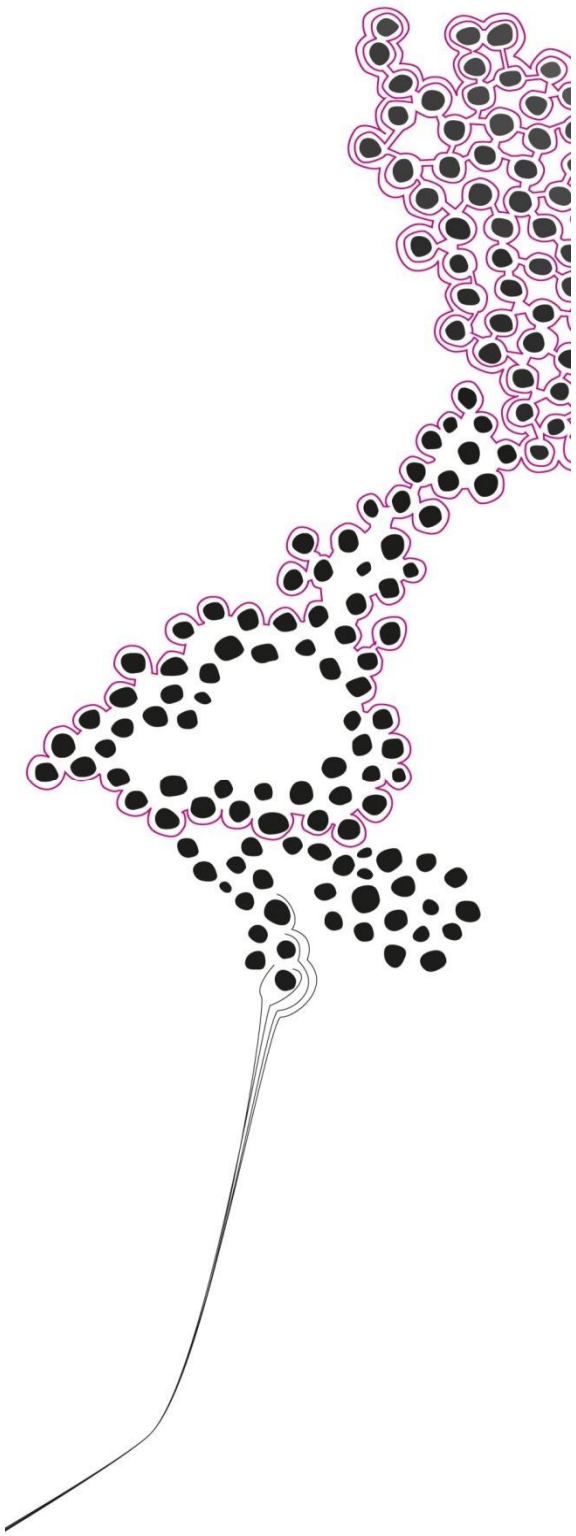
Explanations for Substance Use – The role of implicit and explicit Compensatory Health Beliefs and Personality for Alcohol/Nicotine-related Risk Behavior



by Maria Austermann

University of Twente
Faculty of Behavioral Sciences

Bachelorthesis – Psychology

First Supervisor: Dr. M. Pieterse
Second Supervisor: Dr. P. ten Klooster

Enschede, January, 2016

ABSTRACT

Despite the awareness that substance use constitutes health risks, a large number of German adults are found to enjoy smoking or excessive alcohol consumption. The development of compensatory health beliefs (CHBs), thus believing that the harmful impacts of unhealthy behaviors are compensable through the engagement in other healthy behaviors, might support alcohol and nicotine-related behaviors among young adults.

Research already showed that substance use-related CHBs (SU-CHBs) play a predicting role in substance use. These conclusions were commonly based on explicit measures but less is known about the value of implicit SU-CHBs measures in this context. Using a sample of young German students, this study examined the associations between implicit as well as explicit SU-CHBs and alcohol/nicotine-related behaviors. Since earlier studies described substance use especially as expression of impulsivity and sensation seeking, it was further analyzed if the relationships between implicit SU-CHBs as well as explicit SU-CHBs and alcohol/nicotine-related behavior vary with the magnitude of these personality facets.

An online study was conducted. Implicit alcohol and smoking SU-CHBs were measured with a specially designed ST-IAT. Surveys were used to assess explicit SU-CHBs, personality facets and alcohol/nicotine consumptive behavior. The total sample size was N=100.

The relationships between the measured constructs differed among gender. For both gender types, implicit alcohol and smoking SU-CHBs were not significantly related to their respective behaviors but males with stronger implicit smoking CHBs also had higher explicit SU-CHBs (r=.36). Sensation seeking was also positively related to explicit SU-CHBs in the total sample (r=.23). Mainly males with higher explicit SU-CHBs reported to have higher frequencies of smoking (r=.40), alcohol consumption (r=.42) and binge drinking (r=.50). For females, behavior was more strongly related to personality than explicit SU-CHBs. In the female group, the magnitude of sensation seeking moderated the positive relation between explicit SU-CHBs and binge drinking. For both gender types, personality did not significantly moderate the relation between implicit SU-CHBs and substance use.

The reasons for substance use could be gender specific and more strongly associated with SU-CHBs among men and personality among women. Further research should address implicit CHB measurement techniques as well as their predictive value for behavior. Personality might play a greater role for CHB development as well as for the relation between CHBs and behavior and should be subject to further research addressing the CHB construct.

Keywords: Compensatory health beliefs, implicit and explicit CHB cognitions, personality, impulsivity, sensation seeking, substance use behavior

Hoewel mensen zich bewust zijn van de gezondheidsrisico's die in verband staan met middelengebruik, consumeren veel jonge Duitse volwassenen overmatig alcohol en roken. Door het gebruik van compensatory health beliefs (CHBs), dus de opvatting dat negatieve consequenties van middelengebruik gecompenseerd kunnen worden door het uitvoeren van een ander gezond gedrag, worden deze ongezonde gedragingen van jonge volwassenen misschien nog versterkt.

Onderzoek liet al zien dat expliciete, aan middelengebruik gerelateerde CHBs (MG-CHBs) een significante voorspeller zijn van middelengebruik. Minder kennis bestaat over de waarde van impliciete MG-CHBs voor middelengebruik. Deze studie onderzocht de relatie van zowel impliciete als expliciete MG-CHBs met middelengebruik. Eerdere studies hebben middelengebruik voornamelijk als expressie van impulsiviteit en sensatie seeking beschreven. Daarom werd ook geanalyseerd of de genoemde relaties van MG-CHBs met middelengebruik gemodereerd werden door deze specifieke facetten van persoonlijkheid.

Een online survey werd uitgevoerd. Impliciete, aan alcohol en roken gerelateerde MG-CHBs werden met een speciaal ontworpen ST-IAT gemeten. Vragenlijsten werden gebruikt om expliciete MG-CHBs, persoonlijkheid en alcohol/nicotine gerelateerd gedrag te beoordeelen. De steekproefgrootte was N=100.

De relaties tussen de gemeten constructen verschilden tussen m/v-geslacht. In de totale groep werd geen significante relatie tussen impliciete, aan alcohol en roken gerelateerde MG-CHBs en de respectivelijke gedragingen gevonden. Echter, mannen met sterkere impliciete, aan roken gerelateerde MG-CHBs hadden ook sterkere expliciete MG-CHBs (r=.36). Sensatie seeking was ook positief gerelateerd aan expliciete MG-CHBs (r=.23) in de gehele steekproef. Voornamelijk mannen met hogere expliciete MG-CHBs hadden ook hoger frekwenties van tabaksgebruik (r=.40), alcohol consumptie (r=.42) en binge drinking (r=.50). Bij vrouwen was gedrag sterker gerelateerd aan persoonlijkheid dan expliciete MG-CHBs. Bij vrouwen modereerde de dimensie van sensatie seeking de relatie tussen MG-CHBs en binge drinking.

De reden voor middelengebruik zou voor het geslacht kunnen variëren en bij mannen sterker geassocieerd zijn met MG-CHBs en bij vrouwen sterker geassocieerd zijn met persoonlijkheid. Verdere studies zouden zich focuseren op de waarde en het meten van impliciete CHBs. Persoonlijkheid speelt misschien een grotere rol voor het ontwikkelen van CHBs zoals voor de relatie tussen CHBs en gedrag en zou in onderzoek over CHBs betrokken kunnen worden.

Keywords: Compensatory health beliefs, impliciete en expliciet CHB cognities, persoonlijkheid, impulsiviteit, sensatie seeking, middelengebruik

TABLE OF CONTENTS

1. Introduction

1.1 Substance Use

Epidemiological research in Germany identified the most prevalent substance use-related health-risk behaviors of young adults that are associated with high rates of mortality and morbidity. A majority of male (90 %) and female (83 %) habitants between 18 and 24 years old consume alcohol regularly. A third of this age group even reported excessive drinking (Burger & Mensink, 2003). In line with that, Jonas, Dobson, and Brown (2000) revealed that binge drinking, where more than 6 glasses of alcohol are consumed in a rapid manner on one occasion (Korte, Pieterse, Postel & Van Hoof, 2012), became a common habit among young adults.

A further health-damaging substance consumed by this age group is tobacco. 38 % of men and 28 % of women in the German population between 20 and 30 years are smokers (Statistisches Bundesamt, 2013). By smoking or drinking alcohol, people often aim to provide a source of personal pleasure and sociability (Harrison, Kelly, Lindsay, Advocat, & Hickey, 2011; Gilman, 2004). Nevertheless, cardiac diseases, impairments of the nervous system, and various cancers constitute only a few afflictions that are related to excessive alcohol consumption (Seitz, 2000). Smoking is similarly accountable for diverse diseases and one of the leading reasons for an early death (Doll, Peto, Boreham, & Sutherland, 2004). Notably, smoking or excessive drinking is often not the only unhealthy behavior substance users engage with. Substance consumption constitutes a behavioral pattern, that is often associated with other harmful conditions like physical inactivity (Nelson & Gordon-Larsen, 2006), obesity (Lahti-Koski, Pietinen, Heliovaara & Vartiainen, 2002) and unhealthy weight regulation (Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008).

The findings described above suggest that a lot of young German adults engage in substance use and are therefore at high risk of developing harmful diseases. However, these behavioral patterns conflict with findings concerning people's knowledge and conception of health. People usually set a high value on a positive health status (Bowling, 1995). Furthermore, it was found that young adults mostly develop an understanding of health risks and the awareness that quitting unhealthy behavior reduces harmful consequences (Nigg, Burbank, Padula, Dufresne, Rossi, Velicer & Prochaska, 1999). This meets the aim of widespread health campaigns, which attempt to enhance people's perception and internalization of risks related to substance use. Accordingly, people often exhibit an intention to quit or reduce their unhealthy behaviors but many do not execute this intention (Rabiau, Knäuper & Miquelon, 2006).

Yet, it remains unclear why young adults engage in substance use behavior, although they apparently do not want to harm their health. The concept of compensatory health beliefs might provide an answer to this particular question through dealing with the gap between the intention to be healthy and behaviors that are desired to be carried out but are conflicting with this intention (Radtke, Scholz, Keller, Knäuper, & Hornung, 2011).

1.2 Compensatory Health Beliefs

In the normal course of life, people perceive a permanent confrontation with pleasurable but unhealthy temptations, such as the invitation for a couple of after-work beers or smoking an occasional cigarette. These circumstances often lead to a state of cognitive dissonance. That is the motivational conflict that arises if an individual holds conflicting attitudes (Fried & Aronson, 1995), like the wish to engage in a desired behavior (e.g. excessive beer drinking) on the one hand, and the awareness of its harmful consequences or the intention to fulfill other health objectives (e.g. lose weight) on the other. For the purpose of reaching a state of equilibrium, that is maximizing pleasure and minimizing pain, people tend to diminish the negative feelings related to their unhealthy behavior through using dissonance reducing strategies (Fried & Aronson, 1995). Because quitting unhealthy habits (e.g. smoking) appears to be difficult (Dally, Edler, Jäger, Schmezer, Spiegelhalder, Dienemann, & Risch, 2003) it is plausible that people develop alternative approaches to solve their motivational conflicts (Radtke et al., 2011). However, these so-called indirect strategies are principally based on false beliefs, excuses and illogical argumentations. They often do not lead to behavioral change (Fried & Aronson, 1995).

One approach to solve such inner conflicts provides the concept of compensatory health beliefs (CHBs). According to this framework, people reduce cognitive dissonance through holding the belief that the negative consequences of an unhealthy behavior can be counteracted or compensated for by engaging in another healthy behavior (Knäuper, Rabiau, Cohen, & Patriciu, 2004). Once created, CHBs proceed as regulatory mechanisms and are activated automatically in anticipation or subsequently of fulfilling a desire like smoking or drinking (Knäuper et al., 2004). E.g.: Smoking is o.k., if I eat healthy'. In this way, quitting an unhealthy behavior is interrupted by CHBs. Strictly speaking, CHBs even promote further engagement in unhealthy behaviors without the person feeling guilty about the negative health effects (Radtke et al., 2011). Therefore, holding CHBs can lead to harmful long-term impacts on physical well-being (Rabiau et al., 2006).

Next to unhealthy eating behavior and abnormal weight regulation (e.g. Knäuper et al, 2004), CHBs are often found to be used as justification for smoking or alcohol consumptive behavior. Substance use-related CHBs (SU-CHBs) are one of the main explanations for smoking maintenance (Radtke, Scholz, Keller, & Hornung, 2012). Glock, Müller, and Krolak Schwerdt (2013), revealed that smokers believing balanced diets or exercise can compensate for the health impacts related to smoking, often do not aim to quit their unhealthy behavior. Concerning alcohol consumption, Bryant, Darkes and Rahal (2012) found that college students' intention to quit binge drinking is diminished by the idea that athletic behavior compensates for alcohol-related weight gain. Altogether, Knäuper et al. (2004) revealed significant correlations between SU-CHBs and alcohol/nicotine-related risk behavior. Participants who scored high on SU-CHBs more often reported to smoke, to have a high daily alcohol intake and to consume more drinks when drinking alcohol.

Interestingly, Nelson and Wechsler (2001) found that athletic students had a higher binge drinking frequency than non-athletic students. Athletic students were also more likely to exhibit the strong social ties that are usually associated with alcohol drinking (Nelson & Wechsler, 2001). Viewing these findings in the context of CHBs, one could carefully hypothesize that athletic students are more prone to follow their sociable but unhealthy drinking temptations, due to their regular engagement in compensatory behavior. Regarding this, executing compensatory behavior might lead to subsequent engagement in unhealthy behaviors.

1.2.1 Explicit and implicit CHBs

Most research so far has measured the construct of CHBs in an explicit manner by using questionnaires. Here, people had to rate the extent to which they agree with statements regarding CHBs, like: 'A bigger lunch meal can compensate for a skipped breakfast' or 'Physical activity can compensate for the negative impacts of smoking' (Knäuper et al., 2004). This measurement technique refers to a rule-based and reflective consideration of responses, since it provides the facility to process the statements with respect to conscious deliberation, emotion regulation and expected outcomes (Deutsch & Strack, 2004 as cited in Houben, Nosek & Wiers, 2010). On the basis of the research from Knäuper et al. (2004), one could argue that explicit CHB cognitions are significantly related to the engagement in unhealthy behaviors. However, behavior could not only be determined by explicit cognitions from which it is assumed that they are processed in an individual's reflective system (Wilson, Lindsey, & Schooler, 2000). Research revealed that implicit processes, which originate in the impulsive

system of a person, also can have a significant influence on behavior. Here, impulses to a certain behavior are generated automatically (e.g. Wilson et al., 2000).

Knäuper et al. (2004) already hypothesized that once created, CHBs are mechanisms that can be activated automatically in presence of stimuli that are related to unhealthy temptations. This corresponds to an implicit association pathway. Therefore, behavior might not only be related to explicit CHB cognitions but also be determined by CHBs which are processed based on an unconscious and hence automatic valuation of stimuli concerning their affective and motivational significance (Wilson et al., 2000). This is in line with the dual process theory of attitudes which suggests that behavior is induced by the respective strengths of explicit as well as implicit processes (Wilson et al., 2000). In this respect, it is assumed that addictive behaviors are determined by the process that emerged more strongly (Deutsch & Strack, 2004 as cited in Houben et al., 2010). With reference to alcohol consumption, Thush & Wiers (2007) showed that explicit measures did not add significantly to the prediction of binge drinking, whereas implicit measures did, which points to the importance of measuring implicit associations for the explanation of substance use. This is further supported by the findings that implicit associations between smoking as well as alcohol and positive feelings are a reliable predictor of smoking and alcohol consumption (e.g. Rooke, Hine, & Thoreinsson 2008) and seem to guide these behaviors nearly automatically (Stacy, 1997).

Concerning implicit SU-CHBs, Glock et al. (2013) assume that smokers pair the concept of 'smoking' with the concept of 'healthy behavior' to diminish cognitive dissonance related to smoking behavior. Regarding this, it can also be supposed that people who engage in alcohol consumption match the concept of 'alcohol' to the concept of 'healthy behavior' to reduce cognitive dissonance related to alcohol intake. In line with previous knowledge about implicit cognitions, the concept of 'healthy behavior' would then be activated automatically in the presence of cues that are linked to smoking (Glock et al., 2013) or alcohol. Given the finding that explicit CHBs predict alcohol/nicotine intake, it seems plausible that implicit CHBs are also related to this behavioral construct. In case that CHBs are more strongly processed implicitly, people might use CHBs, even though they do not believe in the compensatory effects on a conscious and thus explicit level (Glock et al., 2013).

However, until now, only one study has measured CHBs in an implicit manner. Glock et al. (2013) assessed implicit SU-CHBs with reference to smoking behavior. The results showed that smokers and non-smokers had significant stronger implicit associations between smoking and healthy behaviors than smokers who were confronted with warning labels. No significant difference in implicit CHBs strength has been found between the smoking control

group and non-smokers. These results do not completely correspond to the plausible assumption that, in order to reduce cognitive dissonance by using CHBs, smokers might have stronger implicit associations between smoking and healthy behavior than non-smokers. For this reason, more research is needed to examine which specific role implicit SU-CHBs play for substance use behavior.

As such, it is worth considering that cognitions are not the only reason that account for substance consumption. Many studies also highlighted the specific role of personality in this behavioral construct. In the context of CHBs, Knäuper et al. (2004) revealed that the personality trait conscientiousness, which describes a person's tendency to be goal-directed and organized, significantly predicts the engagement in the health-damaging behaviors people often have compensatory beliefs for. Furthermore, participants with lower scores on conscientiousness had a stronger explicit expression of the belief that unhealthy behavior can be compensated by another healthy behavior (Knäuper et al., 2004), which could indicate that personality might also play a role in the development of explicit SU-CHBs. Additionally, personality also influences the implicit associations people make (Banse & Greenwald, 2007) and might therefore be important for the development of implicit CHBs. Early studies already showed that implicit and explicit cognitive processes can specify how and why the predictive effect of personality on the engagement in a particular behavior occurs (e.g. Mischel & Shoda, 1995). This mediating role of cognition might therefore also be appropriate for the effect of implicit and explicit SU-CHBs on the relation between personality and substance use behavior.

Altogether, research suggests that personality traits might underlie implicit and explicit CHBs as well as the tendency to engage in unhealthy behavior. If personality also moderates the relationship between CHBs and unhealthy behavior has not been examined. Adding the possible influence of personality to the relation of SU-CHBs and substance use behavior could reveal if the strength of this relationship varies as a function of a high or low character trait.

1.3 Personality

Personality systems such as the Big-Five Factor model define personality as an entity of underlying facets (Goldberg, 1992). Five basic personality dimensions were identified that are found to be stable over time and account for variance in specific behavioral patterns: Openness to experience, conscientiousness, extraversion, agreeableness and neuroticism. Each basic dimension is superordinated to a number of lower-ordered personality facets, which enables a more precise description of personality.

The possible influencing effect of personality on the relationship between SU-CHBs and substance use can be analyzed more accurately by focusing on personality facets that are found to have a high explanatory value for substance use. According to Woicik, Stewart, Pihl, and Conrod (2009), the personality facets that are the strongest predictors for substance use are: impulsivity, that is a lower-ordered facet of neuroticism, and sensation seeking, which is a lower-ordered facet of extraversion. The personality facets were identified by analyzing data from substance users who completed a large battery of personality inventories with proven reliability, like the NEO- Five Factor Inventory (Costa & McCrae, 1991). Both of these facets are connected to reward-sensitivity, indicating that the responsiveness to rewarding stimuli affects substance consumption. This is further supported by Comeau, Stewart, and Loba (2001) who found that people mainly drink or smoke to achieve a feeling of reward that is connected to internal (e.g. mood changing) or external motives (e.g. social approval). Notably, the two facets differ in their influence on behavior. Whereas sensation seekers consume substances because they basically view them as stimulants to achieve positive affect by self-reward (Comeau et al., 2001), impulsive people mostly engage in substance use as they fail to resist the rewarding temptation of consumption (Woicik et al., 2009). Further explanation was provided by the findings that sensation seekers generally underestimate the risks that are associated with substance use (Hoyle, Stephenson, Palmgreen, Lorch, & Donohew 2002), and impulsive people basically consume on instinct without rethinking their decisions (Woicik et al., 2009). It was found that impulsivity and sensation seeking are related to substance use among college students (Woicik et al., 2009), predict substance consumption among young adults (Jurk, Kuitunen-Paul, Kroemer, Artiges, Banaschewski, Bodke & Smolka, 2015), are associated with increased alcohol consumption (Granö, Virtanen, Vahtera, Elovainio & Kivimäki, 2004; Comeau et al., 2001) and the daily number of cigarettes smoked (Granö, et al. 2004; Crawford, Pentz, Chou, & Dwyer, 2003).

Knäuper et al. (2004) already indicated that people tend to differ in their tendencies of developing CHBs as justification for unhealthy behavior. In this regard, the hypothesized effect of SU-CHBs on substance consume might also vary between individuals. The previous findings suggest that SU-CHBs and specific personality facets are predictors of substance use behavior. Since impulsivity and sensation seeking are related to the tendency to engage in substance use as well as an enhanced frequency of consumption, it could be assumed that these personality facets have a particular influence on the effect of SU-CHBs on substance use behavior. If a person developed SU-CHBs for smoking and/or alcohol behavior the magnitude of impulsivity and/or sensation seeking might influence the engagement in the respective substance use.

Furthermore, explicit as well as implicit SU-CHBs may differently interact with personality in accounting for the engagement in substance use. Implicit cognitions refer to an impulsive processing pathway that can activate behavior automatically. Due to the finding that impulsivity describes the tendency to act on instinct (Woicik et al., 2009) and hence the difficulty to obstruct the impact of automatic impulses, it can be assumed that the effect of implicit SU-CHBs on alcohol/nicotine-related risk behavior might be more clearly moderated by impulsivity than by sensation seeking. Additionally, the relation between explicit SU-CHBs and the tendency to engage in alcohol/nicotine-related risk behavior might be more clearly influenced by sensation seeking than impulsivity, since sensation seeking is related to the active and thus explicit quest for rewarding stimulations (Comeau et al., 2001).

1.4 Aim of the study

This study primarily concentrates on SU-CHBs and the engagement in substance use behavior in a sample of young German adults. Here, substance use is defined as smoking and alcohol consumption as these behaviors are assumed to be most common in the specific target group (Burger & Mensink, 2003; Statistisches Bundesamt, 2013). Knäuper et al. (2004) revealed that more pronounced SU-CHBs are associated with higher engagement in substance use behavior. The predictive ability of CHBs in this relation was mostly revealed by explicit measures. However, sufficient evidence suggests that CHBs could also be processed in an implicit manner. Therefore, this study aims to reveal if implicit SU-CHB measures are significantly related to substance use behavior. CHBs will also be measured explicitly to compare the relationship strengths between implicit SU-CHBs and substance use and explicit SU-CHBs and substance use.

Furthermore, since the personality facets impulsivity and sensation seeking are proven to be strong predictors for the frequency and amount of substance use (e.g. Granö et al., 2004; Zuckermann, 2007), the relation between SU-CHBs and risky alcohol or cigarette consumption might be stronger for people who score high on impulsivity or sensation seeking, compared to people with lower scores on these personality facets. People who display SU-CHBs might have a higher engagement in the respective behaviors if they score high on impulsivity or sensation seeking because these personality types have an enhanced receptiveness for the rewarding sensations that are associated with the consumption of substances (Comeau et al., 2001; Woicik et al., 2009).

It is expected that sensation seeking is a stronger moderator for the relationship between explicit SU-CHBs and substance use than impulsivity. Sensation seekers have an enlarged

tendency to actively search for exciting stimuli that provide rewarding sensations (Comeau et al., 2001), which explains why these people are more prone to engage in substance use. Having SU-CHBs explicitly might lead to an enhanced tendency to engage in the respective substance use behaviors for people scoring high on sensation seeking. They might consciously believe that the negative effects of these behaviors are compensable and therefore succumbing to these exciting temptations is less bad. This is further supported by the fact that sensation seekers generally underestimate the risks associated with substance consumption (Hoyle et al., 2002). Furthermore, people who display SU-CHBs might have a higher engagement in the respective substance use behavior when they score high on impulsivity. Impulsive people might hold the belief that the negative effect that is associated with this rewarding but unhealthy behavior is compensable and therefore, the impulse to yield to a smoking or drinking temptation does not have to be regulated.

However, it is expected that impulsivity is a stronger moderator for the relationship between implicit SU-CHBs and substance use behavior than sensation seeking. Higher scores on impulsivity account for an enlarged tendency to act on impulse (Woicik et al., 2009). This leads to the supposition that impulsive people are more susceptible to the influences of implicit CHBs which are assumed to be processed in an individual's impulsive system. Furthermore, the influence of implicit and thus unconscious SU-CHBs on behavior could only be regulated through self-control (Flores, 2011), a capability that is less pronounced in impulsive people (Woicik et al., 2009). Therefore, people who display implicit SU-CHBs might have a higher engagement in the respective substance use behavior when they score high on impulsivity, compared to people who score low on this trait.

The suggestions made above lead to the following research questions:

1. Are implicit and explicit SU-CHBs uniquely associated with substance use?
2. Are implicit or explicit SU-CHBs more strongly associated with substance use?
3. Do impulsivity and sensation seeking moderate the relationships of implicit, as well as explicit SU-CHBs to substance use?
4. Is sensation seeking a stronger moderator for the relationship between explicit SU-CHBs and substance use than impulsivity?
5. Is impulsivity a stronger moderator for the relationship between implicit SU-CHBs and substance use than sensation seeking?

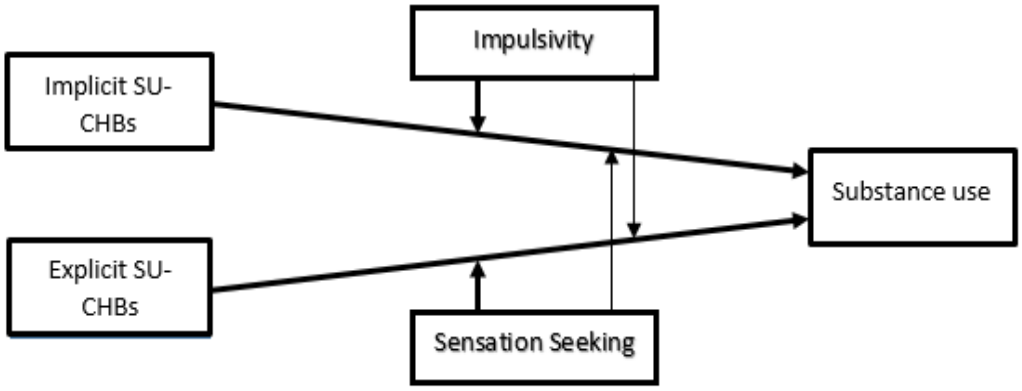


Figure 1. Moderating effect of personality on the relationships between SU-CHBs and Substance Use

To answer these questions in detail, SU-CHB measures address the constructs of smoking and alcohol consumption. Measures concerning substance use behavior will focus on actual smoking,- alcohol consumption,- as well as previous binge drinking frequency. By this, the specific relation between SU-CHBs and substance use, as well as the moderating effect of personality can be addressed distinctly for the two behaviors. Due to the finding that in the German population of young adults slightly more men than women engage in smoking as well as risky drinking behavior, the analysis will also consider differences among gender.

These measures could provide additional knowledge for health research in the context of CHBs and could give more explanations for the engagement in substance consumption.

2. Method

2.1 Procedure

A German online survey was set up with the SocialSci Survey Software [socialsci.com]. The study protocol was approved by the ethical commission of the University of Twente. Part of the sampling took place via SONA systems, an online platform which provides subject pool management and is used by the faculty of behavioral sciences at the University of Twente. Students acquired 0,5 credit points for their participation. Further respondents were recruited via the private network of the researchers as well as the social platform Facebook. The link to the questionnaire was spread as of 27 October. Participation via SONA systems was possible as of 9 November. End of sampling was scheduled on 11 November. All respondents had to follow the same procedure. Completing the study took 30 minutes. Topic and objectives of the

study were outlined at the beginning. The subject CHBs was mentioned in the introduction section but not further explained, in order to avoid response bias like social desirability. Respondents completed an informed consent form assuring that all data will be processed in an anonymous manner and will not be made accessible to third parties. Participation was voluntary and respondents could stop the survey at any time due to feelings of discomfort. After agreeing with the consent form, participants had to answer demographic questions (age, gender, origin, education and occupational activities), which were used for descriptive analysis. Data from respondents that did not fall into the qualifications of being a German citizen and a student were excluded afterwards. To measure implicit SU-CHBs, participants completed two single target implicit association tests (ST-IAT). After completion, respondents were asked to continue with the questionnaire by rating the presented items as honest and deliberated as possible. The questionnaire contained scales to measure explicit CHBs (28 items); personality traits (11 items); as well as substance use behavior (4 items). After completion of the survey, researchers' mailing addresses were provided for further questions about content and results of the study.

2.2 Measures

2.2.1 ST-IAT

To reveal if participants display implicit SU-CHBs by cognitively pairing the concepts of 'smoking' as well as 'alcohol' with the concept of 'healthy behavior' an implicit association test (IAT) was developed. IATs offer computerized reaction investigations that are found to have high psychometric qualities in terms of validity (Greenwald, Nosek, & Banaji 2003). The rationale behind these test is that people find it easier to react to cognitively associated stimuli with the same response key than with the opposite one. Through this, the reaction time that is needed to match a stimulus can be used to indicate how strongly different concepts are associated (Greenwald, 2003).

Two values are important to reveal if participants, for instance, have stronger implicit associations between smoking and unhealthy behavior or between smoking and healthy behavior. Firstly, the reaction time needed to match stimulus items that represent the concept of smoking, healthy behavior and unhealthy behavior to their corresponding categories, if items related to smoking or healthy behavior have to be assigned with the same key and items related to unhealthy behavior have to be assigned with another key. This layout is also called incompatible block design, as the two concepts paired on the same key are conflicting at first sight (Greenwald, Mc Ghee & Schwartz, 1998). Secondly, it is important to compute the reaction time taken to match the described concepts when the mapping position of smoking was

shifted. Since the evaluatively compatible categories of smoking and unhealthy behavior are thus paired on the same key, this configuration constitutes a compatible block design (Greenwald et al., 1998).

For the present study two single-targeted implicit association tests (ST-IAT) were created, based on the model for automatic affective measures as developed by Wigboldus, Holland and van Knippenberg, (2004). With reference to the study from Glock et al. (2013) that already measured implicit CHBs, the first test was created with two attribute categories labeled as *unhealthy behavior* and *healthy behavior* and the target category *smoking* to measure implicit smoking CHBs. The second test was designed similarly, but with the target category *alcohol* to measure implicit alcohol CHBs. Both tests were set up single-targeted (ST-IAT) because with this, a singularly, non-relative evaluation of associations with smoking (and, alcohol respectively) was enabled (Wigboldus et al., 2004). The stimulus items which participants had to assign to the attribute and target categories via a keypress, were selected from prior studies which successfully conducted implicit measures in health research. It was also considered that the chosen items reflect the behaviors measured in the explicit CHB scale (substance use; weight regulation; stress; eating and sleeping habits) and that items used to represent the category healthy behavior have their antagonist in the category unhealthy behavior. Herewith, it was ensured that implicit and explicit measures address the same topics. Finally, each category was represented by 8 items which were estimated as suitable for the purpose of the present ST-IATs. Concerning the assumption that, in the study from Glock et al. (2013) a visual representation of CHB stimuli might lead to imprecise measuring results on grounds of distraction and inaccuracy, the items were presented verbally.

During the smoking ST-IAT respondents were requested to sort *smoking* items [e.g. Zigarette (cigarette)] and items representing the attribute categories *healthy behavior* [e.g. Sportlichkeit (‘Sportiness’)] or *unhealthy behavior* [e.g. Unsportlichkeit (‘lack of sportmanship’)] as quickest as possible to their corresponding categories using a left (‘E’) or right (‘I’) response key. The ST-IAT consisted of two test periods. In the first test period, *smoking* and *healthy behavior* were mapped on the same response key, and *unhealthy behavior* on the other (incompatible block). In the test second period, the mapping position of *smoking* was shifted (compatible block). Each test period was followed by a practice period. During the first practice period 32 items were displayed, randomly chosen from the existing attribute categories. The second and third practice periods also displayed 32 items, randomly selected from the attribute categories as well as the target category. The number of items was increased

to 96 in the test periods. If a wrong response was given, a red cross appeared on the screen until the answer was corrected. This test design was also used for the alcohol ST-IAT.

It was hypothesized that the IAT effect, which is the difference in reaction times between the first and the second test period (Wigboldus et al., 2004) reflected if smoking (and, alcohol respectively), is more strongly associated with either attribute category. Hereof, quick responses implicated stronger associations. Stronger association between smoking (and, alcohol respectively) and healthy behavior pointed to implicit SU-CHBs. See the appendix for an overview of the list of items used for the ST-IATs.

2.2.2 CHB scale

To measure CHBs explicitly, the scale 'Kompensatorische Gesundheitsüberzeugungen' was used. Lippke, Hohmann, Kalusche, and Knäuper (2005) developed this scale to measure CHBs in a German population. Creation was based on the original version of the CHB questionnaire which was used for a Canadian sample by Knäuper, et al. (2004). Together with reliability (α = .80), Knäuper et al. (2004) verified the criterion-related validity of the CHB scale. A great advantage of the German scale is that it was constructed in collaboration with Knäuper who also took part in the creation of the original version. The present scale finally consisted of 4 subscales with 17 items, that stem from the original CHB scale and were already translated and culturally adapted to a German language sample by Radtke, Scholz, Keller, Perren, and Hornung (2013) and 11 additional items which stem from the index 'Compensatory Health Beliefs Scale, 20 items, diet focus.' The 28 items in total were presented in a mixed order. Measures concerning explicit SU-CHBS were comprised by the subscale *substance use*, consisting of 6 items. An example item is: 'A healthy diet can compensate for frequent alcohol intake.' Opinions had to be rated on a five point Likerscale from 1 (strongly disagree) to 5 (strongly agree). Other subscales were used to assess compensatory beliefs about *stress* (4 items), *eating/sleeping habits* (4 items), and *weight regulation* (3 items). The explicit CHB questionnaire was conducted after the ST-IATs. So it was avoided that implicit CHB measures were influenced by the conscious deliberation of explicitly stated CHBs. Reliability analysis revealed a Cronbach's alpha of α = .76 for the whole scale and α = .53 for the subscale substance use.

2.2.3 SURPS

The German version of the substance use risk profile scale (SURPS) was used to measure the personality facets impulsivity and sensation seeking (Jurk et al., 2015). The total

SURPS consists of 23 items that were allocated to the subscales: anxiety-sensitivity, hopelessness, sensation seeking and impulsivity. The 4-factor structure of the scale was affirmed by confirmatory factor analysis. For the subscale *impulsivity*, a predictive value for substance consumption two years later has been revealed (Jurk et al., 2015). An example item for the subscale *impulsivity* (5 items) was:'I often say something without thinking about it'. An example item of the subscale *sensation seeking* (6 items) was: 'I would like to skydive'. Response options could be rated from 1 (strongly disagree) to 4 (strongly agree). Jurk et al. (2015) tested their scale in a German sample of undergraduate students. Therefore, one item to measure sensation seeking had to be adapted to adult standards. The statement 'I would like to have a driver's license for a motorcycle' was replenished with the annotation 'If you already have a driver's license for a motorcycle select 'strongly agree'. The Cronbach's alpha for the subscales impulsivity and sensation seeking was $\alpha = .51$ and $\alpha = .69$, respectively. Due to its low internal consistency item 22 from the subscale impulsivity was deleted and the Cronbach's alpha for the subscale increased $\alpha = .63$.

2.2.4 Substance use behavior

To examine participant's behavior concerning alcohol consumption 5 items were selected from a Dutch questionnaire which was developed to measure adolescents' habits concerning alcohol intake (Korte et al., 2012). Respondents had to rate on a scale how often and how much alcohol they generally drink during the week and on weekdays. With this the average weekly *alcohol consumption frequency* was estimated. Participants could fall in 1 of 3 categories: none (0 glasses), moderate (1-5 glasses) or high (more than 6 glasses). *Binge drinking frequency* was measured for the last month by asking: 'How often did you drink 6 or more glasses of alcohol at one occasion in the last 4 weeks?'. Here, 1 of 11 response options ranging from 'I did not drink at all' to '9 times or more' could be chosen. To improve validity of responses, a table was displayed that showed the amounts of alcohol that are contained in diverse drinks (e.g. 1 beer = 1 standard glass; bottle of wine = 7,5 standard glasses). *Smoking frequency* was measured by asking the respondents about their average weekly cigarette consumption. 1 of 15 response options could be selected ranging from '0 cigarettes a week' to 'more than 70 cigarettes a week'. Herewith, participants could fall in 1 of 3 categories: none (0 cigarettes), moderate (1-10 cigarettes) and high (11-70 cigarettes). This item stems from a collection of measuring instruments that has been proven usable for single measurements regarding smoking and smoking cessation (Mudde, Willemsen, Kremers, & de Vries 2006). All selected items were translated into German language.

2.3 Analysis

The Statistical Package for the Social Science (SPSS 22.0) was used for data analysis. Next to analysis of demographic variables, each construct that was measured via the questionnaires was tested for internal consistency. Cronbach's alpha (α) was used as an index to evaluate the reliability of the items. To assess the relationship between the measured constructs a correlational analysis was performed by using Pearson correlation coefficients. The standard level of statistical significance was set at $p < .05$ (Cohen, Cohen, West & Aiken, 2013). A borderline significance was indicated at $p < .10$. Effect sizes were used to describe the strength of relationships. A small effect is $r = .10$, whereas $r = .30$ stands for medium, and $r = .50$ for large effect sizes (Ellis, 2010).

The IAT effect was calculated with the D600 scoring algorithm, as developed by Greenwald et al. (2003). Trials greater than 10,000 ms were discarded and data from participants who had matching latencies less than 300 ms in more than 10% of the trials were eliminated from the analysis. Next, the inclusive standard deviation for all trials in the incompatible test block and the compatible test block were computed. The mean latencies for responses for both test blocks were calculated. Then the mean difference between the test blocks was computed by subtracting the mean latencies of the incompatible block from the compatible block. Then the difference score was divided by its associated inclusive standard deviation. The D score was coded so that associations between smoking (and drinking, respectively) and healthy behavior were indicated by positive values. Negative values indicated associations between smoking (and drinking, respectively) and unhealthy behavior. Therefore, positive values pointed to more implicit CHBs and negative values pointed to less implicit CHBs.

Based on the suggestions made by Cohen et al. (2013) moderation analyses were done with multiple regression analysis. By this means, it was measured if personality moderates the relationship of SU-CHBs and substance use behavior. For this, the predictor variables were centered and their interaction term was computed. Then, the predictor variables, the interaction term and the dependent variable were entered into a simultaneous regression model (Cohen et al., 2013). Moderation analyses were done with impulsivity as well as sensation seeking as moderator variable, substance use-related CHBs as independent variable and substance use behaviors as dependent variables.

3. Results

3.1 Participants

The data of 100 participants were suitable for analysis. The survey was started by a total of 127 participants. Concerning the aims of this study, responses from participants who did not fall into the qualifications of being a student or a German citizen (N=13) as well as responses from participants who were too fast or slow at the ST-IAT test (N=14) were excluded from analyses.

The mean age of the sample was 22 years (SD=2.5). The age ranged from 18 to 30 years. 69% percent of the sample were women and 31% were men. The majority of the sample were non-smokers (68%). 90% of the sample reported to have a weekly alcohol consumption and 69% engaged in binge drinking behavior for at least one time in the last 4 weeks. Table 1 shows the descriptive statistics of the measured constructs: total explicit CHBs, explicit SU-CHBS, implicit CHBs, personality and substance use behavior.

Table 1.
Descriptive statistics of CHBs, personality and substance use.

	Scale	Min	Max	Mean	SD
Explicit CHBs	1-5	1.57	3.54	2.60	0.37
Explicit SU-CHBs	1-5	1.00	3.83	2.00	0.54
Implicit smoking CHBs		-0.95	0.41	-0.29	0.29
Implicit alcohol CHBs		-0.88	0.47	-0.10	0.22
Impulsivity	1-5	1.00	3.50	2.23	0.51
Sensation Seeking	1-5	1.33	4.00	2.71	0.56
Smoking^{+}	1-3	1.00	3.00	1.53	0.82
Alcohol consumption^{++}	1-3	1.00	3.00	2.48	0.67
Binge drinking^{+++}	1-11	1.00	11.00	3.84	1.98

Note. $^{+}$ average number of cigarettes consumed per week; $^{++}$ average number of alcohol units consumed per week; $^{+++}$ binge drinking frequency in the last 4 weeks

3.2 Substance use

Table 2 shows the frequencies of weekly smoking, average weekly alcohol consumption and binge drinking for the last 4 weeks, stratified by gender. There was a significant difference for gender in alcohol consumption ($\chi^2 = 9.57$, df = 2, $p < .05$). Men had a higher alcohol consumption than women. Most of the participants fell in the category of high alcohol consumption and these were remarkably more men (81%) than women (48%). Men also had a significantly higher binge drinking frequency (M = 4.94, SD = 1.92) than women (M = 3.35,

SD = 1.82). During the last four weeks remarkably more men (90%) than women (60%) engaged in binge drinking behavior. The difference for gender in smoking frequency was not significant ($\chi^2 = 2.31$, df = 2, p = .32). 36% of men and 31% of women reported to smoke.

Table 2.
Substance use stratified by gender.

	Smoking^{+} (%)		Alcohol consumption^{++} (%)			Binge drinking^{+++} (%)	
Codes	Men	Women	Men	Women	Codes	Men	Women
none	20 (64.5)	48 (69.6)	1 (3.2)	9 (13)	1	0 (0)	5 (7.2)
moderate	2 (6.5)	9 (13)	5 (16.1)	27 (39.1)	2	3 (9.7)	23 (33.3)
high	9 (29)	12 (17.4)	25 (80.6)	33 (47.8)	3	4 (12.9)	15 (21.7)
					4	9 (29)	12 (17.4)
					5	2 (6.5)	5 (7.2)
					6	7 (22.6)	6 (8.7)
					7	2 (6.5)	1 (1.4)
					8	3 (9.7)	1 (1.4)
					9	1 (3.2)	0 (0)
					11	0 (0)	1 (1.4)
	χ^2 (df)	p	χ^2 (df)	p		t (df)	p
	2.31 (2)	.32	9.57 (2)*	.01		3.97 (98)**	<.001

*Note.**p < .05, ** p < .01,
$^{+}$ average number of cigarettes consumed per week classified into the categories: none = 0 cigarettes, moderate = 1 – 10 cigarettes, high = 11 – 70 cigarettes; $^{++}$ average number of alcohol units consumed per week classified into the categories: none = 0 glasses, moderate = 1 – 5 glasses, high = more than 6 glasses;$^{+++}$ Codes for binge drinking frequency in the last 4 weeks are: 1 = none, 2 = did not consume more than six glasses in the last four weeks, 3 = 1 time during the last four weeks, … - 11 = 9 times during the last four weeks.

3.3 Correlation analysis

Table 3 shows the correlation coefficients of the measured constructs. Concerning the relationship between explicit CHBs and substance use, it was found that explicit SU-CHBs had a moderate positive correlation with all substance use behaviors. As expected, participants who scored high on explicit SU-CHBs had higher smoking,- alcohol consumption,- and binge drinking frequencies. Total explicit CHBs only correlated weakly positive with smoking. People with higher total explicit CHBs also had a higher smoking frequency.

Regarding the relationship between implicit SU-CHBs and substance use, only a weak positive correlation was found between implicit smoking CHBs and alcohol consumption. Participants who had stronger implicit smoking CHBs also had a higher alcohol consumption. Contrary to expectations, no significant correlation was found for the relationship between implicit smoking CHBs and smoking as well as for the relationships between implicit alcohol

CHBs and alcohol consumption or binge drinking. Implicit CHBs were also not significantly related to explicit SU-CHBs.

Concerning the relationship between personality and substance use, it was found that sensation seeking was weakly positive related to smoking and alcohol consumption and moderately positive related to binge drinking. As predicted by literature, participants who scored high on sensation seeking had higher smoking,- alcohol consumption,- and binge drinking frequencies. Impulsivity correlated weakly positive with binge drinking. Participants who scored high on impulsivity had a higher binge drinking frequency.

Personality was also significantly related to explicit SU-CHBs, because a weakly positive correlation between sensation seeking and explicit SU-CHBs was found. Participants who scored high on sensation seeking had a higher amount of explicit SU-CHBs.

Table 3.
Bivariate correlations of CHBs, personality and substance use in the total sample.

		1	2	3	4	5	6	7	8
1	Explicit CHBs								
2	Explicit SU-CHBs	**.67****							
3	Implicit smoking CHBs	**.24***	.20						
4	Implicit alcohol CHBs	.05	.12	**.34****					
5	Impulsivity	-.03	.19	.09	.06				
6	Sensation Seeking	.04	**.23***	.07	.09	**.42****			
7	Smoking^{+}	**.21***	**.37****	.04	.02	.14	**.23***		
8	Alcohol consumption^{++}	.18	**.30****	**.22***	.19	.04	**.20***	.19	
9	Binge Drinking^{+++}	.18	**.31****	.13	.19	**.23***	**.30****	**.29****	**.51****

Note. * p < .05, ** p < .01,
$^{+}$average number of cigarettes consumed per week $^{++}$ average number of alcohol units consumed per week $^{+++}$binge drinking frequency in the last 4 weeks

3.3.1 Correlation analysis stratified by gender

Table 4 and 5 show the descriptive statistics and correlation coefficients of the measured constructs stratified by gender. In the male subpopulation (Table 4) the positive relationship between explicit SU-CHBs and substance use showed moderate to strong correlation coefficients and was therefore stronger than in the total sample. Notably, men had moderately positive relationships of implicit smoking CHBs to explicit SU-CHBs and total explicit CHBs. For males, personality was not significantly related to explicit SU-CHBs or substance use. This was different to the female sample (Table 5). Here, a weekly positive correlation between the personality trait sensation seeking and explicit SU-CHBs was found. Furthermore, females had moderate positive relations of impulsivity as well as sensation seeking to binge drinking.

Altogether, for females, more significant relationships were found between personality and substance use than between explicit SU-CHBs and substance use. Unlike the male sample, explicit SU-CHBs only moderately positive correlated with smoking in this subpopulation.

Table 4.
Descriptive statistics and bivariate correlations of CHBs, personality and substance use for the male subpopulation.

		Scale	Min	Max	Mean	SD	1	2	3	4	5	6	7	8
1	Explicit CHBs	1-5	1.75	3.43	2.63	0.37								
2	Explicit SU-CHBs	1-5	1.17	3.17	2.13	0.47	**.51****							
3	Implicit smoking CHBs		-0.83	0.32	-0.20	0.30	**.46****	**.36***						
4	Implicit alcohol CHBs		-0.48	0.47	-0.02	0.23	.12	.07	.24					
5	Impulsivity	1-5	1.25	3.50	2.18	0.50	-.19	.16	.24	.13				
6	Sensation seeking	1-5	2.00	4.00	2.98	0.49	-.32	-.01	.01	.17	**.42***			
7	Smoking^{+}		1.00	3.00	1.65	0.91	.10	**.40***	.19	.02	.00	.15		
8	Alcohol consumption^{++}	1-3	1.00	3.00	2.77	0.50	**.50****	**.42***	.16	.18	-.34	-.09	.18	
9	Binge drinking^{+++}	1-11	2.00	9.00	4.94	1.91	.29	**.50****	-.07	.00	-.19	-.15	**.37***	**.51****

Note. * p < .05, ** p < .01,
$^{+}$ average number of cigarettes consumed per week; $^{++}$ average number of alcohol units consumed per week,;$^{+++}$ binge drinking frequency in the last 4 weeks

Table 5.
Descriptive statistics and bivariate correlations of CHBs, personality and substance use for the female subpopulation.

		Scale	Min	Max	Mean	SD	1	2	3	4	5	6	7	8
1	Explicit CHBs	1-5	1.57	3.54	2.58	0.37								
2	Explicit SU-CHBs	1-5	1.00	3.83	1.93	0.56	**.74****							
3	Implicit smoking CHBs		-0.95	0.41	-0.33	0.27	.11	.08						
4	Implicit alcohol CHBs		-0.88	0.19	-0.14	0.20	.00	.09	**.34****					
5	Impulsivity	1-5	1.00	3.50	2.25	0.52	.04	.21	.05	.05				
6	Sensation seeking	1-5	1.33	3.67	2.58	0.55	.16	**.26***	-.01	-.07	**.48****			
7	Smoking^{+}		1.00	3.00	1.48	0.78	**.26***	**.35****	-.08	-.02	.22	.24		
8	Alcohol consumption^{++}	1-3	1.00	3.00	2.35	0.70	.07	.22	.17	.11	.18	.18	.18	
9	Binge drinking^{+++}	1-11	1.00	11.00	3.35	1.82	.11	.18	.12	.17	**.48****	**.36****	.23	**.44****

Note. * p < .05, ** p < .01,
$^{+}$ average number of cigarettes consumed per week; $^{++}$ average number of alcohol units consumed per week; $^{+++}$ binge drinking frequency in the last 4 weeks

3.4 Moderation analysis

The correlational analyses for the total sample showed that explicit SU-CHBs and the personality subscale sensation seeking significantly correlated with the substance use behaviors smoking, alcohol consumption and binge drinking. Additionally, SU-CHBs and the personality subscale impulsivity significantly correlated with the substance use behavior binge drinking. Due to the found correlations, the mentioned constructs came into consideration of testing the moderating effect of personality on the relationship between explicit SU-CHBs and substance use behavior. The relationships between SU-CHBs and substance use behavior as well as between personality and substance use behavior varied among gender. Furthermore, significant differences in substance use behavior between men and women were found. For these reasons the moderation analyses were also stratified by gender.

The multiple regression analysis conducted to determine the possible moderating effect of sensation seeking on the relation between SU-CHBs and alcohol consumption showed that the effect of the interaction between SU-CHBs and sensation seeking on alcohol consumption was not significant (b = 2.13, SE = 1.58, ß = .14, t = 1.35, p > .05). There was no moderating effect of sensation seeking on the relation between SU-CHBs and alcohol consumption. SU-CHBs (b = 2.6, SE = .93, ß =.27, t = 2.79, p < .01) and sensation seeking (b = 2.38, SE = .95, ß = .26, t = 2.52, p < .05) were both independently related to alcohol consumption. Both predictors were of equal effect size. However, the model explained a low proportion of variance in alcohol consumption (r^2 = .17) (Table 6).

Table 6.
Multiple regression analysis with alcohol consumption as dependent variable.

	B	SEB	β	t	p
Explicit SU-CHBs $^{+}$	2.60**	0.93	.27	2.79	.006
Sensation seeking $^{+}$	2.38*	0.95	.26	2.52	.014
Interactionterm^{+}	2.13	1.58	.14	1.35	.181

Note. *p < .05, ** p < .01, $^{+}$ centered, r^2=.17, F(3;96) = 6.63, p < .01.

The multiple regression analysis conducted to determine the possible moderating effect of sensation seeking on the relation between SU-CHBs and alcohol consumption stratified by gender, showed that the effect of the interaction between SU-CHBs and sensation seeking on alcohol consumption was not significant for men (b = -2.70, SE = 3.59, ß = -.16, t = -.75, p > .05) and not significant for women (b = 2.46, SE = 1.80, ß = .18, t = 1.36, p > .05). In both groups, no moderating effect of sensation seeking on the relation between SU-CHBs and

alcohol consumption was found. In the male subpopulation SU-CHBs were related to alcohol consumption (b = 7.92, SE = 2.64, ß = .62, t = 2.99, p < .01) and in the female subpopulation sensation seeking was related to alcohol consumption (b = 2.48, SE = 1.07, ß = .32, t = 2.33, p < .05). Notably, the model for women explained a low proportion of variance in alcohol consumption (r^2 = .11) (Table 7).

Table 7.
Multiple regression analysis stratified by gender with alcohol consumption as dependent variable.

	Men, r^2=.29					Women, r^2=.11				
	B	SEB	β	t	p	B	SEB	β	t	p
Explicit SU-CHBs$^+$	7.92**	2.64	.62	2.99	.006	1.07	.93	.14	1.15	.253
Sensation seeking $^+$	0.68	1.98	.06	0.34	.734	2.48*	1.07	.32	2.33	.023
Interactionterm$^+$	- 2.70	3.59	-.16	-0.75	.457	2.46	1.80	.18	1.36	.177

Note. *p < .05, ** p < .01, $^+$ centered, men: F(3;27) = 3.72, p < .05, women: F(3;65) = 2.78, p < .05.

The multiple regression analysis conducted to determine the possible moderating effect of sensation seeking on the relation between SU-CHBs and binge drinking showed no significant effect of the interaction between SU-CHBs and sensation seeking on binge drinking but a tendency was indicated (b = 1.13, SE = .60, ß = .19, t = 1.87, p = .064). Sensation seeking could have moderated the effect of SU-CHBs on binge drinking. SU-CHBs (b = .84, SE = .35, ß = .23, t = 2.37, p < .05) and sensation seeking (b = 1.11, SE = .36, ß = .31, t = 3.08, p < .01) were both independently related to binge drinking but the main effect of sensation seeking was stronger (Table 8).

Table 8.
Multiple regression analysis with binge drinking as dependent variable.

	B	SE_B	β	t	p
Explicit SU-CHBs$^+$	0.84*	0.35	.23	2.37	.020
Sensation seeking $^+$	1.11**	0.36	.31	3.08	.003
Interactionterm$^+$	1.13	0.60	.19	1.87	.064

Note. *p < .05, ** p < .01, $^+$ centered, r^2=.19, F(3;96) = 7.25, p < .01.

The multiple regression analysis conducted to determine the possible moderating effect of sensation seeking on the relation between SU-CHBs and binge drinking stratified by gender, showed that in the female subpopulation sensation seeking (b = 1.54, SE = .45, ß = .46, t = 3.53, p < .01) and the interaction between SU-CHBs and sensation seeking (b = 1.52, SE = .74, ß = .26, t = 2.06, p < .05) were both related to binge drinking. In this group, there was a moderating

effect of sensation seeking on the relation between SU-CHBs and binge drinking behavior. For women, the effect of CHBs on binge drinking was dependent on the degree of sensation seeking. In the male subpopulation only SU-CHBs were related to binge drinking (b = 1.81, SE = .85, ß = .45, t = 2.13, p < .05) (Table 9).

Table 9.
Multiple regression analysis stratified by gender with binge drinking as dependent variable.

	Men, r^2=.28					Women, r^2=.19				
	B	SE_B	β	t	p	B	SE_B	β	t	p
Explicit SU-CHBs+	1.81*	0.85	.45	2.13	.043	0.33	0.38	.10	0.88	.382
Sensation seeking +	-.58	0.64	-.15	-.92	.367	1.54**	0.45	.46	3.53	.001
Interactionterm+	0.43	1.16	.08	0.38	.716	1.52*	0.74	.26	2.06	.043

Note. *p < .05, ** p < .01, + centered, men: F(3;27) = 3.41, p < .05, women: F(3;65) = 5.12, p < .01.

The multiple regression analysis conducted to determine the possible moderating effect of impulsivity on the relation between SU-CHBs and binge drinking showed no significant effect of the interaction between SU-CHBs and impulsivity on binge drinking (b = .44, SE = .64, ß = .07, t = .70, p > .05). There was no moderating effect of impulsivity on the relation between SU-CHBs and binge drinking. SU-CHBs were again related to binge drinking (b = .98, SE = .37, ß = .27, t = 2.69, p < .01). The effect of impulsivity on binge drinking was borderline significant (b = .75, SE = .38, ß = .19, t = 1.95, p = .054), indicating that impulsivity might have been related to binge drinking. Also here, the model explained a low percentage of binge drinking (r^2 = .13) (Table 10).

Table 10.
Multiple regression analysis with binge drinking as dependent variable.

	B	SEB	β	t	p
Explicit SU-CHBs+	0.98**	0.37	.27	2.69	.008
Impulsivity +	0.75	0.38	.19	1.95	.054
Interactionterm+	0.44	0.64	.07	0.70	.485

Note. p < .05, ** p < .01, + centered, r^2=.13, F(3;96) = 4.94, p < .01.

The multiple regression analysis conducted to determine the possible moderating effect of impulsivity on the relation between SU-CHBs and binge drinking stratified by gender, showed that in the female subpopulation impulsivity was related to binge drinking (b = 1.79, SE = .39, ß = .51, t = 4.56, p < .01) and the effect of the interaction between SU-CHBs and impulsivity on binge drinking was borderline significant (b = .99, SE = .57, ß = .19, t = 1.73, p = .089). For women, the effect of SU-CHBs on binge drinking might have been moderated by

impulsivity. In the male subpopulation SU-CHBs were again related to binge drinking (b = 2.13, SE = .65, ß = .53, t = 3.28, p < .01). In this group the effect of impulsivity on binge drinking was borderline significant (b = -1.07, SE = .61, ß = -.28, t = -1.74, p = .093), which indicates that impulsivity might have been related to binge drinking for men. In both groups, impulsivity was found to describe binge drinking, however in opposite directions. For men, more impulsivity meant less binge drinking (ß = -.28) and for women more impulsivity meant more binge drinking (ß=.51) (Table 11).

Table 11.
Multiple regression analysis stratified by gender with binge drinking as dependent variable.

	Men, r^2=.34					Women, r^2=.27				
	B	SE_B	β	t	p	B	SE_B	β	t	p
Explicit SU-CHBs$^+$	2.13**	0.65	.53	3.28	.003	0.12	0.37	.04	0.32	.751
Impulsivity $^+$	-1.07	0.61	-.28	-1.74	.093	1.79**	0.39	.51	4.56	.000
Interactionterm$^+$	1.25	1.80	.11	0.69	.494	0.99	0.57	.19	1.73	.089

Note. * p < .05, ** p < .01, $^+$ centered, men: F(3;27) = 4.56, p < .05, women: F(3;65) = 2.78, p < .01.

No (borderline) significant moderating effect of personality was found for the relationships between implicit CHBs and substance use behavior. Therefore, these analyses are not reported.

4. Discussion

This study examined the relation between substance use-related CHBs (SU-CHBs) and substance use behavior, defined as smoking and alcohol consumption, in a sample of German students. Previous research that dealt with this particular relationship, mostly drew conclusions on the basis of explicit SU-CHB measurements. In this context, it was revealed that explicit SU-CHBs and the engagement in substance use are positively related. Although research suggested that CHBs could also be processed implicitly (Glock et al., 2013), less is known if implicit CHB measures could also add significantly to the prediction of behavior. Therefore, the present study aimed to provide additional knowledge to the existing CHB construct through measuring SU-CHBs explicitly as well as implicitly, and to compare their explanatory value in substance use. Additionally, since many studies described substance use as expression of personality, it was examined whether the relationships between implicit CHBs and substance use and explicit CHBs and substance use are differently influenced by the magnitude of

impulsivity and sensation seeking. These are two stable personality facets that are proven to be strong predictors for the risky consumption of substances.

Concerning the purpose of this study, three central conclusions were made. At first, no significant relationship between implicit SU-CHBs and the frequency of their respective substance use was found in the gathered sample. However, implicit smoking SU-CHBs were significantly related to explicit SU-CHBs for men. Secondly, for females, the relationship between explicit CHBs and binge drinking was dependent on sensation seeking. Thirdly, the frequency of substance use as well as the associations between CHBs, personality and substance use were obviously different between men and women. This led to the assumption that the reasons for substance consumption might differ among male and female students. In this regard it was hypothesized that especially explicit SU-CHBs are a predictor for substance use among men, whereas female's substance use behavior might be better explained in the context of personality. The subsequent sections will provide a clearer explanation of the findings the central statements were drawn on. Important suggestions are made for further issues addressing the concept of CHBs or substance use. Possible limitations will be discussed in the appendant sections.

With reference to the assumptions made by Knäuper et al. (2004), it was expected that CHBs are activated automatically in presence of stimuli that are related to a desired but unhealthy behavior and that this implicit processing pattern consequently has a determining effect for substance use behavior. Glock et al. (2013) expanded this hypothesis by suggesting that the effect of implicit CHBs on behavior could be over and above to the effect of explicit CHBs. However, this study did not find a significant relation between implicit smoking or alcohol CHBs and their respective behaviors. Only a weak correlation was found between implicit smoking CHBs and alcohol consumption. This relation was assumed to be spurious since implicit alcohol CHBs were not related to their respective behaviors. Additionally, it was assumed that impulsive people were especially influenceable by implicit cognitions (Flores, 2011). But, other than expected, the relation between implicit CHBs and substance use was not existent for people who scored high on impulsivity.

In contrast to implicit CHBs, explicit SU-CHBs were related to smoking,- alcohol consumption,- and binge drinking frequencies. This is in line with the findings from Knäuper et al. (2004), showing that participants with higher scores on explicit SU-CHBs had a higher substance consumption. Viewing these results in the context of the dual process theory (Deutsch & Strack, 2004 as cited in Houben et al., 2010), it can be assumed that SU-CHBs emerge more strongly explicitly. This could be plausible, since health-campaigns are intended to address the

harmfulness of tobacco and alcohol on their particular packings. So the awareness of health consequences could steadily arise in presence of substances and people might perceive the permanent challenge to search for options that afford an unrestrained consumption. Regarding this, the SU-CHB development could especially require conscious deliberation and rule-based decision making and is therefore less pronounced implicitly. This is further supported by the finding that smokers have higher explicit but not implicit CHBs than non-smokers (Glock et al. 2013).

However, the hypothesis that CHBs can be activated automatically, should not be discarded. CHBs seemingly arise from conscious thought. However, according to Mechner, Fredrick, and Jenkins (2013), after multiple repetition, even difficult conscious processes can become unconscious and hence, can automatically activate behavior. One reason that no relevant association between implicit CHBs and substance use was found, could be that the mean age of the student sample was young. White, Labouvie, and Papadaratsakis (2005) revealed that the frequency of substance consumption among young adults' primary increases after the begin of university. Therefore, the participant's might not had to use their explicit SU-CHBs frequent enough so that they could automatically influence behavior. Interestingly, the male sample showed a positive relation between explicit SU-CHBs and implicit smoking CHBs, which indicates that explicit SU-CHBs might already partially became implicit among males. However, for men, only explicit SU-CHBs but not implicit SU- CHBs were related to substance use. According to the dual process theory (Deutsch & Strack, 2004 as cited in Houben et al., 2010) it can be assumed that implicit and explicit CHB processes interacted. However, behavior was determined by explicit SU-CHBs because this process emerges more strongly.

The following suggestions can be made for further studies dealing with the concept implicit CHBs. Research should address a broader age range to examine if CHBs become activated automatically after using them repeatedly on an explicit level. Furthermore, next to the hypothesis that the concept of healthy behavior can be activated in presence of desirable but unhealthy stimuli, it can also be assumed that this activation proceeds conversely. Measuring if the concept of unhealthy behavior becomes quickly activated in presence of healthy stimuli could indicate if people are more prone to engage in unhealthy behavior after they executed a healthy behavior.

Concerning the assumptions made above, it should be considered that the research on implicit CHBs is in its infancy and certainly expandable. This study measured implicit CHBs by using stimuli that were already successfully utilized in IATs for health research. The present ST-IAT was created based on the suggestions for implicit measures made by Wigboldus et al.

(2004). Creation also leaned on the ST-IAT from Glock et al. (2013) which was designed to asses implicit smoking CHBs. Therefore, the quality of the used ST-IATs was estimated as adequate. However, implicit measurements are often influenced by distraction (Fiedler, Messner, & Bluemke, 2006). Since the ST-IATs were conducted in an online study, it could not be ensured that participants fully concentrated on the tests. This might have led to imprecise results. An additional limitation is that IATs generally have a low test-retest reliability (Bluemke & Friese, 2008), which indicates that the results of the present ST-IATs might not be consistent over time and different conclusions might be made if the ST-IATs would be repeated.

A further implication that can be made for the existing CHB construct, is based on the present finding that the relationships between explicit SU-CHBs and substance use behaviors had moderate to strong correlation coefficients for men, whereas for women, explicit SU-CHBs were only moderately related to smoking behavior. This indicates that CHBs could be specific for gender. Men seemingly had a greater tendency to reduce cognitive dissonance related to substance use by holding the belief that the effects of smoking or alcohol consumption are compensable. A reason why the relation between explicit SU-CHBs and substance use was more strongly among men could be that males have a larger tendency to solve problems by rational thought than women (Oliver, 1991). Therefore, men might have a stronger propensity to rationalize their unhealthy behaviors through CHBs.

Although it was found that personality influences CHB development (Knäuper et al., 2004) as well as substance use behavior (e.g. Comeau et al., 2001), this effect was not significant in the male sample. This could be traced back to a small sample size of male students. Small sample sizes can lead to a type 2 error in statistical testing (Samuels, Witmer, & Schaffner, 2012), which suggests that the hypothesized effects of personality might be present for men, but the gathered sample of males did not show it. This is further supported by the borderline significant main effect of impulsivity on binge drinking that was found for males by multiple regression analysis. Notably, different to females, this relation was negative for men which indicates that for males, less impulsivity meant more binge drinking. This is contrary to results from earlier studies (e.g. Waldeck, & Miller, 1997). However, since lower levels of impulsivity account for more behavioral planning (Woicik et al., 2009) it could be assumed that male students execute binge drinking behavior because they actively plan to do so. For example, they might plan to drink higher amounts of alcohol to equalize the amount of money that they paid to join an “all-you-can-drink-party”.

Different from the male sample, for female’s significant correlations were found between personality and explicit SU-CHBs as well as between personality and substance use.

The results indicated that women who scored high on sensations seeking or impulsivity also had higher binge drinking frequencies. Furthermore, multiple regression analyses inter alia showed a significant main effect of sensation seeking on alcohol consumption for women. Overall, these results are in line with the findings that impulsive people are more prone to substance use as they fail to resist the rewarding temptation of consumption (Woicik et al., 2009) and sensation seekers are more prone to substance use because they want to achieve positive affect by self-reward (Comeau et al., 2001). Notably, the moderation analyses showed that the relationship between explicit SU-CHBs and binge drinking was significant for women who scored high on sensation seeking and also possibly significant for women who scored high on impulsivity. This part of the female sample might therefore be more prone to use explicit SU-CHBs as justification for their enhanced responsiveness to the rewarding effects of binge drinking. Furthermore, the results also showed that sensation seeking was positively related to explicit SU-CHBs. This relation was significant for the total sample as well as for the female sample, but not for men. Knäuper et al. (2004) already revealed that the personality trait conscientiousness is related to explicit CHBs. The found correlation provides further knowledge to the existing CHB construct by suggesting that sensation seekers could be more prone to develop CHBs. This relation is assumable, since sensation seekers often underestimate the risks associated with substance use (Hoyle et al., 2002). Therefore, these people might be more convinced that the negative consequences of substance use are compensable.

Altogether the results showed that personality could be a better predictor for substance use for females than for males, and the effect of explicit SU-CHBs on binge drinking might be only significant for impulsive or sensation seeking women. A reason for this could be that women perceive substance use as less socially acceptable than men (Galea, Nandi, & Vlahov, 2004). So higher substance consumption, as well as the tendency to develop CHBs for this behavior, might only occur for women who can't resist the rewarding temptations that are connected to substance use. To reduce substance use, health campaigns should therefore consider the latent influences that make females more prone to consumption and to develop CHBs. However, for men it might be more appropriate to focus on their SU-CHBs to reduce substance consumption. Confronting men with the inescapable risks of substance use, could reduce the irrational beliefs that underlie SU-CHBs and hence, diminish the influence of SU-CHBs on behavior.

Concerning the assumption that personality moderates the relation between SU-CHBs and substance use, the hypothesis that sensation seeking is a stronger moderator for the relation between explicit SU-CHBs and substance use than impulsivity could be possible. In the female

sample, the moderating effect of sensation seeking for the relation between explicit SU-CHBs and binge drinking was stronger than the moderating effect of impulsivity. Female sensation seekers might be more prone to the influence of explicit SU-CHBs, since they tend to be on the explicit quest for rewarding stimulations. The hypothesis that impulsivity is a stronger moderator for the relation between implicit SU-CHBs and substance use than sensation seeking could not be supported. However, the moderation models mostly explained statistically low proportion of variance in substance use. Therefore, the constructs might be differently related to each other than expected. Mischel and Shoda (1995) suggested that cognitions can specify why the predictive effect of personality on behavior occurs. Further research could therefore address the mediating role of SU-CHBs related cognitions for the relation between personality and substance use.

On the whole, it can be concluded that explicit SU-CHBs play an important role in substance use and this hypothesis might be especially appropriate for men. Explicit SU-CHBs also influence substance use behavior among women, but personality seems to have a primary influence on their consumptive behavior. Subsequent research should consider this gender difference to enhance knowledge about the reasons for other risky behaviors, like unhealthy eating. If explicit CHB measures will be addressed in this context, the suggestion can be made that CHB scales should be selected that deal with the specific behavior the research will focus on. This suggestion is based on the finding that the total CHB scale was less related to substance use than the specific SU-CHB scale. Furthermore, it was concluded that the hypotheses that CHBs can be activated automatically, should not be discarded. Additional research could address implicit CHB measurement techniques as well as their predictive value for unhealthy behavior. Personality might play a greater role for CHB development and should be subject to further research addressing the CHB construct.

References

Banse, R., & Greenwald, A. G. (2007). Personality and implicit social cognition research: Past, present and future. *European Journal of Personality*, *21*(3), 371-382. doi: 10.1002/per.638

Bluemke, M., & Friese, M. (2008). Reliability and validity of the Single-Target IAT (ST-IAT): Assessing automatic affect towards multiple attitude objects. *European journal of social psychology*, *38*(6), 977-997. doi: 10.1002/ejsp.487

Bowling, A. (1995). What things are important in people's lives? A survey of the public's judgements to inform scales of health related quality of life. *Social science & medicine*, *41*(10), 1447-1462. doi:10.1016/0277-9536(95)00113-L

Bryant, J. B., Darkes, J., & Rahal, C. (2012). College students' compensatory eating and behaviors in response to alcohol consumption. *Journal of American College Health*, *60*(5), 350-356. doi: 10.1080/07448481.2011.630702

Burger, M., & Mensink, G. (2003). Bundes-Gesundheitssurvey: Alkohol. Retrieved from: http://www.rki.de/DE/Content/Gesundheitsmonitoring/Gesundheitsberichterstattung/GBEDownloadsB/alkohol.pdf?__blob=publicationFile

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2013). Routledge. *Applied multiple regression/correlation analysis for the behavioral sciences*.

Comeau, N., Stewart, S. H., & Loba, P. (2001). The relations of trait anxiety, anxiety sensitivity, and sensation seeking to adolescents' motivations for alcohol, cigarette, and marijuana use. *Addictive behaviors*, *26*(6), 803-825. doi:10.1016/S0306 4603(01)00238-6

Costa, P. T., & McCrae, R. R. (1991). NEO five-factor inventory. *Odessa, FL: Psychological Assessment Resources*. doi: 10.1002/j.1556-6676.1991.tb01524.x

Craeynest, M., Crombez, G., Haerens, L., & De Bourdeaudhuij, I. (2007). Do overweight youngsters like food more than lean peers? Assessing their implicit attitudes with a personalized Implicit Association Task. *Food Quality and Preference*, 18(8), 1077 1084. doi:10.1016/j.foodqual.2007.05.003

Crawford, A. M., Pentz, M. A., Chou, C. P., Li, C., & Dwyer, J. H. (2003). Parallel developmental trajectories of sensation seeking and regular substance use in adolescents. *Psychology of Addictive Behaviors*, *17*(3), 179.

Dally, H., Edler, L., Jäger, B., Schmezer, P., Spiegelhalder, B., Dienemann, H., & Risch, A. (2003). The CYP3A4* 1B allele increases risk for small cell lung cancer: effect of gender and smoking dose. *Pharmacogenetics and Genomics*, *13*(10), 607-618.

Deutsch & Strack (2004). Reflection and impulse as determinants of conscious and unconscious motivation. *Social motivation: Conscious and unconscious processes*, 91-112.

Doll, R., Peto, R., Boreham, J., & Sutherland, I. (2004). Mortality in relation to smoking: 50 years' observations on male British doctors. *Bmj*, *328*(7455), 1519.

Ellis, P. D. (2010). The essential guide to effect sizes: Statistical power, meta-analysis, and the interpretation of research results. *Cambridge University Press.*

Fiedler, K., Messner, C., & Bluemke, M. (2006). Unresolved problems with the "I", the "A", and the "T": A logical and psychometric critique of the Implicit Association Test (IAT). *European Review of Social Psychology*, *17*(1), 74-147.

Flores, S. A. (2011). *The Cognitive Costs of Regulating Implicit Impulses* (Doctoral dissertation, Texas A&M University). Retrieved from: http://oaktrust.library.tamu.edu/

Fried, C. B., & Aronson, E. (1995). Hypocrisy, misattribution, and dissonance reduction. *Personality and Social Psychology Bulletin*, *21*(9), 925-933.doi: 10.1177/0146167295219007

Galea, S., Nandi, A., & Vlahov, D. (2004). The social epidemiology of substance use. *Epidemiologic reviews*, *26*(1), 36-52. doi: 10.1093/epirev/mxh007

Gilman, S. L. (2004). Smoke: a global history of smoking. *Reaktion books.*

Glock, S., Müller, B. C., & Krolak‐Schwerdt, S. (2013). Implicit associations and compensatory health beliefs in smokers: Exploring their role for behavior and their change through warning labels. *British journal of health psychology*, *18*(4), 814-826. doi: 10.1111/bjhp.12023

Goldberg, L. R. (1992). The development of markers for the Big-Five factor structure. *Psychological assessment*, *4*(1), 26.

Granö, N., Virtanen, M., Vahtera, J., Elovainio, M., & Kivimäki, M. (2004). Impulsivity as a predictor of smoking and alcohol consumption. *Personality and individual differences*, *37*(8), 1693-1700. doi:10.1016/j.paid.2004.03.004

Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the implicit association test: I. An improved scoring algorithm. *Journal of personality and social psychology*, *85*(2), 197.

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. (1998). Measuring individual differences in implicit cognition: the implicit association test. *Journal of personality and social psychology*, *74*(6), 1464.

Harrison, L., Kelly, P., Lindsay, J., Advocat, J., & Hickey, C. (2011). 'I don't know anyone that has two drinks a day': Young people, alcohol and the government of pleasure. *Health, risk & society*, *13*(5), 469-486.

Houben, K., Havermans, R., & Wiers, R. (2010). Learning to dislike alcohol: conditioninining negative implicit attitudes toward alcohol and its effect on drinkingbehavior. *Psychopharmacology*, 211(1), 79-86. doi: 10.1007/s00213-010-1872-1

Houben, K., Nosek, B, & Wiers, W. (2010). Seeing the forest through the trees: A comparison of different IAT variants measuring implicit alcohol associations. *Drug and Alcohol Dependence*, *106*(2), 204-211. doi:10.1016/j.drugalcdep.2009.08.016

Hoyle, R. H., Stephenson, M. T., Palmgreen, P., Lorch, E. P., & Donohew, R. L. (2002). Reliability and validity of a brief measure of sensation seeking. *Personality and individual differences*, *32*(3), 401-414. doi:10.1016/S0191-8869(01)00032-0

Huijding, J., de Jong, P. J., Wiers, R. W., & Verkooijen, K. (2005). Implicit and explicit attitudes toward smoking in a smoking and a nonsmoking setting. *Addictive behaviors*, 30(5), 949-961. doi:10.1016/j.addbeh.2004.09.014

Jajodia, A., & Earleywine, M. (2003). Measuring alcohol expectancies with the implicit association test. *Psychology of addictive behaviors*, 17(2), 126.

Jonas, H. A., Dobson, A. J., & Brown, W. J. (2000). Patterns of alcohol consumption in young Australian women: socio demographic factors, health related behaviours and physical

health. *Australian and New Zealand journal of public health*, *24*(2), 185-191. doi: 10.1111/j.1467-842X.2000.tb00140.x

Jurk, S., Kuitunen Paul, S., Kroemer, N., Artiges, E., Banaschewski, T., Bokde, A., & Smolka, M. (2015). Personality and substance use: psychometric evaluation and validation of the Substance Use Risk Profile Scale (SURPS) in English, Irish, French, and German adolescents. *Alcoholism: Clinical and Experimental Research*, *39*(11), 2234-2248. doi: 10.1111/acer.12886

Knäuper, B., Rabiau, M., Cohen, O., & Patriciu, N. (2004). Compensatory health beliefs: scale development and psychometric properties. *Psychology & Health*, *19*(5), 607-624. doi: 10.1080/0887044042000196737

Korte, J., Pieterse, M. E., Postel, M. G., & Van Hoof, J. J. (2012). Private peer group settings as an environmental determinant of alcohol use in Dutch adolescents: Results from a representative survey in the region of Twente. *Health & place*, 18(4), 892-897. doi:10.1016/j.healthplace.2012.02.010

Lahti-Koski, M., Pietinen, P., Heliövaara, M., & Vartiainen, E. (2002). Associations of body mass index and obesity with physical activity, food choices, alcohol intake, and smoking in the 1982–1997 FINRISK Studies. *The American journal of clinical nutrition*, *75*(5), 809-817.

Lippke, S., Hohmann, C., Kalusche, A., & Knäuper, B. (2005). Kompensatorische Gesundheitsüberzeugungen

Mechner, F., Fredrick, T., & Jenkins, T. (2013). How can one specify and teach thinking skills. *European Journal of Behavior Analysis*, *14*, 285-293.

Mischel, W., & Shoda, Y. (1995). A cognitive-affective system theory of personality: reconceptualizing situations, dispositions, dynamics, and invariance in personality structure. *Psychological review*, *102*(2), 246.

Mudde, A. N., Willemsen, M. C., Kremers, S., & de Vries, H. (2006). Measuring instruments for research regarding smoking and smoking cessation [Meetinstrumenten voor onderzoek naar roken en stoppen met roken.]. The Hague. *STIVORO.*

Nigg, C., Burbank, P., Padula, C., Dufresne, R., Rossi, J., Velicer, W., & Prochaska, J. (1999). Stages of change across ten health risk behaviors for older adults. *The Gerontologist*, *39*(4), 473-482. doi: 10.1093/geront/39.4.473

Nelson, M. C., & Gordon-Larsen, P. (2006). Physical activity and sedentary behavior patterns are associated with selected adolescent health risk behaviors. *Pediatrics*, *117*(4), 1281- 1290.

Nelson, M. C., Story, M., Larson, N. I., Neumark-Sztainer, D., & Lytle, L. A. (2008). Emerging adulthood and college-aged youth: an overlooked age for weight-related behavior change. *Obesity*, *16*(10), 2205-2211. doi: 10.1038/oby.2008.365

Nelson, T. F., & Wechsler, H. (2001). Alcohol and college athletes. *Medicine & Science in Sports & Exercise*.

Oliver, P. (1991). What do Girls Know Anyway?': Rationality, Gender and Social Control. *Feminism & Psychology*, *1*(3), 339-360. doi: 10.1177/0959353591013003

Rabiau, M., Knäuper, B., & Miquelon, P. (2006). The eternal quest for optimal balance between maximizing pleasure and minimizing harm: The compensatory health beliefs model. *British journal of health psychology*, *11*(1), 139-153. doi: 10.1348/135910705X52237

Radtke, T., Scholz, U., Keller, R., & Hornung, R. (2012). Smoking is ok as long as I eat healthily: Compensatory Health Beliefs and their role for intentions and smoking within the Health Action Process Approach. *Psychology & health*, *27*(sup2), 91-107. doi: 10.1080/08870446.2011.603422

Radtke, T., Scholz, U., Keller, R., Knäuper, B., & Hornung, R. (2011). Smoking_specific compensatory health beliefs and the readiness to stop smoking in adolescents. *British journal of health psychology*, *16*(3), 610-625. doi: 10.1348/2044-8287.002001

Radtke, T., Scholz, U., Keller, R., Perren, S., & Hornung, R. (2013). German-language version of the Compensatory Health Belief Scale: *Assessing its psychometric properties.*

Robertson, N., & Vohora, R. (2008). Fitness vs. fatness: Implicit bias towards obesity among fitness professionals and regular exercisers. *Psychology of Sport and Exercise*, 9(4), 547-557. doi:10.1016/j.psychsport.2007.06.002

Rooke, S. E., Hine, D. W., & Thorsteinsson, E. B. (2008). Implicit cognition and substance use: a meta-analysis. *Addictive behaviors*, *33*(10), 1314-1328. doi:10.1016/j.addbeh.2008.06.009

Samuels, M. L., Witmer, J. A., & Schaffner, A. (2012). Statistics for the life sciences. *Pearson education.*

Seitz, H. (2000). Wieviel Alkohol macht krank. *Deutsches Ärzteblatt*, 97(22), 1304-1307.

Shono, Y., Ames, S. L., & Stacy, A. W. (2015). Evaluation of Internal Validity Using Modern Test Theory: Application to Word Association.

Stacy, A. W. (1997). Memory activation and expectancy as prospective predictors of alcohol and marijuana use. *Journal of abnormal psychology*, *106*(1), 61.

Statistisches Bundesamt, (2013). Statistisches Jahrbuch 2013. *Statistisches Bundesamt, Wiesbaden*. Retrieved from: https://www.destatis.de/DE/Publikationen/StatistischesJahrbuch/StatistischesJahrbuch2013.pdf?__blob=publicationFile

Steinberg, R., & Kornguth, S. E. (2009). Sustaining performance under stress: Overview of this issue. *Military Psychology*, 21(S1), S1.

Thush, C., & Wiers, R. W. (2007). Explicit and implicit alcohol-related cognitions and the prediction of future drinking in adolescents. *Addictive behaviors*, *32*(7), 1367-1383. doi:10.1016/j.addbeh.2006.09.011

Waldeck, T. L., & Miller, L. S. (1997). Gender and impulsivity differences in licit substance use. *Journal of Substance Abuse*, *9*, 269-275. doi:10.1016/S0899-3289(97)90021-3

White, H. R., Labouvie, E. W., & Papadaratsakis, V. (2005). Changes in substance use during the transition to adulthood: A comparison of college students and their noncollege age peers. *Journal of Drug Issues*, 35(2), 281-306. doi: 10.1177/002204260503500204

Wigboldus, D. H., Holland, R. W., & van Knippenberg, A. (2004). Single target implicit associations.

Wilson, T. D., Lindsey, S., & Schooler, T. Y. (2000). A model of dual attitudes. *Psychological review*, *107*(1), 101.

Woicik, P. A., Stewart, S. H., Pihl, R. O., & Conrod, P. J. (2009). The substance use risk profile scale: A scale measuring traits linked to reinforcement-specific substance use profiles. *Addictive behaviors*, *34*(12), 1042-1055. doi:10.1016/j.addbeh.2009.07.001

Zuckerman, M. (2007). *Sensation Seeking and Risk*. American Psychological Association.

APPENDIX

ST-IAT

Items selected for the ST-IAT with smoking as the target category

Attribute category gesundes Verhalten (healthy behavior):

Obstsalat, Gurke, Erdbeere (Craeynest, Crombez, Haerens, & De Bourdeaudhuij, 2007), schlafen,

Wasser trinken, Saft (Houben, Havermans, & Wiers, 2010),

Sportlichkeit (Robertson & Vohora, 2008),

entspannt sein (Steinberg & Kornguth, 2009)

Attribute category ungesundes Verhalten (unhealthy behavior):

Pfannkuchen, Pommes, Schokolade (Creaynest et al., 2007),

durchmachen,

sich betrinken (Shono, Ames & Stacy, 2015), Wodka (Jajodia & Earleywine, 2003), Unsportlichkeit (Robertson & Vohora, 2008),

überfordert sein (Steinberg & Kornguth, 2009)

Target category rauchen (smoking):

Tabak, Nikotin, Raucher, Aschenbecher, Zigarette, Rauchen, Raucherbereich, Drehtabak (Huijding, de Jong, Wiers, & Verkooijen, 2005).

Items selected for the ST-IAT with alcohol as the target category

Attribute category gesundes Verhalten (healthy behavior):

Obstsalat, Gurke, Erdbeere, (Craeynest, et al., 2007),

schlafen,

nicht rauchen, rauchfrei (Huijding et al., 2005),

Sportlichkeit (Robertson & Vohora, 2008),

entspannt sein (Steinberg & Kornguth, 2009)

Attribute category ungesundes Verhalten (unhealthy behavior):

Pfannkuchen, Pommes, Schokolade (Craeynest et al., 2007),

durchmachen,

rauchen, rauchig, (Huijding et al., 2005),

Unsportlichkeit (Robertson & Vohora, 2008),

überfordert sein (Steinberg & Kornguth, 2009)

Target category Alkohol (alcohol):

Bier, Whisky, Cocktail, Gin, Wodka, Rum, Wein, Scotch (Jajodia & Earleywine, 2003)

German CHB Scale Lippke, Hohmann, Kalusche, & Knäuper (2005)

Menschen denken unterschiedlich über Verhaltensweisen und deren Auswirkung auf die Gesundheit. Im Folgenden sehen Sie eine Liste mit Aussagen darüber, wie man möglicherweise versuchen kann, gesund zu bleiben und ungesundes Verhalten auszugleichen. Bitte lesen Sie sich die Aussagen genau durch und kreuzen Sie an, wie sehr Sie persönlich diesen Aussagen zustimmen. Wichtig ist, dass es keine richtigen oder falschen Aussagen gibt, da es nur um Ihre persönliche Einschätzung geht.

1. Stress während der Woche kann man durch Entspannung am Wochenende ausgleichen.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

2. Durch körperliche Aktivität ist es möglich, die Nebenwirkungen des Rauchens auszugleichen.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

3. Es ist in Ordnung, spät zu Bett zu gehen, wenn man am nächsten Morgen ausschlafen kann.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

4. Nachtisch zu essen ist in Ordnung, wenn man sich bei der Hauptmahlzeit zurückhält.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

5. Sich vor dem Fernseher zu entspannen, kann einen stressigen Tag ausgleichen.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

6. Eine gesunde Ernährung vermindert die Effekte eines regelmäßigen Alkoholkonsums.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

7. Körperliche Betätigung wirkt ausgleichend auf die negativen Auswirkungen von Stress.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

8. Man kann ruhigen Gewissens in Maßen rauchen, wenn man sich gesund ernährt.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

9. Die Verwendung von künstlichem Süßstoff kann ein paar extra Kalorien ausgleichen.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

10. Einen hohen Alkoholkonsum am Wochenende kann man ausgleichen, indem man unter der Woche keinen Alkohol trinkt.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

11. Wenn man den ganzen Tag lang nicht gegessen hat, kann man abends essen, was man möchte.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

12. Zu wenig Schlaf während der Woche kann man durch mehr Schlaf am Wochenende ausgleichen.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

13. Es ist in Ordnung, sich einen Tag lang nicht an seine Diät zu halten, wenn man sich ab dem nächsten Tag wieder daran hält.

- Stimme überhaupt nicht zu

- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

14. Die Auswirkungen von Kaffeetrinken können durch das Trinken der gleichen Menge Wasser ausgeglichen werden.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

15. Es ist in Ordnung das Frühstück ausfallen zu lassen, wenn man beim Mittagessen mehr isst.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

16. Stress kann man durch Schlaf ausgleichen.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

17. Es ist in Ordnung viel Alkohol zu trinken, solange man genug Wasser trinkt, um den Alkohol auszuspülen.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

18. Wenn man in einer Woche seinen Sport ausfallen lässt, kann man das durch die doppelte Menge Sport in der nächsten Woche ausgleichen.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch

- Stimme eher zu
- Stimme voll zu

19. Die Auswirkungen von regelmäßigem Alkoholkonsum können durch gesundes Essen ausgeglichen werden.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

20. Zu wenig körperliche Bewegung kann ausgeglichen werden, indem man weniger isst.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

21. Stress während der Woche kann man ausgleichen, indem man sich am Wochenende entspannt.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

22. Wenn man sich gesund ernährt ist es nicht so wichtig, körperlich aktiv zu sein.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

23. Vitamintabletten können die negativen Auswirkungen einer ungesunden Ernährung ausgleichen.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

24. Gelegentlich Süßigkeiten zu essen ist in Ordnung, weil es Stress abbaut.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

25. Wenn man körperlich aktiv ist, kann man ohne viele Einschränkungen essen.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

26. Gelegentlich Fast Food (McDonald`s, Curry Wurst, Döner) zu essen ist in Ordnung, wenn man sich regelmäßig körperlich bewegt.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

27. Einen gelegentlichen kalorienreichen Nachtisch kann man ausgleichen, indem man seinen Kaffee oder Tee nicht süßt.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

28. Gelegentlich Kuchen oder Torte zu essen ist in Ordnung, wenn man nicht regelmäßig kalorienreichen Nachtisch isst.

- Stimme überhaupt nicht zu
- Stimme eher nicht zu
- Weder noch
- Stimme eher zu
- Stimme voll zu

German SURPS (measuring the subscales impulsivity and sensation seeking)

Jurk, Kuitunen-Paul, Kroemer, Artiges, Banaschewski, Bodke & Smolka, 2015

Lesen Sie bitte die Fragen und die Antworten aufmerksam durch und kreuzen Sie bei jeder Frage diejenige Antwort an, die am ehesten auf Sie zutrifft. Es gibt keine richtigen oder falschen Antworten.

1. Oftmals sage ich Dinge, ohne groß vorher darüber nachzudenken.

- Starke Ablehnung
- Ablehnung
- Zustimmung
- Starke Zustimmung

2. Ich würde gerne Fallschirm springen.

- Starke Ablehnung
- Ablehnung
- Zustimmung
- Starke Zustimmung

3. Ich bringe mich häufig in Situationen, bei denen ich es später bereue involviert gewesen zu sein.

- Starke Ablehnung
- Ablehnung
- Zustimmung
- Starke Zustimmung

4. Ich mache gerne neue und aufregende Erfahrungen, auch wenn sie unkonventionell sind.

- Starke Ablehnung
- Ablehnung
- Zustimmung
- Starke Zustimmung

5. Ich tue gerne Dinge, die ein wenig furchteinflößend sind.

- Starke Ablehnung
- Ablehnung
- Zustimmung
- Starke Zustimmung

6. Normalerweise tue ich Dinge ohne vorher darüber nachzudenken.

- Starke Ablehnung
- Ablehnung
- Zustimmung
- Starke Zustimmung

7. Ich würde gerne lernen Motorrad zu fahren. (Wenn Sie schon einen Motorradführerschein besitzen, dann wählen Sie „Starke Zustimmung“)

- Starke Ablehnung
- Ablehnung
- Zustimmung
- Starke Zustimmung

8. Im Allgemeinen bin ich ein impulsiver Mensch.

- Starke Ablehnung
- Ablehnung
- Zustimmung
- Starke Zustimmung

9. Ich bin an Erfahrungen als solchen interessiert, selbst wenn sie illegal sind.

- Starke Ablehnung
- Ablehnung
- Zustimmung
- Starke Zustimmung

10. Mir würden lange Wanderungen durch wildes und unbewohntes Gebiet Spaß machen.

- Starke Ablehnung
- Ablehnung
- Zustimmung
- Starke Zustimmung

11. Ich glaube, ich muss andere manipulieren, um das zu bekommen, was ich will.

- Starke Ablehnung
- Ablehnung
- Zustimmung
- Starke Zustimmung

Substance Use Behavior Korte, J., Pieterse, M. E., Postel, M. G., & Van Hoof, J. J. (2012); Mudde, Willemsen, Kremers, & de Vries (2006)

In der Tabelle befinden sich Angaben über die Standarddefinition von einem Glas Alkohol. Schauen Sie sich die Informationen gut an, da diese für die Beantwortung der folgenden Fragen wichtig sind.

Tabelle Standardgläser Alkohol

Alkoholisches Getränk	Anzahl der Standartgläser
Glas Bier 0,33	1
Flasche Bier	1,5
Halber Liter Bier	2
Weinglas	1
Flasche Wein	7,5
Mixgetränk (hochprozentiger Alkohol mit Limonade oder Saft)	1
Breezer	1,25
Shooter (z B. ein Feigling)	0,35
Kleines Glas Whiskey, Likör etc.	1
Flasche Hochprozentiger	22

An wie vielen der Wochentage (Montag-Donnerstag) trinken Sie durchschnittlich Alkohol?

- 4 Tage
- 3 Tage
- 2 Tage
- 1 Tag
- weniger als ein Tag
- Ich trinke nie Alkohol an Wochentagen

Wie viele Gläser trinken Sie normalerweise an einem Wochentag?

- 11 Gläser am Tag
- 7-10 Gläser am Tag
- 6 Gläser am Tag
- 5 Gläser am Tag
- 4 Gläser am Tag
- 3 Gläser am Tag
- 2 Gläser am Tag
- 1 Glas am Tag
- 0 Gläser am Tag

An wie vielen der Wochenendtage (Freitag, Samstag, Sonntag) trinken Sie gewöhnlich Alkohol?

- 3 Tage
- 2 Tage
- 1 Tag
- Ich trinke am Wochenende kein Alkohol

Wie viele Gläser Alkohol trinken Sie meistens an einem Wochenendtag?

- 20 Gläser oder mehr am Tag

- 15-19 Gläser am Tag
- 11-14 Gläser am Tag
- 7-10 Gläser am Tag
- 6 Gläser am Tag
- 5 Gläser am Tag
- 4 Gläser am Tag
- 3 Gläser am Tag
- 2 Gläser am Tag
- 1 Glas am Tag
- 0 Gläser am Tag

Wie oft haben Sie in den vergangenen 4 Wochen bei einer Gelegenheit 6 oder mehr Gläser Alkohol getrunken (z B. bei einem Fest oder an einem Abend)?

- Ich habe keinen Alkohol in den vergangenen 4 Wochen getrunken
- Nicht mehr als 6 Gläser in den vergangenen 4 Wochen
- 1 mal in den vergangenen 4 Wochen
- 2 mal in den vergangenen 4 Wochen
- 3 mal in den vergangenen 4 Wochen
- 4 mal in den vergangenen 4 Wochen
- 5 mal in den vergangenen 4 Wochen
- 6 mal in den vergangenen 4 Wochen
- 7 mal in den vergangenen 4 Wochen
- 8 mal in den vergangenen 4 Wochen
- 9 mal oder öfter in den vergangenen 4 Wochen

Wie viele Zigaretten rauchen Sie circa wöchentlich?

- 0
- 0-1
- 1
- 2
- 3
- 4
- 5
- 6
- 11-20
- 21-30
- 31-40
- 41-50
- 51-60
- 61-70
- mehr als 70