking, total sample	1	0.50	0.42	0.92	.842	0.87	.731
	at risk smoking (daily), total sample	1	*0.80*	*0.78*	*1.05*	*.906*	*1.02*	*.962*
	number of cigarettes, total sample	0	*-0.26*	*0.18*	*0.68*	*.499*	*0.53*	*.595*
	number of cigarettes among consistent regular smokers	0	*-0.84*	*0.28*	-0.07	.944	-0.20	.840

Remarks: *Scale level coded 1 are for categorical variables, with test-values being Odds Ratios (OR) from logistic regressions, scale level coded 0 are linear regressions on continuous variables with test-values being t-values for the coefficient of the regression on the intervention (coded 1= cases and 0=controls)*
values are means for continues variables and percentages for categorical variables
** for categorical variables , values are odds for changers; example for past 6 months smoking without booster: there were 4 who became smokers, but 8 stopped smoking; 4/8=0.5*
italics: tendency of results towards a negative impact of the booster
bold: significant at p < 0.05
*** adjustment for age, education and residency*

Though the odds for becoming a smoker versus changing from smoking to non-smoking were slightly better in the booster group (=0.42) compared with the non-booster group (=0.50, i.e. an OR of 0.92)), the opposite

was the case for at-risk smoking (OR=1.05). Regarding the number of cigarettes smoked, for both measures among the total sample and among those who stayed daily smokers, the reduction in smoking was higher in the no-booster group. Incidentally, the regression test of follow-up measures adjusted for baseline measures showed an inverted sign favoring booster sessions, but the significance level approached 1.0. It is one of the rare cases where the analysis of difference measures (not tabulated) had a different sign for effect compared to the analysis of follow-up measures adjusted for baseline measures. The reason for this is that the booster group smoked fewer cigarettes (about 11 cigarettes on average, not tabulated) compared to the non-booster group (about 14 cigarettes on average, not tabulated) at both baseline and follow-up. Whereas difference measures delete the interpersonal variance between groups, linear baseline adjustment does not completely counter this effect.

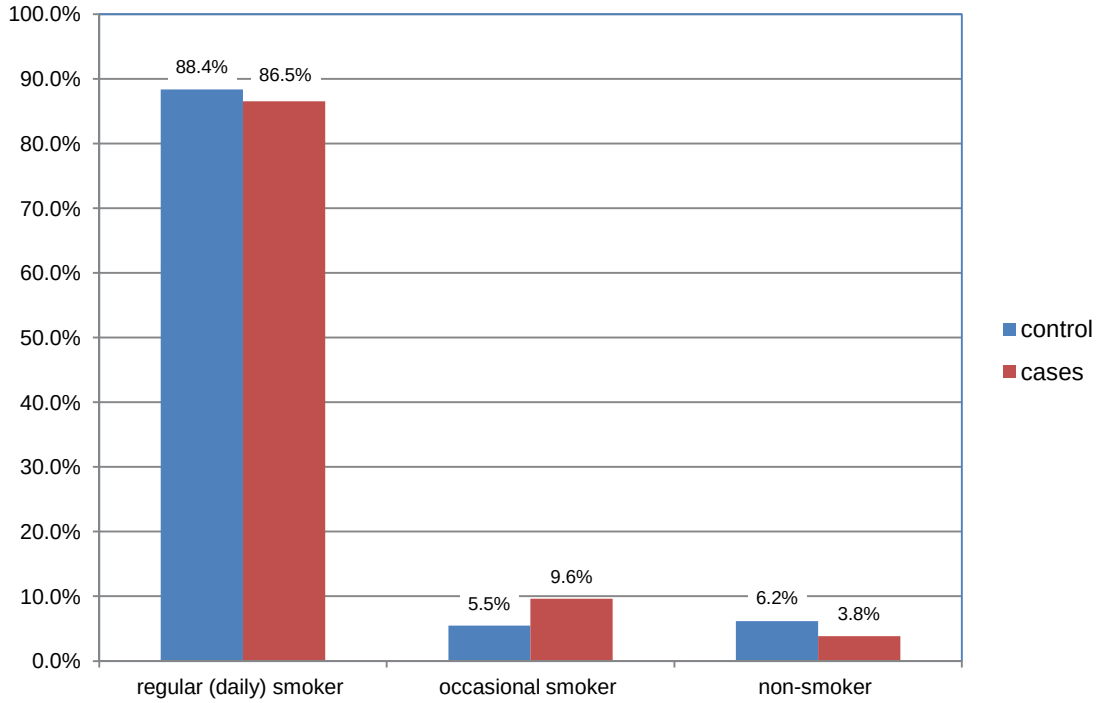
The important message is that the analyses did not show positive effects from the booster. Significance levels were high ($p \geq .5$), independent of whether difference measures or baseline adjustment were used.

3.2.3 Effectiveness of intervention for statuses of tobacco smoking (secondary outcome ii)

As seen above, there have been consistent but non-significant positive effects for smoking outcomes from the intervention. Outcomes were measured very strictly, i.e. smoking/non-smoking or at-risk smoking. The weak effects may point to the possibility that large changes in smoking are rare, but there may be smaller effects of BMI, such as avoiding the progression from occasional to daily smoking, or a reduction in frequency of smoking, from daily to occasional. These subtle effects would not be detected in analyses of "smoker" versus "non-smoker".

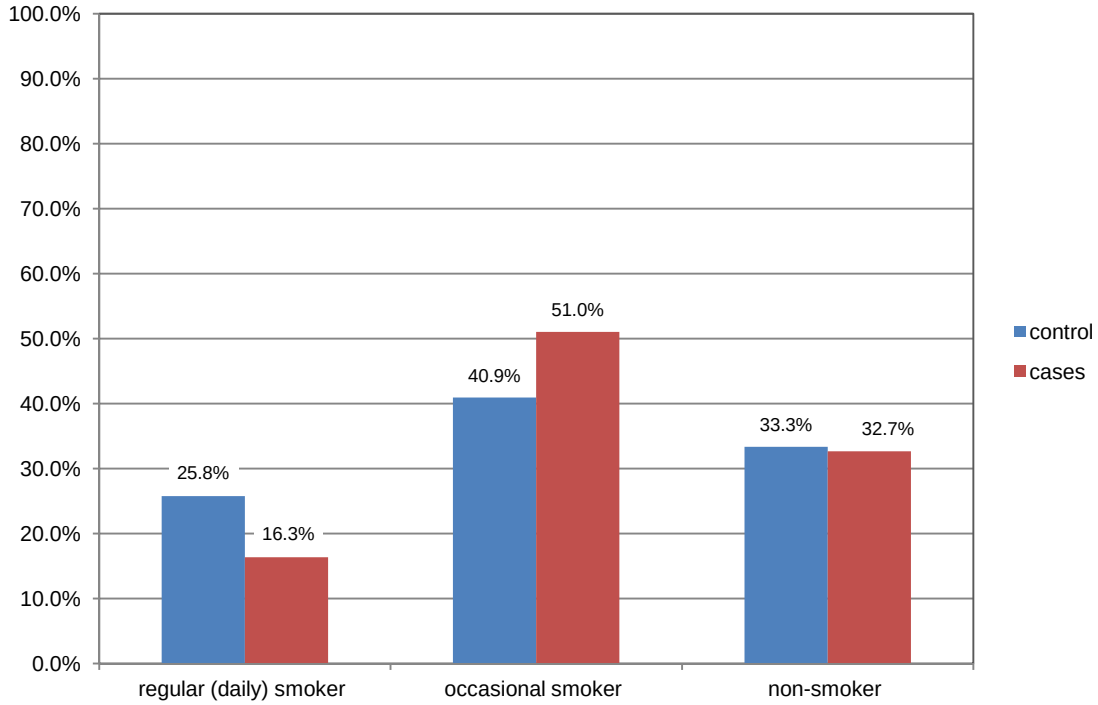
Figures 1 to 3 show the transition from regular daily smoking, occasional smoking, and non-smoking to corresponding changes at the 6-month follow-up. Among regular smokers, fewer individuals remained regular smokers, but moved more often to occasional smoking (compared with controls) rather than stopping smoking. Occasional smokers more often continued occasional smoking following intervention, whereas controls switched more often to regular smoking. Similarly, non-smokers remained non-smokers more often among cases than did controls. Therefore, the intervention seems to have had a stronger "primary preventive" effect of hindering individuals from "progressing" in their smoking career, and less of a "secondary/tertiary" effect of reducing smoking.

Figure 1: Transition from regular smoking to the smoking status 6 months later



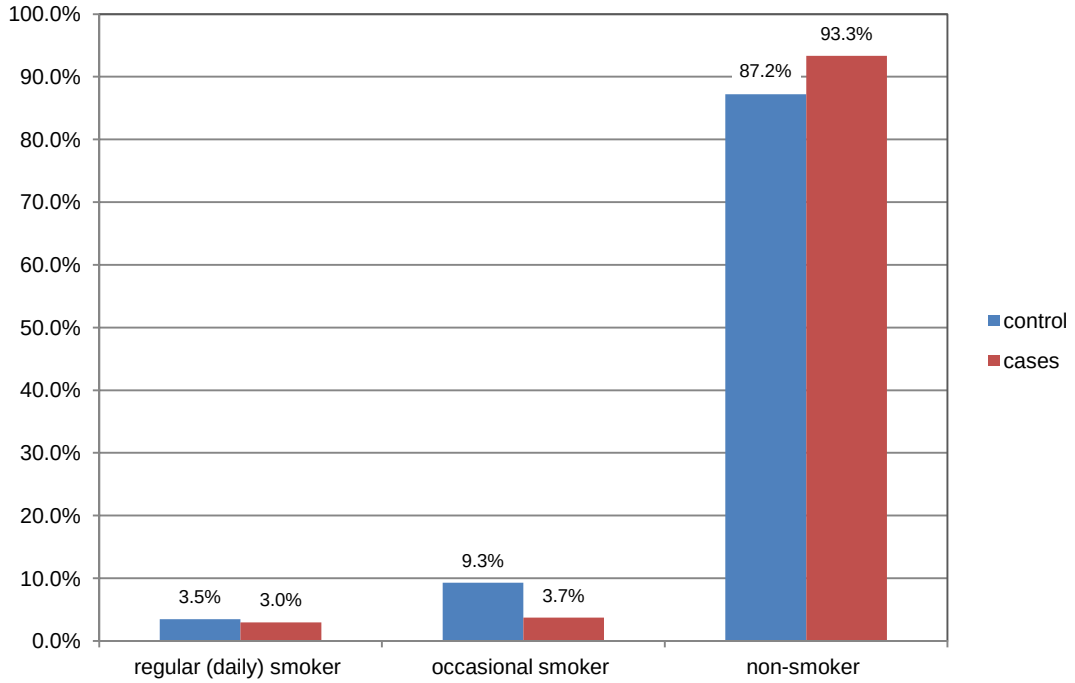
Remark: *Chi^2 = 2.09; df= 2; p =0.351*

Figure 2: Transition from occasional to the smoking status 6 months later



Remark: *Chi^2 = 1.79; df= 2; p = 0.409*

Figure 3: Transition from non-smoking to the smoking status 6 months later



Remark: *Chi^2 = 3.85; df= 2; p =0.146*

3.2.4 Effectiveness of intervention for cannabis use (Primary outcome II, secondary outcome i)

Table 6 shows that BMI had the desired outcome for cannabis use in the baseline-adjustment models. The reduction in prevalence of cannabis use among cases was significantly larger than that of controls. Sensitivity analyses for difference models (not tabulated) had the same results.

Table 6: Intervention effects compared with controls on cannabis use outcomes

					Regression on follow-up values adjusted for baseline values			
					baseline adjustment only		**fully baseline adjusted****	
		scale level	**controls***	**cases***	**OR /t-value**	**p**	**OR /t-value**	**p**
Cannabis use	6 months cannabis use, total sample	1	0.41	0.22	**0.60**	**.024**	**0.57**	**.013**
	at risk (> once a week) use, total sample	1	1.40	1.29	0.77	.445	0.79	.493
	number of days with cannabis use per months, total sample	0	0.41	0.05	-1.55	.122	-1.59	.113
	number of days with cannabis use per months, consistent users	0	1.45	0.75	-1.38	.168	-0.95	.342

Remarks: *Scale level coded 1 are for categorical variables, with test-values being Odds Ratios (OR) from logistic regressions, scale level coded 0 are linear regressions on continuous variables with test-values being t-values for the coefficient of the regression on the intervention (coded 1= cases and 0=controls)*
values are means for continues variables and percentages for categorical variables
** for categorical variables , values are odds for changers ; example for past 6 months cannabis controls: there were 15 who became cannabis user, but 37 stopped using cannabis; 15/37=0.41*
italics: tendency of results towards a negative impact of the intervention
bold: significant at p < 0.05
***adjustment for age, education and residency*

It should be noted that both cases and controls increased the frequency (days with use) of cannabis use. However, this increase was lower for cases than for controls. The same is true for at-risk use. Although the odds were larger than one (e.g. 9 people become at-risk users, whereas only 7 stopped at-risk use = 1.29) the increase in at-risk use was smaller for cases. Despite favoring the intervention, neither of these effects was significant.

The cannabis use booster sessions did not increase the effectiveness of BMI; instead, they commonly produced the opposite effects (Table 7). Although there seemed to be a small effect in the right direction for 6 months use, this effect was reversed after adjustment for control variables.

Table 7: Comparison of effects for interventions with and without booster sessions on cannabis use outcomes

					Regression on follow-up values adjusted for baseline values			
					Baseline adjustment only		fully baseline adjusted**	
		scale level	non booster (n=143)	booster (n=145)	OR / t-value	p-values	OR / t-value	p-values
Cannabis use	6 months cannabis use, total sample	1	0.25	0.18	*1.00*	*1.000*	*1.05*	*.888*
	at risk (> once a week) use, total sample	1	*0.80*	*2.50*	*1.61*	*.380*	*1.59*	*.422*
	number of days with cannabis use per months, total sample	0	*-0.04*	*0.14*	*0.27*	*.785*	*0.32*	*.747*
	number of days with cannabis use per months, consistent users	0	*0.18*	*1.27*	*0.59*	*.558*	*0.66*	*.508*

Remarks: *Scale level coded 1 are for categorical variables, with test-values being Odds Ratios (OR) from logistic regressions, scale level coded 0 are linear regressions on continuous variables with test-values being t-values for the coefficient of the regression on the intervention (coded 1= cases and 0=controls)*
values are means for continues variables and percentages for categorical variables
** for categorical variables , values are odds for changers ; example for past 6 months cannabis use without booster: there were 6 who became cannabis user, but 24 stopped using cannabis; 6/24=0.25*
italics: tendency of results towards a negative impact of the booster
bold: significant at p < 0.05
***adjustment for age, education and residency*

3.2.5 Crossover effects: Alcohol use outcomes (secondary outcome iii)

The alcohol use outcomes were mixed, although never significant. For volume of drinking and number of drinks per week, both cases and controls reduced this aspect of alcohol use, more strongly so among cases. Being at risk for binge drinking, and in number of binge drinking occasions, both groups decreased their consumption, and this reduction was even stronger among controls than it was among cases (Table 8)

Table 8: Intervention effects compared with controls on alcohol use outcomes

					Regression on follow-up values adjusted for baseline values			
					baseline adjustment only		fully baseline adjusted**	
		scale level	controls*	cases*	OR / t-value	p-values	OR / t-value	p-values
Alcohol use	risk volume (> 14 drinks/week), total sample	1	0.95	0.73	0.88	.680	0.92	.784
	risk binge (> once a month), total sample	1	*0.63*	*0.80*	*1.07*	*.693*	*1.11*	*.559*
	number of drinks per week, total sample	0	-0.15	-0.53	-0.70	.484	-0.49	.627
	number of binge occasions per week, total sample	0	*-0.54*	*-0.44*	*0.13*	*.893*	*0.29*	*.769*

Remarks: *Scale level coded 1 are for categorical variables, with test-values being Odds Ratios (OR) from logistic regressions, scale level coded 0 are linear regressions on continuous variables with test-values being t-values for the coefficient of the regression on the intervention (coded 1= cases and 0=controls)*
** for categorical variables , values are odds for changers ; example for risk volume drinking among controls: there were 21 who became at risk drinkers, but 22 stopped at risk drinking; 21/22=0.95*
**for continues variables values are mean differences (baseline - follow-up)*
italics: tendency of results towards a negative impact of the intervention
bold: significant at p < 0.05
*** adjustment for age, education and residency*

Table 9: Comparison of effects for interventions with and without booster sessions on alcohol use outcomes

					Regression on follow-up values adjusted for baseline values			
					Baseline adjustment only		Fully baseline adjusted	
		effect	non booster (n=143)	booster (n=145)	OR / t-value	p-values	OR / t-value	p-values
Alcohol use	risk volume, total sample	1	*0.60*	*1.00*	*1.93*	*.198*	*1.93*	*.198*
	risk binge, total sample	1	0.91	0.61	0.80	.413	0.77	.352
	number of drinks per week, total population	0	0.01	-1.07	-0.15	.880	-0.10	.917
	number of binge occasions per week, total population	0	*-0.56*	*-0.32*	*0.94*	*.348*	*0.90*	*.371*

Remarks: *Scale level coded 1 are for categorical variables, with test-values being Odds Ratios (OR) from logistic regressions, scale level coded 0 are linear regressions on continuous variables with test-values being t-values for the coefficient of the regression on the intervention (coded 1= cases and 0=controls)*
** for categorical variables , values are odds for changers ; example for risk volume drinking among non boosters: there were 6 who became at risk drinkers, but 10 stopped at risk drinking; 6/10=0.6*
**for continues variables values are mean differences (baseline - follow-up)*
italics: tendency of results towards a negative impact of the booster
bold: significant at p < 0.05
adjustment for age, education and residency

The findings on booster sessions were similarly mixed and never significant (Table 9). Results point towards the (expected) finding of higher booster effectiveness for number of drinks per week, but not for number of at-risk drinkers. This might be interpreted to mean that when stronger reductions in volume occurred among cases compared with controls, they were among non-at-risk drinkers and did not reduce the number of

drinks enough for at-risk drinkers to become non-at -risk drinkers. Similar contradictory results in direction of effects were found for binge drinking. Generally, the conclusion is that booster sessions did not increase the effectiveness of BMI.

3.2.6 Ancillary analysis: Focus of the intervention

In order to best assess the “real picture” of problematic use of multiple substances in young men, counselors negotiated the focus of BMI with them. Interventionists were asked to record the focus of the discussion at the end of the BMI. Thus, even if more than one substance was discussed, “focus” describes the “major” substance problems from the recruit’s point of view. In some cases there was no clear focus, multiple substances were involved, or the recruit wanted to discuss problems with substances other than cannabis, alcohol or tobacco. Some even wanted to discuss non-substance use related behaviors such as gambling (coded as “other focus”).

To analyze whether the chosen focus of the intervention corresponded to the most problematic behavior, a two-stage cluster analysis was performed, using the PASW 18 software (SPSS Inc., 2010).

Table 10 shows the solution with 5 clusters; Table 11 lists the rank order of BMI focus. The first group is labeled “good boys”, where the problematic behavior is mainly related to binge drinking. Accordingly the first chosen option for the BMI was alcohol followed by tobacco use. There were no cannabis users among them, thus no BMI on cannabis was chosen. In the second cluster, all members were cannabis users with the second highest number of days with use. Two thirds of them were also at risk for binging. We therefore labeled this group “the bingeing weedheads”. Members of this group chose alcohol and cannabis as the focus of their BMI. The third cluster consisted of those with the heaviest alcohol consumption, which was problematic not only for binging but also for regular use (volume of drinking), which is rare for men in this age group. We labeled them “alcoholics”, and the preferred choices were alcohol and tobacco BMI. The fourth group, labeled “bad boys”, showed problematic use for all substances. They were all daily smokers and used cannabis more often than once per week; accordingly, BMI on cannabis and tobacco were the preferred choices. Finally, the fifth cluster, “the bingeing smokers”, had the second highest rates of smoking and was at risk for bingeing, but none was at risk for cannabis use. The preferred focus of BMI was on smoking, followed by alcohol.

Table 10: Cluster solution based on baseline substance use measures

	Cluster number and label	6 months smoking (yes/no)	at risk smoking (1+ cigarettes/ day)	No. of cigarettes per day of smoking	6 months cannabis use (yes/no)	at risk cannabis use (> 1x/week)	No of days with cannabis use per month	at risk volume (21 drinks/ week)	at risk bingeing (> 1 binge/ month)	number of glasses alcohol per week	No. of binge occasions (6+ drinks) per week	cluster size in %
1	good boys	.1646	.0000	.80	.0000	.0000	.0000	.0000	.3571	5.1581	1.63	36.5
2	the bingeing weedheads	.4558	.0000	1.53	1.0000	.2109	4.8118	.0068	.6463	7.2354	2.92	20.9
3	alcoholics	.6515	.4545	8.91	.5152	.0303	1.5328	.9697	.9848	43.4091	9.86	8.6
4	bad boys	1.0000	1.0000	13.26	1.0000	1.0000	18.7973	.1171	.6126	9.4018	3.35	10.3
5	the bingeing smokers	1.0000	1.0000	12.15	.4643	.0000	.6786	.0000	.6369	7.7107	2.78	23.7

Table 11: First and second preferred focus for the change talk during the brief interventions

		Focus			Multiple focus and other
		Tobacco	Cannabis	Alcohol	
Rank order of focus	good boys	2		1	
	the bingeing weedheads		2	1	
	alcoholics	2		1	
	bad boys	2	1		
	the bingeing smokers	1		2	

In conclusion, these young men seemed aware of their most problematic substance use behaviors, and sought a corresponding intervention.

3.2.6.1 Second order crossover effects: focus of the intervention on tobacco

The above-mentioned young men came for intervention on substance use they perceived to be problematic for them. Therefore, one might expect that the interventions would result in reductions in usage, especially for the substance on which the BMI was focused.

Table 12 lists findings broken down by whether the focus was on tobacco or other substances. Again it should be noted that the BMI may have addressed multiple substances, even if there was a focus on a particular substance. It should also be noted that sample sizes go down for sub-group analyses, so we base interpretations more on effect sizes than on p-values.

Interestingly, although among consistent daily smokers interventions focused on tobacco resulted in larger decreases in number of cigarettes smoked (which was borderline significant), this was not the case for other tobacco measures (e.g. at-risk smoking). Moreover, tobacco-focused intervention resulted in stronger crossover effects for alcohol and cannabis, compared with interventions having a focus on substances other than tobacco. The effects were significant for most of the cannabis measures. The preventive effects of a tobacco BMI may influence the crossover effects on other substances.

Table 12: Effectiveness of the intervention for cases compared with controls (n=381) depending on focus of the intervention being tobacco or other substances

			Regression of follow-up values, adjusted for baseline measures							
			only baseline adjustment				**fully adjusted**			
	Focus		**tobacco**		**other substances**		**tobacco**		**other substances**	
		scale level	**OR/mean difference**	**p-value**	**OR/mean difference**	**p-value**	**OR/mean difference**	**p-value**	**OR/mean difference**	**p-value**
	n		120		168		120		168	
Smoking	past 6 months smokers	1	1.125	.714	.666	.158	1.111	.747	.686	.194
	at risk smoking (daily), total population	1	.933	.842	***.563***	***.086***	.953	.890	.596	.125
	number of cigarettes, total population	0	-.397	.692	-1.568	.117	-.372	.710	-1.466	.143
	number of cigarettes among consistent regular smokers	0	***-1.742***	***.083***	*-.968*	*.334*	*-1.521*	*.130*	*-.884*	*.378*
Cannabis use	6 months cannabis user	1	***.430***	***.004***	*.775*	*.338*	***.395***	***.002***	*.743*	*.271*
	at risk (> once a week) use, total population	1	*.697*	*.453*	*.822*	*.623*	*.698*	*.445*	*.859*	*.712*
	number of days with cannabis use per months, total population	0	***-2.044***	***.041***	*-.586*	*.558*	***-2.165***	***.031***	*-.562*	*.575*
	number of days with cannabis use per months, consistent users	0	***-2.271***	***.024***	*-.233*	*.816*	***-1.875***	***.062***	*.041*	*.968*
Alcohol use	risk volume, total population	1	*.821*	*.637*	*.927*	*.832*	*.862*	*.726*	*.959*	*.907*
	risk binge, total population	1	*.830*	*.443*	*1.289*	*.236*	*.870*	*.571*	*1.319*	*.200*
	number of drinks per week, total population	0	*-.568*	*.570*	*-.552*	*.581*	*-.330*	*.742*	*-.437*	*.662*
	number of binge occasions per week, total population	0	-.619	.536	*.698*	*.486*	-.481	.630	*.808*	*.419*

Remark: *Scale level coded 1 are for categorical variables, with test-values being Odds Ratios (OR) from logistic regressions, scale level coded 0 are linear regressions on continuous variables with test-values being t-values for the coefficient of the regression on the intervention (coded 1= cases and 0=controls)*
italics: favouring the tobacco focus of the intervention
bold : p < 0.10

Table 13: Effectiveness of the intervention for cases compared with controls (n=381) depending on focus of the intervention being cannabis or other substances

			Regression of follow-up values, adjusted for baseline measures							
			only baseline adjustment				fully adjusted			
	Focus		**cannabis**		**other substances**		**cannabis**		**other substances**	
		Scale level	**OR/mean difference**	**p-value**	**OR/mean difference**	**p-value**	**OR/mean difference**	**p-value**	**OR/mean difference**	**p-value**
	n			50		238				
Smoking	past 6 months smokers	1	1.062	.897	.797	.370	1.064	.891	.802	.390
	at risk smoking (daily), total population	1	1.152	.778	.642	.120	1.189	.726	.665	.159
	number of cigarettes, total population	0	-.764	.445	-1.203	.229	-.731	.465	-1.127	.260
	number of cigarettes among consistent regular smokers	0	-1.315	.190	-1.540	.125	-1.315	.190	-1.540	.125
Cannabis use	6 months cannabis user	1	1.608	.258	**.454**	**.001**	1.487	.346	**.430**	**.001**
	at risk (> once a week) use, total population	1	2.162	.149	**.452**	**.059**	2.101	.159	**.465**	**.074**
	number of days with cannabis use per months, total population	0	1.586	.113	**-2.456**	**.014**	1.584	.114	**-2.495**	**.013**
	number of days with cannabis use per months, consistent users	0	.677	.499	**-2.606**	**.010**	.897	.371	**-2.205**	**.029**
Alcohol use	risk volume, total population	1	1.249	.682	.814	.528	1.294	.640	.850	.624
	risk binge, total population	1	1.473	.267	1.005	.981	1.524	.228	1.041	.836
	at risk (either volume or binge), total population	1	1.488	.253	1.017	.929	1.540	.215	1.052	.791
	number of drinks per week, total population	0	.641	.522	-1.048	.295	.753	.452	-.842	.400
	number of binge occasions per week, total population	0	1.653	.099	-.481	.630	1.665	.096	-.295	.768

Remark: *Scale level coded 1 are for categorical variables, with test-values being Odds Ratios (OR) from logistic regressions, scale level coded 0 are linear regressions on continuous variables with test-values being t-values for the coefficient of the regression on the intervention (coded 1= cases and 0=controls)*
italics: favouring the cannabis focus of the intervention
bold : p < 0.10

Table 14: Effectiveness of the intervention for cases compared with controls (n=381) depending on focus of the intervention being alcohol or other substances

			Regression of follow-up values, adjusted for baseline measures							
			only baseline adjustment				fully adjusted			
	Focus		alcohol		other substances		alcohol		other substances	
		Scale level	OR/mean difference	P-value	OR/mean difference	P-value	OR/mean difference	P-value	OR/mean difference	P-value
	n		142		146		142		146	
Smoking	past 6 months smokers	1	***.553***	***.057***	*1.200*	*.541*	***.577***	***.079***	*1.184*	*.578*
	at risk smoking (daily), total population	1	***.375***	***.012***	*1.098*	*.770*	***.397***	***.018***	*1.142*	*.681*
	number of cigarettes, total population	0	*-1.571*	*.117*	*-.518*	*.605*	*-1.485*	*.138*	*-.470*	*.639*
	number of cigarettes among consistent regular smokers	0	-.108	.914	**-2.025**	**.044**	-.007	.994	**-1.818**	**.070**
Cannabis use	6 months cannabis user	1	***.506***	***.026***	*.675*	*.134*	***.480***	***.018***	***.634***	***.087***
	at risk (> once a week) use, total population	1	***.348***	***.077***	*1.100*	*.803*	***.354***	***.093***	*1.085*	*.832*
	number of days with cannabis use per months, total population	0	***-1.887***	***.060***	*-.602*	*.547*	***-1.854***	***.064***	*-.689*	*.491*
	number of days with cannabis use per months, consistent users	0	***-1.779***	***.077***	*-.750*	*.454*	*-1.447*	*.149*	*-.437*	*.663*
Alcohol use	risk volume, total population	1	.897	.775	.867	.712	.935	.860	.903	.794
	risk binge, total population	1	1.259	.312	.921	.715	1.292	.263	.960	.857
	number of drinks per week, total population	0	*-.936*	*.349*	*-.190*	*.849*	*-.833*	*.405*	*.050*	*.960*
	number of binge occasions per week, total population	0	.231	.818	-.013	.990	.337	.736	.132	.895

Remark: *Scale level coded 1 are for categorical variables, with test-values being Odds Ratios (OR) from logistic regressions, scale level coded 0 are linear regressions on continuous variables with test-values being t-values for the coefficient of the regression on the intervention (coded 1= cases and 0=controls)*
italics: favouring the alcohol focus of the intervention
bold : p < 0.10

3.2.6.2 Second order crossover effects: focus of the intervention on cannabis

The effects of interventions focused on cannabis use show a clear picture. On almost all measures, the 50 individuals who chose this intervention exacerbated their substance use**,** compared with controls. There was a positive tendency only on measures related to number of cigarettes (i.e. reductions in number smoked). This tendency was stronger when the focus was not on cannabis (Table 13).

Contrary to our hypotheses, the mostly significant reductions in cannabis use occurred among the young men whose BMI focus was on other substances.

3.2.6.3 Second order crossover effects: focus of the intervention on alcohol

For alcohol, interventions focused on it may have had an effect over and above the controls in number of drinks consumed per week (on the volume measure, but not on the most problematic alcohol use behavior of this age group, namely binge drinking). Even if the effects were in the expected beneficial direction, they were mostly non-significant (Table 14), thus the null findings cannot be explained by low statistical power.

Again, as was true for some of the other interventions, a focus on alcohol during BMI seems to have effects on cannabis and tobacco greater than did those interventions focused on those substances; despite a reduced sample size for this subgroup, some of the cannabis and tobacco effects were significant for those measures.

3.2.6.4 Second order crossover effects: a short intermediate summary

Findings on the focus of the BMI were puzzling. First, when the focus was on cannabis, practically no protective effects of BMI could be found. It should be noted that cannabis BMI was the priority choice for those labeled “bad boys” in the cluster analyses, i.e. those with the highest substance use patterns in general.

Second, individuals focusing on a particular intervention almost never had protective effects above those who focused on some other substance. Alcohol-focused BMI had greater effects on tobacco and cannabis smoking, and tobacco-focused BMI had greater protective effects on cannabis and alcohol use.

How can this be interpreted? BMI might be more effective for individuals with substance use problems, provided they are not “full-blown” (e.g. Babor and Higgings-Biddle, 2001). Thus, for the heaviest users brief advice and counseling is often not effective, and referral to a more comprehensive form of treatment is the recommended choice for intervention.

In this light, the findings are meaningful. “Cannabis BMI choosers” are the most problematic substance users (of alcohol and tobacco was well), and no effects for any of these substances could be found. Choosers of other BMI focuses have the most problems with their chosen substance, as demonstrated in the cluster analysis. Hence, it is likely that for substances that are the most problematic, BMI itself is not effective enough. However, BMI did have effectiveness in reducing concomitant substance use.

In addition, there was no *a priori* screening included in the BMI trial; therefore, individuals showing up for an intervention were often those who needed it the most, and a single BMI session may not be sufficient for reducing their most problematic behavior.

There are three conclusions to guide further research. 1) Large scale screening is recommended to suggest BMI for those who underestimate the extent of their substance use, as they may benefit most from BMI. 2) Even though there is a desired focus of the BMI on one substance, the interventionist should also include co-occurring other substance use behaviors, for which the BMI can have an effect. 3) BMIs should include referral for the most problematic substance to treatment that is more comprehensive.

3.2.7 Matching of controls: a summary of findings

The preceding sections have shown that the effectiveness of interventions also depends on the severity of the underlying problematic substance use behaviors, e.g. with reduced effectiveness in groups with multiple severe substance use, or reduced effectiveness for a focus of the BMI on the most problematic behavior. It may be that by including all controls (including subgroups with the most severe substance use problems) the effects of BMI may be further reduced because “too many” of these controls have severe substance use problems. We analyzed the effectiveness of BMI by matching controls to cases. Matching means that exactly one control is matched to exactly one case and this control “equals” the substance use pattern of the corresponding case at baseline. Equality here means that the control comes as close as possible to the corresponding case. If there was no exact match found, a control as close as possible was chosen (based on the Mahalanobis distance). The analyses used conditional logistic regression for dichotomous categorical outcomes and matched-pairs t-tests for continuous outcomes.

Table 15 shows the results of BMI for a) all recipients, b) those with booster, c) all those with focus on other substances, d) all those with focus on other substances and booster, e) all those with the substance-specific focus, and f) all those with the substance-specific focus and booster.

The matching of cases resulted in a clearer picture of the effectiveness of BMI compared with analyses using unmatched controls. For all substances there were protective effects only, which were significant for the number of cigarettes smoked and the number of days with cannabis use (i.e. smoking in general, for which the intervention was designed). For alcohol, the results were in the right direction (positive and preventive), but did not reach significance on any of the alcohol use measures.

Table 15: Effects of Brief Interventions using matched controls (n=288)

			BMI for all				BMI for those with booster		
					95.0% CI for OR/mean difference				95.0% CI for OR/mean difference
		scale level	Sig.	OR/mean difference	Lower	Upper	Sig.	OR/mean difference	Lower	Upper
Smoking	n		288				145			
	past 6 months smoking, total sample	1	.213	0.73	0.44	1.20	.591	0.82	0.41	1.67
	at risk smoking (daily), total sample	1	.152	0.66	0.37	1.17	.549	0.79	0.36	1.73
	number of cigarettes, total sample	0	.013	-1.06	-1.89	-0.22	.129	-0.92	-2.11	0.27
	number of cigarettes among consistent regular smokers	0	**.000**	**-4.27**	**-6.08**	**-2.47**	**.001**	**-4.18**	**-6.66**	**-1.71**
Cannabis use			288							
	6 months cannabis use, total sample	1	.104	0.66	0.40	1.09	.111	0.55	0.26	1.15
	at risk (> once a week) use, total population	1	.549	0.79	0.36	1.73	*.796*	*1.14*	*0.41*	*3.15*
	number of days with cannabis use per months, total sample	0	.109	-0.55	-1.21	0.12	.911	-0.05	-0.92	0.82
	number of days with cannabis use per months, consistent users	0	.029	-2.08	-3.95	-0.21	.635	-0.58	-3.00	1.85
Alcohol use			288							
	risk volume, total sample	1	.648	0.87	0.48	1.58	*1.000*	*1.00*	*0.45*	*2.23*
	risk binge, total sample	1	.921	0.98	0.66	1.45	.579	0.86	0.50	1.48
	number of drinks per week, total sample	0	.546	-0.49	-2.09	1.11	.971	-0.05	-2.60	2.50
	number of binge occasions per week, total sample	0	.873	-0.04	-0.51	0.43	*.673*	*0.14*	*-0.53*	*0.82*

Remarks: *shadowed: stronger preventive effect-size for booster compared with non-booster*
italics: detrimental effect
bold: significant at p < .10
scale level: 1: categorical analysed with conditional logistic regression; 0: continuous with matched t-test

Table 15: Effects of Brief Interventions using matched controls (n=288) - continued

			BMI for all those with focus on other substances				BMI for all those with focus on other substances and booster			
		scale level	Sig.	OR/mean difference	95.0% CI for OR/mean difference Lower	Upper	Sig.	OR/mean difference	95.0% CI for OR/mean difference Lower	Upper
Smoking	n		168				82			
	past 6 months smoking, total sample	1	**.021**	**0.48**	**0.26**	**0.90**	.280	0.62	0.26	1.48
	at risk smoking (daily), total sample	1	**.040**	**0.42**	**0.18**	**0.96**	.410	0.63	0.20	1.91
	number of cigarettes, total sample	0	**.008**	**-1.30**	**-2.26**	**-0.35**	.220	-0.96	-2.51	0.59
	number of cigarettes among consistent regular smokers	0	**.001**	**-5.00**	**-7.94**	**-2.06**	**.039**	**-4.16**	**-8.09**	**-0.23**
Cannabis use			238				121			
	6 months cannabis use, total sample	1	.134	0.66	0.38	1.14	.136	0.56	0.26	1.20
	at risk (> once a week) use, total population	1	.232	0.55	0.20	1.47	.530	0.67	0.19	2.36
	number of days with cannabis use per months, total sample	0	**.031**	**-0.66**	**-1.25**	**-0.06**	.305	-0.38	-1.10	0.35
	number of days with cannabis use per months, consistent users	0	**.008**	**-3.15**	**-5.45**	**-0.86**	.127	-2.05	-4.71	0.61
Alcohol use			146				77			
	risk volume, total sample	1	.514	0.75	0.32	1.78	*1.000*	*1.00*	*0.29*	*3.45*
	risk binge, total sample	1	.338	0.77	0.45	1.32	.481	0.78	0.39	1.56
	number of drinks per week, total sample	0	.496	-0.82	-3.18	1.55	.906	-0.22	-3.99	3.54
	number of binge occasions per week, total sample	0	.567	-0.21	-0.94	0.52	*.767*	*0.16*	*-0.89*	*1.20*

Remarks: *shadowed: stronger preventive effect-size comparing booster with non-booster*
italics: detrimental effect
bold: significant at p < .10
scale level: 1: categorical analysed with conditional logistic regression; 0: continuous with matched t-test

Table 15: Effects of Brief Interventions using matched controls (n=288) - continued

			BMI for all those with the substance-specific focus				BMI for all those with the substance-specific focus and booster			
		scale level	Sig.	OR/mean difference	95.0% CI for OR/mean difference Lower	Upper	Sig.	OR/mean difference	95.0% CI for OR/mean difference Lower	Upper
Smoking	n		120				63			
	past 6 months smoking, total sample	1	.166	*2.00*	*0.75*	*5.33*	*.530*	*1.50*	*0.42*	*5.32*
	at risk smoking (daily), total sample	1	.827	*1.10*	*0.47*	*2.59*	*1.000*	*1.00*	*0.32*	*3.10*
	number of cigarettes, total sample	0	.351	-0.71	-2.21	0.79	.370	-0.86	-2.75	1.04
	number of cigarettes among consistent regular smokers	0	**.002**	**-3.79**	**-6.14**	**-1.44**	**.017**	**-4.20**	**-7.58**	**-0.82**
Cannabis use			50				24			
	6 months cannabis use, total sample	1	.530	0.67	0.19	2.36	.571	0.50	0.05	5.51
	at risk (> once a week) use, total population	1	.484	*1.67*	*0.40*	*6.97*	*.215*	*4.00*	*0.45*	*35.79*
	number of days with cannabis use per months, total sample	0	.990	-0.02	-2.69	2.65	*.409*	*1.60*	*-2.34*	*5.55*
	number of days with cannabis use per months, consistent users	0	.797	-0.41	-3.64	2.82	*.448*	*1.77*	*-3.03*	*6.58*
Alcohol use			142				68			
	risk volume, total sample	1	1.000	1.00	0.43	2.31	*1.000*	*1.00*	*0.35*	*2.85*
	risk binge, total sample	1	.388	1.29	0.73	2.27	*1.000*	*1.00*	*0.42*	*2.40*
	number of drinks per week, total sample	0	.887	-0.16	-2.33	2.02	*.930*	*0.15*	*-3.33*	*3.64*
	number of binge occasions per week, total sample	0	*.642*	*0.14*	*-0.46*	*0.74*	*.760*	*0.13*	*-0.73*	*0.99*

Remarks: *shadowed: stronger preventive effect-size comparing booster with non-booster*
italics: detrimental effect
bold: significant at p < .10
scale level: 1: categorical analysed with conditional logistic regression; 0: continuous with matched t-test

Again it became clear that booster sessions do not increase effectiveness; the effect size (OR for dichotomous and mean difference for continuous variables) was only slightly larger for two of the outcomes (6-months prevalence of cannabis use and being at risk for bingeing). However, none of these findings favoring boosters was significant. The effect sizes, independent of significance levels (which are logically reduced in subgroup analyses using those with booster compared with the total sample), were smaller or even pointed toward detrimental effects.

Booster sessions almost never had beneficial effects over those of the corresponding combined sample of individuals with and without a booster. There were some cases where the booster was less detrimental. For example, the substance-focused intervention on past 6 months smoking had a detrimental effect of OR=2 for all those receiving the tobacco BMI, but the effect size was only OR=1.5) for those with a booster. In both cases the focus of the BMI on tobacco was detrimental (but slightly less so for the booster). For those with a focus of the BMI on smoking, the booster had a larger preventive effect on number of cigarettes smoked. This effect was as strong as the effect for individuals without a focus on tobacco, but smaller than the effect in the group without booster. Thus, booster in the group with a BMI focus on smoking mitigated the negative effects of focusing on the substance.

Clearly, if the interventions function as designed in the present research, they do not need to include booster sessions.

Another unexpected finding was confirmed in the matched analyses. Effectiveness was larger for those with a BMI that did not focus on the reported substance. To better explain Table 15: for tobacco measures there were individuals who had no focus on tobacco; for cannabis measures, there were those without a focus on cannabis; and for alcohol measures, there were those without a focus on alcohol. Although not necessarily significant, the effect sizes were more protective for all 12 measures in Table 2 compared with the total sample. Logically, this means once again that interventions were less effective for substances when the focus of the intervention was on the corresponding substance. Additionally for tobacco, not only did the number of cigarettes become significant in a non-tobacco-focused intervention, but also the effects on number of smokers and number of at-risk smokers reached significance. This was in spite of the reduced sample size, compared to the analyses that included all cases (and matched controls).

3.2.8 Conclusions of the evaluation of the intervention

Many of the described effects did not reach statistical significance. We nevertheless take the perspective that BMI in the setting of an army recruitment center is useful, and base this conclusion on four reflections:

a) In the total sample and the matched analyses, for all outcomes a beneficial development 6 months after the intervention was found, although not all measures reached significance.
b) Significant protective effects were found (mainly) for the two substances related to smoking (tobacco and cannabis), for which the intervention was designed.
c) The intervention was very complex and had a number of potential subgroup analyses, for which statistical power calculations were not considered a priori. The study was powered for the overall smoking outcome of the intervention in general, not for subgroup analyses on the focus of the intervention or on the incremental effectiveness of booster sessions. For these analyses, sample sizes became very small; that there were still significant findings attests to the strength of brief interventions.

d) Interventions were very heterogeneous, as the focus of the intervention changed. Similarly, the sample of individuals showing up for receiving an intervention was very heterogeneous and had a high complexity of underlying substance use patterns.

The study showed beneficial effects after 6 months, mainly for the smoking outcomes for both tobacco and cannabis. These effects were generally rather small. There were mixed findings for alcohol with even smaller effects, mainly related to average consumption (volume of drinking in number of drinks per week), and even less for the more problematic binge drinking (i.e. large quantities on single occasions often consumed on weekends).

The study showed a rather unexpected finding. Booster sessions that were a second brief intervention conducted via telephone 3 months after baseline had no additional effect. This is surprising, since booster sessions have been shown to be effective (Fiore et al., 2000; Kottke et al., 1988; Longabaugh et al., 2001; Mello et al., 2005; Miller and Wood, 2003). It may be that conscripts felt “forced into” a second intervention because this session was not voluntary like the first one done directly in the army, where they chose to see a counselor. They were approached by phone and may have felt pressured into something which they did not intend to get when they received the call. To be clear, no one was actually forced” to do the intervention; any one could turn down the invitation. They were all informed at the beginning of the trial that half of them would be randomly contacted for a second session. Although all of them consented to the possibility of a second BMI contact (booster), they may have forgotten this when they were called, and perceived the offer as an intrusion into their life, or an additional annoyance. It may also be that the two-fold discussion on substance use may have sensitized individuals to their substance use. This might have resulted in better subsequent monitoring of it and in a more precise reporting of it 3 months later (assessment reactivity). More accurate reporting of substance use often reveals higher levels of use. In this case, the weaker effects would mainly be artifacts of different methodology and greater assessment reactivity to the instruments used. We can only speculate on that. The present findings do show that boosters are not needed to achieve (minimally) the same effects that are obtained without them; in fact, sometimes even opposite, reduced beneficial effects are found. Therefore, the recommendation would be to avoid boosters in this group, and make the use of BMI this is more cost-effective. At least for alcohol, it has been shown that more extended versions of BMI can produce larger beneficial effects, but these gains are rather small (Kaner et al., 2007)

A second unexpected finding was that the focus of the discussion negotiated between counselor and conscript had stronger effects on other substances. For example, “alcohol interventions” had effects on tobacco and cannabis use; tobacco interventions had stronger effects on cannabis than on tobacco, etc. Stated differently, effects on reduction of tobacco smoking were stronger in interventions focusing on alcohol and cannabis, and effects on cannabis were stronger in interventions focusing on alcohol and tobacco than they were in those focused on cannabis.

This finding deserves particular attention. The intervention model in this research has thus far rarely been used (but see McCambridge and Strang, 2003; McCambridge and Strang, 2004). BMIs were originally designed to take the overarching background of substance use behaviors among young men into account. Presently, substance use often involves not just the use of a single problematic drug, but consists of a complex pattern of behaviors surrounding multiple substances. Studies using a single-substance focus rarely report the potentially stronger crossover effects.

Although this study was introduced as having its aim to reduce smoking and had smoking as its priority, the possibility to talk about substance use in general was explicitly raised for all individuals, not only the smokers. The focus of the BMI was negotiated and chosen during the intervention. The content of the BMI thus was not necessarily centered on the discussion of tobacco use only or on cannabis use only. Linking one substance use to another one was desired; it was not excluded *a priori* during the BMI discussion, unlike other BMI studies that focused on a single substance only. It is well known that alcohol and tobacco use are connected, as are cannabis and tobacco use. Multiple substance use is a major problem in this cohort study, as has been shown e.g. by Gmel and colleagues (2010). We therefore expected crossover effects to other substances even if there was a focus on one substance, because the discussion of multiple substance use was part of the BMI, and most substance use is interconnected.

However, the interconnectedness of usage behaviors does not explain why, on average, lesser effects were found for the drug of focus than for the substances not focused on. We were puzzled, not so much by the existence of crossover effects, but by the relative strength of these effects compared to effects on the focused substance. We do not know why this occurred, but we do have some hypotheses.

Again, two peculiarities of this type of intervention must be stressed. Individuals were not enrolled as part of a scientific, randomized clinical explanatory trial based on screening, but were invited to voluntarily receive an intervention, if wanted. The intervention was planned as a pragmatic trial in a "real environment" with the premise that it can maintained and implemented in future projects easily. We believe that systematic screening in such an environment is nearly impossible, and substantively adds to costs even if it were. Explanatory trials strive for maximum internal validity, often using paid participants or strict exclusion criteria. In BMI studies exclusion criteria often eliminate the heaviest (or dependent) substance users. They often seek to include "only" harmful or hazardous users, because BMI has been shown to be inefficient for the heaviest users, especially for those who need referral to treatments than are more intensive (Babor and Higgings-Biddle, 2001). Minimally, more evidence regarding BMI for heaviest users is needed (Saitz, 2010). Including "everyone" may have reduced some effects in our intervention; this has been shown to be the case by Kaner and colleagues (2007). Although they claimed that the differences were insignificant, beneficial effects in effectiveness trials were only half those shown in efficacy trials.

Individuals coming "voluntarily" into BMI may include those that would not otherwise be recommended for BMI (based on cut-offs of high substance use involvement detected at screening), because their use is not at hazardous or harmful levels. One reason for including "non-at-risk users" may be simply to get more information, or to make sure that their consumption is not yet problematic. The present intervention study therefore may include:

a) Individuals with low-risk use; in the present study cluster analyses showed that there was a large group (labeled "good boys") showing up for an intervention.
b) Individuals with very heavy (possibly dependent) use who often would be excluded in explanatory trials.

For individuals (particularly young men) with low risk use, one success of the intervention would be for them to maintain rather low substance use patterns; average reductions in use would be smaller than in individuals preselected because of their high use levels. Of course, these "primary preventive" effects should come out in comparison with controls; however, these effect sizes would be smaller. The tobacco results

supported this view, since maintenance of non-problematic tobacco use patterns were stronger than effects for at-risk use reductions.

The second group, i.e. individuals with very heavy use (possibly dependent) may be more important, regarding the finding of relative ineffectiveness of interventions focused on one substance. As shown above, individuals were actually choosing to focus on the substance they used most heavily. It can be hypothesized that the heaviest users did not benefit at all (or got less benefit) from BMI for their most problematic drug, because it simply is too difficult for them to reduce this (quasi-dependent) pattern. Nevertheless, there would still be beneficial effects on the non-dependent use of those substances that the BMI did not focus on (but which were discussed during the change talk). This hypothesis gets it support from results for the group focusing their BMI on cannabis. The most problematic multi-substance users mainly chose cannabis focus, and there were almost no beneficial effects for any of the substances they used.

Four conclusions or suggestions for future BMI designs that invite "everyone" and are not based on screening, and deal with many substances simultaneously or with other patterns of multi-substance use can be made:

a) *Booster sessions provided on the phone for 19/20 year-old-men are ineffective*.
   Currently, it remains unclear whether boosters are generally inefficient in this age group, or are only effective if BMIs are commonly designed to deal with a single substance only (for exceptions see McCambridge and Strang, 2003; McCambridge and Strang, 2004), or are ineffective because phone contact with the counselor is too limited. There are studies, mostly on parent-child communications, showing that it is not the quantity, but rather the quality of the communication that counts. Adolescents and other young men may quickly feel "over-talked" when approached for a second, unrequested session in which to discuss their usage behaviors. To our knowledge, there has been no research incorporating boosters in a more general change talk framework, i.e. BMIs that leave the opportunity to define the focus of the change talk. It may be that during the booster a new or different focus was chosen and consequently the booster was not "actually" a booster, but closer to a second BMI with another content; therefore, it did not add to the changes in substance use of the first BMI conducted face-to-face.
   For this multi-substance intervention there is no evidence that booster sessions are needed or have any effect; for reasons of cost-effectiveness and cost-efficiency boosters can be omitted.
b) *Voluntary BMI may be relatively ineffective compared to BMI based on systematic screening*
   The present intervention was planned as a pragmatic intervention. If we want to implement BMI on a wider scale, feasibility becomes important. In contrast to explanatory trials, where researchers can take precautions to achieve optimal internal validity (e.g. screening, pre-selection based on screening, and remuneration of participants), in pragmatic trials the question becomes; does it work under suboptimal, though real conditions? The army recruitment procedures provide a very hectic and stressful atmosphere for the young men. Although the army was highly interested in providing possibilities for prevention, any action in the center had to be done in a manner that did not disturb army procedures, such as medical examinations. It would be rather impossible in a short window to screen everyone, to select participants based on screening criteria, to invite them for intervention, and to implement procedures to make the intervention possible. By inviting everyone at the outset use of the short window is optimized because individuals can use their free time during the recruitment to receive a BMI. This comes with the downside that some individuals may show up who

actually do not need an intervention, which in turn may lower effectiveness. In an earlier study with another sample in the same context, effectiveness was shown for randomly selected people (Daeppen et al., 2011), but not for a sample of "voluntarily" participating individuals (Gaume et al., in press). The results of this intervention seem to support earlier findings in the alcohol field and among older populations that for "volunteers" substance use reductions can be less (e.g. Ballesteros et al., 2004). It should be noted, however, that studies on volunteers of this age are very rare and little is known. We found some studies investigating BMI using voluntary subjects (Bailey et al., 2004; Berghuis et al., 2006; Brown et al., 2005; D'Amico and Edelen, 2007; Walker et al., 2006). They were conducted on adolescents or young adults and addressed alcohol and/or cannabis use. Self-selection was a consistently successful inclusion strategy, although these projects varied in methodological quality and showed mixed results. Three of them reported positive effects from BMI, but they were not randomized controlled trials: one compared volunteers to non-volunteers (Brown et al., 2005), one was a single-group, pre-post design (Berghuis et al., 2006); the third was a pilot test comparing participating versus non-participating schools, and individual volunteers versus matched controls (D'Amico and Edelen, 2007). Another study was a randomized controlled trial and showed significant reduction of substance use within both the intervention and control groups, but no differences between the two groups (Walker et al., 2006). One other randomized controlled trial showed results in favor of BMI, but was a pilot study on a small sample of 34 individuals (Bailey et al., 2004).This raises the question of whether results from efficacy studies can be translated one-for-one into results of effectiveness studies.

We strongly recommend more effectiveness studies.

Although logistic considerations played a role, the aim was to implement an intervention and to measure its effectiveness, not to estimate the efficacy of an explanatory trial. Although among general practitioners systematic screening may be feasible, it is not in many other settings. The aim was to implement an intervention for those who sought it, not for those who are chosen in order to optimize scientific concerns in an explanatory trial. Other preventive options such as internet interventions (e.g. AlcoTool: http://www.alcotool.ch/ or Alcooquizz: www.alcooquizz.ch) provide help, but do not preselect people on scientific rationales. Hence, interventions like that described in the present study add to preventive options. Their effectiveness seems to be lower than what the efficacy of explanatory trials may suggest, but they are realistic. The intervention provided herein had some positive outcomes, and can be implemented fairly easily. Even if there are smaller effects than those suggested by efficacy studies, this intervention is accessible by more individuals and should therefore have an even greater public health impact.

It is suggested to continue the BMI in the army recruitment centers, and this can only be done without using systematic screening:

c) *A multi-substance BMI may be relatively ineffective compared with BMIs that were designed to treat only one substance*

In general, when BMI works among young people it seems to work mostly for alcohol; findings on tobacco BMI or Cannabis BMI are at best mixed, use more complex, multi-session interventions (Colby et al., 2005; D'Amico et al., 2008; Helstrom et al., 2007; Lang et al., 2000; Madras et al., 2009; McCambridge and Strang, 2005). On the one hand, to design a BMI for one substance is certainly more convenient. It is easier to train counselors, to prepare the background material for discussing pros and cons; no time is needed to negotiate the focus or the starting point of the change talk, etc. On the other hand, a single substance BMI often does not reflect the real-life circumstances of young men, who rarely show a single problematic behavior (Gmel et al., 2010). Of

course, if there were unlimited resources, e.g. on the number of counselors, office space where BMIs can be provided in a confidential environment, etc., one may consider multiple interventions instead of single interventions on multiple substances, and thus arrange multiple options beforehand, from which young men can choose. However, it must be said that under such circumstances, money should play no role. It is not very cost-efficient, because there may just not be enough young men to justify using, say, three counselors for three different substances. In addition, as stated above, BMI would not be possible where the problematic behavior consists of an interaction of substances. For example, there were individuals who had few problems with smoking per se, but smoked excessively when drinking alcohol, which was their primary problem. A single alcohol-focused intervention would probably overlook the secondary problem during the intervention. The astonishing finding during the multi-substance defined interventions was that there were cross-effects on the secondary substances that overshadowed effects on the primary substance.

The possibility to discuss several substance use related problems is feasible in the army setting and should be continued as a cost-efficient alternative to providing three separate interventions.

d) *The heaviest user may receive less benefit from BMI*

Some of the present findings point in this direction; however, a final conclusion cannot be drawn. There is still a need for more fine-grained analyses, which will be part of subsequent publications. It would nevertheless probably not be an unexpected finding. Often in explanatory trials, heaviest users are excluded; this once again raises the question of the transferability of explanatory trials to real word implementations. In the implementation of our intervention we do not want to exclude heavier users, even though it may have reduced effect sizes for the estimated effectiveness of our intervention.

It seems necessary to explore additional strategies, such as referral to more intensive treatment for the heaviest users.

3.3 Impact

Implementation of the present intervention and the steps taken to accomplish this has clear impacts. First, a concept for the extensive training of counselors has been developed, and experiences with this concept have left their mark on the wider training of medical students. The need for such training material has been expressed by many specialists in the field of prevention. The development of the present training concept and the exchange with specialists will lead to a more detailed book publication. In parallel, preparations for conducting BMI in other settings (e.g. group intervention in schools) have begun, in collaboration with Addiction Info Switzerland. It will help facilitate the use of BMI in many settings in Switzerland in the future.

Second, the possibility of receiving a (rather unobtrusive) chance to change substance use patterns has been widely accepted by those for which they were designed. Young men were looking for such an intervention, even within the rather hectic and generally unpleasant situation of being in army recruitment procedures. In the recruitment center, there were many days on which counselors could not provide an intervention to all those who wanted it, simple because of time and space constraints.

Finally, although not always reaching statistical significance, the intervention yielded small but consistent effects for all substances. It is hard to imagine other individual-centered approaches that can claim this level of success. For smoking, although there are some encouraging findings for motivational interviewing (not

necessarily brief), the effect sizes are generally small in older populations (Heckman et al., 2010), and almost nonexistent for young people (Tait and Hulse, 2003). Larger effects can be found for more intensive programs, including cognitive behavioral therapy (Grimshaw and Stanton, 2006), which may be needed for tertiary prevention and smoking cessation, because of nicotine's high potential for dependency. Our findings point to the potential of brief intervention, particularly in the early stages of one's smoking "career", where the patterns have not yet become firmly entrenched.

We could not find a meta-analytical review of BI effectiveness for cannabis. Effect sizes may be larger (Tait and Hulse, 2003) but more research is needed. We found rather consistent beneficial effects for cannabis use, but these results have to be viewed cautiously because of the numerous dropouts from intervention by cannabis users.

3.4 Long-term goals for the future (Zielsystem)

This study has shown that preventive actions in an army recruitment environment are feasible and well accepted by the conscripts. In Switzerland, were conscription is mandatory, almost all young men can be reached for such an intervention.

A long-term aim should be to increase the number of recruitment centers that are willing to use its facilities for preventive action programs. The literature is fairly clear on the fact that simple educative strategies such as suspending posters with preventive content or distributing flyers are ineffective. BMI is one of the rare individual-centered preventive approaches with proven efficacy and proven effectiveness. Results have shown that there is a potential not only for the BMI itself, but also for referral to other, more intensive treatments.

4 Sustainability and Valorization (Use)

Sustainability of the project depends largely on its continuation and wider implementation. Whether the intervention has long-lasting effects over a 6-month period could not be evaluated. In general, BMI has diminished, but not vanished, effects in individuals followed-up longer than 6 months, but known results are mainly relevant only for BMI on alcohol (Moyer et al., 2002; Vasilaki et al., 2006).

We know that in Switzerland interventions that work are desperately sought; successful projects (e.g. recent group interventions in secondary schools in Zurich) are imitated quickly. There also exists a friendly rivalry across recruitment centers that nurtures hope for wider implementation in multiple recruitment centers.

Given that extensive training material has already been developed, the intervention can be implemented in settings other than army recruitment centers. What is needed is personal contact with young people, trained counselors, and rooms to provide confidentiality. Therefore, the proposed intervention can be extended, not only to other settings and to schools, but also to other locations where young people meet or congregate. Adolescents and young adults are particularly receptive to motivational methods and can be approached within a wide range of settings (Barnett et al., 2001; Tevyaw and Monti, 2004). BMI has great potential among individuals of this age group (Tevyaw and Monti, 2004) because the interviewing style avoids argumentation and hostile confrontation. BMI style accepts the individuality of participants without lecturing them or giving ultimatums. This intervention style may foster an atmosphere of self-directed change that teachers, parents or other authority figures have trouble adopting easily.

The rather unexpected findings on booster and substance-focused interventions have led to analyses that were more extensive and have hindered further publications. Therefore, plans for publication of articles including more fine-tuned analyses of the heaviest users were delayed. , but are now ready as first drafts and have been submitted for publication; In total, four scientific articles have been submitted (see appendix). In addition, a book detailing the training of counselors is in preparation. Publication of this report is envisioned, once it is accepted. Wider distribution in the media, including a press conference in collaboration with the army have been prepared and are envisioned with the publication.

5 Equality of opportunities

Since army recruitment procedures target mainly young men, BMI in this environment is not gender equitable, *per se*. However, most of the BMI approaches among young persons draw their samples from the college/university system, and thus are unfair regarding the inclusion of individuals from lower socioeconomic strata. The army is an ideal place to target the male general population.

6 References

Arvers, P. & Choquet, M. (1999). Regional variations in alcohol use among young people in France. Epidemiological approach to alcohol use and abuse by adolescents and conscripts. *Drug and Alcohol Dependence 56*, 145-155.

Babor, T. F. & Higgings-Biddle, J. C. (2001). Brief intervention - For hazardous and harmful drinking: a manual for use in primary care. In D. o. H. a. S. D. World Health Organization (WHO) (Ed.) *Screening and Brief Intervention: For Alcohol Problems in Primary Care* (2nd Edition), (pp. Geneva: WHO.

Bachman, J. G., Freedman-Doan, P., O'malley, P. M., Johnston, L. D. & Segal, D. R. (1999). Changing patterns of drug use among US military recruits before and after enlistment. *American Journal of Public Health 89*, 672-677.

Baer, J. S., Rosengren, D. B., Dunn, C. W., Wells, E. A., Ogle, R. L. & Hartzler, B. (2004). An evaluation of workshop training in motivational interviewing for addiction and mental health clinicians. *Drug and Alcohol Dependence 73*, 99-106.

Bailey, K. A., Baker, A. L., Webster, R. A. & Lewin, T. J. (2004). Pilot randomized controlled trial of a brief alcohol intervention group for adolescents. *Drug and Alcohol Review 23*, 157-166.

Ballesteros, J., Duffy, J. C., Querejeta, I., Ariño, J. & González-Pinto, A. (2004). Efficacy of brief interventions for hazardous drinkers in primary care: systematic review and meta-analyses. *Alcoholism: Clinical and Experimental Research 28*, 608-618.

Barnett, N. P., Monti, P. M. & Wood, M. D. (2001). Motivational interviewing for alcohol-involved adolescents in the emergency room. In E. F. Wagner & H. B. Waldron (Eds.), *Innovations in Adolescent Substance Abuse Interventions*, (pp. 143-168). New York, NY: Pergamon Press.

Berghuis, J., Swift, W., Roffman, R., Stephens, R. & Copeland, J. (2006). The Teen Cannabis Check-up: Exploring Strategies for Reaching Young Cannabis Users. In R. A. Roffman & R. S. Stephens (Eds.), *Cannabis Dependence: Its Nature, Consequences and Treatment*, (pp. 275-296). Cambridge: Cambridge University Press.

Bertholet, N., Cheng, D. M., Palfai, T. P., Samet, J. H. & Saitz, R. (2009a). Does readiness to change predict subsequent alcohol consumption in medical inpatients with unhealthy alcohol use? *Addictive Behaviors 34*, 636-640.

Bertholet, N., Daeppen, J.-B., Wietlisbach, V., Fleming, M. & Burnand, B. (2005). Reduction of alcohol consumption by brief alcohol intervention in primary care: systematic review and meta-analysis. *Archives of Internal Medicine 165*, 986-995.

Bertholet, N., Horton, N. J. & Saitz, R. (2009b). Improvements in readiness to change and drinking in primary care patients with unhealthy alcohol use: a prospective study. *BMC Public Health 9*, 101.

Bianchi, G. & Popper, M. (2000). Interaction of substance use and risks to sexual health in the Slovak army: general, sociocultural and individual behaviour patterns. *AIDS Care 12*, 757-765.

Bien, T. H., Miller, W. R. & Tonigan, J. S. (1993). Brief interventions for alcohol problems: a review. *Addiction 88*, 315-335.

Bieri Buscho, C. & Forrer, E. (2002). Premiers résultats extraits de "L'enquête fédérale auprès de la jeuness et des recrues" 2000/2001 (YAS, Young Adult Survey). Zürich: Universität Zürich, Forschungsbereich Schulqualität und Schulentwicklung.

Bray, R. M., Marsden, M. E. & Peterson, M. R. (1991). Standardized comparisons of the use of alcohol, drugs, and cigarettes among military personnel and civilians. *American Journal of Public Health 81*, 865-869.

Brown, S. A., Anderson, K. G., Schulte, M. T., Sintov, N. D. & Frissell, K. C. (2005). Facilitating youth self-change through school-based intervention. *Addictive Behaviors 30*, 1797-810.

Chen, J. (2003). Age at diagnosis of smoking-related disease. *Health Reports 14*, 9-19.

Chong, S. A., Lee, C., Bird, L. & Verma, S. (2004). A risk reduction approach for schizophrenia: the Early Psychosis Intervention Programme. *Annals of the Academy of Medicine, Singapore 33*, 630-635.

Coffey, C., Lynskey, M. T., Wolfe, R. & Patton, G. C. (2000). Initiation and progression of cannabis use in a population-based Australian adolescent longitudinal study. *Addiction 95*, 1679-1690.

Colby, S. M., Monti, P. M., Barnett, N. P., Rohsenow, D. J., Weissman, K., Spirito, A., Woolard, R. H. & Lewander, W. J. (1998). Brief motivational interviewing in a hospital setting for adolescent smoking: a preliminary study. *Journal of Consulting and Clinical Psychology 66*, 574-578.

Colby, S. M., Monti, P. M., O'leary Tevyaw, T., Barnett, N. P., Spirito, A., Rohsenow, D. J., Riggs, S. & Lewander, W. J. (2005). Brief motivational intervention for adolescent smokers in medical settings. *Addictive Behaviors 30*, 865-874.

Coups, E. J., Gaba, A. & Orleans, C. T. (2004). Physician screening for multiple behavioral health risk factors. *American Journal of Preventive Medicine 27*, 34-41.

D'Amico, E. J. & Edelen, M. O. (2007). Pilot test of Project CHOICE: a voluntary afterschool intervention for middle school youth. *Psychology of Addictive Behaviors 21*, 592-598.

D'Amico, E. J., Miles, J. N. V., Stern, S. A. & Meredith, L. S. (2008). Brief motivational interviewing for teens at risk of substance use consequences: a randomized pilot study in a primary care clinic. *Journal of Substance Abuse Treatment 35*, 53-61.

Daeppen, J.-B., Anex, F., Leutwyler, J., Gammeter, R., Darioli, R. & Pecoud, A. (2005). Binge drinking in 19 year old men. *Swiss Medical Weekly 135*, 179-83.

Daeppen, J.-B., Bertholet, N., Gaume, J., Fortini, C., Faouzi, M. & Gmel, G. (2011). Efficacy of brief motivational intervention in reducing binge drinking in young men: A randomized controlled trial. *Drug and Alcohol Dependence 113*, 69-75.

Difranza, J. R., Savageau, J. A., Rigotti, N. A., Fletcher, K., Ockene, J. K., Mcneill, A. D., Coleman, M. & Wood, C. (2002). Development of symptoms of tobacco dependence in youths: 30 month follow up data from the DANDY study. *Tobacco Control 11*, 228-235.

Dunn, C., Deroo, L. & Rivara, F. P. (2001). The use of brief interventions adapted from motivational interviewing across behavioral domains: a systematic review. *Addiction 96*, 1725-1742.

Fiore, M. C., Bailey, W. C., Cohen, S. J., Dorfman, S. F., Goldstein, M. G., Gritz, E. R., Heyman, R. B., Jaén, C. R., Kottke, T. E., Lando, H. A., Mecklenburg, R. E., Mullen, P. D., Nett, L. M., Robinson, L., Stitzer, M. L., Tommasello, A. C., Villejo, L. & Wewers, M. E. (2000). Treating Tobacco Use and Dependence. Clinical Practice Guidline. Retrieved 31.01.2011, from http://www.surgeongeneral.gov/tobacco/treating_tobacco_use.pdf

Gaume, J., Gmel, G. & Daeppen, J.-B. (2008). Brief alcohol interventions: Do counsellors' and patients' communication characteristics predict change? *Alcohol and Alcoholism 43*, 62-69.

Gaume, J., Gmel, G., Faouzi, M., Bertholet, N. & Daeppen, J.-B. (in press). Is brief motivational intervention effective in reducing alcohol use among young men voluntarily receiving it? A randomized controlled trial. *Journal of Substance Abuse Treatment*

Gmel, G., Gaume, J., Willi, C., Michaud, P.-A., Cornuz, J. & Daeppen, J.-B. (2010). Challenging the "inoffensiveness" of regular cannabis use by its associations with other current risky substance use--a census of 20-year-old Swiss men. *International Journal of Environmental Research and Public Health 7*, 46-59.

Gmel, G., Rehm, J., Kuntsche, E., Wicki, M. & Grichting, E. (2004). *Das European School Survey Project on Alcohol and Other Drugs (ESPAD) in der Schweiz. Wichtigste Ergebnisse 2003 und aktuelle Empfehlungen.* Lausanne: Schweizerische Fachstelle für Alkohol- und andere Drogenprobleme (SFA). Also available at http://www.suchtundaids.bag.admin.ch/imperia/md/content/drogen/60.pdf.

Goldhammer, K. A., Dooley, D. P., Ayala, E., Zera, W. & Hill, B. L. (2006). Prospective study of bacterial and viral contamination of exercise equipment. *Clinical Journal of Sport Medicine 16*, 34-38.

Goldstein, M. G., Whitlock, E. P. & Depue, J. (2004). Multiple behavioral risk factor interventions in primary care. Summary of research evidence. *American Journal of Preventive Medicine 27*, 61-79.

Gotham, H. J., Sher, K. J. & Wood, P. K. (2003). Alcohol involvement and developmental task completion during young adulthood. *Journal of Studies on Alcohol 64*, 32-42.

Grant, J. D., Scherrer, J. F., Lynskey, M. T., Lyons, M. J., Eisen, S. A., Tsuang, M. T., True, W. R. & Bucholz, K. K. (2006). Adolescent alcohol use is a risk factor for adult alcohol and drug dependence: evidence from a twin design. *Psychological Medicine 36*, 109-118.

Grimshaw, G. M. & Stanton, A. (2006). Tobacco cessation interventions for young people. *Cochrane Database Systematic Reviews (online)*CD003289.

Heckman, C. J., Egleston, B. L. & Hofmann, M. T. (2010). Efficacy of motivational interviewing for smoking cessation: a systematic review and meta-analysis. *Tobacco Control 19*, 410-416.

Heir, T. & Eide, G. (1997). Injury proneness in infantry conscripts undergoing a physical training programme: smokeless tobacco use, higher age, and low levels of physical fitness are risk factors. *Scandinavian Journal of Medicine and Science in Sports 7*, 304-311.

Helstrom, A., Hutchison, K. & Bryan, A. (2007). Motivational enhancement therapy for high-risk adolescent smokers. *Addictive Behaviors 32*, 2404-2410.

Hibell, B., Guttormsson, U., Ahlström, S., Balakireva, O., Bjarnason, T., Kokkevi, A. & Kraus, L. (2009. 02.2009). The 2007 ESPAD Report. Substance use among students in 35 European countries. Retrieved 31.01.2011, from http://www.espad.org/documents/Espad/ESPAD_reports/2007/The_2007_ESPAD_Report-FULL_091006.pdf

Hingson, R. W., Heeren, T., Zakocs, R. C., Kopstein, A. & Wechsler, H. (2002). Magnitude of alcohol-related mortality and morbidity among U.S. college students ages 18-24. *Journal of Studies on Alcohol 63*, 136-144.

Hintze, J. L. (Ed.) (2007). *NCSS - User's Guide I*. Kaysville, UT: NCSS Statistical System, Dr. Jerry L. Hintze.

Horn, K., Dino, G., Hamilton, C. & Noerachmanto, N. (2007). Efficacy of an emergency department-based motivational teenage smoking intervention. *Preventing Chronic Disease 4*, A08.

Kaner, E. F., Beyer, F., Dickinson, H. O., Pienaar, E., Campbell, F., Schlesinger, C., Heather, N., Saunders, J. & Burnand, B. (2007). Effectiveness of brief alcohol interventions in primary care populations. *Cochrane Database of Systematic Reviews*CD004148.

Kentala, J., Utriainen, P., Pahkala, K. & Mattila, K. (1999). Can brief intervention through community dental care have an effect on adolescent smoking? *Preventive Medicine 29*, 107-111.

Kottke, T. E., Battista, R. N., Defriese, G. H. & Brekke, M. L. (1988). Attributes of successful smoking cessation interventions in medical practice. A meta-analysis of 39 controlled trials. *JAMA 259*, 2883-2889.

Lang, E., Engelander, M. & Brooke, T. (2000). Report of an integrated brief intervention with self-defined problem cannabis users. *Journal of Substance Abuse Treatment 19*, 111-116.

Larsen, K., Weidick, F. & Leboeuf-Yde, C. (2002). Can passive prone extensions of the back prevent back problems? A randomized, controlled intervention trial of 314 military conscripts. *Spine 27*, 2747-252.

Law, M. & Tang, J. L. (1995). An analysis of the effectiveness of interventions intended to help people stop smoking. *Archives of Internal Medicine 155*, 1933-1941.

Longabaugh, R., Woolard, R. E., Nirenberg, T. D., Minugh, A. P., Becker, B., Clifford, P. R., Carty, K., Licsw, Sparadeo, F. & Gogineni, A. (2001). Evaluating the effects of a brief motivational intervention for injured drinkers in the emergency department. *Journal of Studies on Alcohol 62*, 806-816.

Madras, B. K., Compton, W. M., Avula, D., Stegbauer, T., Stein, J. B. & Clark, H. W. (2009). Screening, brief interventions, referral to treatment (SBIRT) for illicit drug and alcohol use at multiple healthcare sites: comparison at intake and 6 months later. *Drug and Alcohol Dependence 99*, 280-295.

Marttunen, M., Henriksson, M., Pelkonen, S., Schroderus, M. & Lönnqvist, J. (1997). Suicide among military conscripts in Finland: a psychological autopsy study. *Military Medicine 162*, 14-18.

McCambridge, J., Hunt, C., Jenkins, R. J. & Strang, J. (2010). Cluster randomised trial of the effectiveness of Motivational Interviewing for universal prevention. *Drug and Alcohol Dependence*

McCambridge, J. & Strang, J. (2003). Development of a structured generic drug intervention model for public health purposes: a brief application of motivational interviewing with young people. *Drug and Alcohol Review 22*, 391-399.

McCambridge, J. & Strang, J. (2004). The efficacy of single-session motivational interviewing in reducing drug consumption and perceptions of drug-related risk and harm among young people: results from a multi-site cluster randomized trial. *Addiction 99*, 39-52.

McCambridge, J. & Strang, J. (2005). Deterioration over time in effect of Motivational Interviewing in reducing drug consumption and related risk among young people. *Addiction 100*, 470-478.

Mello, M. J., Nirenberg, T. D., Longabaugh, R., Woolard, R., Minugh, A., Becker, B., Baird, J. & Stein, L. (2005). Emergency department brief motivational interventions for alcohol with motor vehicle crash patients. *Annals of Emergency Medicine 45*, 620-625.

Miller, M. & Wood, L. (2003). Effectiveness of smoking cessation interventions: review of evidence and implications for best practice in Australian health care settings. *Australian and New Zealand Journal of Public Health 27*, 300-309.

Miller, W. R., Moyers, T. B., Arciniega, L., Ernst, D. & Forcehimes, A. (2005). Training, supervision and quality monitoring of the COMBINE Study behavioral interventions. *Journal of Studies on Alcohol Suppl. 2005 July*, 188-195.

Miller, W. R. & Rollnick, S. (1991). *Motivational Interviewing: Preparing People to Change Addictive Behavior.* New York, NY: Guilford Press.

Mottillo, S., Filion, K. B., Belisle, P., Joseph, L., Gervais, A., O'loughlin, J., Paradis, G., Pihl, R., Pilote, L., Rinfret, S., Tremblay, M. & Eisenberg, M. J. (2009). Behavioural interventions for smoking cessation: a meta-analysis of randomized controlled trials. *European Heart Journal 30*, 718-730.

Moyer, A., Finney, J. W., Swearingen, C. E. & Vergun, P. (2002). Brief interventions for alcohol problems: a meta-analytic review of controlled investigations in treatment-seeking and non-treatment-seeking populations. *Addiction 97*, 279-292.

Moyers, T. B., Martin, T., Manuel, J. K., Hendrickson, S. M. L. & Miller, W. R. (2005). Assessing competence in the use of motivational interviewing. *Journal of Substance Abuse Treatment 28*, 19-26.

Narring, F., Tschumper, A., Inderwildi Bonivento, L., Jeannin, A., Addor, V., Bütikofer, A., Suris, J. C., Diserens, C., Alsaker, F. D. & Michaud, P.-A. (2004). Gesundheit und Lebensstil 16- bis 20-Jähriger in

der Schweiz (2002). SMASH 2002: Swiss Multicenter Adolescent Study on Health 2002. Lausanne: Institut universitaire de médecine sociale et préventive.

Nguyen, T. H., Nguyen, T. L. & Trinh, Q. H. (2004). HIV/AIDS epidemics in Vietnam: evolution and responses. *AIDS Education and Prevention 16*, 137-154.

Nieman, L. Z., Velasquez, M. M., Groff, J. Y., Cheng, L. & Foxhall, L. E. (2005). Implementation of a smoking cessation counseling module in a preceptorship program. *Family Medicine 37*, 105-111.

O'malley, P. M. & Johnston, L. D. (2002). Epidemiology of alcohol and other drug use among American college students. *Journal of Studies on Alcohol Suppl. 14*, 23-39.

Palkin, V. V. (2005). [Risk factors in preconscripts and conscripts]. *Gigiena i Sanitariia*43-46.

Pbert, L., Moolchan, E. T., Muramoto, M., Winickoff, J. P., Curry, S., Lando, H., Ossip-Klein, D., Prokhorov, A. V., Difranza, J. & Klein, J. D. (2003). The state of office-based interventions for youth tobacco use. *Pediatrics 111*, e650-e660.

Perkins, H. W. (2002). Surveying the damage: A review of research on consequences of alcohol misuse in college populations. *Journal of Studies on Alcohol Suppl. 14*, 91-100.

Rollnick, S., Heather, N., Gold, R. & Hall, W. (1992). Development of a short "readiness to change" questionnaire for use in brief, opportunistic interventions among excessive drinkers. *British Journal of Addiction 87*, 743-754.

Russell, M. A. (1990). The nicotine addiction trap: a 40-year sentence for four cigarettes. *British Journal of Addiction 85*, 293-300.

Saitz, R. (2010). Alcohol screening and brief intervention in primary care: absence of evidence for efficacy in people with dependence or very heavy drinking. *Drug and Alcohol Review 29*, 631-640.

Saitz, R., Svikis, D., D'Onofrio, G., Kraemer, K. L. & Perl, H. (2006). Challenges applying alcohol brief intervention in diverse practice settings: populations, outcomes, and costs. *Alcoholism: Clinical and Experimental Research 30*, 332-338.

Sargent, J. D., Mott, L. A. & Stevens, M. (1998). Predictors of smoking cessation in adolescents. *Archives of Pediatrics and Adolescent Medicine 152*, 388-393.

Schei, E. & Sogaard, J. (1994). The impact of military service on young men's smoking behavior. *Preventive Medicine 23*, 242-248.

Schmid, H., Delgrande Jordan, M., Kuntsche, E., Kuendig, H. & Annaheim, B. (2007). Der Konsum psychoaktiver Substanzen von Schülerinnen und Schülern in der Schweiz - Ausgewählte Ergebnisse einer Studie, durchgeführt unter der Schirmherrschaft der Weltgesundheitsorganisation (WHO). Lausanne: Schweizerische Fachstelle für Alkohol- und andere Drogenprobleme (SFA).

Schulenberg, J. E. & Maggs, J. L. (2002). A developmental perspective on alcohol use and heavy drinking during adolescence and the transition to young adulthood. *Journal of Studies on Alcohol. Supplement 14*, 54-70.

Seneviratne, A., Fortini, C., Gaume, J. & Daeppen, J.-B. (2007). Intervention motivationnette breve multisubstances aupres des jeunes adultes. *Revue Médicale Suisse 3*, 1691-1694.

Silagy, C. & Stead, L. F. (2001). Physician advice for smoking cessation. *Cochrane Database Systematic Reviews (online)*CD000165.

Siliquini, R., Faggiano, F., Geninatti, S., Versino, E., Mitola, B. & Ippolito, R. (2001). Patterns of drug use among young men in Piedmont (Italy). *Drug and Alcohol Dependence 64*, 329-335.

SPSS Inc. (2010). *PASW Statistics Base 18.* Chicago, IL: SPSS Inc.

Suzuki, K., Takeda, A., Murakami, S., Yuzuriha, T., Hiezima, M., Yoshimori, C. & Fuzibayashi, T. (2003). [Brief intervention for smoking, problem drinking and drug abuse by high school students]. *Nihon Arukoru Yakubutsu Igakkai Zasshi 38*, 475-482.

Tait, R. J. & Hulse, G. K. (2003). A systematic review of the effectiveness of brief interventions with substance using adolescents by type of drug. *Drug and Alcohol Review 22*, 337-346.

Tevyaw, T. O. L. & Monti, P. M. (2004). Motivational enhancement and other brief interventions for adolescent substance abuse: foundations, applications and evaluations. *Addiction 99 Suppl 2*, 63-75.

Toumbourou, J. W. & Catalano, R. F. (2005). Predicting developmentally harmful substance use. In T. Stockwell, P. J. Gruenewald, J. W. Toumbourou & W. Loxley (Eds.), *Preventing Harmful Substance Use - The Evidence Base for Policy and Practice*, (pp. 53-66). Chichester, UK: John Wiley & Sons Ltd.

Toumbourou, J. W., Stockwell, T., Neighbors, C., Marlatt, G. A., Sturge, J. & Rehm, J. (2007). Interventions to reduce harm associated with adolescent substance use. *Lancet 369*, 1391-1401.

Vasilaki, E. I., Hosier, S. G. & Cox, W. M. (2006). The efficacy of motivational interviewing as a brief intervention for excessive drinking: a meta-analytic review. *Alcohol and Alcoholism 41*, 328-335.

Vik, P. W., Carrello, P., Tate, S. & Field, C. (2000). Progression of consequences among heavy-drinking college students. *Psychology of Addictive Behaviors 14*, 91-101.

Walker, D. D., Roffman, R. A., Stephens, R. S., Wakana, K., Berghuis, J. & Kim, W. (2006). Motivational enhancement therapy for adolescent marijuana users: a preliminary randomized controlled trial. *Journal of Consulting and Clinical Psychology 74*, 628-632.

Williams, E. C., Horton, N. J., Samet, J. H. & Saitz, R. (2007). Do brief measures of readiness to change predict alcohol consumption and consequences in primary care patients with unhealthy alcohol use? *Alcoholism: Clinical and Experimental Research 31*, 428-435.

Withnall, R., Eastaugh, J. & Freemantle, N. (2006). Do shock absorbing insoles in recruits undertaking high levels of physical activity reduce lower limb injury? A randomized controlled trial. *Journal of the Royal Society of Medicine 99*, 32-37.

World Health Organization (WHO) (2002). *Prevention of Psychofictive Substance Use - A Selected Review of What Works in the Area of Prevention.* Geneva: World Health Organization (WHO).

Appendix

Effectiveness of a brief integrative multiple substance use intervention among young men with and without booster sessions

Gerhard Gmel[1,2,3,4], Jacques Gaume[1], Nicolas Bertholet[1], Julien Flückiger[1], Jean-Bernard Daeppen[1]

1) Alcohol Treatment Centre, Lausanne University Hospital CHUV, Mont-Paisible 16, CH - 1011 Lausanne, Switzerland, Gerhard.Gmel@chuv.ch , Jacques.Gaume@chuv.ch , Nicolas.Bertholet@chuv.ch , julien.fluckiger@chuv.ch; Jean-Bernard.Daeppen@chuv.ch

2) Swiss Institute for the Prevention of Alcohol and Drug Problems, Case postale 870, CH - 1001 Lausanne, Switzerland

3) Centre for Addiction and Mental Health, 250 College St, Toronto, Ontario, M5T 1R8, Canada

4) University of the West of England, Frenchay Campus Coldharbour Lane, Bristol BS16 1QY, United Kingdom

Corresponding author and guarantor: G. Gmel; Alcohol Treatment Centre, Lausanne University Hospital CHUV, Mont-Paisible 16, CH-1011 Lausanne, Switzerland, gerhard.gmel@chuv.ch ; Tel.:++41 21 3147352; Fax: ++41 21 3140562

Submitted to Journal of Substance Abuse Treatment

Abstract

Brief motivational interventions on substance use commonly target a single drug. Multi-substance use interventions may be a more adequate reflection of multiple risk behaviors in adolescents and young adults. The effectiveness of a voluntary multi-substance use intervention among 19-year-old men and the incremental impact of randomized booster sessions were analyzed. Participants were enrolled during army conscription procedures, mandatory for about 98% of males in Switzerland. Results for 392 BMI subjects and 461 controls showed reductions in tobacco and cannabis use at six months and for mean alcohol use on ten of 12 measures. Effects were small and non-significant (except for cannabis use). Three-month booster sessions were not effective and the results were commonly in the wrong direction. The usefulness of targeting multi-substances during brief interventions depends on whether achieving small effects is acceptable, while the addition of booster sessions is probably not cost-effective and therefore is not recommended.

Key words:

Multiple substance use, brief intervention, young adults, tobacco, alcohol, cannabis

Introduction

Substance use of adolescents and young adults is an important and costly health problem (Rehm, Taylor, & Room, 2006). Brief Motivational Interviewing (BMI) has been shown to be one of the most cost-effective individual-centered approaches among strategies targeting substance use within the general population (Babor et al., 2010). BMI is an adaptation of Motivational Interviewing (Miller & Rollnick, 2002) used in short sessions of 20-60 minutes each (Rollnick, Heather, & Bell, 1992). The present study looks at the effectiveness of a multi-substance targeted brief intervention for 20-year-old men using an offered intervention on their alcohol, tobacco, and cannabis use.

Most BMI studies have addressed a single risk behavior like alcohol or tobacco use. This narrow approach has been criticized, since many individuals at risk for one of these behaviors are much more susceptible to other associated risk categories (Saitz, Svikis, D'Onofrio, Kraemer, & Perl, 2006). There is only limited research on interventions aimed at multiple risk behaviors, such as substance use, lack of physical activity and obesity in general (Coups, Gaba, & Orleans, 2004; Goldstein, Whitlock, & DePue, 2004). Recently, some promising results among adults entering health services were obtained in the SBIRT (screening, brief interventions, referral to treatment) study (Gryczynski et al., in press; Madras et al., 2009). The paucity of studies is surprising, because young individuals often use more than one legal or illegal drug, as shown in Switzerland within a comparable sample of 20-year-old men (Gmel et al., 2010). Although an MI-approach has been adapted to simultaneously target multiple drugs (McCambridge & Strang, 2003), there is little research on its efficacy or effectiveness when single sessions are integrated within BMI multi-substance interventions among adolescents and young adults.

McCambridge and Strang (2004) found support for staging generic multiple drug interventions among London college students, demonstrating reductions in cigarette, cannabis and alcohol use after three months. However, these effects were dramatically reduced and were no longer significant after 12 months (McCambridge & Strang, 2005). In a similar study in London colleges (Gray, McCambridge, & Strang, 2005) some effects for alcohol use were found. There were more attempts to quit in the intervention group of cigarette smokers, but no overall differences in smoking rates by the end of the study, and no effects on cannabis use. Werch et al. (2011; 2010) used a brief intervention based on the Behavior Image Model among university students and found beneficial effects (at 3 and 12 months) for physical activity and driving after drinking, but not for alcohol, cigarette or marihuana use. McCambridge and colleagues (2010) conducted a cluster randomized trial using universal, multiple substance use interventions in London college classes. They concluded that this strategy should not be further pursued because of its ineffectiveness. Overall, targeting young people simultaneously on more than one risk factor is appealing and theoretically more suitable in addressing the usage patterns common among young individuals, but little is known about its effectiveness. The present study should add to the existing sparse evidence.

Although there is not much justification to date for continuing multi-substance use BMI, there is some evidence regarding single-substance use addressed in the present study, i.e. alcohol, tobacco, and cannabis. A large number of meta-analyses show that brief interventions may have beneficial effects in reducing alcohol use in the adult population (e.g. Bertholet, Daeppen, Wietlisbach, Fleming, & Burnand, 2005; Kaner et al., 2007; Moyer, Finney, Swearingen, & Vergun, 2002). However, the literature concerning the efficacy and effectiveness of brief interventions for adolescents or young adults is mixed, and has been mostly conducted within samples of college students who often have been mandated to treatment for various types of violations (Barnett et al., 2004; Grenard, Ames, Pentz, & Sussman, 2006; Larimer & Cronce, 2007).

Some promising results for young individuals were found in research at hospital emergency departments (Bernstein et al., 2010; Magill, Barnett, Apodaca, Rohsenow, & Monti, 2009; Monti et al., 2007).

The efficacy of brief, minimal tobacco cessation interventions in the general adult population has been demonstrated in some meta-analyses over the last decade (Fiore et al., 2000; Silagy & Stead, 2001). Stead et al. (2008), as well as Lancaster and Stead (2005), found significant increases in smoking cessation with brief individual counseling or advice, whereas giving more extensive advice or adding follow-up visits had limited (if any) success. These findings were confirmed in a later meta-analysis by Lai et al. (2010). Although there is ample evidence for the effectiveness of intensive behavioral interventions, there is still not enough evidence to draw solid conclusions regarding the efficacy of minimal clinical interventions in general adult populations (Mottillo et al., 2009). Among adolescents and young adults, there is relatively little research on BMI, *per se*. Colby et al. (2005) documented MI as having benefits at 3 months, which then declined after six months. Similarly, Horn et al. (2007) found promising, but non-significant effects among teenagers. A Cochrane review (Grimshaw & Stanton, 2006) of tobacco cessation interventions for young people concluded that trials of brief interventions could still be considered useful, particularly since they were often used as control conditions in more complex intervention designs.

The literature on the effectiveness of cannabis use BMI among adolescents and young adults is scarcer. Another Cochrane review (Gates, McCambridge, Smith, & Foxcroft, 2006) found only one study of cannabis MI that was beneficial. McCambridge et al. (2008) found no added effect for MI over that gained by brief advice, but it did prove to be more promising for cannabis than it did for other drug use. Gray et al. (2005) found some effects for alcohol, weaker ones for tobacco, and none for cannabis. D'Amico et al. (2008) found significant cannabis use reduction and only a marginal tendency for reduced alcohol consumption (three months after BMI) among at-risk adolescents recruited in a primary care setting. Martin & Copeland (2008) found medium effects at their three-month follow-ups, and Bernstein et al. (2009) found beneficial effects in an Emergency Department study among 14-21 year-olds.

In summary, BMI research on substance use by young individuals is rare, limited to few settings, and has often shown only weak effects if any; nevertheless, findings have been interpreted as promising (Grenard et al., 2006; Larimer, Cronce, Lee, & Kilmer, 2004; Tevyaw & Monti, 2004; Toumbourou et al., 2007).

It has often been argued that the diminishing effects as a function of time between intervention and follow-up may be counteracted by providing booster sessions (e.g. Academic ED SBIRT Research Collaborative, 2010; McCambridge & Strang, 2005). However, enhancing brief interventions with boosters seemed to have very little additional effect on smoking, compared with brief advice or counseling that is more intensive (Lai et al., 2010; Lancaster & Stead, 2005; Stead et al., 2008). Booster sessions may additionally have some impact on reducing alcohol use among adults (Longabaugh et al., 2001; Mello et al., 2005), but there is a lack of evidence regarding substance use interventions among adolescents or young adults. For the few studies found, there were no sustained or increased effects of BMI resulting from booster sessions (Caudill et al., 2007). Some studies did build them into the research design, but failed to test for additional impact (Bernstein et al., 2009; D'Amico et al., 2008; Magill et al., 2009; Monti et al., 2007).

The aims of the present study were to evaluate a) the effectiveness (after 6 months) of a brief intervention simultaneously targeting multi-substance use behaviors, and b) to determine whether booster sessions (after 3 months) can increase the effectiveness of the intervention.

Methods

This study was undertaken as an effectiveness trial among young men voluntarily seeking an intervention. Conscripts were invited to a counseling session on tobacco, cannabis, and alcohol use lasting approximately 20 minutes. The object was not to systematically screen individuals and to provide counseling for those who were positive for at-risk use, but to test the effectiveness of preventive counseling offered to anyone who opted for it. Although this self-selection process may decrease internal validity, we believe that it increases external validity in "real life" voluntary preventive intervention.

Setting and participants

Switzerland has a mandatory two-day army recruitment process for all males at age 19, and virtually all non-institutionalized Swiss men of this age are called for conscription and complete the physical, medical and cognitive assessments to determine eligibility for service in the military. In Lausanne, around 190 individuals pass the recruitment procedures each week over about 46 weeks, thus approximately 8,700 recruits are processed each year. In the present study, individuals were enrolled between October 2008 and September 2009.

Groups consisting of 30 conscripts each were assigned by the army to move through the various medical, physical, and psychological assessments in different sequences. Time was arranged to conduct the trial during the 3 hours allotted for medical examinations (i.e. three sessions per day on two days per week). Conscripts had ample time to participate in trial activities during this segment, since the actual examination takes about 1.5 hours and the remainder is waiting time. The examination slot was used for proposing voluntarily participation in the study, randomly assigning intervention and control groups, conducting detailed assessments of substance use, substance use history and related problems in the groups, and for delivering BMI to the intervention group. Written informed consent was obtained from all intervention participants, and the study was approved by the Ethics Committee for Clinical Research of the Lausanne University Medical School (Protocol No. 15/07).

Intervention

The experimental condition consisted of BMI intended to reinforce motivation to change behavior, based on Rollnick and colleagues (Miller & Rollnick, 1991, 2002; 1992) and adapted by McCambridge & Strang (2003) for young persons using various substances. It involves exploring the use of tobacco, cannabis, alcohol and other substances by introducing and discussing behavior change perspectives in a non-judgmental, empathic and collaborative manner (Seneviratne, Fortini, Gaume, & Daeppen, 2007). BMI consisted of the following components to focus on the main problem(s) of each individual: a) establish a collaborative rapport to enable elicitation of multiple substance use; b) ensure confidentiality; c) ask permission to talk about behaviors; d) ask with open questions about substance use and focus on areas that the conscript considers problematic; d) explore pros and cons; f) reflect and affirm change talk and enhance values that might be incompatible with present substance use; g) explore the importance, confidence and readiness to change; h) evoke commitment to a change plan; and i) support the conscript's self-efficacy. Counselors received supervision throughout the whole project. To guarantee the integrity and quality of BMI delivery, the process included weekly individual supervision in which difficulties and challenges were discussed, and monthly joint supervision with two senior psychologists. Audiotapes of the interventions were reviewed and trainees were given feedback on various aspects of BMI (e.g. MI spirit, reflective listening techniques, eliciting change talk).

Booster sessions via telephone contact took place three months following BMI and lasted about 20 minutes. They were furnished for half of the initial experimental group. Each participant had his booster session conducted by the same counselor who provided the baseline BMI. Counselors could not be blinded to the objectives of the study since they had to refer to the objectives set during the intervention session to build on the initial BMI. MI style was used either to reinforce changes that had been made, or to reiterate the aims of BMI.

Randomization

Randomization to the BMI and control groups was done *a priori* before conscripts entered the army, precluding the possibility that counselors might influence randomization. Assignment to each condition was provided on generated "Randomization Sheets" for each three-hour medical examination block via a computerized randomization algorithm. Counselors got one sheet for every block of 30 recruits that assigned each of them to the assessment only or to the BMI-plus-assessment group. Then, counselors merely had to consult this list to identify those actually enrolled for counseling. This randomization could be done in advance because each of the 30 individuals in each block already had a number from 1 to 30 that was assigned by the army. Since the research group did not know *a priori*, who received which number, they remained blinded to the selection of any particular conscript.

Every sixth group of 30 individuals had psychological testing as an army procedure after the scheduled time for our study. Army psychologists were concerned that BMI might inadvertently influence the results of their testing; therefore, the conscripts in every sixth group were ineligible. The army randomly assigned those groups who could not participate.

Computer randomization to booster sessions was done after baseline among those who received an intervention. Due to time constraints, 30 individuals were excluded and could not get the intervention and thus were not randomized to either receive a booster or not.

Outcomes and data collection

Baseline data was collected by the counselors before the intervention with a standardized questionnaire lasting about 15 minutes. Two psychologists who did not provide BMI conducted follow-up telephone interviews six months after baseline assessment. They were blinded to baseline data and randomization status, and were trained to conduct computer-assisted telephone interviewing. When the interview was finished a prompt on the monitor informed them whether that participant belonged to the control group (waiting list for BMI) and should be forwarded to the BMI counselors. This protocol guaranteed blinding to an individual's condition or group assignment during follow-up data collection. All questions at baseline and at follow-up referred to a timeframe of six months.

Smoking: Participants were first asked whether they smoked, even occasionally. They could make a distinction between regular (daily), occasional (non-daily), former smoking, or never smoking. Smokers in the past 6 months were asked about the number of cigarettes used. Regular smokers were asked about their daily number of cigarettes, and occasional smokers about the number of cigarettes on days when they smoked. Since quantities may differ for occasional smokers who become regular smokers and vice versa, we additionally evaluated the change in number of cigarettes among consistent regular smokers at both baseline and at follow-up. At-risk smoking was defined as daily smoking.

Cannabis use: Questions started with lifetime use. Frequency of use in the past six months among lifetime users had the categories of "never", "once a month or less often" (coded as 0.5 days per month), "2-3 times a month" (coded 2.5 days per month), "2-3 times a week" (coded 10 days a month), and "4 times or more often a week" (coded 20 days a month). Changes in use days were estimated for the total sample (with non-users coded 0) and for consistent (both at baseline and at follow-up) cannabis users. At-risk cannabis use was defined as at least twice a week.

Alcohol use: Volume of usual alcohol use was assessed with a quantity-frequency instrument. Frequency of alcohol use (in days) was asked for weekly alcohol users in an open-ended question, while non-weekly users were given the closed-ended choices of "2-3 times a month" (coded 0.58 days per week, i.e. 2.5*12 months/52 weeks), or "once a month or less often" (coded 0.12 days a week). Quantity was asked in an open-ended question for the number of standard drinks consumed on days when drinking. Pictures of different kinds of standard drinks containing around 10-12 grams of pure alcohol were provided. Number of days was multiplied with the usual number of drinks on drinking days. Volume of at-risk drinking was defined as more than 21 drinks per week.

The monthly frequency of risky single occasion drinking (RSOD, or occasions with at least 6 standard drinks) was also assessed. At risk for RSOD was defined as having at least 2 such occasions per month.

Socio-demographics: Age, education and living environment were measured.

Sample Size

Sample size calculations were based on smoking, which commonly had lower effect sizes compared with alcohol, while information for cannabis was insufficient. Reviews (Lancaster & Stead, 2004, 2005) and overviews (Humair & Cornuz, 2005) generally point to odds ratios around 2.0 for various effects in adult populations. Similar odds ratios have been found among adolescents and young adults (Hollis et al., 2005; Kentala, Utriainen, Pahkala, & Mattila, 1999). Assuming statistical power of 80%, standard significance level at 5% and odds ratios of 2.0, 199 individuals per group for the treatment versus control comparison would be needed.

Consumption reduction has been studied mainly in nicotine replacement therapies, where a 50% decrease in cigarette smoking has been achieved for 6-35% of smokers (Bolliger et al., 2000; Etter, Laszlo, Zellweger, Perrot, & Perneger, 2002; Wennike et al., 2003). In a pilot study, recruits smoked 11.5 cigarettes (SD=8.5) daily, on average. Assuming an intermediate percentage of 20% of smokers who reduce consumption by 25%, with the rest reducing it by 10%, the result would be an average reduction of 1.5 to 10 cigarettes per day in the control group. To demonstrate this reduction with the standard parameters ($p = .05$, power = 0.80) a sample size of 256 per group would be needed, under the conservative assumption that the standard deviation for the difference measure in a matched paired test is the same as in the baseline (SD=8.5).

Statistical analysis

Attrition was evaluated with Analysis of Variance (ANOVA) for continuous variables, and logistic regressions with a likelihood ratio test for the main effect model (cases/controls and attrition/non-attrition) versus the additional interaction between attrition and cases/controls to test for differential effects of attrition among cases and controls. Effectiveness was assessed with logistic regressions for dichotomous and linear regressions for continuous variables. The models were adjusted for demography and baseline use.

Results

Baseline, attrition analyses, and sample characteristics

Among the 8,419 conscripts present in recruitment center during study inclusion, 1,640 had left the center before encountering the research staff, 2,012 were ineligible due to army constraints as explained above, and 4,767 were eligible for participation in the proposed study (Figure 1). Of the eligible, 1,052 (22.1%) were interested in voluntarily receiving BMI. A number of these were consequently lost, due to priority military assessment (n=157) or lack of time or space for conducting assessment and BMI (n=21). Twenty-one more were dropped because they refused the follow-up at six months. This resulted in 853 conscripts randomized into intervention (n=392) and control (n=461) groups. The imbalance occurred because on some days more individuals came for an intervention than could be accommodated, and due to a "first come, first served" protocol, those remaining were assigned to be controls. Thirty more could not get BMI due to time constraints and had to leave to participate in other army procedures, and were subsequently excluded from the analyses.

After three months, BMI booster sessions were delivered by telephone to the randomized half (n=192) who received BMI at baseline. After six months, follow-up telephone interviews were conducted. With an average attrition rate of 20.4%, the final sample size at follow-up consisted of one intervention group with boosters (n=145), one intervention group without boosters (n=143), and one control group volunteering for BMI but receiving assessment only (n=384).

Figure 1 about here

Except for controls coming more often from rural areas and higher cannabis frequencies among the controls that used it, baseline equivalence was achieved (Table 1). More than 37% were daily smokers, more than 16% were at-risk cannabis users and more than 55% were at risk for RSOD. Nearly all of those at risk for either alcohol volume or RSOD were at risk for RSOD. Most of the participants were alcohol users, thus analyses of drinkers versus abstainers were dropped.

Table 1 about here

With the exception of number of days with cannabis use (significant) and number of RSODs (borderline), there were no significant differences between trial attritors and non-attritors, and there were no differences between cases and controls (see interaction analysis; table 2).

Table 2 about here

Outcome analysis

With the exception of at-risk for RSOD and number of occasions of RSOD, all of the effects of the intervention on outcomes, though not significant, showed decreases in substance use (or at least smaller increases) compared with controls having no intervention (Table 3). Cannabis use in the past 6 months did reach significance.

Table 3 about here

Ancillary analysis: booster sessions

For those who received the intervention, none of the comparisons between those receiving a booster and those who did not was significant. Risk of volume drinking (p=.20) in the fully adjusted model was the nearest to $p < .05$ of all the effects, and only 3 of the 12 regression coefficients were in the direction favoring the effectiveness of the boosters (Table 4).

Table 4 about here

Discussion

The present study is one of the few to target multiple drug use behaviors, in contrast to concentrating on single substances as is common in most of the brief intervention designs. It was thought that this would help address the problem behaviors of young men, who by virtue of being at risk for any single substance are also more susceptible to other associated risks (Saitz et al., 2006). Like many of the other reports on brief interventions among adolescents and young adults, this one yielded promising results that tend to go in the desired direction, but yielded small effects that were usually not significant (Grenard et al., 2006; Larimer et al., 2004; Tevyaw & Monti, 2004; Toumbourou et al., 2007). This study is unique in several ways, making it difficult to compare with other studies. First, it has the advantage of being in Switzerland, where mandatory recruitment procedures are in place for virtually the whole population of 19-year-old males. Unlike samples of college students elsewhere, there is no inherent social selection bias built into the recruitment center population. Second, studies with interventions that have multiple substance targets are still rare (however, see e.g. Gray et al., 2005; McCambridge & Strang, 2004; Werch et al., 2011; Werch et al., 2010). Third, to our knowledge there are only a handful of BMI substance use studies designed exclusively for adolescents and young adults.

There are two main findings for the present study. First, cannabis use was the only significant effect from BMI. Risky single occasion drinking (RSOD) is an exception, but all the other effects of intervention were in the desired direction (i.e. decreased substance use) although statistically not significant. Second, including booster sessions did not seem to strengthen the results in positive ways, and had a tendency to run in the wrong direction, i.e. towards increases in substance use. A positive feature of this research is that BMI does not appear to cause any harm, and it shows that many young men will actually seek intervention or treatment when it is offered on a voluntary basis in a non-threatening environment. Regarding statistical significance (or lack of), this becomes a question of cost-to-benefits ratios which can be evaluated in terms of how many of the participants derived some good from the intervention, as opposed to no action. There are generally few effective brief individual interventions among adolescents and young adults (Foxcroft, Ireland, Lister-Sharp, Lowe, & Breen, 2002; Gates et al., 2006; Toumbourou et al., 2007), so it has to be decided if the interventions are worth the effort needed to achieve small gains. One negative side of this study is the finding that most of the desired effects were non-significant, and in the case of one of the main risk factors in this age group, i.e. RSO drinking (Rehm et al., 2006), ran counter to the expected direction.

Under these circumstances, it would more economical to discontinue booster sessions, despite the intuitive appeal and belief that they add to the overall effectiveness of the main intervention. Several factors may explain the failure of boosters to have the impact one might expect. It may be that individuals voluntarily using an offered intervention are bothered by the fact that they were contacted again for another intervention, without initiating the request for it themselves. The psychological reactance theory literature provides one explanation for why subjects may participate and cooperate fully in the beginning (i.e. in the

main intervention they requested) but change their minds when they perceive a threat to their freedom of choice (Brehm & Cole, 1966; Brehm & Brehm, 1981). The disappointing results from the booster sessions would be consistent with the psychological reactance reported among young adults after exposure to certain alcohol prevention messages (Bensley & Wu, 1991). In particular, heavy-drinking young males can react negatively to suggestions that they reduce their consumption, and indeed often end up drinking significantly more. Within the adult population, there is not much convincing evidence that booster sessions or additional brief counseling that is more intensive add to the effectiveness of single sessions. There is some evidence that these strategies may increase effectiveness in tobacco intervention (Lai et al., 2010; Lancaster & Stead, 2005; Stead et al., 2008) and alcohol use in emergency room studies (Longabaugh et al., 2001; Mello et al., 2005), but there is generally a dearth of research on cannabis interventions, and very little data regarding booster sessions among young individuals.

Another possible explanation for the small effect sizes in the outcome variables is that those who voluntarily use the offer for an intervention are often heavier users, and a brief intervention might not be intensive enough. It has been argued in the alcohol literature that BMI is less effective on heavy drinkers (Moyer et al., 2002). Saitz and colleagues (2009) found that BMI was not significantly associated with fewer drinks per day among alcohol-dependent subjects, whereas it was for those with unhealthy alcohol use without dependence. In most of the screening and brief intervention studies, individuals with severe alcohol use are typically excluded, thus there is no clear evidence of the success or failure of brief intervention on this class of drinkers (Saitz, 2010). Interestingly, in a sample comparable to that in the present study, effectiveness for alcohol outcomes depended on whether participants were actively seeking intervention or were randomly selected (Daeppen et al., 2011; Gaume, Gmel, Faouzi, Bertholet, & Daeppen, in press). One conclusion from this study is that successful strategies might require systematic screening and suggesting BMI to those who may not think they need it. However, this would reduce the scope of intervention and make it less overarching, since systematic screening is costlier and more difficult to implement outside of more controlled settings, as found in schools or in primary health care milieus. Funding could also a problem when setting up new sites and staffing outside of (already) funded projects. Another observation is that is easier to attract candidates for BMI in some situations than it is in others. For example, some of the most encouraging results were obtained in emergency department studies (Monti et al., 2007, Magill et al., 2009, Bernstein et al., 2010), where self-harm as a consequence of substance use may increase the feeling of urgency to get help, and perhaps enhance the effectiveness of brief interventions.

It may also be that a multi-targeted brief intervention of such short duration (about 20 minutes) is too superficial to sufficiently address multiple problematic substance use. Brief interventions might need to focus more narrowly on single substances. McCambridge and colleagues (2010) came to this conclusion when they decided to stop pursuing the “universal” approach to brief multiple substance use interventions in London colleges.

In conclusion, the current strategy tested herein does not appear to be very promising overall (although it does not seem harmful). Findings suggest that rather than pursuing this intervention model, future research should probably either increase the intensity of single counseling sessions for multiple substance use or implement the use of systematic screening in the attempt to enroll individuals at risk. This entails the process of first convincing at-risk individuals who are not fully aware of the severity of their problems with substances that they might be able to benefit from intervention. This increases the research burden and expenses, and makes BMI (as a universal tool for preventing adolescent and young adult substance misuse) less practical and less attractive than was first thought.

References

Academic ED SBIRT Research Collaborative. (2010). The impact of screening, brief intervention and referral for treatment in emergency department patients' alcohol use: a 3-, 6- and 12-month follow-up. *Alcohol and Alcoholism, 45*(6), 514-519.

Babor, T. F., Caetano, R., Casswell, S., Edwards, G., Giesbrecht, N., Graham, K., et al. (2010). *Alcohol : No Ordinary Commodity: Research and Public Policy*. Oxford: Oxford University Press.

Barnett, N. P., Tevyaw, T. O., Fromme, K., Borsari, B., Carey, K. B., Corbin, W. R., et al. (2004). Brief alcohol interventions with mandated or adjudicated college students. *Alcoholism: Clinical and Experimental Research, 28*(6), 966-975.

Bensley, L. & Wu, R. (1991). The role of psychological reactance in drinking - following alcohol prevention messages. *Journal of Applied Social Psychology, 21*(13), 1111-1124.

Bernstein, E., Edwards, E., Dorfman, D., Heeren, T., Bliss, C., & Bernstein, J. (2009). Screening and brief intervention to reduce marijuana use among youth and young adults in a pediatric emergency department. *Academic Emergency Medicine, 16*(11), 1174-1185.

Bernstein, J., Heeren, T., Edward, E., Dorfman, D., Bliss, C., Winter, M., et al. (2010). A brief motivational interview in a pediatric emergency department, plus 10-day telephone follow-up, increases attempts to quit drinking among youth and young adults who screen positive for problematic drinking. *Academic Emergency Medicine, 17*(8), 890-902.

Bertholet, N., Daeppen, J.-B., Wietlisbach, V., Fleming, M., & Burnand, B. (2005). Reduction of alcohol consumption by brief alcohol intervention in primary care: systematic review and meta-analysis. *Archives of Internal Medicine, 165*(9), 986-995.

Bolliger, C. T., Zellweger, J.-P., Danielsson, T., van Biljon, X., Robidou, A., Westin, Å., et al. (2000). Smoking reduction with oral nicotine inhalers: double blind, randomised clinical trial of efficacy and safety. *British Medical Journal, 321*(7257), 329-333.

Brehm, J. W. & Cole, A. H. (1966). Effect of a favor which reduces freedom. *Journal of Personality and Social Psychology, 3*(4), 420-426.

Brehm, S. S. & Brehm, J. W. (1981). *Psychological Reactance: A Theory of Freedom and Control*. New York: Academic Press.

Caudill, B. D., Luckey, B., Crosse, S. B., Blane, H. T., Ginexi, E. M., & Campbell, B. (2007). Alcohol risk-reduction skills training in a national fraternity: a randomized intervention trial with longitudinal intent-to-treat analysis. *Journal of Studies on Alcohol and Drugs, 68*(3), 399-409.

Colby, S. M., Monti, P. M., O'Leary Tevyaw, T., Barnett, N. P., Spirito, A., Rohsenow, D. J., et al. (2005). Brief motivational intervention for adolescent smokers in medical settings. *Addictive Behaviors, 30*(5), 865-874.

Coups, E. J., Gaba, A., & Orleans, C. T. (2004). Physician screening for multiple behavioral health risk factors. *American Journal of Preventive Medicine, 27*(2 Suppl), 34-41.

D'Amico, E. J., Miles, J. N., Stern, S. A., & Meredith, L. S. (2008). Brief motivational interviewing for teens at risk of substance use consequences: a randomized pilot study in a primary care clinic. *Journal of Substance Abuse Treatment, 35*(1), 53-61.

Daeppen, J.-B., Bertholet, N., Gaume, J., Fortini, C., Faouzi, M., & Gmel, G. (2011). Efficacy of brief motivational intervention in reducing binge drinking in young men: A randomized controlled trial. *Drug and Alcohol Dependence, 113*(1), 69-75.

Etter, J.-F., Laszlo, E. R. N., Zellweger, J.-P., Perrot, C., & Perneger, T. V. (2002). Nicotine replacement to reduce cigarette consumption in smokers who are unwilling to quit: a randomized trial. *Journal of Clinical Psychopharmacology, 22*(5), 487-495.

Fiore, M. C., Bailey, W. C., Cohen, S. J., Dorfman, S. F., Goldstein, M. G., Gritz, E. R., et al. (2000). Treating Tobacco Use and Dependence. Clinical Practice Guidline Retrieved 31.01.2011, from http://www.surgeongeneral.gov/tobacco/treating_tobacco_use.pdf

Foxcroft, D. R., Ireland, D., Lister-Sharp, D. J., Lowe, G., & Breen, R. (2002). Primary prevention for alcohol misuse in young people. *Cochrane Database Systematic Reviews (online)*(3), CD003024.

Gates, S., McCambridge, J., Smith, L. A., & Foxcroft, D. R. (2006). Interventions for prevention of drug use by young people delivered in non-school settings. *Cochrane Database of Systematic Reviews*(1), CD005030.

Gaume, J., Gmel, G., Faouzi, M., Bertholet, N., & Daeppen, J.-B. (in press). Is brief motivational intervention effective in reducing alcohol use among young men voluntarily receiving it? A randomized controlled trial. *Alcoholism: Clinical and Experimental Research*.

Gmel, G., Gaume, J., Willi, C., Michaud, P.-A., Cornuz, J., & Daeppen, J.-B. (2010). Challenging the "inoffensiveness" of regular cannabis use by its associations with other current risky substance use--a census of 20-year-old Swiss men. *International Journal of Environmental Research and Public Health, 7*(1), 46-59.

Goldstein, M. G., Whitlock, E. P., & DePue, J. (2004). Multiple behavioral risk factor interventions in primary care. Summary of research evidence. *American Journal of Preventive Medicine, 27*(2 Suppl), 61-79.

Gray, E., McCambridge, J., & Strang, J. (2005). The effectiveness of motivational interviewing delivered by youth workers in reducing drinking, cigarette and cannabis smoking among young people: quasi-experimental pilot study. *Alcohol and Alcoholism, 40*(6), 535-539.

Grenard, J. L., Ames, S. L., Pentz, M. A., & Sussman, S. (2006). Motivational interviewing with adolescents and young adults for drug-related problems. *International Journal of Adolescent Medicine and Health, 18*(1), 53-67.

Grimshaw, G. M. & Stanton, A. (2006). Tobacco cessation interventions for young people. *Cochrane Database Systematic Reviews (online)*(4), CD003289.

Gryczynski, J., Mitchell, S. G., Petersonb, T. R., Gonzales, A., Moseley, A., & Schwartz, R. P. (in press). The relationship between services delivered and substance use outcomes in New Mexico's Screening, Brief Intervention, Referral and Treatment (SBIRT) Initiative. *Drug and Alcohol Dependence*.

Hollis, J. F., Polen, M. R., Whitlock, E. P., Lichtenstein, E., Mullooly, J. P., Velicer, W. F., et al. (2005). Teen reach: outcomes from a randomized, controlled trial of a tobacco reduction program for teens seen in primary medical care. *Pediatrics, 115*(4), 981-989.

Horn, K., Dino, G., Hamilton, C., & Noerachmanto, N. (2007). Efficacy of an emergency department-based motivational teenage smoking intervention. *Preventing Chronic Disease, 4*(1), A08.

Humair, J.-P. & Cornuz, J. (2005). *Désaccoutumance au tabac. Document de référence pour les médecins*. Berne/Bâle: "Vivre sans tabac".

Kaner, E. F., Beyer, F., Dickinson, H. O., Pienaar, E., Campbell, F., Schlesinger, C., et al. (2007). Effectiveness of brief alcohol interventions in primary care populations. *Cochrane Database of Systematic Reviews*(2), CD004148.

Kentala, J., Utriainen, P., Pahkala, K., & Mattila, K. (1999). Can brief intervention through community dental care have an effect on adolescent smoking? *Preventive Medicine, 29*(2), 107-111.

Lai, D. T., Cahill, K., Qin, Y., & Tang, J. L. (2010). Motivational interviewing for smoking cessation. *Cochrane Database of Systematic Reviews*(1), CD006936.

Lancaster, T. & Stead, L. F. (2004). Physician advice for smoking cessation. *Cochrane Database of Systematic Reviews (online)*(4), CD000165.

Lancaster, T. & Stead, L. F. (2005). Individual behavioural counselling for smoking cessation. *Cochrane Database of Systematic Reviews (online)*(2), CD001292.

Larimer, M. E. & Cronce, J. M. (2007). Identification, prevention, and treatment revisited: individual-focused college drinking prevention strategies 1999-2006. *Addictive Behaviors, 32*(11), 2439-2468.

Larimer, M. E., Cronce, J. M., Lee, C. M., & Kilmer, J. R. (2004). Brief intervention in college settings. *Alcohol Research and Health, 28*(2), 94-104.

Longabaugh, R., Woolard, R. F., Nirenberg, T. D., Minugh, A. P., Becker, B., Clifford, P. R., et al. (2001). Evaluating the effects of a brief motivational intervention for injured drinkers in the emergency department. *Journal of Studies on Alcohol, 62*(6), 806-816.

Madras, B. K., Compton, W. M., Avula, D., Stegbauer, T., Stein, J. B., & Clark, H. W. (2009). Screening, brief interventions, referral to treatment (SBIRT) for illicit drug and alcohol use at multiple healthcare sites: comparison at intake and 6 months later. *Drug and Alcohol Dependence, 99*(1-3), 280-295.

Magill, M., Barnett, N. P., Apodaca, T. R., Rohsenow, D. J., & Monti, P. M. (2009). The role of marijuana use in brief motivational intervention with young adult drinkers treated in an emergency department. *Journal of Studies on Alcohol and Drugs, 70*(3), 409-413.

Martin, G. & Copeland, J. (2008). The adolescent cannabis check-up: randomized trial of a brief intervention for young cannabis users. *Journal of Substance Abuse Treatment, 34*(4), 407-414.

McCambridge, J., Hunt, C., Jenkins, R. J., & Strang, J. (2010). Cluster randomised trial of the effectiveness of Motivational Interviewing for universal prevention. *Drug and Alcohol Dependence, 114*(2-3), 177-184.

McCambridge, J., Slym, R. L., & Strang, J. (2008). Randomized controlled trial of motivational interviewing compared with drug information and advice for early intervention among young cannabis users. *Addiction, 103*(11), 1809-1818.

McCambridge, J. & Strang, J. (2003). Development of a structured generic drug intervention model for public health purposes: a brief application of motivational interviewing with young people. *Drug and Alcohol Review, 22*(4), 391-399.

McCambridge, J. & Strang, J. (2004). The efficacy of single-session motivational interviewing in reducing drug consumption and perceptions of drug-related risk and harm among young people: results from a multi-site cluster randomized trial. *Addiction, 99*(1), 39-52.

McCambridge, J. & Strang, J. (2005). Deterioration over time in effect of Motivational Interviewing in reducing drug consumption and related risk among young people. *Addiction, 100*(4), 470-478.

Mello, M. J., Nirenberg, T. D., Longabaugh, R., Woolard, R. F., Minugh, A. P., Becker, B., et al. (2005). Emergency department brief motivational interventions for alcohol with motor vehicle crash patients. *Annals of Emergency Medicine, 45*(6), 620-625.

Miller, W. R. & Rollnick, S. (1991). *Motivational Interviewing: Preparing People to Change Addictive Behavior*. New York, NY: Guilford Press.

Miller, W. R. & Rollnick, S. (2002). *Motivational Interviewing: Preparing People for Change* (2 ed.). New York, NY: Guilford Press.

Monti, P. M., Barnett, N. P., Colby, S. M., Gwaltney, C. J., Spirito, A., Rohsenow, D. J., et al. (2007). Motivational interviewing versus feedback only in emergency care for young adult problem drinking. *Addiction, 102*(8), 1234-1243.

Mottillo, S., Filion, K. B., Belisle, P., Joseph, L., Gervais, A., O'Loughlin, J., et al. (2009). Behavioural interventions for smoking cessation: a meta-analysis of randomized controlled trials. *European Heart Journal, 30*(6), 718-730.

Moyer, A., Finney, J. W., Swearingen, C. E., & Vergun, P. (2002). Brief interventions for alcohol problems: a meta-analytic review of controlled investigations in treatment-seeking and non-treatment-seeking populations. *Addiction, 97*(3), 279-292.

Rehm, J., Taylor, B., & Room, R. (2006). Global burden of disease from alcohol, illicit drugs and tobacco. *Drug and Alcohol Review, 25*(6), 503-513.

Rollnick, S., Heather, N., & Bell, A. (1992). Negotiating behaviour change in medical settings: the development of brief motivational interviewing. *Journal of Mental Health, 1*, 25-37.

Saitz, R. (2010). Alcohol screening and brief intervention in primary care: absence of evidence for efficacy in people with dependence or very heavy drinking. *Drug and Alcohol Review, 29*(6), 631-640.

Saitz, R., Palfai, T. P., Cheng, D. M., Horton, N. J., Dukes, K., Kraemer, K. L., et al. (2009). Some medical inpatients with unhealthy alcohol use may benefit from brief intervention. *Journal of Studies on Alcohol and Drugs, 70*(3), 426-435.

Saitz, R., Svikis, D., D'Onofrio, G., Kraemer, K. L., & Perl, H. (2006). Challenges applying alcohol brief intervention in diverse practice settings: populations, outcomes, and costs. *Alcoholism: Clinical and Experimental Research, 30*(2), 332-338.

Seneviratne, A., Fortini, C., Gaume, J., & Daeppen, J.-B. (2007). Intervention motivationnette breve multisubstances aupres des jeunes adultes. [

A brief motivational intervention targeting multi-risk behaviours among young people]. *Revue Médicale Suisse, 3*(118), 1691-1694.

Silagy, C. & Stead, L. F. (2001). Physician advice for smoking cessation. *Cochrane Database Systematic Reviews (online)*(2), CD000165.

Stead, L. F., Bergson, G., & Lancaster, T. (2008). Physician advice for smoking cessation. *Cochrane Database Syst Rev*(2), CD000165.

Tevyaw, T. O. L. & Monti, P. M. (2004). Motivational enhancement and other brief interventions for adolescent substance abuse: foundations, applications and evaluations. *Addiction, 99 Suppl 2*, 63-75.

Toumbourou, J. W., Stockwell, T., Neighbors, C., Marlatt, G. A., Sturge, J., & Rehm, J. (2007). Interventions to reduce harm associated with adolescent substance use. *Lancet, 369*(9570), 1391-1401.

Wennike, P., Danielsson, T., Landfeldt, B., Westin, Å., Tonnesen, P., Wennike, P., et al. (2003). Smoking reduction promotes smoking cessation: results from a double blind, randomized, placebo-controlled trial of nicotine gum with 2-year follow-up. *Addiction, 98*(10), 1395-1402.

Werch, C. E., Bian, H., Carlson, J. M., Moore, M. J., Diclemente, C. C., Huang, I. C., et al. (2011). Brief integrative multiple behavior intervention effects and mediators for adolescents. *J Behav Med, 34*(1), 3-12.

Werch, C. E., Moore, M. J., Bian, H., DiClemente, C. C., Huang, I. C., Ames, S. C., et al. (2010). Are effects from a brief multiple behavior intervention for college students sustained over time? *Prev Med, 50*(1-2), 30-34.

Table 1: Baseline comparison of cases and controls

		Scale level	Controls (n=461)	Cases (n=362)	Test value	p-value
Smoking	% past 6 months smoking, total sample	1	54.5	54.4	0.000	0.994
	% at risk for daily smoking, total sample	1	37.3	37.9	0.025	0.875
	number of cigarettes per smoking day, total sample	0	5.8	5.4	0.636	0.425
	number of cigarettes per smoking day, regular smokers only	0	13.7	12.3	3.106	0.079
Cannabis use	% Cannabis users past 6 months, total sample	1	44.3	48.1	1.188	0.276
	at risk (> once a week) use, total sample	1	18.9	15.8	1.373	0.241
	number of days with cannabis use per month, total sample	0	3.9	3.4	1.205	0.273
	number of days with cannabis use per month, cannabis users only	0	8.9	7.0	3.939	0.048
Alcohol	% drinkers past 6 months, total sample	1	95.9	96.7	0.379	0.538
	% risk volume (> 21 drinks/week), total sample	1	9.2	9.2	<0.001	0.996
	% risk RSOD (> once a month), total sample	1	55.5	55.0	0.026	0.873
	% at risk (either volume or binge), total sample	1	57.1	55.3	0.264	0.607
	number of drinks per week, total sample	0	9.5	9.6	0.034	0.853
	number of RSODs per month, total sample	0	3.0	2.9	0.142	0.706
Socio-demography						
Education	mandatory (9 years of schooling)	1	41.2	40.1	3.804	0.149
	apprenticeship, professional school		33.8	29.3		
	high school preparing for eligibility for universities		24.9	30.7		
residency	% rural (vs. urban)	1	55.1	47.0	5.374	0.020
age	Age	0	20.0	20.2	2.283	0.131

Remarks: *Scale levels for variables coded 1 are for categorical variables, with test-values being Chi-squared values, scale levels coded 0 are variable means and tests are mean comparisons of continuous variables with test-values being F-values (ANOVA)*

Values in the columns "Cases/Controls" are means for continuous variables and percentages for categorical variables

Table 2: Differential effects of sample attrition on cases and controls, baseline measures

							Multivariate tests (logistic regression or ANOVA)			
			Controls		*Cases*		*Test attrition versus non-attrition*		*Test Interaction*	
	Scale level		**Attrition**	**Non-attrition**	**Attrition**	**Non-attrition**	**Test value**	**p-value**	**Test value**	**p-value**
Attrition		N	77.0	384.0	74.0	288.0				
		%	16.7	83.3	20.4	79.6				
Smoking	1	% past 6 months smoking, total sample	50.7	55.2	59.5	53.1	1.201	0.464	0.643	0.226
	1	% at risk for daily smoking, total sample	33.8	38.0	44.6	36.1	1.203	0.481	0.584	0.148
	0	number of cigarettes per day, total sample	5.5	5.9	5.9	5.2	0.060	0.810	0.570	0.450
	0	number of cigarettes per day, daily smokers only	14.3	13.6	10.9	12.8	0.300	0.584	1.697	0.194
Cannabis use	1	% cannabis users past 6 months, total sample	42.9	44.5	55.4	46.2	1.070	0.787	0.645	0.228
	1	at risk (> once a week) use	19.5	18.8	23.0	13.9	0.954	0.881	0.567	0.210
	0	number of days with cannabis use per month, total sample	4.3	3.9	5.3	2.8	4.740	0.030	2.390	0.123
	0	number of days with cannabis use per month, cannabis users only	10.0	8.7	9.6	6.2	3.986	0.047	0.803	0.371
Alcohol	1	% risk volume (> 21 drinks/week), total sample	12.0	8.9	9.6	9.4	0.696	0.366	1.365	0.605
	1	% risk RSOD (> once a month), total sample	57.1	55.2	67.6	51.7	0.924	0.755	0.557	0.116
	0	number of drinks per week, total sample	9.6	9.5	10.9	9.3	0.490	0.486	0.350	0.556
	0	number of RSODs per week, total sample	3.6	2.9	3.5	2.8	3.750	0.053	0.020	0.887
Socio-demography										
education	1	mandatory (9 years of schooling)	29.9	43.0	25.7	42.4	3.659	0.160	1.505	0.471
		apprenticeship, professional school	24.7	30.5	27.0	24.0				
		high school preparing for eligibility for universities	45.5	26.6	47.3	33.7				
residency		% rural (vs. urban)	49.4	56.3	44.6	47.6	1.320	0.268	0.854	0.664
age	0	Age	20.3	20.0	20.2	20.2	1.370	0.242	1.644	0.200

Remarks: *Scale level coded 1 are for categorical variables, with test-values being Chi-square (log likelihood-ratio tests), scale level coded 0 are mean comparisons of continuous variables with ANOVA and test-values being F-values*
Values for columns "cases/controls" are means for continuous variables and percentages for categorical variables

Table 3: Effectiveness of Intervention on outcomes on follow-up measures, adjusted for baseline measures

Outcomes			Controls (%/means)*		Cases (%/means)*		Regression on follow-up values adjusted for baseline values: baseline adjustment only			Regression on follow-up values adjusted for baseline values: fully baseline adjusted**		
		scale level	baseline	Follow-up	baseline	Follow-up	coeff.	SE	p	coeff.	SE	p
Smoking	past 6 months smoking, total sample	1	55.2%	52.9%	53.1%	49.3%	-.177	.239	.459	-.169	.242	.486
	at risk smoking (daily), total sample	1	38.0%	39.6%	36.1%	35.4%	-.336	.267	.208	-.297	.271	.272
	number of cigarettes, total sample	0	5.9	6.2	5.2	5.2	-.446	.341	.191	-.423	.344	.220
	number of cigarettes among consistent daily smokers	0	14.2	15.0	13.2	12.9	-1.154	.640	.073	-1.044	.656	.113
Cannabis use	6 months cannabis use, total sample	1	44.5%	38.6%	46.2%	33.7%	-.507	.224	.024	-.566	.228	.013
	at risk (> once a week) use, total sample	1	18.8%	19.8%	13.9%	14.6%	-.260	.340	.445	-.239	.349	.493
	number of days with cannabis use per month, total sample	0	3.9	4.3	2.8	2.9	-.520	.336	.122	-.538	.339	.113
	number of days with cannabis use per month, consistent users	0	10.6	12.0	8.5	9.3	-1.260	.911	.168	-.900	.944	.342
Alcohol use	risk volume (> 21 drinks/week), total sample	1	8.9%	8.6%	9.4%	8.0%	-.125	.303	.680	-.084	.308	.784
	risk RSOD (> once a month), total sample	1	55.2%	49.3%	51.7%	48.6%	.071	.180	.693	.106	.182	.559
	number of drinks per week, total sample	0	9.5	9.4	9.3	8.8	-.527	.752	.484	-.370	.759	.627
	number of RSODs per week, total sample	0	2.9	2.4	2.8	2.4	.029	.216	.893	.064	.218	.769

Remarks: *Scale level coded 1 are for categorical variables and 0 for dichotomous outcomes; coeff. being regression coefficients from logistic regressions(scale level coded 0) and from linear regressions (scale level coded 1); intervention: coded 1= intervention and 0=no intervention*

** values are percentages for categorical variables and means for continuous variables*

*** additional to baseline adjustment, adjustment for age, education and residency*

Table 4: Comparison of effects for interventions with and without booster sessions on outcomes among participants receiving the intervention, adjusted for baseline measures

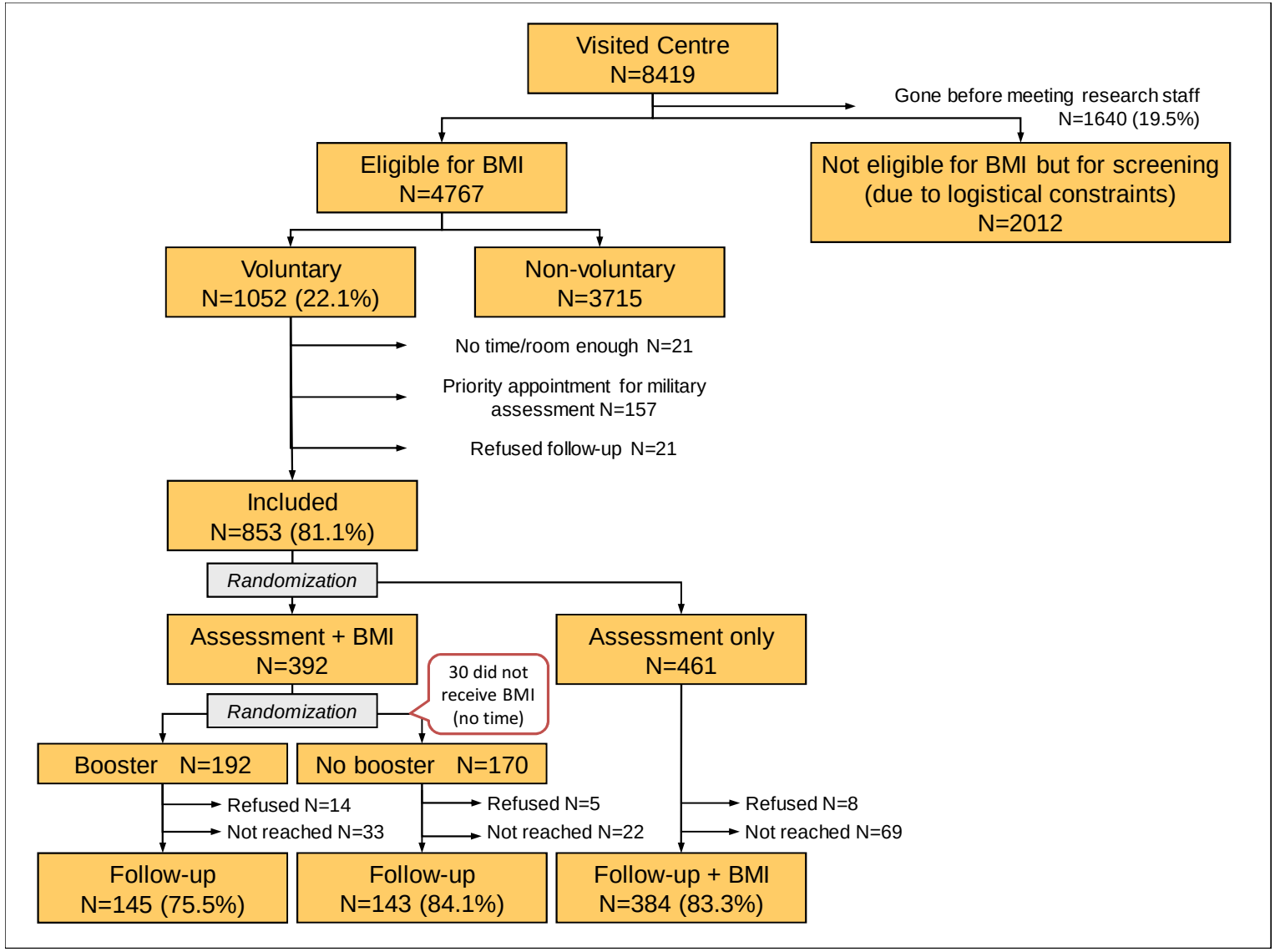
			non booster (n=143; % /means)*		booster (n=145; %/ means)*		Regression on follow-up values adjusted for baseline values					
							baseline adjustment only			fully baseline adjusted**		
		scale level	baseline	follow-up	baseline	follow-up	coeff.	SE	p	coeff.	SE	p
Smoking	past 6 months smoking, total sample	1	49.7%	46.9%	56.6%	51.7%	-.079	.396	.842	-.139	.403	.731
	at risk smoking (daily), total sample	1	33.6%	32.9%	38.6%	37.9%	.050	.423	.906	.020	.429	.962
	number of cigarettes, total sample	0	5.5	5.2	5.0	5.1	.341	.503	.499	.269	.505	.595
	number of cigarettes among consistent daily smokers	0	14.8	14.0	11.7	12.0	-.068	.976	.944	-.203	1.004	.840
Cannabis use	6 months cannabis use, total sample	1	46.2%	33.6%	46.2%	33.8%	.000	.319	1.000	.047	.333	.888
	at risk (> once a week) use, total sample	1	14.7%	14.0%	13.1%	15.2%	.476	.542	.380	.461	.575	.422
	number of days with cannabis use per month, total sample	0	2.7	2.7	3.0	3.1	.127	.464	.785	.151	.468	.747
	number of days with cannabis use per month, consistent users	0	8.6	8.7	8.5	9.8	.806	1.369	.558	.996	1.499	.508
Alcohol use	risk volume (> 21 drinks/week), total sample	1	8.4%	5.6%	10.3%	10.3%	.694	.502	.167	.657	.510	.198
	risk RSOD (> once a month), total sample	1	53.1%	51.7%	50.3%	45.5%	-.224	.273	.413	-.257	.276	.352
	number of drinks per week, total population	0	8.4	8.4	10.3	9.2	.141	.937	.880	.098	.942	.917
	number of RSODs per week, total population	0	2.8	2.2	2.8	2.5	.312	.332	.348	.295	.329	.371

Remarks: *Scale level coded 1 are for categorical variables and 0 for dichotomous outcomes; coeff. being regression coefficients from logistic regressions (scale level coded 0) and from linear regressions (scale level coded 1);*

** values are percentages for categorical variables and means for continuous variables*

*** additional to baseline adjustment, adjustment for age, education and residency*

Figure 1. Flowchart of study inclusion



Brief integrative multiple substance use intervention among young men – out of focus?

Gerhard Gmel[1,2,3,4], Jacques Gaume[1], Nicolas Bertholet[1], Jean-Bernard Daeppen[1]

1) Alcohol Treatment Centre, Lausanne University Hospital CHUV, Mont-Paisible 16, CH - 1011 Lausanne, Switzerland, Gerhard.Gmel@chuv.ch , Jacques.Gaume@chuv.ch , Nicolas.Bertholet@chuv.ch , julien.fluckiger@chuv.ch; Jean-Bernard.Daeppen@chuv.ch

2) Swiss Institute for the Prevention of Alcohol and Drug Problems, Case postale 870, CH - 1001 Lausanne, Switzerland

3) Centre for Addiction and Mental Health, 250 College St, Toronto, Ontario, M5T 1R8, Canada

4) University of the West of England, Frenchay Campus Coldharbour Lane, Bristol BS16 1QY, United Kingdom

Corresponding author and guarantor: G. Gmel; Alcohol Treatment Centre, Lausanne University Hospital CHUV, Mont-Paisible 16, CH-1011 Lausanne, Switzerland, gerhard.gmel@chuv.ch ; Tel.:++41 21 3147352; Fax: ++41 21 3140562

Submitted to Prevention Science

Abstract

The study is a secondary analysis of a brief motivational intervention (BMI) to reduce substance use among young men. The intervention was different compared with most randomized control trials: a) An integrated multiple substance use intervention (alcohol, tobacco, cannabis) was used (no focusing on a single substance), and b) individuals were invited to voluntarily receive an intervention (no *a priori* systematic screening). The present analysis looked at differences of the intervention according to the main substance focus within the integrative multiple substance use intervention. The intervention took place in the army recruitment center. Volunteers were randomly assigned to cases and controls. Post hoc, controls were matched to cases according to substance use patterns at baseline (n=288 pairs). Overall, the intervention showed consistent beneficial, but insignificant effects for all substances. Breaking down the analysis by focus of the intervention, beneficial effects were found for the substances on which there was not the focus (i.e., beneficial effects for cannabis when the focus was on alcohol). Effects were always weaker and partly even opposite (iatrogenic) for the substances on which was the focus. It is hypothesized that people showing voluntarily up for getting an intervention without screening may be more aware of their problematic substance use, problems may be already more settled, and therefore BMI may be less effective than in trials with screening (and therefore participants unaware of their behaviors being problematic). This hypothesis may be supported by the fact that beneficial effects were on those substances on which the focus was not placed, suggesting that individuals see these as less problematic.

Key words: brief multiple substance intervention, focus of intervention, young men, matched case control

Introduction

It is well known that substance use of adolescents and young adults is probably the most important public health problem of this age group in developed societies (Rehm, Taylor, & Room, 2006). Besides regulatory interventions (e.g. price increases) to reduce substance use, most both universal and targeted interventions for adolescents and young adults have – at best – shown mixed results (Tobler, 2000; Cheon, 2008; Toumbourou et al, 2007; Foxcroft et al, 2002); Moreira et al, 2009; Faggiaono et al, 2005; Foxcoft & Tvertsavtse, 2011). Brief interventions (BI) have been shown to be one of the most cost-effective individual-centered approaches among within the general population (Babor et al., 2010). BI among young people seemed to have mostly mixed results, but sometimes small positive effects (Tait & Hulse, 2003 ; Toumbourou et al, 2007), particularly for alcohol interventions ((Barnett et al., 2004; Grenard, Ames, Pentz, & Sussman, 2006; Larimer & Cronce, 2007). (Bernstein et al., 2010; Magill, Barnett, Apodaca, Rohsenow, & Monti, 2009; Monti et al., 2007), but also tobacco (Colby et al. (2005), Horn et al. (2007) (Grimshaw & Stanton, 2006) or cannabis interventions (Gates, McCambridge, Smith, & Foxcroft, 2006) McCambridge et al. (2008), Gray et al. (2005) D'Amico et al. (2008), Martin & Copeland (2008), Bernstein et al. (2009). The literature on young people, however, remains scarce and studies were often related to particular samples such as college students, to particular settings such as emergency studies, or found only short term (e.g., 3 months) effects. The present study tests the effectiveness of a multi-substance targeted brief intervention for 20-year-old men six months after the intervention.

BI studies on substance use commonly focused on a single substance, most often alcohol. However, many individuals at risk for one behavior are also susceptible to other associated risk behaviors (Saitz, Svikis, D'Onofrio, Kraemer, & Perl, 2006). In Switzerland, at risk use of at least one substance is almost the norm among 20 year old men (Gmel et al., 2010), and at least one third of the sample used two of three substances in a risky way (defined as drinking 5 or more drink at least twice a month, daily tobacco smoking or cannabis use at least twice per week).

Although there are some studies on multiple risk behavior intervention (including weight loss and physical inactivity interventions) in primary care setting (Goldstein et al, 2004), there is only limited BI research on integrative multiple substance use on adolescents and young adults. This is despite the fact that a brief motivational intervention approach has been adapted to simultaneously target multiple drugs (McCambridge & Strang, 2003).

Support for multiple drug interventions after 3 months was found among London college students, demonstrating reductions in cigarette, cannabis and alcohol use (McCambridge and Strang, (2004). After 12 months, however, these effects were dramatically reduced and no longer significant (McCambridge & Strang, 2005). In another study in London colleges some effects for alcohol use were found, but no significant reduction in smoking rates or cannabis use (Gray, McCambridge, & Strang, 2005). Based on the Behavior Image Model among university students, Werch et al. (2011; 2010) found beneficial effects (at 3 and 12 months) for physical activity and driving after drinking, but not for alcohol, cigarette, or marihuana use. Based on a cluster randomized trial using universal, multiple substance use interventions in London college classes, McCambridge and colleagues (2010) concluded that this strategy should not be further pursued because of its ineffectiveness.

Although theoretically appealing, little is known about the effectiveness of brief multiple substance use interventions, and effects seem at best small. In a companion paper to the present study (Gmel et al,

submitted) a multiple substance use intervention for alcohol, tobacco and cannabis use was not effective. The authors speculated whether a brief, 20 minutes lasting intervention may be too short to cover more than one substance. In almost all brief interventions of the present study, despite embedding counseling in the larger picture of multiple substance use, the counseling focused nevertheless on a substance, which was negotiated between patients and counselors. The present study hypothesizes that larger effects should be obtained for the substance, on which the intervention focused.

Methods

A counseling session on tobacco, cannabis, and alcohol use of approximately 20 minutes was suggested to conscripts in a recruitment center of Lausanne. Conscripts were not systematically screened because the study wanted to estimate effectiveness of an offer for obtaining counseling that could voluntarily be used by young men. The aim was not to test the efficacy of a scientific SBI-trial (screening and brief intervention). It was assumed that in real life, systematic screening would be too laborious, but an offer for receiving an intervention for those opting to get it would be feasible.

Setting and participants

Individuals were enrolled between October 2008 and September 2009 in the army recruitment center of Lausanne that is responsible for all Swiss French speaking men. The recruitment process in Switzerland is mandatory, and therefore, besides heavily disabled, all males at around 19 years of age are called for conscription and complete the physical, medical and cognitive assessments to determine eligibility for service in the military. In Lausanne, around 190 individuals pass the recruitment procedures on two days each week (6 weeks of holidays during the course of a year), thus approximately 8,700 recruits a year.

Groups consisting of around 30 conscripts assigned by the army moved through the various medical, physical, and psychological assessments in different sequences. The medical session, lasting 3 hours, (three sessions per day on two days per week) were used to enroll participants. Conscripts had ample waiting time to participate in trial activities during this segment, since the actual examination takes about 1.5 hours only. During the remaining 1.5 hours the opportunity for an intervention was proposed, participants were assigned to intervention and control groups, and the assessment of substance use, substance use history and related problems was done. Finally, a brief intervention was delivered to the intervention group. A brief intervention was also offered to control participants at follow-up (waiting list design). Written informed consent was obtained from all intervention participants, and the study was approved by the Ethics Committee for Clinical Research of the Lausanne University Medical School (Protocol No. 15/07).

Intervention

The experimental condition consisted of BI using motivational interviewing (MI) philosophy and techniques (BMI). The intervention was based on Rollnick and colleagues (Miller & Rollnick, 2002) and the adaptation of McCambridge & Strang (2003) for young individuals using various substances. It involved discussing the use of tobacco, cannabis, alcohol and other substances with a behavior change perspectives in a non-judgmental and empathic (Seneviratne, Fortini, Gaume, & Daeppen, 2007). BMI lasted around 20-30 minutes and consisted of the following components: a) establish a collaborative rapport to enable elicitation of multiple substance use; b) ensure confidentiality; c) ask permission to talk about behaviors; d) ask with open questions about substance use and focus on areas that the conscript considers problematic; d) explore pros and cons; f) reflect and affirm change talk and enhance values that might be incompatible with present

substance use; g) explore the importance, confidence and readiness to change; h) evoke commitment to a change plan; and i) support the conscript's self-efficacy. Although problematic substance use in general was discussed, during the component d) counselors negotiated the focus of BMI with the young adults. Interventionists were asked to record the focus of the discussion at the end of the BMI. Thus, even if more than one substance was discussed, "focus" describes the "major" substance of interest from the recruit's point of view. In some cases there was no clear focus, multiple substances were involved and participants were analyzed with all foci.

Two master level psychologists provided the intervention. They received a two-day training in counseling, observed tobacco counseling in the hospital, viewed video examples, made additional role-plays with standardized patients under supervision, conducted BMI with voluntary young men in the army conscription centre, and read manuals and articles related to MI and BMI. One month after the project started in the army, they received a specific MI training during which they went into further details about the spirit, principles and tools of MI, through exercises aimed at improving performance using an active, empathic listening style to avoid confrontation, as described elsewhere (Baer et al., 2004). Counselors received supervision throughout the whole project. To guarantee the integrity and quality of BMI delivery, the process included weekly individual supervision in which difficulties and challenges were discussed, and monthly joint supervision with two senior psychologists. Audiotapes of the interventions were reviewed and trainees were given feedback on various aspects of BMI (e.g. MI spirit, reflective listening techniques, eliciting change talk).

Randomization

To assign conscripts accepting the offer to either BMI or control condition "Randomization Sheets" for each three-hour medical examination block were used. These sheets were produced by a computer randomization algorithm *a priori* for each block of about 30 recruits before conscripts entered the army. This precluded the possibility that counselors might influence group allocation. This randomization could be done in advance because each of the 30 individuals in each block already received a number from 1 to 30 that was assigned by the army to monitor recruitment procedures. Therefore, the research group could do a blinded randomization without knowing *a priori*, who received which number.

Every sixth group of 30 individuals had psychological testing as an army procedure after the medical examination, the scheduled time for our study. There were concerns of army psychologists that BMI might inadvertently influence the results of army testing. In order not to bedevil the good relations with the army administration, it was decided to exclude these groups from the study. This should not affect our findings, because army group assignment was also randomly done.

Outcomes and data collection

Baseline data was collected by the counselors before the intervention with a standardized assessment questionnaire lasting about 15 minutes.

Follow-up data were obtained by computer assisted telephone interviews six months after baseline assessment. Interviewers were blinded to baseline data and randomization status, and were trained to conduct computer-assisted telephone interviewing. At the end of each interview they were prompted to the randomization status in order to forward participants in the control group to the BMI counselors (waiting list design) for their opportunity to get a counseling session. This protocol guaranteed blinding to an individual's

condition or group assignment during follow-up data collection. All questions at baseline and at follow-up referred to a timeframe of six months.

Smoking: Smoking was measured with four categories: regular (daily), occasional (non-daily), former smoking, or never smoking. Smokers in the past 6 months were asked about the number of cigarettes used on smoking days. At-risk smoking was defined as daily smoking.

Cannabis use: First, lifetime use of cannabis was asked. Frequency of use in the past six months among lifetime users was measured with the categories: "never", "once a month or less often" (coded as 0.5 days per month), "2-3 times a month" (coded 2.5 days per month), "2-3 times a week" (coded 10 days a month), and "4 times or more often a week" (coded 20 days a month). At-risk cannabis use was defined as at least twice a week.

Alcohol use: Volume of usual alcohol use was assessed with a quantity-frequency instrument. The number of drinking days was asked for weekly alcohol users in an open-ended question. Non-weekly users were given the closed-ended choices of "2-3 times a month" (coded 0.58 days per week, i.e. 2.5*12 months/52 weeks), or "once a month or less often" (coded 0.12 days a week). The number of standard drinks on drinking days was asked in an open-ended question. Standard drinks contained around 10-12 grams of pure alcohol. Pictures of different kinds of standard drinks containing were provided. Number of days was multiplied with the quantity on drinking days. Volume of at-risk drinking was defined as more than 21 drinks per week.

Risky single occasion drinking (RSOD, occasions with at least 6 standard drinks) was also assessed with an open-ended question. At risk for RSOD was defined as having at least 2 such occasions per month.

Socio-demographics: Age, education and residence (urban vs rural) were measured.

Sample Size determination

To be conservative because of lower effect sizes compared with alcohol, sample size calculations were based on smoking. Information for cannabis was insufficient for power calculations. Odds ratios around 2.0 for various interventions effects in adult populations are common for smoking (Lancaster & Stead, 2004, 2005) Humair & Cornuz, 2005). Similar odds ratios have been found among adolescents and young adults (Hollis et al., 2005; Kentala, Utriainen, Pahkala, & Mattila, 1999). With a statistical power of 80%, 199 individuals per group for the treatment versus control comparison would be needed (standard significance level at 5%).

As regards smoking reduction a 50% decrease in cigarette smoking has been achieved commonly achieved for 6-35% of smokers (Bolliger et al., 2000; Etter, Laszlo, Zellweger, Perrot, & Perneger, 2002; Wennike et al., 2003). In a pilot study, recruits smoked 11.5 cigarettes (SD=8.5) daily, on average. An intermediate percentage of 20% of smokers who reduce consumption was assumed with a reduction of 25%. In addition a reduction of 10% was assumed for the remaining 80% of smokers. With results from a pilot test in the present population (mean 11.5 cigarettes smoked on average; SD = 8.5), a reduction of 1.5 cigarettes from 11.5 to 10 cigarettes per day was assumed, for which a sample size of 256 per group ($p = .05$, power = 0.80) would be needed.

Statistical analysis

There were more controls than cases (see below). Cases differed according to their multiple substance use patterns and not all controls may serve as adequate controls. For example, a heavy cannabis user may have lower reductions in alcohol use compared with an alcohol only user; therefore, testing effects in heavy multi-substance against controls with less severe substance use patterns may create test unfairness. We therefore matched cases to controls based on baseline substance use patterns. There are several reasons for using matched control subjects (Le Cessie et al, 2008; Rosenbaum & Rubin, 1985; Jarrold & Brock, 2004): Matching is useful if potential confounders are difficult to measure or if there are many different strata (here substance use patterns). If many of the unexposed controls are different from exposed because of background variables, matching on control variables may reduce the imbalance between cases and controls. If there are non-central explanations for group differences, e.g. due to interactions between several outcome variables but also due to an interaction between exposure (here intervention) and mixture of outcomes (here multiple use patterns) matching may map out these unwarranted associations across tasks and domains.

Therefore, from the pool of controls, a single individual was matched to each case (1:1 matching) based on baseline substance use patterns and socio-demographics. Variables used for matching were smoking status and number of cigarettes smoked among current smokers, cannabis use status and frequency of cannabis use among current users , drinking status and drinks per week as well as frequency of RSOD among drinkers, age, residence and education. In addition at risk use for alcohol, cannabis and tobacco was also entered in the matching algorithm. Optimal matching was done using the algorithm provided in the NCSS software package (Hintze, 2007), which resulted either in perfect matches or in matches that came closest to the corresponding case, according to the Mahalanobis distance. For the analysis of 1:1 matched data conditional logistic regression or McNemar Chi-squared tests were used for dichotomous outcomes, and paired t-tests for continuous measures.

Results

Baseline, attrition analyses, and sample characteristics

During study inclusion 8,419 conscripts passed recruitment procedures in the Lausanne center. Of those, 4,767 were eligible for participation in the proposed study (Figure 1), because 1,640 had already left the center before encountering the research staff, and 2,012 were ineligible due to army constraints as explained above. Of the eligible, 1,052 (22.1%) were interested in voluntarily receiving BMI. It should be noted that twenty one could not be served because of lack of time or space for conducting assessment and BMI (n=21). A further 157 individuals had to leave due to priorities set by the army, and 21 wanted an intervention but were not willing to participate in the follow-up. This resulted in 853 conscripts randomized into intervention (n=392) and control (n=461) groups. The imbalance occurred, when there were more individuals than time available to conduct BMIs. A “first come, first served” protocol was used, and those remaining were assigned to be controls. Thirty more could not finalize BMI as they were called to participate in other army procedures. These were subsequently excluded from the analyses.

After six months, follow-up telephone interviews were conducted. With an attrition rate of 20.4%, the final sample size of the intervention group consisted of 288 individuals, and 384 controls could be re-contacted (attrition: 16.7%). There was no differential attrition between cases and controls for any of the variables used in the present study (cannabis users significantly dropped out more often, but drop out was similar in both

groups cases and controls, i.e. there was no interaction effect). Out of the 384 controls 288 individuals were matched to cases.

Figure 1 about here

As can be seen in Table 1, baseline equivalence was obtained by matching across all substance measures for the total sample. There were 120 cases with a BMI focus on tobacco, 50 cases with a focus on cannabis, and 142 cases with a focus on alcohol use (note multiple foci for some individuals). Substance use was higher among those with a focus on the corresponding substance compared with those with a focus on other substances. As an example, 56% of those with a BMI focus on cannabis were at risk for cannabis use, whereas only 5% of cases (5.5% of controls) with no focus on cannabis (but with a focus on tobacco or alcohol). Taking into account the focus of the BMI (Table 2), matching did not achieve baseline equivalence for numbers of drinks per week among the 142 cases and matched controls with a BMI focus on alcohol.

Table 1 about here

Table 2 about here

Effects of BMI always pointed in the expected direction (Table 3), e.g. stronger substance use reduction (or smaller increases) among the cases compared with controls (OR < 1 resp. negative mean difference (means of cases minus means of controls)). This was significant however only for the number of cigarettes smoked. Whereas controls smoked on average 5.17 cigarettes per smoking day, controls smoked 6.23. The mean difference (-1.06 cigarettes) was significant ($p = 0.013$).

Table 3 about here

When analysis was performed stratified by those who had a BMI focus on the corresponding substance, two seemingly paradoxical finding emerged (Table 4). First, for each of the substances the effectiveness of BMI was more pronounced for those for which the BMI did not focus on the substance. To give two examples: a) with no focus on smoking, the 168 cases smoked significantly ($p = 0.008$) 1.3 cigarettes less at follow-up (= 3.18 cigarettes on average) compared with controls (4.48 cigarettes on average), whereas among those 120 pairs with a focus on smoking, the difference between cases (= 7.96 cigarettes) and controls (= 8.67 cigarettes) was smaller (= - 0.71) and insignificant ($p = 0.351$); b) with no focus on cannabis use, the 238 cases had significantly ($p = 0.031$) fewer cannabis days (= 1.07 days) compared with controls (= 1.72 days), whereas the difference was smaller among the 50 matched pairs with a focus on cannabis use (11.56 days versus 11.57 days) and was clearly insignificant ($p = 0.990$). Significant effectiveness of BMI could only be found for the 3 tobacco measures and the number of cannabis use days and only among those participants who did not focus on the corresponding substance.

Second, findings on individuals with a BMI focus was not only non-significant but pointed even in the opposite direction of effects, e.g. increased substance use among cases compared with controls for six of the ten substance use measures.

Discussion

This is one of the first studies using BMI with an integrated multi-substance use approach. The intervention effect was not significant in a global effect analysis (with an unmatched sample of controls, (Gmel et al., submitted). Using a subgroup analysis with matched controls, the intervention tended to go in the expected

direction with preventive effects on all measures used here. However, effects were non-significant for all measures when applied to the total sample of cases.

Despite the fact that the intervention was designed as a multi-substance use intervention, the intervention was short and in negotiating and talking with individuals one or two substances were treated more pronounced than others, and the corresponding focus (or foci) were noted by the counselors. This opened the possibility to analyze the intervention by means of their foci. Findings were surprising, as only cross-over effects were found. To our knowledge there is no corresponding study to compare our findings with it.

For all substance measures the beneficial effects were more pronounced among those who did not focus during the intervention on the corresponding substance. Moreover, individuals had even effects that went in the opposite direction (i.e. potential iatrogenic effects) for the substances on which the intervention focused. However the same individuals showed nevertheless beneficial effects for those substances which were discussed during the BMI but on which the BMI did not focus. To put it differently, the BMI was more effective for substances on which there was no strong focus during the intervention.

This finding is clearly unexpected, because single substance use brief interventions, i.e. those with a clear single focus, have shown efficacy and effectiveness for tobacco, alcohol and cannabis (e.g. Barnett et al., 2004; Larimer & Cronce, 2007). ; Monti et al., 2007) Colby et al. (2005), Horn et al. (2007), McCambridge et al. (2008), Bernstein et al. (2009); Martin, G. & Copeland, J. (2008) among adolescents. A major difference of the present study to other studies is that participants were not screened, but could use an offer to voluntarily receive an intervention. We hypothesize that those voluntarily looking for an intervention may differ from participants in other trials based on screening. One difference may be that those more actively looking for an intervention were already aware that their substance use may be problematic, whereas in other trials this awareness was raised by the intervention and therefore the examination of this behaviour during the intervention could be more effective in leading into changes of behaviour. The individuals requesting an intervention have more heavier use patterns than those who do not (Gmel et al., in press) and their behaviour may be already more consolidated and therefore more difficult to change. There is some support for this assumption; BMI might be more effective for individuals with substance use problems, provided they are not “full-blown” (e.g., Babor and Higgings-Biddle, 2001). Thus, for the heaviest users, brief advice and counseling is often not effective, and referral to a more comprehensive form of treatment is the recommended choice for intervention. BMI studies therefore often exclude the heaviest users. Participant were not treatment seakers in the narrower sense, but beeing “volunteers” may similarly have had more problematic substance use behaviors. Moyer et al. (2002) showed for brief alcohol interventions that almost 80% of the research designs did not include the heaviest or problem drinkers, or those with dependence. Meta-analytical studies have shown smaller effects of brief interventions for treatment seekers compared with non-seekers (Moyers et al 2002, Ballesteros et al., 2004; Kaner et al, 2007). Interestingly, in a comparable sample of conscripts but using an alcohol intervention only, the effectiveness for alcohol outcomes depended on whether participants were voluntarily looking for an intervention or were randomly selected (Daeppen et al., 2011; Gaume, Gmel, Faouzi, Bertholet, & Daeppen, in press). The present study supports these findings in so far as effects went stronger in the expected preventive direction for those substances that were not negotiated between participants and counselors to be in the focus of the change talk, but were addressed more on the brink.

Similarly, some of the most encouraging results on adolescents were obtained in emergency department (ED) studies (Monti et al., 2007, Magill et al., 2009, Bernstein et al., 2010), where self-harm as a

consequence of substance use may increase the feeling of urgency to get help or being the first situation that actually raised awareness of the need to change something, what perhaps enhanced the effectiveness of brief interventions. The intervention of the present study could not be based on such experienced harmful incidents as in ED studies.

The downside of our findings is that a voluntary offer that is feasible in the real world may show lower effects than those of scientific trials with screening of subjects that may perhaps be less aware of having problematic behaviors than volunteers and may therefore be more responsive to brief interventions. However, this would reduce the opportunities for interventions and make them less overarching, since systematic screening is costlier and more difficult to implement outside of more controlled scientific trials. Funding for systematic screening could also a problem when setting up new sites and staffing outside of (already) funded projects, i.e. for implementing BMI on a wide scale, e.g. in settings such as schools or in primary health care milieus.

In conclusion, the current strategy tested herein does not appear to be very promising overall. Findings suggest that rather than pursuing this intervention model, future research should probably either increase the intensity of single counseling sessions for multiple substance use or implement the use of systematic screening in the attempt to enroll individuals at risk, and not only those who voluntary are looking for an opportunity to get counseling. This entails the process of first convincing at-risk individuals who are not fully aware of the severity of their problems with substance use that they might be able to benefit from intervention. This increases the research burden and expenses, and may make BMI as a universal tool for preventing adolescent and young adult substance misuse less practical and less attractive than is generally thought.

References:

Babor TF, Higgins-Biddle JC (2001) Brief Intervention for Hazardous and Harmful Drinking: A Manual for Use in Primary Care. (WHO Publication No. 01.6b). World Health Organization, Geneva, Switzerland.

Barnett, N. P., Tevyaw, T. O., Fromme, K., Borsari, B., Carey, K. B., Corbin, W. R., et al. (2004). Brief alcohol interventions with mandated or adjudicated college students. Alcoholism: Clinical and Experimental Research, 28(6), 966-975.

Baer, J. S., Rosengren, D. B., Dunn, C. W., Wells, E. A., Ogle, R. L. & Hartzler, B. (2004). An evaluation of workshop training in motivational interviewing for addiction and mental health clinicians. Drug and Alcohol Dependence 73, 99-106.

Bernstein, J., Heeren, T., Edward, E., Dorfman, D., Bliss, C., Winter, M., et al. (2010). A brief motivational interview in a pediatric emergency department, plus 10-day telephone follow-up, increases attempts to quit drinking among youth and young adults who screen positive for problematic drinking. Academic Emergency Medicine, 17(8), 890-902.

Bernstein, E., Edwards, E., Dorfman, D., Heeren, T., Bliss, C., & Bernstein, J. (2009). Screening and brief intervention to reduce marijuana use among youth and young adults in a pediatric emergency department. Academic Emergency Medicine, 16(11), 1174-1185.

Bolliger, C. T., Zellweger, J.-P., Danielsson, T., van Biljon, X., Robidou, A., Westin, Å., et al. (2000). Smoking reduction with oral nicotine inhalers: double blind, randomised clinical trial of efficacy and safety. British Medical Journal, 321(7257), 329-333.

le Cessie, S., Nagelkerke, N., Rosendaal, F.R., van Stralen, K.J., Pomp, E.R. & van Houwelingen, H.C. (2008). Combining Matched and Unmatched Control Groups in Case-Control Studies. Am J Epidemiol, 168:1204–1210

Cheon, J.W. (2008). Best practices in community based prevention for youth substance reduction: towards strenghts-based positive policy. Journal of Community Psychology, Vol. 36, No. 6, 761–779.

Colby, S. M., Monti, P. M., O'Leary Tevyaw, T., Barnett, N. P., Spirito, A., Rohsenow, D. J., et al. (2005). Brief motivational intervention for adolescent smokers in medical settings. Addictive Behaviors, 30(5), 865-874.

Daeppen, J.-B., Bertholet, N., Gaume, J., Fortini, C., Faouzi, M., and Gmel, G. (2011). Efficacy of brief motivational intervention in reducing binge drinking in young men: A randomized controlled trial. Drug Alcohol Depend 113, 69-75.

D'Amico, E. J., Miles, J. N., Stern, S. A., & Meredith, L. S. (2008). Brief motivational interviewing for teens at risk of substance use consequences: a randomized pilot study in a primary care clinic. Journal of Substance Abuse Treatment, 35(1), 53-61.

Etter, J.-F., Laszlo, E. R. N., Zellweger, J.-P., Perrot, C., & Perneger, T. V. (2002). Nicotine replacement to reduce cigarette consumption in smokers who are unwilling to quit: a randomized trial. Journal of Clinical Psychopharmacology, 22(5), 487-495.

Faggiano F, Vigna-Taglianti F, Versino E, Zambon A, Borraccino A, Lemma P. (2005). School-based prevention for illicit drugs' use. Cochrane Database of Systematic Reviews, Issue 2. Art. No.: CD003020. DOI:10.1002/14651858.CD003020.pub2.

Foxcroft D, Ireland D, Lowe G, Breen R. (2002). Primary prevention for alcohol misuse in young people. Cochrane Database of Systematic Reviews, Issue 3. Art. No.: CD003024. DOI: 10.1002/14651858.CD003024

Foxcroft DR & Tsertsvadze A. (2011). Universal school-based prevention programs for alcohol misuse in young people. Cochrane Database of Systematic Reviews, Issue 5. Art. No.: CD009113. DOI: 10.1002/14651858.CD009113

Gates, S., McCambridge, J., Smith, L. A., & Foxcroft, D. R. (2006). Interventions for prevention of drug use by young people delivered in non-school settings. Cochrane Database of Systematic Reviews(1), CD005030.

Gaume, J., Gmel, G., Faouzi, M., Bertholet, N., & Daeppen, J.-B. (in press). Is brief motivational intervention effective in reducing alcohol use among young men voluntarily receiving it? A randomized controlled trial. Alcohol Clin Exp Res.

Gmel, G., Gaume, J., Bertholet, N. & Daeppen, J.-B. (in press). Brief alcohol intervention as pragmatic intervention: who is voluntarily taking an offered intervention? Alcohol

Gmel, G., Gaume, J., Willi, C., Michaud, P.-A., Cornuz, J., & Daeppen, J.-B. (2010). Challenging the "inoffensiveness" of regular cannabis use by its associations with other current risky substance use--a census of 20-year-old Swiss men. International Journal of Environmental Research and Public Health, 7(1), 46-59.

Gmel, G., Gaume, J., Bertholet, N., Flückiger, J & Daeppen, J.-B. (submitted). Effectiveness of a brief integrative multiple substance use intervention among young men with and without booster sessions. Journal of Substance Abuse Treatment.

Goldstein, M. G., Whitlock, E. P., & DePue, J. (2004). Multiple behavioral risk factor interventions in primary care. Summary of research evidence. American Journal of Preventive Medicine, 27(2 Suppl), 61-79.

Gray, E., McCambridge, J., & Strang, J. (2005). The effectiveness of motivational interviewing delivered by youth workers in reducing drinking, cigarette and cannabis smoking among young people: quasi-experimental pilot study. Alcohol and Alcoholism, 40(6), 535-539.

Grenard, J. L., Ames, S. L., Pentz, M. A., & Sussman, S. (2006). Motivational interviewing with adolescents and young adults for drug-related problems. International Journal of Adolescent Medicine and Health, 18(1), 53-67.

Hintze, J. L. (Ed.) (2007). NCSS - User's Guide I. Kaysville, UT: NCSS Statistical System, Dr. Jerry L. Hintze.

Hollis, J. F., Polen, M. R., Whitlock, E. P., Lichtenstein, E., Mullooly, J. P., Velicer, W. F., et al. (2005). Teen reach: outcomes from a randomized, controlled trial of a tobacco reduction program for teens seen in primary medical care. Pediatrics, 115(4), 981-989.

Horn, K., Dino, G., Hamilton, C., & Noerachmanto, N. (2007). Efficacy of an emergency department-based motivational teenage smoking intervention. Preventing Chronic Disease, 4(1), A08.

Humair, J.-P. & Cornuz, J. (2005). Désaccoutumance au tabac. Document de référence pour les médecins. Berne/Bâle: "Vivre sans tabac".

Jarrold, C. & Brock, J. (2004) To Match or Not To Match? Methodological Issues in Autism-Related Research. Journal of Autism and Developmental Disorders, Vol. 34, No. 1, 81-86.

Kaner, E. F., Beyer, F., Dickinson, H. O., Pienaar, E., Campbell, F., Schlesinger, C., Heather, N., Saunders, J. & Burnand, B. (2007). Effectiveness of brief alcohol interventions in primary care populations. Cochrane Database of Systematic Reviews CD004148.

Kentala, J., Utriainen, P., Pahkala, K., & Mattila, K. (1999). Can brief intervention through community dental care have an effect on adolescent smoking? Preventive Medicine, 29(2), 107-111.

Lancaster, T. & Stead, L. F. (2004). Physician advice for smoking cessation. Cochrane Database of Systematic Reviews (online)(4), CD000165.

Lancaster, T. & Stead, L. F. (2005). Individual behavioural counselling for smoking cessation. Cochrane Database of Systematic Reviews (online)(2), CD001292.

Larimer, M. E. & Cronce, J. M. (2007). Identification, prevention, and treatment revisited: individual-focused college drinking prevention strategies 1999-2006. Addictive Behaviors, 32(11), 2439-2468.

Magill, M., Barnett, N. P., Apodaca, T. R., Rohsenow, D. J., & Monti, P. M. (2009). The role of marijuana use in brief motivational intervention with young adult drinkers treated in an emergency department. Journal of Studies on Alcohol and Drugs, 70(3), 409-413.

Martin, G. & Copeland, J. (2008). The adolescent cannabis check-up: randomized trial of a brief intervention for young cannabis users. Journal of Substance Abuse Treatment, 34(4), 407-414.

McCambridge, J. & Strang, J. (2003). Development of a structured generic drug intervention model for public health purposes: a brief application of motivational interviewing with young people. Drug and Alcohol Review, 22(4), 391-399.

McCambridge, J. & Strang, J. (2004). The efficacy of single-session motivational interviewing in reducing drug consumption and perceptions of drug-related risk and harm among young people: results from a multi-site cluster randomized trial. Addiction, 99(1), 39-52.

McCambridge, J. & Strang, J. (2005). Deterioration over time in effect of Motivational Interviewing in reducing drug consumption and related risk among young people. Addiction, 100(4), 470-478.

McCambridge, J., Slym, R. L., & Strang, J. (2008). Randomized controlled trial of motivational interviewing compared with drug information and advice for early intervention among young cannabis users. Addiction, 103(11), 1809-1818.

McCambridge, J., Hunt, C., Jenkins, R. J., & Strang, J. (2010). Cluster randomised trial of the effectiveness of Motivational Interviewing for universal prevention. Drug and Alcohol Dependence, 114(2-3), 177-184.

Miller, W. R. & Rollnick, S. (2002). Motivational Interviewing: Preparing People for Change (2 ed.). New York, NY: Guilford Press

Monti, P. M., Barnett, N. P., Colby, S. M., Gwaltney, C. J., Spirito, A., Rohsenow, D. J., et al. (2007). Motivational interviewing versus feedback only in emergency care for young adult problem drinking. Addiction, 102(8), 1234-1243.

Moreira MT, Smith LA, Foxcroft D. (2009). Social norms interventions to reduce alcohol misuse in University or College students. Cochrane Database of Systematic Reviews, Issue 3. Art. No.: CD006748. DOI: 10.1002/14651858.CD006748.pub2.

Moyer A, Finney JW, Swearingen CE, Vergun P (2002) Brief interventions for alcohol problems: a meta-analytic review of controlled investigations in treatment-seeking and non-treatment-seeking populations. Addiction, 97 (3): 279-292.

Rehm, J., Taylor, B., & Room, R. (2006). Global burden of disease from alcohol, illicit drugs and tobacco. Drug and Alcohol Review, 25(6), 503-513.

Rosenbaum, P.J. &Rubin, D.B. (1985). Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. The American Statistician, 39 (1), 33-38.

Saitz, R., Svikis, D., D'Onofrio, G., Kraemer, K. L., & Perl, H. (2006). Challenges applying alcohol brief intervention in diverse practice settings: populations, outcomes, and costs. Alcoholism: Clinical and Experimental Research, 30(2), 332-338.

Seneviratne, A., Fortini, C., Gaume, J., & Daeppen, J.-B. (2007). Intervention motivationnette breve multisubstances aupres des jeunes adultes. [A brief motivational intervention targeting multi-risk behaviours among young people]. Revue Médicale Suisse, 3(118), 1691-1694.

Tait R. J. & Hulse, G. K. (2003). A systematic review of the effectiveness of brief interventions with substance using adolescents by type of drug. Drug and Alcohol Review , 22, 337 – 346.

Tobler, N.S., Roona, M.R., Ochshorn, P., Marshall, D.G., Streke, A.V., & Stackpole, K.M. (2000).School-based adolescent drug prevention programmes: 1998 meta-analysis. Journal of Primary Prevention, 20, 275–336.

Toumbourou, J. W., Stockwell, T., Neighbors, C., Marlatt, G. A., Sturge, J., & Rehm, J. (2007). Interventions to reduce harm associated with adolescent substance use. Lancet, 369(9570), 1391-1401.

Wennike, P., Danielsson, T., Landfeldt, B., Westin, Å., Tonnesen, P., Wennike, P., et al. (2003). Smoking reduction promotes smoking cessation: results from a double blind, randomized, placebo-controlled trial of nicotine gum with 2-year follow-up. Addiction, 98(10), 1395-1402.

Werch, C. E., Bian, H., Carlson, J. M., Moore, M. J., Diclemente, C. C., Huang, I. C., et al. (2011). Brief integrative multiple behavior intervention effects and mediators for adolescents. J Behav Med, 34(1), 3-12.

Werch, C. E., Moore, M. J., Bian, H., DiClemente, C. C., Huang, I. C., Ames, S. C., et al. (2010). Are effects from a brief multiple behavior intervention for college students sustained over time? Prev Med, 50(1-2), 30-34.

Table 1: Comparison between matched cases and controls at baseline

		scale level/ n (pairs)	case		control		t-value/ Chi2	df	p-value
			Mean/%	SD	Mean/%	SD			
smoking	n (pairs)	288			288				
	past 6 months smokers	1	53.1%		53.8%		0.028	1	0.868
	at risk smoking (daily)	1	36.1%		37.2%		0.209	1	0.648
	number of cigarettes per smoking day	0	5.23	7.54	5.59	7.43	-1.470	287	0.143
cannabis use	n (pairs)	288							
	6 months cannabis user	1	46.2%		44.4%		1.462	1	0.227
	at risk (> once a week) use	1	13.9%		14.2%		0.000	1	1.000
	number of days with cannabis use per months	0	2.84	6.49	2.98	6.60	-1.576	287	0.116
alcohol use	n (pairs)	288							
	risk volume (> 21 drinks per week)	1	9.4%		8.3%		1.323	1	0.250
	risk binge (> 1 occasion per month)	1	51.7%		53.5%		2.354	1	0.125
	number of drinks per week	0	9.32	12.41	8.79	11.28	1.496	287	0.136
	number of binge occasions per week	0	2.80	3.48	2.71	3.45	0.942	287	0.347

***Remarks**: scale level 1=dichotomous analysed with McNemar Chi-squared; 2 = continuous analysed with matched paired t-test*

Table 2: Comparison between matched cases and controls according to whether a focus of the BMI (among cases) was on the substance

		BMI for those with focus on other substances								BI for those with the substance-specific focus						
		scale level/ n (pairs)	Case Mean/%	SD	Control Mean/%	SD	t-value/ Chi2	df	p-value	Case Mean/%	SD	control Mean/%	SD	t-value/ Chi2	df	p-value
smoking	n (pairs)	168								120						
	past 6 months smokers	1	38.1%		43.5%		2.587	1	0.108	74.2%		68.3%		3.394	1	0.065
	at risk smoking (daily)	1	20.2%		24.4%		2.834	1	0.092	58.3%		55.0%		1.513	1	0.219
	number of cigarettes per smoking day	0	3.10	6.40	3.70	6.18	-1.865	167	0.064	8.19	8.01	8.21	8.21	-0.046	119	0.964
cannabis use	n (pairs)	238								50						
	6 months cannabis user	1	37.8%		35.7%		1.462	1	0.227	86.0%		86.0%		0.000	1	1.000
	at risk (> once a week) use	1	5.0%		5.5%		0.000	1	1.000	56.0%		56.0%		0.000	1	1.000
	number of days with cannabis use per months	0	1.13	3.61	1.29	3.91	-1.530	237	0.127	10.99	10.08	11.04	10.03	-0.375	49	0.709
alcohol use	n (pairs)	146								142						
	risk volume (> 21 drinks per week)	1	8.2%		6.8%		0.455	1	0.500	10.6%		9.9%		0.000	1	1.000
	risk binge (> 1 occasion per month)	1	50.0%		52.7%		1.513	1	0.219	53.5%		54.2%		0.000	1	1.000
	number of drinks per week	0	8.17	9.42	7.92	8.06	0.419	145	0.676	10.51	14.82	9.68	13.81	2.013	141	0.046
	number of binge occasions per week	0	2.67	3.63	2.61	3.44	0.514	145	0.608	2.93	3.33	2.81	3.47	0.794	141	0.428

***Remarks**: Data with focus on substance compare those individuals on measure on which there has been the focus. For example, 120 cases had a focus on tobacco (168 had not a focus on tobacco); scale level 1=dichotomous analysed with McNemar Chi-squared; 2 = continuous analysed with matched paired t-test*

Table 3: Effects of Brief Motivational Interventions using matched controls (n=288), follow-up measures

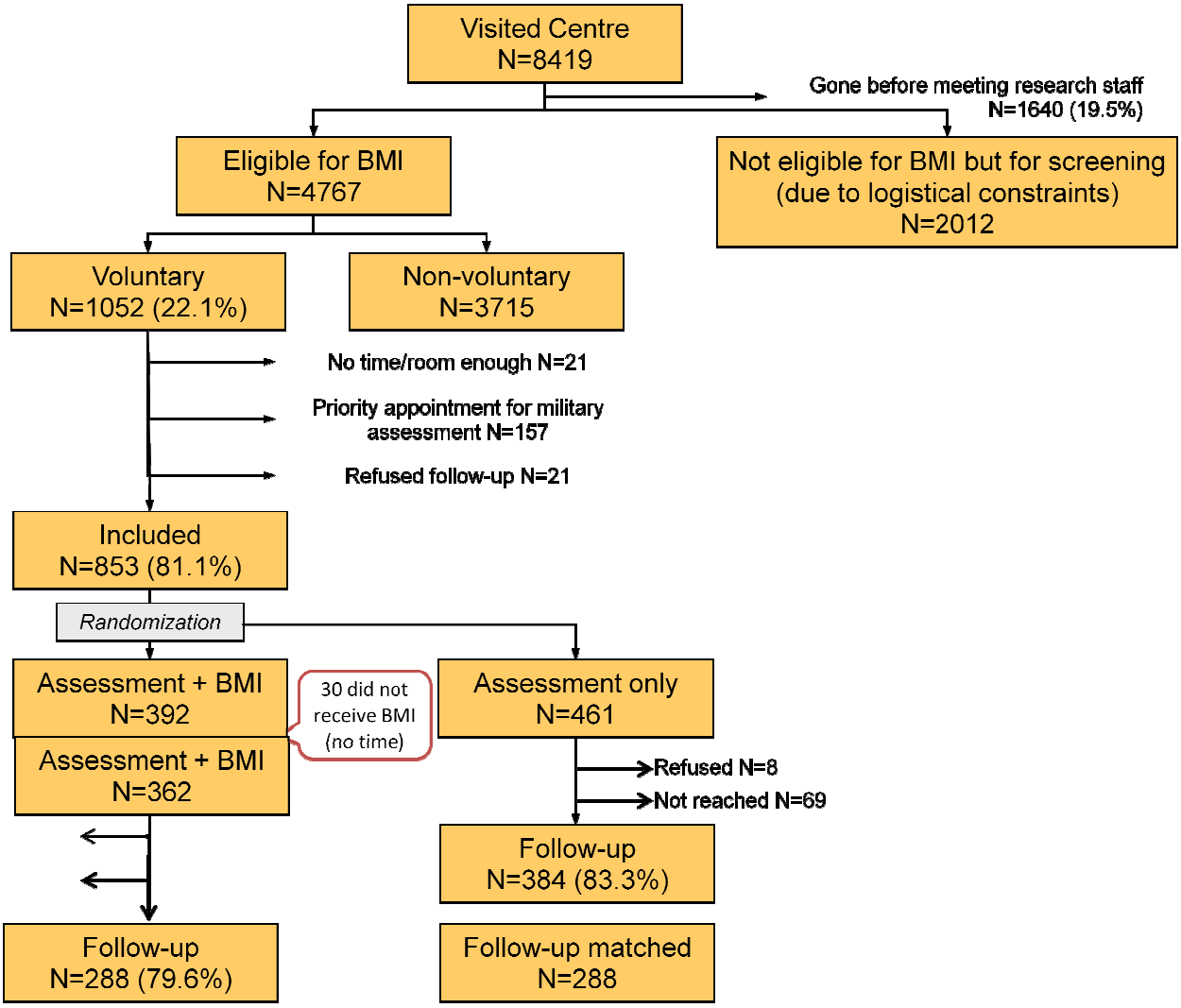
		scale level	case		control			OR/mean difference	95.0% CI for OR/mean difference	
			Mean/%	SD	Mean/%	SD	Sig.		Lower	Upper
smoking	n (pairs)						288			
	past 6 months smokers	1	49.3%		53.1%		0.213	0.73	0.44	1.20
	at risk smoking (daily)	1	35.4%		39.2%		0.152	0.66	0.37	1.17
	number of cigarettes per smoking day	0	5.17	7.42	6.23	8.20	0.013	-1.06	-1.89	-0.22
cannabis use	n (pairs)						288			
	6 months cannabis user	1	33.7%		38.2%		0.104	0.66	0.40	1.09
	at risk (> once a week) use	1	14.6%		15.6%		0.549	0.79	0.36	1.73
	number of days with cannabis use per months	0	2.89	6.75	3.43	7.58	0.109	-0.55	-1.21	0.12
alcohol use	n (pairs)						288			
	risk volume (> 21 drinks per week)	1	8.0%		9.0%		0.648	0.87	0.48	1.58
	risk binge (> 1 occasion per month)	1	48.6%		48.6%		0.921	0.98	0.66	1.45
	number of drinks per week	0	8.79	9.15	9.28	11.28	0.546	-0.49	-2.09	1.11
	number of binge occasions per week	0	2.36	3.19	2.40	3.29	0.873	-0.04	-0.51	0.43

***Remarks**: scale level 1=dichotomous analysed with conditional logistic regression; 2 = continuous analysed with matched paired t-test*

Table 4 Effects of Brief Motivational Interventions using matched controls (n=288), follow-up measures

		BMI for those with focus on other substances									BI for those with the substance-specific focus							
		scale level and n (pairs)	case		control		Sig.	OR/mean difference	95.0% CI for OR/mean difference		scale level and n (pairs)	case		control		Sig.	OR/mean difference	95.0% CI for OR/mean difference	
			Mean/%	SD	Mean/%	SD			Lower	Upper		Mean/%	SD	Mean/%	SD			Lower	Upper
smoking	n (pairs)	168									120								
	past 6 months smokers	1	35.7%		45.8%		0.021	0.48	0.26	0.90	1	68.3%		63.3%		*0.166*	*2.00*	*0.75*	*5.33*
	at risk smoking (daily)	1	21.4%		28.6%		0.040	0.42	0.18	0.96	1	55.0%		54.2%		*0.827*	*1.10*	*0.47*	*2.59*
	number of cigarettes per smoking day	0	3.18	6.00	4.49	7.01	0.008	-1.30	-2.26	-0.35	0	7.96	8.30	8.67	9.11	0.351	-0.71	-2.21	0.79
cannabis use	n (pairs)	238									50								
	6 months cannabis user	1	25.2%		29.8%		0.134	0.66	0.38	1.14	1	74.0%		78.0%		0.530	0.67	0.19	2.36
	at risk (> once a week) use	1	5.9%		8.0%		0.232	0.55	0.20	1.47	1	56.0%		52.0%		*0.484*	*1.67*	*0.40*	*6.97*
	number of days with cannabis use per months	0	1.07	3.48	1.72	5.28	0.031	-0.66	-1.25	-0.06	0	11.56	10.75	11.57	10.96	0.990	-0.02	-2.69	2.65
alcohol use	n (pairs)	146									142								
	risk volume (> 21 drinks per week)	1	7.5%		9.6%		0.514	0.75	0.32	1.78	1	8.5%		8.5%		*1.000*	*1.00*	*0.43*	*2.31*
	risk binge (> 1 occasion per month)	1	45.2%		50.0%		0.338	0.77	0.45	1.32	1	52.1%		47.2%		*0.388*	*1.29*	*0.73*	*2.27*
	number of drinks per week	0	8.79	9.13	9.61	12.27	0.496	-0.82	-3.18	1.55	0	8.79	9.20	8.94	10.20	0.887	-0.16	-2.33	2.02
	number of binge occasions per week	0	2.29	3.54	2.50	3.62	0.567	-0.21	-0.94	0.52	0	2.44	2.80	2.30	2.92	*0.642*	*0.14*	*-0.46*	*0.74*

***Remark**: Data with focus on substance compare those individuals on measure on which there has been the focus. For example, 120 cases had a focus on tobacco (168 had not a focus on tobacco). italics: effects went in opposite direction, i.e. stronger beneficial effects among controls compared with cases. scale level 1=dichotomous analysed with conditional logistic regression; 2 = continuous analysed with matched paired t-test.*


Visited Centre
N=8419
Gone before meeting research staff
N=1640 (19.5%)
Eligible for BMI
N=4767
Not eligible for BMI but for screening
(due to logistical constraints)
N=2012
Voluntary
N=1052 (22.1%)
Non-voluntary
N=3715
No time/room enough N=21
Priority appointment for military
assessment N=157
Refused follow-up N=21
Included
N=853 (81.1%)
Randomization
Assessment + BMI
N=392
30 did not
receive BMI
(no time)
Assessment only
N=461
Assessment + BMI
N=362
Refused N=8
Not reached N=69
Follow-up
N=384 (83.3%)
Follow-up
N=288 (79.6%)
Follow-up matched
N=288

PREDICTIVE VALUE OF READINESS, IMPORTANCE, AND CONFIDENCE IN ABILITY TO CHANGE DRINKING AND SMOKING

Nicolas Bertholet, MD, MSc [1]

Jacques Gaume, PhD [1]

Mohamed Faouzi, PhD [1]

Gerhard Gmel, PhD [1]

Jean-Bernard Daeppen, MD [1]

[1]: Alcohol treatment center, Department of Community Medicine and Health, Lausanne University Hospital, Switzerland

Corresponding author:

Nicolas Bertholet, MD, MSc
Alcohol treatment center, Mont-Paisible 16, 1011 Lausanne, Switzerland

Nicolas.Bertholet@chuv.ch, +41 21 314 73 51

ABSTRACT

Background: Visual analog scales (VAS) are sometimes used to assess change constructs that are often considered critical for change.

Objective : We studied the readiness to change, importance of changing and confidence in ability to change constructs in order to predict risk status six months after baseline for drinking (more than 21 drinks per week/ six drinks or more on a single occasion more than once per month) and smoking (one or more cigarettes per day) among Swiss young men.

Methods: 577 participants in a multi-substance brief intervention randomized trial were assessed at baseline and 6 months later on alcohol and tobacco consumption, and rated on VAS readiness, importance, and confidence scales (ranging 1-10) for each substance. Regression models that controlled for receipt of brief intervention were employed for each change construct. The lowest level (1-4) of each scale was the reference group that was compared to the medium (5-7) and to the high (8-10) levels.

Results: Among the 475 subjects reporting unhealthy alcohol use, mean (SD) readiness, importance and confidence to change drinking scores were 4.0 (3.1), 2.8 (2.2) and 7.2 (3.0), respectively. At six months, 108 (29%) of the 377 who completed the follow-up assessment reported no unhealthy alcohol use. Readiness was not associated with being risk-free at follow-up, but high importance (OR 2.94 [1.15; 7.50]) and high confidence (OR 2.88 [1.46; 5.68]) was. Among the 316 smokers, mean readiness, importance and confidence to change smoking scores were 4.6 (2.6), 5.3 (2.6) and 5.9 (2.6), respectively. Of the 255 smokers who completed the follow-up assessment, 13% (33) reported no longer smoking. Neither readiness nor importance were associated with being a non-smoker, whereas high confidence (OR 3.29 [1.12; 9.62]) was.

Conclusion: High confidence in ability to change was associated with favorable outcomes for both drinking and smoking, and high importance was associated only with drinking. This study points to the value of confidence as an important predictor of successful change for both drinking and smoking, and points to the value of importance in predicting successful change in drinking.

KEYWORDS: Readiness to change, importance of changing, confidence in ability to change, unhealthy alcohol use, smoking

BACKGROUND

Unhealthy alcohol and tobacco use and its consequences represent a major burden of disease in the general population (Rehm et al., 2009; Rehm et al., 2003; Rehm et al., 2007). Among young adults, the consequences of heavy episodic drinking are of primary concern (Gore et al., 2011); smoking is detrimental and is a concern for the future health of young individuals (Baliunas et al., 2007; Gilpin et al., 2009; John et al., 2003). To alleviate the impact on health behavior, counseling and brief interventions have been developed and have demonstrated evidence of efficacy in reducing alcohol use (Bertholet et al., 2005; Kaner et al., 2007) and smoking (Mottillo et al., 2009; Rigotti et al., 2007; Zwar, 2008).

Within motivational intervention paradigms, clinicians are encouraged to assess clients' motivation toward changing these behaviors (Miller and Rollnick, 2002). One's readiness to change, importance of changing and confidence in ability to change are some of the various dimensions of substance use behaviors that have been explored (Bertholet et al., 2009; Bertholet et al., 2007; Chung et al., 2011**;** Harris et al., 2008; Hesse, 2006; Maisto et al., 2011; Williams et al., 2007). Shifts in these dimensions are often considered intermediate goals on the way to achieving decreases in consumption (Harris et al., 2008; Kaysen et al., 2009; Rollnick, 1998). In addition to being useful facilitators during clinical encounters, readiness, importance and confidence may have predictive value for future behavior change.

Nevertheless, several studies suggest that these dimensions may operate differently in various populations and that some may play a more prominent role as predictors of future change than others (Bertholet et al., 2009; Williams et al., 2007). If so, this could help guide clinicians when choosing which of these dimensions to prioritize and assess appropriately. In addition, it is possible that these dimensions will consist of substance-specific characteristics, i.e. readiness may be more important in facilitating tobacco use changes than in effecting alcohol use changes (or vice-versa).

A more complete understanding of the predictive value of these dimensions that impact young adults may help clinicians design more effective interventions and select those dimensions that are of primary interest and importance. Studying these dimensions across a number of different substances will also yield clues to the intrinsic value of these dimensions vis-a-vis the universal cognitive dimensions of behavior change. Therefore, we studied three constructs – readiness to change, importance of changing and confidence in ability to change – associated with alcohol and tobacco use. We investigated the associations between these dimensions and subsequent drinking and smoking in a prospective cohort of 20-year-old men.

METHODS:

The sample was drawn from a large prospective cohort of 20-year-old Swiss men attending the army recruitment center in Lausanne, Switzerland, who participated in a randomized controlled trial of the impact of a multi-substance brief motivational intervention. The army was blinded regarding all data collected during the study, and the primary and secondary prevention effects of the intervention were evaluated. Within the larger study, subjects were randomized to either receive a brief motivational intervention or not, and participation was not restricted to individuals engaging in smoking or unhealthy alcohol use. Within the present study, only those individuals who smoked or had unhealthy alcohol use were included. Subjects were eligible if they reported drinking more than 21 drinks per week, or more than one episode of six or more drinks (one drink = 10g of ethanol) per occasion per month, or smoking one or more cigarettes per day. Before being assigned to a group, all subjects completed a baseline assessment that included demography

(age, occupation, and education level), measures of alcohol and tobacco use, and behavior change items. It was planned to follow up all subjects in six months.

Measures:

Subjects were assessed on each of the three behavior change constructs using visual analog scales ranging from 1 ("not ready/not important to change/not confident to succeed") to 10 ("ready/very important to change/very confident to succeed") for smoking and for alcohol use (total of 6 scales). The questions were: "how ready are you to change your drinking/smoking habits"; "how important is it for you right now to change your drinking/smoking"; and "if you decide to change your drinking/smoking habits, how confident are you that you would succeed". Answers were later recoded into three categories: low (1-4), medium (5-7) and high (8-10). Evaluating change dimension responses is contingent on individuals presenting unhealthy behaviors. Therefore, readiness, importance and confidence responses were retained only for those who met our definition of unhealthy behaviors pertaining to drinking and smoking , i.e. more than 21 drinks per week or more than one episode of six or more drinks per occasion per month, and smoking one or more cigarettes per day.

Outcomes:

Primary outcomes: in order to compare the predictive value of the three behavior change constructs across the two substance use behaviors, a dichotomous risk status outcome was calculated for both smoking and alcohol use. At six months, subjects were classified as having unhealthy alcohol use if they reported drinking more than 21 drinks per week or having more than one episode with six or more drinks per occasion per month (e.g. binge drinking). They were classified as smokers if they reported smoking at least one cigarette per day.

Secondary outcomes were the number of drinks per week, the number of binge drinking episodes per month and the number of cigarettes smoked per smoking day.

Statistical analyses:

Analyses were conducted separately for subjects with unhealthy alcohol use and for those who smoked daily.

Primary outcomes: Logistic regressions were used to assess the relationship between each behavior change construct and subsequent unhealthy substance use at the six-month follow-up. All of the models were adjusted for the receipt of brief intervention. In addition, analyses conducted on subjects with unhealthy alcohol use were adjusted for the presence of smoking risk status, while analyses for subjects who smoked were adjusted for the presence of unhealthy alcohol use. Whenever possible (i.e. adequate number of subjects and absence of collinearity, based on a correlation >0.4 between variables), a model containing all three constructs was used. Such model was not performed for smokers, due to the small number of non-smoking subjects at six months.

Secondary outcomes: the number of drinks per week, the number of binge drinking episodes per month and the number of cigarettes smoked per smoking day were analyzed using negative binomial regression models

(NBRM[1]) to assess their relationship to each behavior change construct. Models were adjusted for baseline values of number of drinks per week, number of binge drinking episodes and number of cigarettes per smoking day. Analyses conducted for subjects with unhealthy alcohol use were adjusted for the presence of smoking risk status, and analyses for smokers were adjusted for the presence of unhealthy alcohol use.

SAS software 9.2 (Cary, North Carolina) was used for these analyses, and P values less than 0.05 were considered to be statistically significant.

RESULTS

Twelve of the 853 potential subjects from the randomized controlled trial were dropped, due to missing values on baseline alcohol measures. Of the remaining 841, 577 were included in the present study because they reported unhealthy alcohol use and/or smoking. There were 261 with unhealthy alcohol use only, 102 with smoking only and 214 with unhealthy alcohol use and smoking. The baseline characteristics of the included subjects are presented in Table 1. Of these subjects, 461 (80%) completed the six-month follow-up protocol. Subjects who were not followed up did not differ from those who were with respect to baseline alcohol use (mean number of drinks per week, mean number of binge drinking episodes per month), smoking (mean number of cigarettes smoked per smoking day), or behavior change (readiness, importance, confidence) constructs ($p < 0.10$ for all measures).

Subjects with unhealthy alcohol use at baseline:

Among the 475 subjects reporting unhealthy alcohol use at baseline, mean (SD) readiness, importance and confidence to change drinking scores were 4.0 (3.1), 2.8 (2.2) and 7.2 (3.0), respectively. The repartition into low, medium and high categories was 62% / 20% / 18% for readiness, 82% / 12% / 6% for importance and 21% / 21% / 58% for confidence. At six months, 108 (29%) of the 377 who completed the follow-up assessment reported no unhealthy alcohol use. Primary outcome: the results of regression models are presented in Table 2. In the separate regression models adjusting for receipt of brief intervention, there was no association between readiness and being risk-free for alcohol use six months later. Subjects with high importance and high confidence levels were more likely to be risk-free compared to subjects with low importance and low confidence levels (OR 2.94 [1.15;7.50] for high importance; 2.88 [1.46;5.68] for high confidence). Given the number of subjects with and without unhealthy alcohol use at follow-up, and given that readiness, importance and confidence were not highly correlated (Spearman correlation coefficient for readiness-importance: 0.37, readiness-confidence 0.21, importance-confidence: 0.13), analyses including all three measures and adjusted for receipt of brief intervention were deemed adequate. Results were similar to the three separate models when all three constructs were included in one model, indicating the independent association of high importance and high confidence with favorable alcohol outcomes at follow-up.

Secondary outcomes: the results are presented in Table 3. Readiness and importance were not associated with number of drinks per week or number of binge drinking episodes per month at six months. Subjects with high confidence levels at baseline reported 20-30% fewer drinks per week or binge episodes per month, compared to subjects with low confidence levels. Both of these associations were significant.

[1]Comparison using standard test BIC/AIC showed that NBRM is a better fit than PRM, ZIP or ZINB models.

Subjects smoking at baseline:

Among the 316 smokers, mean readiness, importance and confidence to change smoking scores were 4.6 (2.6), 5.3 (2.6) and 5.9 (2.6), respectively. The repartition between low, medium and high was 54% / 30% / 16% for readiness, 42% / 34% / 24% for importance and 30% / 39% / 31% for confidence. Of the 255 subjects who completed the follow-up assessment at six months, 33 (13%) reported that they no longer smoked. Primary outcome: the results of regression models are presented in Table 2. Neither readiness nor importance was associated with being a non-smoker, whereas high confidence was associated (OR 3.29 [1.12; 9.62]. Given the number of non-smokers at follow-up, it was not possible to include all three of the behavior change measures in the same regression model.

Secondary outcome: the results are presented in Table 3. There were no significant associations of readiness, importance, and confidence with number of cigarettes smoked per smoking day at six months.

DISCUSSION

We investigated the association of three behavior change constructs (readiness, importance and confidence) with drinking and smoking behaviors. In this prospective cohort sample, it appears that changes in alcohol use are far more frequent then changes in smoking; while 29% of the subjects with baseline unhealthy alcohol use were no longer drinking unhealthy amounts at six months, only 13% of the baseline smokers no longer smoked at least one cigarette per day at follow-up.

Our results show that high confidence levels were associated with subsequent changes in drinking and smoking risk status. The magnitudes of association were similar for both behaviors, i.e. subjects who had high confidence in their ability to change were about three times more likely to no longer report an unhealthy behavior than were subjects with low confidence levels. Thus, confidence appears to be a good predictor of subsequent reductions in both alcohol and tobacco use. These results were confirmed within secondary outcome analyses for alcohol use; subjects with high confidence levels reported fewer drinks per week and fewer binge episodes per month than did subjects with low confidence levels. Results also suggest that there is a dose-response relationship between confidence and drinking outcomes. For smoking, results found with the primary outcome were not confirmed in the secondary outcome analysis (number of cigarettes smoked per smoking day). Nevertheless, the measure of effect suggests a dose-response relationship between confidence and number of cigarettes smoked per day even if the association failed to reach statistical significance. Our findings are consistent with other reports that point out the potential role of confidence in ability to change as a good predictor of change (Williams et al., 2007). They can be linked to other studies showing the impact of self-efficacy on relapse and abstinence for both smoking and drinking (Demmel et al., 2004; Gwaltney et al., 2005; Prochaska et al., 1985; Woodby et al., 1999).

Results were mixed for importance of changing: for primary outcomes, there was an association between high importance and changes in drinking, but not in smoking. There were no associations found for secondary outcomes.

Readiness to change did not seem to be associated with changes in either drinking or smoking, a result that at first seems to be inconsistent with current behavior change theories. However, other studies failed to show an association between readiness to change and behavior change (Biener and Abrams, 1991; Williams et al., 2007). As opposed to confidence, readiness may reflect severity of use rather than a dimension associated with the ability to enact changes (Bertholet et al., 2009; Maisto et al., 1999).

The findings herein should be considered in the context of several limitations of this study. First, our subjects agreed to participate in a research model designed to allow them to receive a brief motivational intervention, and thus might have been predisposed to changing. In addition, secondary analyses of randomized trial data can invite methodological challenges. However, unlike secondary analyses in other cohort designs, an intervention is well specified and its recipients are in an identified group; all of the analyses can be controlled for intervention delivery. Furthermore, efforts were made in this randomized trial within this particular population to ensure an acceptable follow-up rate (in this case, 80%).

Our study also has several noteworthy strengths. We used a population-based sample of young men recruited at the Lausanne army recruitment center that processes all French-speaking Swiss males in order to assess eligibility for military service. This procedure is mandatory in Switzerland; therefore, sample selection bias is a priori and necessarily minimal. Typically, individuals in this setting do not seek treatment and seldom access primary care services. As a result, other population-based studies evaluating behavior change constructs are relatively scarce.

Whether there is a causal relationship between confidence in ability to change and subsequent changes in drinking and smoking, or whether changes in confidence can lead to better outcomes remains to be determined. Nevertheless, this report adds to the body of evidence suggesting that confidence and self-efficacy are critical dimensions that may be causally linked to behavior change. Although assessing the readiness and the importance of changing may have clinical utility, determining one's confidence in ability to change may be a better predictor of future improvements in alcohol and tobacco use, and may relate more specifically to individual capacity for successful change.

Competing interests

The authors declare that they have no competing interests

Authors' contributions

NB: conception and design of the study, analysis and interpretation of data, drafting of the manuscript

JG: acquisition of data, interpretation of data, revision of the manuscript

MF: design of the study, analysis and interpretation of the data, drafting and revision of the manuscript

GG: conception of the study, acquisition of data, interpretation of data, revision of the manuscript

JBD: conception of the study, revision of the manuscript

All authors read and approved the current version of the manuscript

REFERENCES:

Baliunas D, Patra J, Rehm J, Popova S, Taylor B (2007) Smoking-attributable morbidity: acute care hospital diagnoses and days of treatment in Canada, 2002. BMC Public Health 7:247.

Bertholet N, Cheng DM, Palfai TP, Samet JH, Saitz R (2009) Does readiness to change predict subsequent alcohol consumption in medical inpatients with unhealthy alcohol use? Addict Behav 34(8):636-40.

Bertholet N, Daeppen JB, Wietlisbach V, Fleming M, Burnand B (2005) Reduction of alcohol consumption by brief alcohol intervention in primary care: systematic review and meta-analysis. Arch Intern Med 165(9):986-95.

Bertholet N, Horton NJ, Saitz R (2007) Changes in readiness and drinking in primary care patients with unhealthy alcohol use. Alcoholism Clin Exp Res Blackwell(31, suppl.).

Biener L, Abrams DB (1991) The Contemplation Ladder: validation of a measure of readiness to consider smoking cessation. Health Psychol 10(5):360-5.

Chung T, Maisto SA, Mihalo A, Martin CS, Cornelius JR, Clark DB (2011, epub ahead of print) Brief assessment of readiness to change tobacco use in treated youth. J Subst Abuse Treat.

Demmel R, Beck B, Richter D, Reker T (2004) Readiness to change in a clinical sample of problem drinkers: relation to alcohol use, self-efficacy, and treatment outcome. Eur Addict Res 10(3):133-8.

Gilpin EA, White VM, White MM, Pierce JP (2009) Young adult smoking behavior: implications for future population health. Am J Health Behav 33(5):569-80.

Gore FM, Bloem PJ, Patton GC, Ferguson J, Joseph V, Coffey C, Sawyer SM, Mathers CD (2011) Global burden of disease in young people aged 10-24 years: a systematic analysis. Lancet 377(9783):2093-102.

Gwaltney CJ, Shiffman S, Balabanis MH, Paty JA (2005) Dynamic self-efficacy and outcome expectancies: prediction of smoking lapse and relapse. J Abnorm Psychol 114(4):661-75.

Harris TR, Walters ST, Leahy MM (2008) Readiness to change among a group of heavy-drinking college students: correlates of readiness and a comparison of measures. J Am Coll Health 57(3):325-30.

Hesse M (2006) The Readiness Ruler as a measure of readiness to change poly-drug use in drug abusers. Harm Reduct J 3:3.

John U, Rumpf HJ, Hanke M, Gerke P, Hapke U (2003) Estimation of tobacco- or alcohol-attributable disease rates in national hospital care: an approach based on routine in-patient disease register data and systematic diagnosis of alcohol use disorders. Alcohol Alcohol 38(4):339-46.

Kaner EF, Beyer F, Dickinson HO, Pienaar E, Campbell F, Schlesinger C, Heather N, Saunders J, Burnand B (2007) Effectiveness of brief alcohol interventions in primary care populations. Cochrane Database Syst Rev (2):CD004148.

Kaysen DL, Lee CM, Labrie JW, Tollison SJ (2009) Readiness to change drinking behavior in female college students. J Stud Alcohol Drugs Suppl (16):106-14.

Maisto SA, Conigliaro J, McNeil M, Kraemer K, O'Connor M, Kelley ME (1999) Factor structure of the SOCRATES in a sample of primary care patients. Addict Behav 24(6):879-92.

Maisto SA, Krenek M, Chung T, Martin CS, Clark D, Cornelius J (2011) Comparison of the concurrent and predictive validity of three measures of readiness to change marijuana use in a clinical sample of adolescents. J Stud Alcohol Drugs 72(4):592-601.

Miller WR, Rollnick S (2002) Motivational Interviewing: Preparing People for Change. 2nd ed. ed. The Guilford Press, New York, NY.

Mottillo S, Filion KB, Belisle P, Joseph L, Gervais A, O'Loughlin J, Paradis G, Pihl R, Pilote L, Rinfret S, Tremblay M, Eisenberg MJ (2009) Behavioural interventions for smoking cessation: a meta-analysis of randomized controlled trials. Eur Heart J 30(6):718-30.

Prochaska JO, DiClemente CC, Velicer WF, Ginpil S, Norcross JC (1985) Predicting change in smoking status for self-changers. Addict Behav 10(4):395-406.

Rehm J, Mathers C, Popova S, Thavorncharoensap M, Teerawattananon Y, Patra J (2009) Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. Lancet 373(9682):2223-33.

Rehm J, Room R, Monteiro M, Gmel G, Graham K, Rehn N, Sempos CT, Jernigan D (2003) Alcohol as a risk factor for global burden of disease. Eur Addict Res 9(4):157-64.

Rehm J, Taylor B, Roerecke M, Patra J (2007) Alcohol consumption and alcohol-attributable burden of disease in Switzerland, 2002. Int J Public Health 52(6):383-92.

Rigotti NA, Munafo MR, Stead LF (2007) Interventions for smoking cessation in hospitalised patients. Cochrane Database Syst Rev (3):CD001837.

Rollnick S (1998) Readiness, importance and confidence: critical conditions of change in treatment, in Treating Addictive Behaviour,(Miller WR, Heather N eds), 2nd ed. Plenum, New York.

Williams EC, Horton NJ, Samet JH, Saitz R (2007) Do brief measures of readiness to change predict alcohol consumption and consequences in primary care patients with unhealthy alcohol use? Alcohol Clin Exp Res 31(3):428-35.

Woodby LL, Windsor RA, Snyder SW, Kohler CL, Diclemente CC (1999) Predictors of smoking cessation during pregnancy. Addiction 94(2):283-92.

Zwar N (2008) Smoking cessation--what works? Aust Fam Physician 37(1-2):10-4.

Table 1: baseline characteristics of subjects with unhealthy alcohol use and smoking

	Subjects with unhealthy alcohol use (n=475)	**Subjects with smoking (n=316)**
Age, mean (SD)	20.0 (1.2)	20.1 (1.2)
Unhealthy alcohol use, n (%)		214 (68%)
Smoking, n (%)	214 (45%)	
Number of drinks per week, mean (SD)	14.2 (15.7)	11.7 (14.4)
Number of binge drinking episodes per month, mean (SD)	4.9 (4.0)	3.8 (4.5)
Number of cigarettes per smoking day, mean (SD)	6.9 (8.1)	13.0 (6.9)
Education level, obligatory school only, n (%)	194 (41%)	138 (44%)
Occupation:		
In training, n (%)	340 (72%)	211 (67%)
Employed, n (%)	102 (21%)	76 (24%)
Inactive, n (%)	33 (7%)	29 (9%)
Readiness (alcohol), % low / medium / high	62%/ 20% / 18%	
Importance (alcohol),% low / medium / high	82% / 12% / 6%	
Confidence (alcohol), % low / medium / high	21% / 21% / 58%	
Readiness (tobacco), % low / medium / high		54% / 30% / 16%
Importance (tobacco), % low / medium / high		42% / 34% / 24%
Confidence (tobacco), % low / medium / high		30% / 39% / 31%

Note: **: Unhealthy alcohol use was defined as drinking more than 21drinks per week or drinking 6 drinks or more on a single occasion more often than once per month*

***: Smoking was defined as smoking at least one cigarette per day*

For readiness, importance and confidence: low (1-4), medium (5-7), high (8-10), recoded from 1-10

Table 2: association between readiness, importance and confidence and favorable outcomes at six months

	Subjects with unhealthy alcohol use		**Subjects with smoking**
	Separate logistic regression models (one model for each construct), AOR (95%CI)*	**Model including all three constructs, AOR (95%CI)***	**Separate logistic regression models (one model for each construct), AOR (95%CI)***
Readiness (reference group: low)	Model 1		Model 1
Medium	1.26 (0.71, 2.22)	1.08 (0.57, 2.06)	2.05 (0.89, 4.70)
High	1.42 (0.78, 2.58)	0.89 (0.45, 1.76)	2.07 (0.76, 5.68)
Importance (reference group: low)	Model 2		Model 2
Medium	0.91 (0.45, 1.84)	0.95 (0.43, 2.11)	1.41 (0.58, 3.43)
High	**2.94 (1.15, 7.50)**	**3.09 (1.10, 8.68)**	2.10 (0.83, 5.29)
Confidence (reference group: low)	Model 3		Model 3
Medium	2.16 (0.97, 4.78)	2.11 (0.91, 4.91)	2.18 (0.74, 6.45)
High	**2.88 (1.46, 5.68)**	**2.91 (1.44, 5.85)**	**3.29 (1.12, 9.62)**

** All models were adjusted for receipt of a brief intervention and smoking risk status at baseline (for subjects with unhealthy alcohol use) and unhealthy alcohol use (for subjects with smoking). Reporting no unhealthy alcohol use/smoking less than 1 cigarette a day (favorable outcome) was coded 1 in the logistic regression model.*

Unhealthy alcohol use was defined as drinking more than 21 drinks per week or drinking 6 drinks or more on a single occasion more often than once per month. Smoking was defined as smoking one cigarette per day or more.

For readiness, importance and confidence: low (1-4), medium (5-7), high (8-10), recoded from 1-10

Table 3: association between readiness, importance and confidence and drinking and smoking at six months

Readiness, importance and confidence to change drinking	Number of drinks per week			Number of binge drinking episodes per month		
	IRR	*95%CI*	*p*	*IRR*	*95%CI*	*p*
Readiness (reference group: low)						
Medium	0.92	0.74, 1.13	0.40	0.99	0.78, 1.24	0.91
High	1.07	0.86, 1.34	0.53	1.08	0.85, 1.38	0.52
Importance (reference group: low)						
Medium	1.11	0.87, 1.42	0.40	1.11	0.85, 1.45	0.43
High	1.00	0.70, 1.45	0.98	1.07	0.71, 1.60	0.75
Confidence (reference group: low)						
Medium	0.84	0.66, 1.08	0.18	0.82	0.62, 1.06	0.13
High	0.80	0.65, 0.98	0.03	0.74	0.59, 0.92	0.008

Readiness, importance, and confidence to change smoking	Number of cigarettes per smoking day		
	IRR	*95%CI*	*p*
Readiness (reference group: low)			
Medium	1.03	0.88, 1.20	0.73
High	0.98	0.81, 1.18	0.79
Importance (reference group: low)			
Medium	0.99	0.85, 1.15	0.92
High	1.08	0.91, 1.28	0.36
Confidence (reference group: low)			
Medium	0.96	0.82, 1.13	0.62
High	0.91	0.77, 1.08	0.29

IRR: incidence rate ratio

All models were negative binomial regression models. Analyses conducted for subjects with unhealthy alcohol use were adjusted for receipt of brief intervention, drinking at baseline (number of drinks per day or number of binge drinking episodes per month) and smoking status at baseline. Analyses conducted for subjects with smoking were adjusted for receipt of brief intervention, smoking at baseline (number of cigarettes per smoking day), and presence of unhealthy alcohol use at baseline.

For readiness, importance and confidence: low (1-4), medium (5-7), high (8-10), recoded from 1-10

Does motivation to change predicts change? – The Change Questionnaire predicts change in hazardous tobacco and alcohol use

Jacques Gaume [1,2], Nicolas Bertholet [1], Jean-Bernard Daeppen [1], Gerhard Gmel [1]

1. Alcohol Treatment Centre, Department of Community Medicine and Health, Lausanne University Hospital, Lausanne, Switzerland.
2. Center for Alcohol and Addiction Studies, Brown University, Providence, RI, USA.

Corresponding author:

Jacques Gaume
Alcohol Treatment Centre, Mont Paisible 16, 1011 Lausanne, Switzerland

Tel. +41 21 314 73 51, Fax +41 21 314 05 62, Jacques.Gaume@chuv.ch

For submission to Addiction

Abstract:

Aims - To test the predictive validity of the Change Questionnaire, a 12-item questionnaire assessing motivation to change using natural change language, on change in hazardous tobacco and alcohol use.

Design – 213 participants filled in the questionnaire on tobacco and 95 on alcohol as part of the baseline measurements for a randomized controlled trial on multi-substance brief motivational interventions (BMI) and were followed-up six months later.

Setting - Swiss army recruitment center in Lausanne (army recruitment is mandatory in Switzerland and thus provides a unique opportunity to address a non-clinical and largely representative sample of young people).

Participants - Young men aged 20 voluntarily showing up for a BMI.

Measurements - The overall Change questionnaire score and its six sub-scales were introduced as predictors of hazardous tobacco use (defined as daily smoking) and hazardous alcohol use (defined as more than one occasion with six standard drinks or more per month, and/or more than 21 standard drinks per week) at follow-up in bivariate logistic regression models.

Findings - Higher overall Change scores were significant predictors of decreased risk of both hazardous tobacco (odds ratio [OR]=0.83, p=0.046) and alcohol (OR=0.76, p=0.03) uses. Regarding the sub-scales, *Ability to change* predicted tobacco hazardous use (OR=0.71, p=0.001), and *Taking steps toward change* predicted alcohol hazardous use (OR=0.79, p=0.01).

Conclusions - The present findings give first support to the predictive validity of the Change questionnaire on hazardous tobacco and alcohol use, making it a interesting tool for assessing motivation for change among young men.

Introduction

Motivation for change is seen as a central feature in many substance abuse behavioral treatments such as motivational interviewing (MI) and its brief adaptations (Miller and Rollnick 2002), but also cognitive-behavioral therapy (Antony et al. 2005; Westra 2011). In MI and brief MI adaptations (BMI), assessing motivation for change has been viewed as an important step in treatment to further tailor the intervention. Several assessment tools have been developed and their predictive validity has been tested (Maisto et al. 2011).

During MI (and BMI) sessions, motivation for change is expected to be expressed by the client as "change talk" (Miller and Rollnick 2002), i.e. all statements inclined toward or away from change. Recently, several studies have been conducted to empirically test the predictive validity of change talk expressed during treatment on treatment outcomes (Amrhein et al. 2003; Moyers et al. 2007; Baer et al. 2008; Gaume et al. 2008a; Moyers et al. 2009; Bertholet et al. 2010; Gaume et al. 2011). All these studies consistently showed that some dimensions of change talk significantly predicted substance use outcomes. Based on their prior study on change talk dimensions (Amrhein et al. 2003) and on psycholinguistic developments on natural language that clients use to characterize their inclination toward or against change (Amrhein 2004), Miller, Moyers, and Amrhein (2005) developed a 12-item scale, the Change Questionnaire. In this instrument, the client identifies the change he/she is considering and then answers to each item in relation to that change (e.g. "I could…", "I want to…", "I am trying to…", etc., see Table 1). One global score and six sub-dimensions scores are derived (i.e. *Desire*, *Ability*, *Reasons*, *Need*, *Commitment* and *Taking steps*).

Insert Table 1 here

Only a few studies used the Change questionnaire. Miler and Johnson (2008) investigated the internal consistency of this instrument and performed a factor analysis to capture latent dimensions and refined the instrument as a short screening test. Internal consistency was found to be good and three factors (Importance, Commitment, Ability) were derived. The authors proposed a short version of the instrument using 3 items corresponding to the 3 factors ("It's important to me to…", "I am trying to…", and "I could…"). The Change questionnaire was recently used in a study to investigate motivation to quit among smokers with schizophrenia and schizoaffective disorder and non-psychiatric controls (Steinberg et al. 2010). In another recent study (Westra 2011), the author used the Change questionnaire to test the predictive value of motivation for changing in cognitive behavioral therapy for generalized anxiety disorder and found that this measure was significantly related to short- and long-term anxiety outcomes.

Methods

In the present study, we used a sample collected as part of a randomized controlled trial, but analyzed as a prospective cohort. The parent randomized controlled trial (Gmel et al. 2011) tested the impact of a multi-substance brief motivational intervention (BMI) among 823 Swiss young men aged 20 voluntarily showing up for a BMI while attending the army recruitment center in Lausanne, Switzerland. Army recruitment is mandatory in Switzerland and thus provides a unique opportunity to address a non-clinical and largely representative sample

of young people. Women are eligible to serve in the army on a voluntary basis and few of them do so; women were thus not included in the study. At all research stages, participants were reminded that the research staff had no connection with the army and that all information was confidential and had no implications or influence on the army recruitment procedures. Inclusion relied on inviting unscreened conscripts to benefit from a psychologist-led BMI session focusing on tobacco, alcohol, and/or other illicit substance use.

The Change Questionnaire (Miller et al. 2005) was embedded within the baseline assessment that both intervention and control group filled in at study entry. Baseline assessment was auto-administrated but research staff provided help when necessary. This 12-item scale (see Table 1) covers the six sub-dimensions of change language (i.e. *Desire*, *Ability*, *Reasons*, *Need*, and *Commitment* to change, as well as *Taking steps* toward change) hypothesized to be active ingredients in the MI literature (Amrhein et al. 2003; Amrhein 2004). There are 2 items per dimension and those are rated on a 0 (definitely not) to 10 (definitely) Likert scale. Participants first identified the change they were considering. For that, they had to choose between 3 categories of change (stop, decrease, no change) and 4 categories of substances (tobacco, alcohol, cannabis, other illicit substances). Then they completed the 12 items with reference to that change (e.g. "I want to… stop tobacco" [*Desire*]; "I could… stop tobacco" [*Ability*], etc.). The total score ("Change score") was computed as the addition of all items divided by 12 to get a score ranging from 0 to 10. Each sub-scales scores were computed as the addition of the corresponding 2 items divided by 2 to get a score ranging from 0 to 10.

Of the 823 participants included in the study, 254 chose tobacco as the substance they wanted to make a change about, 118 chose alcohol, 54 chose cannabis, and 7 other illicit substances (the 390 remaining indicated imagining no change in their substance use). At follow-up, complete data for the present analysis were available for 213 participants having chosen tobacco (83.8%), 95 alcohol (80.5%), 42 cannabis (77.7%), and 6 other illicit drugs (85.7%). Analyses were conducted only for tobacco and alcohol use to avoid lack of statistical power. We also grouped the different types of change (i.e. 'stop' and 'decrease') in one dimension to avoid loss of power.

Primary outcomes were tobacco and alcohol hazardous use at follow-up. Hazardous tobacco use was defined as daily smoking (1 cigarette or more per day). Hazardous alcohol use was defined as more than one occasion with 6 standard drinks or more per month and/or more than 21 standard drinks per week. One standard drink was defined as containing 10 grams of pure alcohol (e.g. 2.5 dl of beer, 1 dl of wine, 1 shot of spirit).

Cronbach's alpha was used to measure the internal consistency of the overall scale and of the six sub-scales. Then, the overall scale and each sub-scale were separately introduced as predictors of tobacco and alcohol hazardous use at follow-up in bivariate logistic regression models adjusted for the corresponding hazardous use at baseline (i.e. tobacco or alcohol) and for the experimental group allocation (i.e. BMI group or control group with no intervention; this was done to control for the intervention effect as this study uses the sample as a prospective cohort). In a second phase, we conducted two multivariate stepwise regression analyses, one per outcome. All variables having values of $p < 0.10$ in the univariate models were introduced as independent variables in the corresponding multivariate logistic regression model adjusted for hazardous use at baseline and for experimental group allocation. We used a backward entry introducing all variables simultaneously, then excluding those with $p > 0.10$ by dropping the variable with the highest p first, then the second highest, etc. The final model kept only those variables having $p < 0.05$.

Results

Internal consistency was excellent for the overall scale according to Cronbach's alpha (.91). Internal consistency was acceptable to good for the six sub-scales (*Desire:* .72, A*bility*: .71, *Reason*: .73, *Need*: .82, *Commitment*: .88, *Taking steps*: .80). Descriptive statistics for the overall scale and each sub-scale are presented separately for those considering change in tobacco and alcohol (Table 2).

Insert Table 2 here

Using bivariate logistic regressions, the overall scale score was a significant predictor of both hazardous tobacco and hazardous alcohol use at follow-up (Table 3). Findings were in the expected direction with higher scores related to lower risk to be a hazardous user.

Insert Table 3 here

Regarding the sub-scales of the change questionnaire, we found several significant associations, all in the expected direction. *Ability* and *Taking steps* significantly predicted hazardous tobacco use, while *Commitment* was of borderline significance (p=0.054). Using a multivariate backward stepwise procedure, only *Ability* remained significant. *Desire*, *Commitment*, and *Taking Steps* were significant predictors of hazardous alcohol use, while *Reason* was of borderline significance (0=0.07). Using a multivariate backward stepwise procedure, only *Taking Steps* remained significant.

We repeated all analyses using a categorization of the scores (low [0-4], medium [5-7], and high [8-10]) to test for a lack of linearity of the variables. This analysis showed very consistent patterns (same significant variables) but indicated that only high scores (8-10) were significantly predictive of outcomes.

Discussion

The present findings give first support to the predictive validity of the Change questionnaire and its sub-dimensions on hazardous tobacco and alcohol use. We found that higher overall Change scores were significant predictors of decreased risk of both hazardous tobacco and alcohol uses. Several sub-dimensions were associated with the outcomes in bivariate analyses, but using stepwise multivariate procedures, we found that Ability to change was the unique predictor of tobacco hazardous use at follow-up, and that Taking Steps was the unique predictor of alcohol hazardous use at follow-up. Further analyses showed that particularly high scores (8-10 on the 10-point Likert scales) were significantly predictive of outcomes.

Together with the study by Westra (2011), the present findings give some first evidence for the predictive validity of the Change questionnaire. The fact that both studies were conducted in different settings (clinical vs. general population), with different population (Canadian adults vs. Swiss young men), by targeting different kind of change (generalized anxiety disorder vs. hazardous substance use), and using different treatments (cognitive behavioral therapy vs. BMI) suggests that this instrument might have a large applicability. Nevertheless, further validation is needed.

It is of interest that the two sub-scales that significantly predicted outcomes are two dimensions highlighted in the factor analysis by Miller and Johnson (2008). In this study, one of the retained factor was “I could” which corresponds to *Ability* which predicted tobacco outcomes in the present study. Another retained factor was “I am trying to” which corresponds to *Taking Steps* which predicted the alcohol outcome in the present study. These two dimensions seem to be important constructs in the change process since other studies also found support for their implication. For example, confidence in ability to change has been found as a good predictor of change (Williams et al. 2007; Bertholet et al. 2011), and studies using the Stages of Change Readiness and Treatment Eagerness Scale (SOCRATES) found that the “taking steps” scale predicted subsequent behavior change [e.g. Demmel et al. (2004); Bertholet et al. (2009); Maisto et al. (2011)].

Some correspondences with change talk expressed within-session are also to be highlighted. The overall Change score was a predictor of both tobacco and alcohol outcomes in the present study while overall change talk during MI sessions was a significant predictor of change in the studies by Moyers and colleagues (Moyers et al. 2007; Moyers et al. 2009). Looking at change language sub-dimensions, the present finding that *Ability* was a significant predictor of tobacco use corresponds to findings implicating ability to change expressed during BMI as a predictor of better substance use outcomes in 3 studies (Baer et al. 2008; Gaume et al. 2008a; Gaume et al. 2011). However, the link between change language assessed within a questionnaire and within-treatment change talk was never investigate and remained an important question. Indeed, the nature of MI treatment is in enhancing motivation to change by influencing change talk. Change talk should thus essentially evolves during MI sessions making pre-treatment measure of change language a separate construct of within-session change talk. Future studies should examine these relations. Additionally, the Change questionnaire might be a useful tool in research on change talk as an active ingredient of MI, in order to control for the nature of the change language before treatment.

This study has several strengths and weaknesses. We used a sample included at the Lausanne army recruitment center which all French-speaking Swiss males have to visit at age 20 in order to assess eligibility for military service, providing thus a non-clinical and largely representative sample of young men. This advantage directly comes with the limitations that our might not apply to women, persons younger or older, and/or in clinical or other specific settings. Also related is the limitation that the Change questionnaire was used in French while it was developed in English. Prior studies on change talk in French (Gaume et al. 2008b; Gaume et al. 2011) as well as the above noted correspondence between the present findings and previous studies using the Change questionnaire in English (Miller and Johnson 2008; Westra 2011) tend to show similar patterns, even if some underlying linguistic differences might still be present. Finally, our analysis was limited by the sample size and nature of the parent study. The latter targeted several substances and participants were asked to answer to the Change questionnaire on the one substance they were more considering to change. We were not able to analyze the predictive validity of the instrument on cannabis and other illicit drug use since these substances were less often chosen.

References

Amrhein P.C. (2004) How Does Motivational Interviewing Work? What Client Talk Reveals. *Journal of Cognitive Psychotherapy*, 18, 323-36.

Amrhein P.C., Miller W.R., Yahne C.E., Palmer M., and Fulcher L. (2003) Client commitment language during motivational interviewing predicts drug use outcomes. *J Consult Clin Psychol*, 71, 862-78.

Antony M.M., Roth Ledley D., and Heimberg R.G. (2005) *Improving outcomes and preventing relapse in cognitive-behavioural therapy*. New York Guilford Press.

Baer J.S., Beadnell B., Garrett S.B., Hartzler B., Wells E.A., and Peterson P.L. (2008) Adolescent Change Language Within a Brief Motivational Intervention and Substance Use Outcomes. *Psychology of Addictive Behaviors*, 22, 570-5.

Bertholet N., Cheng D.M., Palfai T.P., Samet J.H., and Saitz R. (2009) Does readiness to change predict subsequent alcohol consumption in medical inpatients with unhealthy alcohol use? *Addict Behav*, 34, 636-40.

Bertholet N., Faouzi M., Gmel G., Gaume J., and Daeppen J.B. (2010) Change talk sequence during brief motivational intervention, towards or away from drinking. *Addiction*, 105, 2106-12.

Bertholet N., Gaume J., Faouzi M., Daeppen J.B., and Gmel G. (2011) Predictive value of readiness, importance, and confidence in ability to change drinking and smoking. *Submitted*.

Demmel R., Beck B., Richter D., and Reker T. (2004) Readiness to change in a clinical sample of problem drinkers: relation to alcohol use, self-efficacy, and treatment outcome. *Eur Addict Res*, 10, 133-8.

Gaume J., Bertholet N., Faouzi M., Gmel G., and Daeppen J.B. (2011) Does change talk during brief motivational interventions with young men predict change in alcohol use? *Submitted*.

Gaume J., Gmel G., and Daeppen J.B. (2008a) Brief alcohol interventions: do counsellors' and patients' communication characteristics predict change? *Alcohol Alcohol*, 43, 62-9.

Gaume J., Gmel G., Faouzi M., and Daeppen J.B. (2008b) Counsellor behaviours and patient language during brief motivational interventions: a sequential analysis of speech. *Addiction*, 103, 1793-800.

Gmel G., Gaume J., Bertholet N., Faouzi M., and Daeppen J.B. (2011) Brief motivational interventions for tobacco, alcohol, cannabis, and other drugs use in 20-year old men: A randomized controlled trial. *Submitted*.

Maisto S.A., Krenek M., Chung T., Martin C.S., Clark D., and Cornelius J. (2011) A comparison of the concurrent and predictive validity of three measures of readiness to change alcohol use in a clinical sample of adolescents. *Psychol Assess*, 23, 983-94.

Miller W.R., and Johnson W.R. (2008) A natural language screening measure for motivation to change. *Addict Behav*, 33, 1177-82.

Miller W.R., Moyers T.B., and Amrhein P.C. (2005) *Change Questionnaire, Version 1.2*. Albuquerque: Department of Psychology, University of New Mexico.

Miller W.R., and Rollnick S. (2002) *Motivational interviewing: Preparing people for change*. New York, NY: Guilford Press.

Moyers T.B., Martin T., Christopher P.J., Houck J.M., Tonigan J.S., and Amrhein P.C. (2007) Client language as a mediator of motivational interviewing efficacy: Where is the evidence? *Alcoholism-Clinical and Experimental Research*, 31, 40s-7s.

Moyers T.B., Martin T., Houck J.M., Christopher P.J., and Tonigan J.S. (2009) From in-session behaviors to drinking outcomes: a causal chain for motivational interviewing. *J Consult Clin Psychol*, 77, 1113-24.

Steinberg M.L., Williams J.M., Gandhi K.K., Foulds J., and Brandon T.H. (2010) Lower task persistence in smokers with schizophrenia as compared to non-psychiatric control smokers. *Psychol Addict Behav*, 24, 724-9.

Westra H.A. (2011) Comparing the predictive capacity of observed in-session resistance to self-reported motivation in cognitive behavioral therapy. *Behav Res Ther*, 49, 106-13.

Williams E.C., Horton N.J., Samet J.H., and Saitz R. (2007) Do brief measures of readiness to change predict alcohol consumption and consequences in primary care patients with unhealthy alcohol use? *Alcohol Clin Exp Res*, 31, 428-35.

Table 1. The Change questionnaire

Items	**Sub-scales**
I want to …	Desire
I could …	Ability
There are good reasons for me to …	Reason
I have to …	Need
I intend to …	Commitment
I am trying to …	Taking steps
I hope to …	Desire
I can …	Ability
It is important for me to …	Reason
I need to …	Need
I am going to …	Commitment
I am doing things to …	Taking steps

Table 2. Change questionnaire descriptive statistics

	Mean	SD	Median	IQR	Min	Max
Change considered : Tobacco use (N=213)						
Change score	6.6	2.0	6.7	2.6	0.3	10
Ability	7.4	2.2	8	3	0	10
Desire	7.4	2.2	7.5	3.5	1.5	10
Need	7.2	2.4	7.5	3.5	0	10
Reason	6.3	2.8	6.5	4	0	10
Commitment	6.8	2.7	7	4	0	10
Taking steps	4.7	3.2	4.5	5	0	10
Change considered : Alcohol use (N=95)						
Change score	5.3	2.0	4.9	3.2	1.7	10
Ability	5.7	2.6	5.5	4.5	0	10
Desire	7.8	1.7	8	2.5	4.5	10
Need	4.9	2.9	4.75	5	0	10
Reason	4.0	2.8	4	5	0	10
Commitment	5.4	2.8	5	5	0	10
Taking steps	3.9	2.8	4	4	0	10

***Notes**: All variables measured on a 0-10 scale. SD, standard deviation; IQR, inter-quartile range.*

Table 3. Main change score and change questionnaire sub-scales as predictors of hazardous tobacco and alcohol use at follow-up

	OR	SE	z	p	[95%	CI]
Hazardous tobacco use (N=213)						
Change score	0.83	0.08	-1.99	0.046	0.69	1.00
Desire	0.98	0.08	-0.21	0.83	0.84	1.15
Ability	0.71	0.07	-3.32	0.001	0.58	0.87
Reason	0.95	0.07	-0.69	0.49	0.82	1.10
Need	0.92	0.06	-1.25	0.21	0.81	1.05
Commitment	0.87	0.06	-1.93	0.054	0.75	1.00
Taking steps	0.88	0.05	-2.20	0.03	0.78	0.99
Hazardous alcohol use (N=95)						
Change score	0.76	0.10	-2.19	0.03	0.59	0.97
Desire	0.82	0.08	-1.97	0.049	0.68	1.00
Ability	0.87	0.12	-0.96	0.34	0.66	1.15
Reason	0.85	0.08	-1.81	0.07	0.71	1.01
Need	0.87	0.08	-1.50	0.13	0.73	1.04
Commitment	0.81	0.08	-2.29	0.02	0.67	0.97
Taking steps	0.79	0.07	-2.52	0.01	0.65	0.95

***Notes**: All models are bivariate logistic regressions adjusted for corresponding hazardous use at baseline and for experimental group allocation. Hazardous tobacco use defined as daily smoking; hazardous alcohol use defined as more than one occasion with 6 standard drinks or more per month and/or more than 21 standard drinks per week. OR, Odds ratio; SE, standard error; CI, confidence interval.*