

# UC Office of the President

## Recent Work

### **Title**

Binge drinking: Health impact, prevalence, correlates and interventions

### **Permalink**

<https://escholarship.org/uc/item/5vf3k21b>

### **Authors**

Kuntsche, Emmanuel

Kuntsche, Sandra

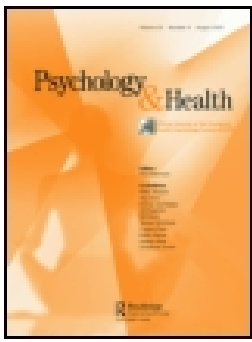
Thrul, Johannes

et al.

### **Publication Date**

2017-05-17

Peer reviewed



## Binge drinking: Health impact, prevalence, correlates and interventions

Emmanuel Kuntsche, Sandra Kuntsche, Johannes Thrul & Gerhard Gmel

To cite this article: Emmanuel Kuntsche, Sandra Kuntsche, Johannes Thrul & Gerhard Gmel (2017): Binge drinking: Health impact, prevalence, correlates and interventions, Psychology & Health, DOI: [10.1080/08870446.2017.1325889](https://doi.org/10.1080/08870446.2017.1325889)

To link to this article: <http://dx.doi.org/10.1080/08870446.2017.1325889>



Published online: 17 May 2017.



[Submit your article to this journal](#)



Article views: 2




[View related articles](#)



[View Crossmark data](#)

## Binge drinking: Health impact, prevalence, correlates and interventions

Emmanuel Kuntsche<sup>a,b,c,\*</sup>, Sandra Kuntsche<sup>a</sup>, Johannes Threlkoff<sup>d</sup>  and Gerhard Gmel<sup>a,e</sup>

<sup>a</sup>Addiction Switzerland, Research Department, Lausanne, Switzerland; <sup>b</sup>Behavioural Science Institute, Radboud University, Nijmegen, The Netherlands; <sup>c</sup>Institute of Psychology, Eötvös Loránd University, Budapest, Hungary; <sup>d</sup>Center for Tobacco Control Research and Education, University of California, San Francisco, CA, USA; <sup>e</sup>Alcohol Treatment Centre, Lausanne University Hospital, Lausanne, Switzerland

(Received 21 September 2016; accepted 28 April 2017)

**Objective:** Binge drinking (also called heavy episodic drinking, risky single-occasion drinking etc.) is a major public health problem. This paper provides an overview of recently published evidence concerning the definition and measurement, prevalence rates, health impact, demographic and psychosocial correlates of, and interventions for, binge drinking.

**Design:** Narrative review.

**Results:** Mostly occurring among young people at weekends, binge drinking increases the risk of both acute (e.g. injuries) and long-term negative consequences (e.g. alcohol disorders). Binge drinkers tend to be extrovert, impulsive and sensation-seeking. Stress, anxiety, traumatic events and depression are also related to binge drinking. Both alcohol-related behaviour of parents and general parenting (e.g. parenting styles, monitoring) are also important. Other major risk factors for binge drinking are frequently spending time with friends who drink, and the drinking norms observed in the wider social environment (e.g. school, community, culture). Emergency departments, birthday parties, fraternities and the workplace serve as settings for interventions; these are increasingly delivered via digital and mobile technology. There is evidence of small-sized effects across approaches (brief interventions, personalised normative feedback, protective behavioural strategies etc.) and populations.

**Conclusion:** A more consistent terminology, investigating multi-level influences and identifying the most effective intervention components are challenges for future research.

**Keywords:** binge drinking; narrative review; health consequences; interventions

### Definitions of binge drinking

Binge drinking is one of the most important concepts used in alcohol epidemiology to determine the burden resulting from alcohol use (World Health Organization, 2014). Interest in binge drinking has increased in recent decades, leading to a growing body of published scientific research. A preliminary PubMed search with the keywords '(binge or risky single occasion or heavy episodic or intoxication or drunkenness or inebriation)

---

\*Corresponding author. Email: [ekuntsche@suchtschweiz.ch](mailto:ekuntsche@suchtschweiz.ch)

and alcohol and drinking' revealed that 3029 papers had been published on the subject in the last five years (from 1 August 2011 to 31 July 2016); 2988 in the 10 years before that (from 1 August 2001 to 31 July 2011); 2191 in the 20 years before that again (from 1 August 1981 to 31 July 2001).

In the 1990s, Wechsler and colleagues (Wechsler, Davenport, Dowdall, Moeykens, & Castillio, 1994; Wechsler & Isaac, 1992) introduced the term 'binge drinking' to describe a consumption pattern of a given amount of alcohol on a single occasion. The National Institute on Alcohol Abuse and Alcoholism (NIAAA, 2004) approved this definition of binge drinking as 'a pattern of drinking alcohol that brings blood alcohol concentration (BAC) to 0.08 gram percent or above. For the typical adult, this pattern corresponds to consuming 5 or more drinks (male), or 4 or more drinks (female), in about 2 hours'.

Historically, the measure of 5+ can be traced to the beginning of survey research in the US back in the late 1960s (Cahalan & Room, 1974); then it was labelled 'heavy intake' (whereas the term 'binge' referred to heavy drinking over an extended period of several days).

Nowadays, the term is commonly used to describe the consumption of more than X number of drinks on one occasion. To confuse matters, other labels are also used in parallel to describe the same drinking pattern. These include heavy episodic drinking, risky single occasion drinking, heavy sessional drinking, heavy drinking and risk drinking (e.g. Dawson, Li, & Grant, 2008). Moreover, some researchers derived a binge drinking measure from standard quantity-frequency instruments that use quantities 'typically' or 'usually' consumed on a given occasion or day (e.g. Foster, Held, Gmel, & Mohler-Kuo, 2016; Lee, 2012). By doing so, binge drinking is assessed not as a single-occasion heavy intake but as the usual high quantity when drinking.

Binge drinking, according to the contemporary definition, is commonly measured by asking about the frequency of consumption that exceeds a given amount at a given moment, e.g. 'How often in the past 12 months (or 30 days) have you had X drinks or more on a single occasion?' For comparative purposes across different studies and subsamples, a single item measure of binge drinking like this one comes with a number of caveats.

First, it inherently needs a definition of a standard drink. What this implies is that with the same number of X drinks, someone who predominantly drinks beer will ingest about the same amount of pure ethanol as a person who predominantly drinks wine or spirits. This may be a relatively easy task in some countries where serving sizes have roughly the same amount of pure ethanol (though this may be questionable for drinks poured at home). However, problems could arise when carrying out surveys in those countries where serving sizes differ in terms of their pure ethanol content. For example, in Switzerland a common serving size for beer is 3 dl. This contains about 12 g of pure ethanol (with an assumed alcohol by volume [ABV] of 5%). However, wine often comes in 1 dl servings, which is less than 9 g of pure ethanol for white wine (with an ABV of 11%), and more than 11 g for red (with an ABV of 14%). Spirits are commonly served as 2 cl, which contains 6.4 g of pure ethanol (ABV of 40%).

Second, it is intuitively clear that the prevalence of binge drinkers, as well as the potential effects of binge drinking, depend on the cut-off used for X drinks. There will be fewer binge drinkers with a cut-off of, say, 10 drinks than with a cut-off of 5 drinks, and the intoxication level will also vary. Of course, differences in measures make

comparisons over time difficult, even within the same country. For example, in the UK the cut-off was commonly defined as 11 + units on one occasion (Gmel, Rehm, & Kuntsche, 2003). Yet, at the same time other measures were used, such as 8+/6+ (men/women) or 10 + for men and 7 + for women. These measures represented half of the recommended maximum intake of alcohol per week.

Third, cross-country comparisons in fact tend not to be comparable even when they use the same cut-off for the number of drinks. This is owing to a large variation in what constitutes 'a drink' or a 'unit' in terms of pure ethanol. For example, in the UK a unit is defined as 8 g of pure ethanol, whereas in the US a drink was considered to contain 12 or 14 g (World Health Organization, 2000). Hence, using the same 5 + measure, an intake of as little as 40 g of pure ethanol, or as much as 70 g, can qualify as a binge. Additionally, the prevalence and composition of binge drinkers will differ depending on the recall period of 12 months, 30 days, or 7 days. A 12-month recall will include individuals who have rare or infrequent binge drinking episodes, whereas a 7-day recall will likely include only more regular binge drinkers. Additionally, the definition of what is an 'occasion' (drinking in a row, in one sitting, within 2 h, within one day) will impact on the composition of binge drinkers in a sample and distort the comparability across studies. For example, in the US (Kerr, Greenfield, Bond, Ye, & Rehm, 2009) binge drinking frequency is often defined as five or more drinks 'on a day', assuming that there is usually only one binge drinking occasion within a day (e.g. in the evening). However, consuming five or more drinks a day tends to have a different meaning when, for example, alcohol is consumed twice a day with meals. The effects of having five or more drinks spread over lunch and suppertime is likely to be completely different from those resulting from the consumption of the same amount of alcohol within 2 h in a bar setting (Kuntsche, Plant, Plant, Miller, & Gmel, 2008).

Until the work of Wechsler et al. (1994), binge drinking was measured identically for both men and women, i.e. the consumption of five or more drinks. To achieve a similar BAC, men tend to have to drink more than women. Consequently, the 4 + -measure was introduced to account for the different body constitution and alcohol metabolism of women. Wechsler et al. (1994) showed that women experienced, with about the same likelihood, alcohol-related consequences after 4 drinks as men did after 5 drinks. Also, Lange and Voas (2001) showed that men need about 1.5 drinks more than women to reach a BAC of about 0.08%. The use of gender-specific measures (4+/5+, 6+/8+, 7+/10+) has since become the norm.

Interestingly, the most widely used screening instrument for problematic alcohol use, the Alcohol Use Disorder Identification Test (AUDIT: Babor, Higgins-Biddle, Saunders, & Monteiro, 2001), does not differentiate between the amount consumed by men and women on a binge, despite some evidence that a lower threshold for women may increase the sensitivity and specificity of the test (see e.g. Olthuis, Zamboanga, Ham, & Van Tyne, 2011; Reinert & Allen, 2002). Recently, drinking guidelines in Australia (National Health and Medical Research Council, 2016) and the UK (Department of Health, 2016) and STEPwise approach to Surveillance (World Health Organization, 2016), for example, use the same quantities for both sexes. One reason may be that women may experience fewer consequences, particularly the acute variety (e.g. traffic casualties and injuries), than men even at the same BAC level because they are less impulsive and risk-seeking, or because they take more precautions against the negative effects of their drinking.

## Health impact of binge drinking

### *Acute consequences of even a single binge to the drinker*

Binge drinking among adolescents and young adults commonly occurs on weekends, with moderate or no drinking on most other weekdays (Kuntsche & Gmel, 2013). This drinking pattern is widely associated with an increased risk of acute consequences, including long-lasting effects, e.g. irreversible disabilities due to injury or death (Anderson, 2007; Courtney & Polich, 2009; Dawson et al., 2008; Gmel et al., 2003; Ham & Hope, 2003; Plant & Plant, 2006). This also includes consequences directly related to the state of intoxication, such as hangovers, blackouts, memory loss, nausea and vomiting. High doses can lead to alcohol poisoning, with occasional fatalities. Among young people, binge drinking is associated with academic or educational impairment owing to missed classes, falling behind on work and lower grades. These consequences become more pronounced as the frequency of binge drinking increases.

Binge drinking may also lead to unintended and unprotected sexual activity (Perkins, 2002). A recent systematic review and meta-analysis showed that the intention to engage in unprotected sex increased by about 5% with a 0.1 g/ml rise in BAC (Rehm, Shield, Joharchi, & Shuper, 2012). Thus, binge drinking may be an important factor in the transmission of HIV and other sexually transmitted diseases. During college years about 20% of women in the US were victims of rape or other sexual assaults; these were often related to binge drinking on the part of the victim and/or the perpetrator (Abbey, 2002; Krebs, Lindquist, Warner, Fisher, & Martin, 2009; Mohler-Kuo, Dowdall, Koss, & Wechsler, 2004; Testa, VanZile-Tamsen, Livingston, & Koss, 2004).

Due to its cognitive and psychomotor effects on reaction time, cognitive processing, and coordination (Gmel et al., 2003), alcohol use is a major contributory factor in the incidence of injuries, motor vehicle accidents and other trauma, particularly among younger age groups. For alcohol-related injuries, binge drinking has been found to be a major factor (Taylor, Shield, & Rehm, 2011). The literature on injury risks associated with binge drinking has found evidence predominantly in relation to drink-driving (Gruenewald, Mitchell, & Treno, 1996; Treno, Gruenewald, & Ponicki, 1997). For example, the reanalysis of the Grand Rapids Study (Hurst, Harte, & Frith, 1994) found that the risk of motor vehicle accidents increased exponentially with rising BAC levels, and that these increases were steeper for those who usually have low drinking frequencies. This may be a result of two factors that unfortunately cluster among young people, namely a lower tolerance of the effects of alcohol among less experienced drinkers, and little driving experience. Using emergency department data, Gmel, Kuntsche, and Rehm (2011) showed that this particular effect of binge drinking (intermittent heavy drinking occasions with otherwise low alcohol consumption) also applies to injuries in general. The study, which differentiated between the volume of drinking and binge drinking, found that those who normally drank lightly (but did have binge drinking episodes) were at higher risk than chronic heavy drinkers, despite ingesting approximately the same volume of alcohol in the 6 h before the injuries occurred.

Binge drinking is not only a risk factor for unintentional injuries (Hingson & Zha, 2009), but also for intentional injuries such as violence and homicide (Brewer & Swahn, 2005), as well as self-inflicted harm and suicide (Borges & Loera, 2010; Norstrom & Rossow, 2016; Schaffer, Jeglic, & Stanley, 2008). However, causality

remains unclear, i.e. whether high doses of alcohol are used prior to the planned suicide to ease expected pain, for example, or to self-medicate alcohol-induced depression as a main factor following suicide attempts.

Overall, it has been estimated that acute conditions, which are often related to binge drinking, may be responsible for over 50% of the alcohol-related deaths with an even higher proportion for years of life lost (Centers for Disease Control and Prevention, 2004). However, using acute conditions as a proxy for the binge drinking-related burden probably overestimates the effects of binge drinkers whose alcohol consumption is otherwise moderate. This is because these effects are commonly not separated from the burden borne by heavy chronic drinkers, whose (almost) daily drinking pattern involves the ingestion of alcohol quantities that qualify as binge drinking. However, such estimates of burden tend not to include the harm of binge drinking to third parties.

### ***Harm to others from binge drinkers***

The harm to others (e.g. Laslett et al., 2011) through binge drinking may be relatively minor, such as being wakened by the noise of a drunken passer-by, but they can also be very severe, including death or a lifelong physical and mental disability, e.g. involvement in a car crash by an intoxicated driver. Binge drinking may harm others through fights and interpersonal violence (Perkins, 2002) resulting from the disinhibiting effects of alcohol; these appear even more influential than the intoxication effect itself (Miller et al., 2016). Also, the expectation that intoxication can be used as a pretext to avoid or reduce social censure and other consequences at a later point in time (McMurran, 2012) may influence the decision to use force instead of avoiding conflict. The effects of alcohol on attention, cognitive processing, and impulse control may also lead to the misinterpretation of cues from others, e.g. wrongly interpreting the behaviours of others as aggressive (Giancola, Josephs, Parrott, & Duke, 2010; Townshend, Kambouropoulos, Griffin, Hunt, & Milani, 2014). The misinterpretation of women's sexual intentions may be a factor in sexual violence and rape perpetrated predominantly by males (Abbey, McAuslan, & Ross, 1998) who had been binge drinking. Frequent binge drinking episodes or the intake of particularly high volumes of alcohol may also have severe long-term consequences for the unborn (Gmel et al., 2011). Binge drinking may result in an economic burden for others through property damage and vandalism, and last but not least for society as a whole because of the social and economic costs incurred by the health-care and justice sector (e.g. law enforcement costs including costs of policing, court costs and costs of incarceration), and productivity losses (Rehm et al., 2009; World Health Organization, 2014).

### ***Binge drinking as a pathway to long-term heavy drinking and related consequences***

Despite the many findings that early (adolescent) binge drinking was associated with long-term consequences including alcohol use disorders (Chassin, Pitts, & Prost, 2002; Dawson et al., 2008; Hill, White, Chung, Hawkins, & Catalano, 2000; Viner & Taylor, 2007; Zucker et al., 2006), it still remains unclear whether these long-term chronic consequences were actually the effects of binge drinking per se, or whether they mainly reflected (a) usual heavy drinking (for which binge drinking is a regular, often daily, pattern); (b) a broader 'problem behaviour syndrome', also associated with general

problems, i.e. a family history of alcohol use disorder; or (c) comorbidities such as antisocial personality disorder and delinquency, where early onset of binge drinking, although clearly related to adverse consequences (Hingson & Zha, 2009; Rossow & Kuntsche, 2013), is sometimes only one of many symptoms, and not the main or single cause of chronic consequences (Gmel et al., 2011; Rossow & Kuntsche, 2013).

However, recent neuroimaging studies using event-related potentials (ERPs) and functional magnetic resonance imaging (fMRI) have found that repeated binge drinking among adolescents and young adults is associated with neurophysiological impairments and with abnormal activities in occipital, hippocampal, frontal and prefrontal areas (for reviews of the literature, see Courtney & Polich, 2009, 2010; Maurage et al., 2012; Petit, Kornreich, Verbanck, & Campanella, 2013; Petit, Maurage, Kornreich, Verbanck, & Campanella, 2014). In some studies this was also found when controlling for family history of alcohol misuse, psychiatric comorbidities, or effects due to the use of other substances like cannabis (Courtney & Polich, 2010; Maurage et al., 2012; Townshend et al., 2014). It appears that adolescence is a critical period for brain development. It is during these extensive neuromaturational processes that significant restructuring of the brain takes place. Consequently, the adolescent brain is particularly sensitive to alcohol, and binge drinking may therefore result in long-term changes in general brain functioning.

Moreover, some studies investigated the typical pattern of binge drinking with heavy alcohol intake during certain episodes (weekend) coupled with abstinence or low consumption on most other days, and compared individuals with a binge pattern to those with the same overall alcohol intake, but who drank more frequently and did not binge. These studies suggest that the specific consumption pattern of alternating alcohol intoxications and abstinent episodes, which is linked to excitotoxic cell death during withdrawal, may be particularly deleterious for the brain (e.g. Maurage et al., 2012; Petit et al., 2014).

Most of the brain deficits among adolescent and young adult binge drinkers mirror those observed in chronic alcohol dependents, although they tend to be less marked. This strengthens the ‘continuum hypothesis’ which posits that binge drinking and alcohol dependence may reflect two stages of the same phenomenon, leading to parallel brain deficits (e.g. Courtney & Polich, 2010). Repeated binge-induced neuroadaptations in incentive motivation and reward systems may cause hypersensitivity to alcohol-related stimuli (cue reactivity), which in turn could prevent binge drinkers from maturing out. As a consequence, heavy drinking patterns could persist and ultimately lead to alcohol dependence (Petit et al., 2013). In addition, young binge drinkers have been shown to be more sensitive to euphorogenic positive effects during the rise of the blood alcohol concentration, but less sensitive to the sedative negative effects during the increasing and declining phase. This differential sensitivity to the biphasic response (e.g. reduction in or absence of negative effects) found in frontal lobe processing may also contribute to the maintenance of ‘bad’ drinking patterns, thereby leading to heavy, problematic or dependent drinking in adulthood (Courtney & Polich, 2009). As stated by Petit et al. (2014), binge drinking is not just inoffensive social fun, but if carried on, may contribute to the onset of cerebral disturbances leading to alcohol dependence later in life. Binge drinking, therefore, may be associated with all of the long-term consequences seen in heavy chronic or even dependent drinkers.



### Prevalence of binge drinking

As explained above, prevalence rates vary widely across countries, but it is often difficult to separate cultural variations from variations due to different measurements, time frames and restriction of age groups etc. For example among 18–29 year olds in Ireland, Mohamed and Aimal (2015) estimated that 73% of men and 53% of women have had at least one binge drinking occasion in the past year, whereas among 15–64 year olds in Spain 10% of men and 4% of women had at least one binge drinking occasion in the past 30 days with a binge occasion being defined by consuming 80 g of pure ethanol for men and 60 g for women (Soler-Vila et al., 2014). It is intuitively clear that such data from surveys are difficult to compare. In an attempt to harmonise estimates of binge drinking (60 g on an occasion at least once in the past 30 days) worldwide for the population of 15 years and older, it was estimated that 7.5% binge drink at least weekly (World Health Organization, 2014). However, this proportion varies widely across regions with only 0.1% in the Eastern Mediterranean Region containing mainly Islamic states and 1.6% in the South-East Asian Region (mainly India) to 13.7% in the American region and 16.5% in Europe. The prevalence of binge drinking strongly depends on the number of abstainers. Among drinkers prevalence rates of bingers is 16% worldwide.

Among young people, the European School Survey Project on Alcohol and Drugs (ESPAD, The ESPAD Group, 2016) provide comparable data on binge drinking of five drinks on an occasion. For 2015 it was estimated that about 35% of 15–16 year olds have had at least one binge drinking occasion in the past 30 days. These prevalence rates in Europe ranged from 8% in Iceland and 11% in the US to 56% in Denmark.

Despite narrowing gender differences in the last two decades (Keyes, Li, & Hasin, 2011; Kuntsche et al., 2011), there is robust evidence that binge drinking is more common among men than women (Kuntsche & Gmel, 2013; Kuntsche, Rehm, & Gmel, 2004). This is generally true for the adult population in almost all countries (World Health Organization, 2014). The largest gender differences can be found in the WHO South East Asia Region and in the West Pacific Region where the binge drinking rates of men are almost 11 times (India) and over 7 times (China) higher than among women. In the European Region and the American Region the rates are 2.5 times higher for men than for women. This is not the case among 15–16-year-olds, at least in Europe. In 2015, binge drinking prevalence in the last 30 days was basically the same among boys (13%) and girls (12%) with some countries such as Malta, the Netherlands and Sweden showing even higher prevalence rates for girls than for boys in this age group (The ESPAD Group, 2016).

In the majority of established market economies, at least in those for which most of the published literature comes from, i.e. North America and Europe, prevalence of binge drinking increases sharply in adolescence and peaks in early adulthood (around the age of 20–25) (Kuntsche & Gmel, 2013). Subsequently, prevalence rates decrease with age, most likely due to maturing out and the adoption of adult roles. It should be noted, however, that the dominance of binge drinking in adolescence and early adulthood is not a worldwide phenomenon. In the WHO South-East Asian Region (including India), binge drinking is more prevalent among older age groups than among adolescents (15–19 year olds); in the Africa region, the prevalence of binge drinking among the adolescent and older populations is at a similar level (World Health Organization, 2014).

The majority of studies have found the higher the level of parental education, the higher their offspring's binge drinking frequency (Abebe, Hafstad, Brunborg, Kumar, & Lien, 2015; Charitonidi et al., 2016; Kendler et al., 2014; Pedersen & von Soest, 2013; Sajber, Tahiraj, Zenic, Peric, & Sekulic, 2016; Stafstrom, 2014; Steiner, Schori, & Gmel, 2014). It is possible that these parents monitor their children's activities less closely due to high job demands. However, some studies found no (Sweeting & Hunt, 2015; Zarzar et al., 2012) or an inverse link (Melotti et al., 2013; Pedersen & von Soest, 2013; Tucker, Pollard, de la Haye, Kennedy, & Green, 2013). The evidence is even less clear concerning greater family affluence and higher socio-economic status. Some studies found a link to frequent adolescent binge drinking (Elisaus et al., 2015; Huang, Ho, Wang, Lo, & Lam, 2016; Kendler et al., 2014; Melotti et al., 2013), while others did not (Steiner et al., 2014; Tucker et al., 2013), or found an inverse link (Legleye et al., 2013). Kwok and Yuan (2016) conclude from their recent literature review that in developing countries where parents tend to be poorer and less educated adolescents from affluent and educated families show more binge drinking whereas in developed countries the frequency of adolescent binge drinking depends more on the specific behaviours of parents and friends (see below).

In the US, there is ample evidence that binge drinking rates are higher among college students than among non-college age-mates (Barnes, Welte, Hoffman, & Tidwell, 2010; Dawson, Grant, Stinson, & Chou, 2004; Patrick & Terry-McElrath, 2017). After high school, students who go to college increase their binge drinking distinctly more and actually surpass their nonstudent age-mates (O'Malley & Johnston, 2002; Timberlake et al., 2007). This is most likely due to the combination of approaching the legal drinking age (21 in the US), leaving home (and parental supervision), and being together with peers most of the day, often in societies instigating drinking (fraternities, sororities, sport teams etc.). Although college students outside the US have also high binge drinking rates (Karam, Kypri, & Salamoun, 2007; Wicki, Kuntsche, & Gmel, 2010), it is unclear whether these rates are significantly higher than those of their non-college age-mates due to a lack of direct comparisons. However, the impact of college attendance on binge drinking is also likely to vary in function of demographic, personality (including sensation-seeking and impulsivity) and environmental characteristics (such as college location and size and alcohol outlet density, Carter, Brandon, & Goldman, 2010; Quinn & Fromme, 2011). For example, college attendance increases the likelihood of binge drinking among whites whereas the opposite is the case among blacks and Asians (Paschall, Bersamin, & Flewelling, 2005).

## **Correlates and determinants of binge drinking**

### ***Person-specific factors (I): personality, impulsivity, attentional bias***

Concerning the 'Big Five' personality traits, there is consistent evidence that binge drinking is more common among those who score highly on extroversion, but low on agreeableness, conscientiousness, openness, and neuroticism (Cheng & Furnham, 2013; Ibanez et al., 2015; Zhang, Bray, Zhang, & Lanza, 2015). However, when a recent large-scale study in Britain accounted for other factors, such as gender, intelligence and socio-economic status, only extroversion and agreeableness remained significant predictors (Cheng & Furnham, 2013). The authors argued that extroverts tend to be more

impulsive and engage more often in social activities which involve alcohol. They also posited that those low in agreeableness (low on modesty, generosity, compliance, sympathy, and consideration for others) may find it easier to ignore behavioural norms (Cheng & Furnham, 2013).

A link has also consistently been found between binge drinking and personality traits like impulsivity, disinhibition and sensation/novelty-seeking (Carlson & Johnson, 2012; Czapla et al., 2015; Kuntsche et al., 2004; Park, Kim, Gellis, Zaso, & Maisto, 2014; Shin, Hong, & Jeon, 2012; Wellman, Contreras, Dugas, O'Loughlin, & O'Loughlin, 2014). A recent meta-analysis even found that among different impulsivity-related personality traits (lack of premeditation, lack of perseverance, sensation-seeking, negative urgency, positive urgency, and reward sensitivity) which were positively associated with binge drinking, sensation-seeking had the strongest association across studies (Stautz & Cooper, 2013). One explanation is that young people, particularly men, who have an impulsive, risk-seeking personality, like and actively seek extreme sensations, such as the feeling of drunkenness (Balodis, Potenza, & Olmstead, 2009; Kuntsche, Knibbe, Gmel, & Engels, 2006b). Binge drinking therefore is a particularly rewarding behaviour for them (Park et al., 2014).

Repeated alcohol intoxication also increases sensitisation to alcohol-related cues owing to an increased attention bias or priming (Field & Cox, 2008; Field, Wiers, Christiansen, Fillmore, & Verster, 2010; Hicks, Fields, Davis, & Gable, 2015). In addition, binge drinking reduces the capacity for self-regulation or inhibitory control, i.e. controlling impulses and resisting urges to drink (Neal & Carey, 2007; Robinson, Jones, Christiansen, & Field, 2015; Townshend et al., 2014; Van der Veen, Cohen, & Watson, 2013; Weafer & Fillmore, 2008, 2013). A recent study found that alcohol-related cues impair inhibitory control even among young adults who usually drink but who were currently sober; this effect was exacerbated when under the influence of alcohol (Weafer & Fillmore, 2015). It would therefore appear that binge drinkers are likely to start drinking due to an automatic appetitive response to alcohol-related cues. Once triggered, these cues become more salient, and acute alcohol-induced disinhibition leads to binge drinking at that given moment because it impairs the ability of the drinker to stop or control further alcohol intake.

### ***Person-specific factors (II): negative experiences and emotions***

Besides positive reinforcement (i.e. binge drinking as a means of sensation-seeking), binge drinking can be used for negative reinforcement, i.e. to alleviate or forget about problems and worries. Consequently, a variety of studies has provided evidence that experiencing stress, anxiety, traumatic events and depressive episodes are related to binge drinking in general, especially among females (Choi & DiNitto, 2011a, 2011b; Kachadourian, Pilver, & Potenza, 2014; Mushquash, Sherry, Mackinnon, Mushquash, & Stewart, 2014; Prado Jde, Kerr-Correa, Lima, da Silva, & Santos, 2012; Skinner, Kristman-Valente, & Herrenkohl, 2016; Timko, Sutkowi, Pavao, & Kimerling, 2008; Wellman et al., 2014). However, in the case of depression, this link was not always significant (Choi & DiNitto, 2011a, 2011b; Gonzalez, Reynolds, & Skewes, 2011; Prado Jde et al., 2012); in certain cases it was even non-existent (Harrell & Karim, 2008).

Self-medication can be a reason for binge drinking, i.e. the consumption of large amounts of alcohol at a given moment to alleviate, cope with or feel better after

negative events or emotions (Kuntsche & Bruno, 2015; Mushquash et al., 2014; Stewart & Conrod, 2008). However, there is also evidence for a reversed causation, i.e. that binge drinking is responsible for depressive symptoms over time (Paljarvi et al., 2009). Binge drinking can also lead to traumatic experiences such as being the victim of physical and/or sexual assault or a severe accident (Kachadourian et al., 2014), as well as other assorted negative consequences (see above).

Using binge drinking to cope with problems, depressive symptoms and negative experiences or emotions often creates a vicious circle, in which both aspects feed off each other because the deficits in problem-focused coping have not been adequately addressed (Kuntsche, Knibbe, Gmel, & Engels, 2006a; Stewart & Conrod, 2008). Likewise, abstaining from alcohol when being confronted with adversities can protect individuals from binge drinking. Feeling sad, hopeless or worthless curtails outgoing behaviour and participation in social relationships or events (e.g. parties and celebrations) during which context binge drinking usually occurs. It may also prompt the person to seek help or professional support to enable them to cope better with stress, depression or negative events (Wellman et al., 2014). One study found that among those who scored low on coping motives for drinking, the higher their anxious or depressed mood was, the lower their alcohol consumption on a given day; this was not the case for those scoring high on coping motives for drinking (Grant, Stewart, & Mohr, 2009). It appears that when facing depression or anxiety, only those who drink in an attempt to alleviate these negative emotional states (coping drinkers) are at risk for binge drinking and, as such, do not seek help or reduce drinking-related social activities. Thus, finding a significant link between depression and binge drinking is likely to depend on factors such as drinking motives and this may be responsible for the inconsistent findings described above.

### ***Person-specific factors (III): motives, expectancies***

There is consistent evidence across studies that the higher participants score on enhancement motives (defined as drinking to increase positive affect internally, e.g. drinking to have fun), the higher their binge drinking frequency (Cooper, Kuntsche, Levitt, Barber, & Wolf, 2016; Kuntsche, Stewart, & Cooper, 2008). The same was found for coping motives (drinking to reduce negative affect internally, e.g. drinking to forget about problems), although to a lesser degree (about half the effect size). For social motives (drinking to increase positive affect externally, e.g. to celebrate with friends) and for conformity motives (drinking to decrease negative affect externally, e.g. to fit in or avoid peer rejection), there was no consistent association. It appears that enhancement and coping drinkers need to consume a large volume of alcohol per occasion to feel the psychoactive effects and to forget about their problems. In contrast, only one or two drinks per occasion are principally enough to achieve the goal of celebrating (social motives) or fitting in with peers (conformity motives).

Enhancement-motivated drinkers were also found to score high on sensation-seeking and extroversion, and coping drinkers on neuroticism and depression (Cooper et al., 2016; Kuntsche et al., 2006b). There is even strong evidence that the effect of these personality traits on binge drinking frequency is mediated through high levels of enhancement and coping motives (Adams, Kaiser, Lynam, Charnigo, & Milich, 2012; Kuntsche, von Fischer, & Gmel, 2008; Lammers, Kuntsche, Engels, Wiers, & Kleinjan,

2013; Tragesser, Sher, Trull, & Park, 2007). A recent study concluded that aspects such as motivations and norms (see below) are more important predictors of drinking patterns, including binge drinking, than personality factors (Lac & Donaldson, 2016).

Binge drinking among enhancement- and coping-motivated drinkers appears to be particularly common among older adolescents and young adults in North America and in some European countries like Switzerland. Among younger adolescents (Kuntsche & Müller, 2012; Kuntsche et al., 2014), or in countries such as Brazil, Hungary, the Netherlands and Spain (Hauck-Filho, Teixeira, & Cooper, 2012; Németh, Kuntsche, Urbán, Farkas, & Demetrovics, 2011; Schelleman-Offermans, Kuntsche, & Knibbe, 2011), social motives played a more prominent role in explaining binge drinking frequency than coping motives, and were sometimes as closely related to binge drinking as enhancement motives. It appears that younger adolescents' binge drinking occurs more often in conjunction with social factors and rewards than it does for older adolescents, who are more likely to drink to change internal emotional states (Kuntsche et al., 2014). Among young adults in Vietnam, the relationship between binge drinking and coping motives was much stronger than the relationship to enhancement and social motives (Diep, Schelleman-Offermans, Kuntsche, De Vries, & Knibbe, 2016).

Like personality traits, there is consistent evidence that drinking motives mediate the link between alcohol expectancies and binge drinking frequency (Diep et al., 2016; Kuntsche, Knibbe, Gmel, & Engels, 2007; Kuntsche, Wiers, Janssen, & Gmel, 2010). This would suggest that drinking motives constitute a final common pathway to binge drinking, i.e. the gateway through which a variety of more distal influences are mediated (Cooper et al., 2016).

### ***Social factors (I): parents***

Parents are the primary socialisation agency and also function as role models for normative behaviour. A variety of studies provide evidence of the correspondence between the binge drinking behaviour of parents and their adolescent offspring (Abar, Turrisi, & Mallett, 2014; Cleveland, Reavy, Mallett, Turrisi, & White, 2014; Crutzen, Giabbanelli, Jander, Mercken, & de Vries, 2015; Donaldson, Handren, & Crano, 2016; Haugland, Strandheim, & Bratberg, 2012; Klima, Skinner, Haggerty, Crutchfield, & Catalano, 2014; Pedersen & von Soest, 2013). Besides shared genetic factors that may be partly responsible for this link (Crabbe, Harris, & Koob, 2011; Desrivieres et al., 2008), role modelling and social learning processes are important because adolescents may adopt the excessive substance use habits of parents and siblings even if they perceive the negative consequences of it and judge it as 'too high' (Kuntsche & Meyer, 2002). However, the strength of the role modelling effect was found to be stronger for young people growing up with a binge drinking father than with a binge drinking mother, and stronger for boys than for girls (Crutzen et al., 2015). The authors concluded that fathers are more visible role models and thus more important for binge drinking modelling than mothers. In addition to direct modelling, parental binge drinking can establish or contribute to the impression that this behaviour is normal (descriptive norms) or approved (injunctive norm). Adolescents may interpret seeing parents drink to intoxication as a sign that binge drinking is acceptable and a normal drinking pattern (Haugland et al., 2012; Pape, Rossow, & Storrø, 2015; Pedersen & von Soest, 2013).

Whereas adolescents' binge drinking is unlikely to occur when drinking at home under the supervision, or in the company of their parents, there is consistent and strong evidence that parental behaviours, such as permission to drink at home or drinking together, are risk factors for adolescent binge drinking (Kaynak, Winters, Cacciola, Kirby, & Arria, 2014; Pape et al., 2015; van der Vorst, Engels, & Burk, 2010); though this usually occurs outside the home. Interestingly, parental supply of alcohol was not consistently associated with adolescent binge drinking (Kaynak et al., 2014). Dietze and Livingston (2010) found that the likelihood of binge drinking was lower when the alcohol was provided by parents than by other sources. In contrast, procuring alcohol from both parental and other sources was associated with the highest binge drinking likelihood. There is consistent evidence that stricter parental rules on drinking or stronger parental disapproval of underage drinking was associated with a lower frequency of adolescent binge drinking (Abar et al., 2014; Fairlie, Wood, & Laird, 2012; Harakeh, de Looze, Schrijvers, van Dorsselaer, & Vollebergh, 2012; Pape et al., 2015). This was even the case when controlling for peer influences (Martino, Ellickson, & McCaffrey, 2009; Schwinn & Schinke, 2014). Among young adults, however, the perceived approval of alcohol use by friends fully mediated the relationship between perceived parental approval and binge drinking: those who believed their parents approved of drinking tended to believe that their friends also approved, which in turn was associated with their binge drinking (Rulison, Wahesh, Wyrick, & DeJong, 2016).

Besides the alcohol-related behaviours of parents, general parenting features – parenting styles, monitoring, emotional support and consistent discipline – are important. There is consistent evidence that adolescents whose parents provide both boundaries and empathy, and monitor their activities and whereabouts have a lower binge drinking risk (Donaldson et al., 2016; Kelly et al., 2016; Klima et al., 2014; Pedersen & von Soest, 2013; Soloski, Kale Monk, & Durtschi, 2016; Song, Smiler, Wagoner, & Wolfson, 2012; Steiner et al., 2014; Stickley et al., 2013). In contrast, authoritarian or neglectful parents are more likely to have binge drinking offspring (Stafstrom, 2014). The impact of older siblings' binge drinking on younger siblings' binge drinking was also found to be higher in dysfunctional families than among those with a good parent-child relationship and close parental monitoring (Gossrau-Breen, Kuntsche, & Gmel, 2010; Richmond-Rakerd, Slutske, Heath, & Martin, 2013). Aspects of general parenting appear to be more important in adolescence than in young adulthood, although one study found that parental monitoring had no impact on the child's binge drinking (Fairlie et al., 2012).

In terms of family structure, the evidence is inconsistent as to whether or not living in a single-parent family is a risk factor for binge drinking (Harakeh et al., 2012; Pedersen & von Soest, 2013; Song et al., 2012; Steiner et al., 2014). This may depend on third variables, such as parent-child communication and a good parent-child relationship (Kuntsche & Silbereisen, 2004; Tomcikova, Veselska, Geckova, van Dijk, & Reijneveld, 2015). If the single parent enjoys a good relationship and open communication with her or his child, the binge drinking risk of the latter is no higher than that of a child living in a two-parent family.

### ***Social factors (II): peers***

Peers become more and more influential as adolescents grow older. Consequently, a variety of recently published studies have demonstrated that frequently spending time



with friends, having friends who drink, or drinking with friends is a major risk factor for binge drinking (Dietze, Livingston, Callinan, & Room, 2014; Eisenberg, Golberstein, & Whitlock, 2014; Elisaus et al., 2015; Hahm, Kolaczyk, Jang, Swenson, & Bhindarwala, 2012; Harakeh et al., 2012; He, Assanangkornchai, Cai, & McNeil, 2016; Kelly et al., 2016; Kuntsche, Kuendig, & Gmel, 2008; Kuntsche, Otten, & Labhart, 2015; Mustonen, Makela, & Lintonen, 2016; Scholly, Katz, & Kehl, 2014; Seid, Hesse, & Bloomfield, 2016; Simons-Morton et al., 2016; Soloski et al., 2016; Song et al., 2012; Stickley et al., 2013; Tomczyk, Isensee, & Hanewinkel, 2015; Washburn, Capaldi, Kim, & Feingold, 2014).

Peers can directly influence the binge drinking behaviour of an individual, e.g. by offering drinks (Schwinn & Schinke, 2014). They can also exert an indirect influence through role modelling and perceived norms. Binge drinkers tend to have a higher social status within their peer group than those who drink less (Dumas, Graham, Bernards, & Wells, 2014; Dumas, Wells, Flynn, Lange, & Graham, 2014; Hahm et al., 2012), hence a greater likelihood that others will model this behaviour. Similar to the parental factors described above, perceived norms and approval of friends were closely linked to own binge drinking (Fairlie et al., 2012; Lac & Donaldson, 2016; Rulison et al., 2016). In a cross-national study, binge drinking was also rated as being most acceptable in situations involving friends (Fjær, Pedersen, von Soest, & Gray, 2016). Moreover, social norms from multiple sources (parents, friends and schools) are likely to interact with each other – apparently creating an overall impression of normality and acceptability of alcohol use – and were found to predict adolescent binge drinking over time (Lynch, Coley, Sims, Lombardi, & Mahalik, 2015).

Other prominent explanations concern the selection and socialisation effects of peers. A recent review of longitudinal evidence (Leung, Toumbourou, & Hemphill, 2014) found that exposure to peer alcohol use (socialisation) maintained a significant predictive effect on own alcohol use (including binge drinking) after adjusting for prior alcohol use (selection). In a recent study, however, the impact of peers on own binge drinking was found only among those who had a history of alcohol use (Guo, Li, Owen, Wang, & Duncan, 2015). This favours the selection hypothesis more than the socialisation/influence hypothesis. Most likely, both processes are happening, i.e. when adolescents look for new friends (e.g. when changing school or moving to another town), they tend to select those who have similar substance use habits to their own, and being together with those friends will further boost or trigger their substance use (Urberg, Luo, Pilgrim, & Degirmencioglu, 2003).

Besides the general link between alcohol-using peers and individual binge drinking, a series of moderators were identified. For example, similar to the child–parent relationship, the impact of friends on own binge drinking over time was moderated by friendship quality, i.e. the closer the relationship the higher the impact (Guo et al., 2015; Hiatt, Laursen, Stattin, & Kerr, 2015; Leung et al., 2014). Like the sibling effect, peer influence was found to be stronger among adolescents from dysfunctional families than among those with a good parent–child relationship and close parental monitoring (Leung et al., 2014). As observed for personality factors, one study found that the association between perceived peer drinking and young adult binge drinking was stronger among those with low self-control than among those with high self-control (Robinson et al., 2015).

### ***Social factors (III): the wider social environment***

Like the drinking norms observed within the family or in the peer group, the (perceived) prevalence of alcohol use or binge drinking at school or university was found to be associated with respondents' binge drinking (Eisenberg et al., 2014; Kristjansson, Sigfusdottir, & Allegrante, 2013; Van Damme et al., 2016). In contrast, the better the climate at school or at class level (defined as high quality student-student and student-teacher relationships) the lower the binge drinking frequency (Ryabov, 2015; Tomczyk et al., 2015). Moreover, a high prevalence of drinkers in the community, neighbourhood norms that were more accepting of binge drinking, or seeing others drinking in public were associated with individual binge drinking (Chauhan, Ahern, Galea, & Keyes, 2016; Kuntsche et al., 2008; Song et al., 2012). Similar to the effects of high family affluence and socio-economic status, frequent adolescent binge drinking was found in affluent neighbourhoods even when adjusted for individual characteristics (Kuipers et al., 2013; Pedersen, Bakken, & von Soest, 2015).

In addition, the virtual environment can contribute to alcohol-specific norms. There is recent evidence that the likelihood of participants' binge drinking substantially increased with exposure to pro-alcohol content in Tweets or on Facebook (Cabrera-Nguyen, Cavazos-Rehg, Krauss, Bierut, & Moreno, 2016; D'Angelo, Kerr, & Moreno, 2014; Moreno, Cox, Young, & Haaland, 2015). The effects of social media on individual binge drinking were also found over time (D'Angelo et al., 2014). As is the case for peer selection and socialisation effects, the causal direction of this effect still needs to be clarified. For example, binge drinkers were found to display their alcohol-related behaviours on social media (Moreno, Christakis, Egan, Brockman, & Becker, 2012; Pumper & Moreno, 2013; Ridout, Campbell, & Ellis, 2012). Being exposed to such virtual pro-alcohol displays may further instigate alcohol consumption during drinking events (Whitehill, Pumper, & Moreno, 2015).

In addition to the social environment, there are cultural differences in binge drinking across countries. Despite the fact that adolescents from various European countries have become increasingly similar in terms of binge drinking in the last decades (Kuntsche et al., 2011), a recently published study found that within Europe, there are different country groupings. For example, the Netherlands, Germany, Denmark, Finland and Ireland belong to the group with a high binge drinking prevalence (Braker & Soellner, 2016). Also data from large cross-national projects like the Health Behaviour in School-Aged Children Study (Inchley et al., 2016) and the European School Survey Project on Alcohol and Drugs (Hibell et al., 2012) revealed large cultural differences with countries such as Armenia, Albania, Israel, Italy, Macedonia, and Portugal having a low proportion of binge drinkers and countries such as Bulgaria, Denmark, Estonia, Finland, Ireland, Slovak Republic and United Kingdom having a high proportion. The authors argued that excessive drinking on particular occasions is more socially acceptable in northern Europe than in the wine-producing countries of Southern Europe, where the predominant drinking pattern tends to be frequent consumption of moderate amounts of alcohol, often with meals (Braker & Soellner, 2016; Kuendig et al., 2008; Kuntsche et al., 2004; Room, 2001). Moreover, differences in alcohol policy and traditional drinking patterns in a society may also be partly responsible for cross-national differences in adolescent binge drinking (Bendtsen et al., 2014; Gilligan, Kuntsche, & Gmel, 2012). Interestingly, one recently published study found that cultural differences



in adolescent binge drinking were mediated by individual factors such as drinking motives (Kuntsche et al., 2015). The authors argued that not only do drinking motives represent the final decision to drink or not, and are therefore the most proximal factor for engaging in drinking, but they also tend to reflect or include more distal factors, such as culture (Cox & Klinger, 1988, 1990; Kuntsche et al., 2006a, 2006b).

### **Interventions to change binge drinking**

When focusing on individual approaches, consideration must be given to at least three separate aspects: (1) the kind of intervention – from brief interventions (BI) of only a few minutes to group interventions with several sessions, boosters and motivation calls or structural measures; (2) the setting in which the programme is delivered – from highly specific settings such as an emergency department, parties or the workplace to more general prevention programmes focusing on entire populations; (3) the delivery mode, which in recent years has increasingly shifted from traditional face-to-face or postal mail to electronic delivery. In this section, we will set out the different types of binge drinking-related interventions, identify the target audience and setting of each intervention, and describe their mode of delivery.

#### ***Individual interventions (I): types of interventions***

Brief interventions (BI) are used essentially in medical settings and aim to initiate changes in risky behaviour such as binge drinking. They are typically provided by trained staff and are targeted at drinkers who are non-dependent but whose alcohol consumption may cause harm to themselves and/or others. Once screened or assessed for problematic alcohol use, the individual usually receives feedback about their alcohol use and the associated risks and harm it can cause. Some interventions provide this feedback in the form of a comparison of the person's drinking behaviour with that of similar individuals; this is known as 'personalised normative feedback'. BI often involves motivational interviewing techniques, too (Miller & Rollnick, 2002). Motivational interviewing is a focused and goal-directed counselling style aimed at activating the intrinsic motivation of the drinker with a view to changing their drinking behaviour.

Universal prevention programmes, which are based on theoretical frameworks such as the social norms theory (Perkins, 2003), deploy a set of psychosocial approaches to prevent binge drinking. They often raise the individual's awareness of high-consumption risks, provide strategies and skills to avoid risky drinking, and adjust misperceptions of social norms, motives and expectancies regarding alcohol use. The social norm theory posits that an individual's behaviour is affected by their perception of how their peers think and are likely to act. Correspondingly, normative feedback approaches aim to change attitudes and norms towards drinking by raising awareness about alcohol use in a reference group and correcting misperceptions. These approaches have been successfully used in both universal and individual intervention efforts (Walters, 2000). Certain concepts applied in these prevention approaches overlap with the personalised normative feedback provided in BI. Although both are based on the same theory, the concepts behind them differ. Whereas the BIs described above are traditionally used to reduce the harm caused by existing alcohol misuse, personalised normative feedback

approaches aim to prevent intoxication and related harm, and take a normative, rather than person-centred, approach.

Another set of approaches are protective behavioural strategies (Pearson, 2013), i.e. behaviours that reduce the negative consequences of alcohol use (Martens, Pederson, LaBrie, Ferrier, & Cimini, 2007). These are also referred to as alcohol reduction strategies (Bonar et al., 2011), behavioural self-control strategies (Werch & Gorman, 1988) and drinking control strategies (Sugarman & Carey, 2007). Although these concepts vary somewhat in their operationalisation, all approaches commonly aim to limit the level of alcohol consumption through the setting of drinking limits. Skills' training completes this concept by providing practical advice on how to consume alcohol in a safer way, e.g. learning to say no, avoiding heavy drinking or high-risk situations and refraining from excessive drinking.

Finally, approaches aimed at modifying positive alcohol outcome-related expectancies and/or drinking motives (Cox, Fadardi, & Klinger, 2006) are other psychosocial concepts used either to prevent binge drinking or as part of interventions in cases where the behaviour is already present. Given that positive alcohol expectancies predict higher alcohol use, and negative expectancies are associated with lower use (Jones, 2004; Leigh & Stacy, 2004), interventions have been devised to change these expectancies; they come in two forms. The first is based on experiential learning. This approach, usually in a group, provides alcohol or a placebo in a bar-like setting, and asks participants to socially interact. After a certain amount of time has elapsed, participants are then asked to evaluate whether the individuals to whom they had been talking had been drinking alcohol or a placebo. Incorrect evaluations give participants the opportunity to discuss alcohol-attributed expectancies. This intervention may take place over one or several sessions. The second type is an adaptation of the former scenario, but involves educational presentations. These vary in content, delivery (face-to-face, online) and intensity.

Although clear distinctions exist between these approaches, in practice, prevention or intervention programmes tend to use several components simultaneously in order to reduce binge drinking. Existing programmes often combine personalised normative feedback with BI or protective behavioural strategies, and address social norms by focusing on the individual's motives or expectancies. The interventions mentioned above can therefore be seen as elements in a large toolbox of approaches to address the problem of binge drinking. However, this 'pick-and-mix' approach can make it difficult to separate and evaluate the specific effects that each element in a programme has; thus identifying the active and possible redundant parts of the intervention is almost impossible.

### ***Individual interventions (II): specific settings***

#### *Emergency departments*

Screenings for alcohol use, coupled with BI for those who have screened positive are tried-and-tested approaches deployed in primary care settings to prevent harmful drinking in the future (Kaner et al., 2007). Several studies found a preventive effect on binge drinking (Wurdak, Wolstein, & Kuntsche, 2016), others mixed evidence regarding different cultures (Cherpitel, Ye, Moskalewicz, & Swiatkiewicz, 2015), while others still

found no effects (Clarke, Field, & Rose, 2015). Based exclusively on US American trials, a systematic review and meta-analysis (Kohler & Hofmann, 2015) found that motivational interviewing was more effective in reducing binge frequencies among those under the age of 19 ( $d = 0.21$ , 95% CI [0.34, 0.07]) than any other intervention (e.g. standard care, written information, a contact list, phone follow-up and personalised normative feedback). Similar results were found in a meta-analysis of emergency care users of all ages who were positively screened for alcohol use (Schmidt et al., 2016). Among those who received BI, the reduction in binge drinking frequency was found to be greater than among individuals in the control condition ( $d = 0.09$ , 95% CI [0.03–0.15]). Although both meta-analyses found some evidence of the efficacy of motivational interviewing and BI in reducing binge drinking among those who presented to emergency departments, the effects found to date remain small-sized. The authors argue that this is largely due to the high heterogeneity of intervention characteristics (length, number of sessions, boosters, single vs. multiple components), comparison groups (treatment as usual, information, feedback), and outcomes (timeframe, alcohol measure) included in the single studies (Kohler & Hofmann, 2015; Schmidt et al., 2016). This assumption is in line with the results of two other reviews among young binge drinkers in emergency departments. The first review found no significant effects of BI on binge drinking reduction among patients younger than 20 compared to the control groups (Newton et al., 2013). The second review found little to no effect of BI among the 12–25 age group, and that the few preventive effects of BI found, varied considerably regarding the different alcohol outcomes considered (Diestelkamp et al., 2016). These results illustrate the need for high-quality studies in order to draw firmer conclusions on the usefulness of BI in emergency departments.

#### *Interventions at parties and in Greek letter organisations*

Settings and occasions with a specific binge drinking risk have triggered ‘event-specific prevention’ approaches, which are based on traditional alcohol interventions (BI, motivational interviewing etc., Neighbors et al., 2012). A recent review focused on the use of BI to address alcohol consumption during 21st birthday celebrations in the United States (21 is the legal drinking age in most states, Steinka-Fry, Tanner-Smith, & Grant, 2015). Eligible for inclusion were birthday-focused controlled studies with interventions delivered by postal mail or electronically, and thus involving no personal contact. The meta-analysis did not find any evidence that BI reduced the quantities of alcohol consumed during these celebrations ( $g^1 = 0.05$ , 95%CI [–0.03, 0.13]). However, in five of the nine eligible studies, it observed a protective effect on blood alcohol concentration (BAC) in the BI group compared to the control group (no treatment or general alcohol-related information;  $g^1 = 0.20$ , 95%CI [0.07, 0.33]).

Another setting in which binge drinking occurs more often among college students in the US (who already frequently binge drink) are fraternities, sororities and especially Greek letter organisations, i.e. student organisations that provide opportunities for social interaction, and are known for their secrecy, rituals and alcohol use (e.g. Scott-Sheldon, Carey, & Carey, 2008; Turrisi, Mallett, Mastroleo, & Larimer, 2006). A recent systematic review on the efficacy of alcohol interventions in Greek letter organisations (Scott-Sheldon, Carey, Kaiser, Knight, & Carey, 2016) included 15 US studies which reported the effects of 21 interventions in a meta-analysis. Most of the interventions

were delivered in groups and provided alcohol education, such as information on how to estimate BAC. About half of the studies provided alcohol reduction strategies, e.g. low-risk choices, skills' training and alcohol use monitoring. The other half addressed high-risk occasions like parties. Frequency of binge drinking was only addressed in four of the 15 studies, and no significant differences were found between the intervention and control groups (i.e. waiting list, no treatment or alcohol-related information). Analyses of alcohol use on specific occasions/days came to the same result.

Overall, for specific settings among high-risk groups it seems that BI and motivational interviewing based on a positive screening for alcohol use are the most effective strategies, mainly when used in the context of special occasions, such as birthday parties or recent events, i.e. ending a night out in an emergency department. They are easy to implement within existing structures, brief in their delivery and less cost-intensive than approaches that focus on social norms or motives. Nevertheless, although BI (including motivational interviewing or personalised normative feedback) is widely used, studies to date have found that its impact on binge drinking is small and short-lived.

#### *Programmes in the workplace*

The workplace is another alcohol prevention setting (Ames & Bennett, 2011) and has the added potential of reaching a target audience beyond emergency departments and colleges who otherwise would be difficult to reach. In the US, about one third of full-time workers reported binge drinking within the past 30 days; 8.8% reported regular heavy drinking, though percentages varied considerably by occupation type (Substance Abuse and Mental Health Services Administration, 2009). Ames and Bennett (2011) provide an overview of different primary prevention programmes used in a workplace setting. Some took the form of individual approaches involving general health promotion, programmes that promote social support and a healthy workplace environment, and BI (including web-based personalised normative feedback). Other programmes focused on environmental approaches, including the availability of alcohol, social control, and norms that aim to reduce workplace-inherent risk factors for binge drinking. The studies found a positive effect when substance misuse prevention efforts like education, counselling and BI were included in general health promotion programmes (e.g. stress or weight management). However, the effect was observed only on the degree of willingness to reduce binge drinking, and not on the behaviour itself (Ames & Bennett, 2011). BI approaches revealed mixed results in the workplace setting, with better outcomes among female heavy drinkers and when delivered face-to-face or electronically. Ames and Bennett (2011) concluded that educational techniques (e.g. health promotion) combined with BI may have the greatest prevention potential in the workplace setting.

#### ***Individual interventions (III): approaches focusing on college students***

As stated above, the behaviour of an individual is largely affected by the drinking behaviour of peers (Baer, Stacy, & Larimer, 1991; Neighbors, Lee, Lewis, Fossos, & Larimer, 2007; Perkins, 2002). Own perceptions of social norms and of alcohol use among peers are frequently overestimated (Borsari & Carey, 2003; Lewis & Neighbors, 2004). Social norm interventions aim to correct these normative beliefs and

misperceptions. A recent review and meta-analysis addressed the impact of social norm interventions on alcohol use and related consequences among undergraduates (Foxcroft, Moreira, Almeida Santimano, & Smith, 2015). Based on 16 studies (11,292 participants) and pooled across the different delivery modes (postal mail, Internet-based, face-to-face and marketing campaigns), the results revealed a small reduction of 2.7% in the number of binge drinkers the intervention group.

Personalised normative feedback was the focus of another meta-analytic review (Dotson, Dunn, & Bowers, 2015). Although binge drinking was not explicitly listed among the assessed outcomes, those receiving personalised normative feedback decreased their number of drinks per week compared to controls from baseline to follow-up (varied between 18 months and 10 years), based on gender-neutral ( $d = 0.29$ , 95% CI [0.16, 0.42]) and gender-specific feedback ( $d = 0.28$ , 95% CI [0.12, 0.45]).

As stated above, protective behavioural strategies, i.e. behaviours that mitigate the negative consequences of alcohol use, is another component of preventive approaches aimed at avoiding or reducing heavy alcohol use. A recent review among college students (Pearson, 2013) concluded that protective behavioural strategies is a central mediator for the success of other intervention components (BI, parental communication) on the reduction found for peak BAC. Nevertheless, results are mixed as some programmes failed to find an increase in protective behavioural strategies use in the intervention group and therefore could not find significant indirect effects of protective behavioural strategies on alcohol use. Consequently, it is not currently possible to draw a firmer conclusion about the usefulness of this concept for intervention efforts to reduce binge drinking even though alcohol-related protective behavioural strategies were consistently negatively associated with heavy or binge drinking.

Addressing alcohol expectancies with a view to preventing binge drinking was also the focus of a meta-analysis (Scott-Sheldon, Terry, Carey, Garey, & Carey, 2012) of 14 US American studies, two studies from the Netherlands and one from Sweden. Compared to the control condition (brief form of the intervention or assessment only), participants in the intervention reported lower positive alcohol expectancies ( $d = 0.28$ , 95% CI [0.14, 0.43]) and a reduction in binge drinking frequency ( $d = 0.27$ , 95% CI [0.06, 0.47]). Unfortunately, these protective effects were short-lived (i.e. less than 4 weeks follow-up).

### ***Individual interventions (IV): digital interventions***

In addition to the various intervention approaches for binge drinking presented above, developments in digital and mobile technology in recent years have brought completely new modes of intervention delivery. With increases in the use of the Internet, smartphone applications, and online social networks in Europe and worldwide (Pew Research, 2016), these media offer a tremendous potential to deliver low-cost interventions to a wide audience.

Several recent reviews have investigated the impact of online interventions (delivered via the Internet) on binge drinking reduction. Black, Mullan, and Sharpe (2016) conducted a meta-analysis to investigate the effectiveness of computer-delivered interventions for reducing alcohol use and included 47 studies using binge drinking outcomes. Overall, the included interventions had small effect sizes on binge drinking frequency ( $d = 0.07$ ). More interestingly the authors conducted a meta-regression to

investigate whether specific aspects of the included studies (e.g. sample, location, length of follow-up) or intervention components (e.g. behaviour change technique, theory) had an impact on effect size. For binge drinking frequency, effects were stronger in the short term ( $\leq 1$  month) than in the medium to long term ( $> 1$  month), when interventions provided personalised feedback on (behaviour change) performance, and when interventions were delivered to predominantly female samples.

In one review focusing on college students, only six studies actually investigated binge drinking as an outcome (Bhochhibhoya, Hayes, Branscum, & Taylor, 2015). Of these, five found a significant reduction in binge drinking frequency at follow-up periods ranging from six weeks to up to 24 months. Interventions resulting in significant effects included general personalised normative feedback (two studies), gender-specific feedback (one study), interactive online education consisting of tailored feedback, goal setting, stress management, and harm reduction (one study), and an online BI combining personalised normative feedback, goal setting, action planning, and enhancement of refusal self-efficacy (one study). The latter comprised an online screening test, together with personalised normative feedback and advice for drinking in accordance with low-risk drinking guidelines, a personal drinking profile, estimates of calorie intake from alcohol, drinking-related expenditure, and normative comparisons of drinking levels (Voogt, Kuntsche, Kleinjan, Poelen, & Engels, 2014; Voogt, Poelen, Kleinjan, Lemmers, & Engels, 2013). Further, the intervention instructed students to set drinking goals and provided tips on how to resist drinking in different situations with a view to enhancing their refusal self-efficacy. Compared to the no-intervention control group, the intervention resulted in no significant effects on past-week binge drinking prevalence at 6-month follow-up (Voogt et al., 2013). However, this was only the case when the analyses were based on single point assessments; i.e. when 26 weekly assessments were used in a latent growth curve analysis, participants in the intervention group had a sustained lower frequency of binge drinking over the entire 26-week period compared to the control group (Voogt et al., 2014).

Despite the promising results of intervention studies with college students, researchers have called into question the ability of online binge drinking interventions to achieve long-term effects among the wider alcohol-misusing population. A systematic review of online interventions, including seven studies on binge drinking reduction among populations who screened positive for alcohol misuse (Dedert et al., 2015), found no decrease in the proportion of binge drinkers or the frequency of binge drinking at 6-month follow-up compared to control conditions (information only, treatment as usual, or waiting list). The interventions investigated by the studies in this systematic review were usually one-time brief interventions consisting of personalised normative feedback, goal setting, psychoeducational, and coping skills training. The authors concluded that there was little evidence for longer-term, clinically significant effects, such as meeting drinking limits, and therefore recommended that future online interventions should provide more intensive treatment and in-person support, such as supplementary phone counselling.

Overall, the evidence for the effectiveness of online interventions to reduce binge drinking among college students has been predominantly positive, at least concerning the outcome of binge drinking frequency as opposed to binge drinking prevalence. Questions remain regarding the potential long-term impact and effect sizes of these interventions, especially when targeting alcohol-misusing and non-student populations.



While stand-alone online interventions can be delivered at low costs and are thus highly scalable, they may need additional in-person cognitive behavioural counselling components to boost their efficacy; these could be delivered via the phone, text messaging or online chats (Dedert et al., 2015). Further, given that many of the online interventions tested so far have differed in terms of content and approach, it is difficult to derive recommendations on what should and should not be implemented.

In addition to online interventions, which are usually delivered to a stationary computer at home, university, work place etc., mobile modes of delivery including text messages, smartphone apps and online social networking sites have become increasingly popular in recent years. The innovative and potentially very useful aspect of these technology platforms is their capability to deliver intervention content during people's everyday lives, and to time it more closely around high-risk situations for binge drinking (e.g. weekend drinking: Suffoletto et al., 2015). They could also serve as a coping resource in these high-risk situations (e.g. Ecological Momentary Interventions: Beckjord & Shiffman, 2014). For example, one recent study tested a smartphone app that alerts recovering alcoholics when they are approaching a high-risk drinking location (e.g. a bar they used to drink in) and contains other intervention features and patient support services (Gustafson et al., 2014). Compared to treatment as usual, the app helped patients reduce the frequency of binge drinking days, although the utility of this technology for helping other populations who are not recovering from alcohol dependence remains to be tested.

Fowler, Holt, and Joshi (2016) conducted a systematic review of mobile technology-based interventions to reduce alcohol use among adults. Of all the studies in their review, five addressed binge drinking, of which four found that the intervention had a significant effect on binge drinking behaviour outcomes, either from pre- to post-test or compared to control groups (treatment as usual without mobile components): However, it should be noted that the effects were only found for up to four months post-intervention, and are thus relatively short-lived. The effective interventions were app- or text message-based, and provided psychoeducation, brief interventions, tailored feedback, and strategies to reduce drinking. The authors emphasised the promising, but still preliminary state of the research in this area due to the pilot nature of many of the studies they included in their review (Fowler et al., 2016).

While mobile technology-based interventions hold great promise, future studies with longer follow-up periods are clearly needed. Further, there is inconclusive evidence on the optimal dose of mobile interventions to obtain the best effects (Berman, Gajecki, Sinadinovic, & Andersson, 2016). Having said that, one previous review suggested that the length of interventions did not have an impact on effectiveness (O'Rourke, Humphris, & Baldacchino, 2016). Also, it should be noted that while there are now hundreds of commercial alcohol-related smartphone apps available on the iTunes and Google Play stores, less than 20% of apps promote alcohol reduction (Milward et al., 2016), and very few of these contain valid behavioural change techniques (Crane, Garnett, Brown, West, & Michie, 2015). Much research remains to be done in this area to both develop and test interventions for binge drinking that harness the potential of mobile technology.

### ***Structural interventions: policy and environmental factors***

In addition to the individual interventions reviewed above, the effects of alcohol policy measures on binge drinking are also of importance. Increasing alcohol taxes is one of the most effective policy instruments to reduce alcohol use at the population level (Babor et al., 2010). Two meta-analyses concluded that a higher price of alcohol reduces both the prevalence and frequency of binge drinking (Elder et al., 2010; Wagenaar, Salois, & Komro, 2009), although these effects may be smaller than on overall consumption (Wagenaar et al., 2009).

The alcohol policy environment (a scale of 29 policies including liquor licencing laws, accessibility restrictions, minimum legal drinking age laws, and others), over and above prices and taxes may also effect binge drinking prevalence (Naimi et al., 2014). When investigating the associations between the alcohol policy environment and the prevalence of binge drinking in US states, a recent publication found that the most promising policies to reduce binge drinking, in addition to increasing the price of alcoholic beverages, were those which targeted the general population (as opposed to policies focusing on underage drinkers), focused on alcohol consumption (e.g. policies focusing on the production, sale or use of alcohol rather on impaired driving), and reduced the availability of alcohol (Xuan et al., 2015). In sum, an effective political strategy to reduce binge drinking at the population level should contain both price increases and efforts to reduce alcohol availability.

Most colleges in the United States nowadays implement some alcohol policy measures alongside individual-centred strategies to reduce binge drinking among students (Lenk, Erickson, Nelson, Winters, & Toomey, 2012; Toomey et al., 2011). However, colleges vary in terms of the specifics of the policies they have elected to adopt. While bans on alcohol use at sport events are common, few colleges ban alcohol advertisements on campus, for example in newspapers and on radio stations. As well as the implementation of new or additional policies, the enforcement of existing policies may also have an impact on binge drinking. Stricter enforcement of college alcohol policies has been found to be associated with reductions in binge drinking prevalence over time (Harris, Sherritt, Van Hook, Wechsler, & Knight, 2010). Other promising alcohol control policies on college campuses include restricting alcohol sales (e.g. outlet density, hours of sales), increasing the price of alcohol, and restricting places for alcohol consumption (Toomey, Lenk, & Wagenaar, 2007). However, it should be mentioned that only a handful of the environmental strategies on college campuses have been tested as part of a comprehensive evaluation (Toomey et al., 2007).

## **Conclusions**

### ***Definitions and health impact***

It seems unlikely that the scientific community will soon reach agreement on the definition of binge drinking. While it does not matter if the same phenomenon is labelled heavy episodic drinking, risky single occasion drinking or binge drinking, for comparative purposes though it is important that the amount consumed in a binge is standardised. In this respect, it is more important to define the number of standard drinks to yield an equivalent amount of pure ethanol instead of fixing the number of drinks to 5 + drinks, say, because this still would imply completely different amounts



due to variations across countries in terms of what constitutes a standard drink. For example, if the US defines binge drinking as five or more standard drinks, corresponding to 60–70 g of pure ethanol, then countries with 10 g as a standard drink should apply six or more drinks in their assessments (as is the case with the Alcohol Use Disorder Identification Test (AUDIT: Saunders, Aasland, Babor, de la Fuente, & Grant, 1993); in countries like the UK, where the standard unit is 8 g, this would have to rise to 8 + drinks. Encouragingly, attempts to make the amount comparable are currently underway (Standardizing Measurement of Alcohol-related Troubles [SMART], 2013).

However, perfect standardisation is highly unlikely given the differences across countries in vessel size, the volume of a standard serving, recall periods (7 days vs. 12 months) and the use or non-use of gender-specific measures. It is more important to distinguish between the assorted drinking patterns that underlie binge drinking behaviour. An analysis of individuals who have binged at least once in the past 12 months, for example, comprises very different drinkers (Gmel et al., 2011): from those who binge on very rare occasions (birthdays, New Year's Eve) to those who are chronic heavy drinkers and so binge every day. The former pattern may (also) be associated with injuries, the latter mainly with liver cirrhosis.

It is important to further analyse the differential effects of single-occasion and frequent binge drinking, particularly in combination with usual volume drinking. Roerecke and Rehm (2010) showed that beneficial effects of moderate alcohol use on ischaemic heart disease did not persist among usually moderate drinkers if they also had infrequent binge drinking occasions. As regards adolescents, more studies are needed on the neurotoxic effects of binge drinking. Alternating episodes of intense intoxication with periods of abstinence may be deleterious for the brain (e.g. Maurage et al., 2012; Petit et al., 2014), hence the need for a more thorough investigation into the effects that a combination of repeated binge occasions (frequency) and 'withdrawal' periods (low volume phases) has on adolescent brain development.

Equally important is the study of the intensity of what constitutes a single binge. In some high-consuming countries, having five drinks from time to time may not be perceived as a risky drinking pattern, and drinking guidelines addressing such a quantity may not be taken seriously. In fact, a 5+ measure includes people who consume five drinks and those who drink 30 drinks on one occasion. Using a 5+ measure has been shown to be a good marker for consequences (Wechsler et al., 1994), yet this could be due to subsuming in this category the higher level drinkers who actually caused the effect. To convince policy-makers, adolescents, parents and practitioners that even low 'binge' levels come with risks, a clearer distinction must be made between drinking levels during a binge, and more dose-response analyses with consequences are needed.

### ***Correlates and determinants***

An important task for future research is to further disentangle the effects and investigate the interaction of psychosocial determinants on binge drinking at different levels (e.g. situation, individual and environment). Whereas binge drinking can occur in a stable, trait-like manner with only some fluctuations over time (Mushquash et al., 2014), situational factors may intervene and weaken the impact of individual factors such as personality. Hicks et al. (2015), for example, argue that despite the link between trait impulsivity and attentional bias among binge drinkers, it still remains to be

demonstrated whether impulsive binge drinkers actually have difficulty controlling their impulses after exposure to alcohol cues in a given situation. Other authors found that drinking motives, which are closely related to personality factors as described above, were only weakly related to the amounts consumed in a given situation, and argue that the effects of drinking motives and possibly also those of other individual-specific factors may be ‘overruled’ by situational characteristics (Grant et al., 2009; Kuntsche & Kuendig, 2012; Thrul & Kuntsche, 2016). However, even if there is no or little impact, individual characteristics or traits may still interact with situational factors. For example, pre-drinking (Kuntsche & Labhart, 2013a), the number of friends present at a drinking occasion (Thrul & Kuntsche, 2016) or the daily mood (Grant et al., 2009) have been found to moderate the impact of drinking motives on the volume of alcohol consumed on a given day.

To complicate matters further, the temporal sequence of psychosocial determinants or events appears to matter. Gottfredson and Hussong (2013) showed that whereas individual differences in affect variation over time and intra-individual fluctuations in affect within a day predicted alcohol consumption on a given day, the average level of negative affect experienced and self-reported drinking to cope did not – a finding that has been repeatedly replicated since (Kuntsche & Bruno, 2015; Simons, Wills, & Neal, 2014).

Fortunately, major advances have been made in terms of data collection techniques and analytical tools. The emergence of personal digital assistants and smartphones has led to more complex and sophisticated protocols to collect data in real life and in real time (Kuntsche & Labhart, 2013b, 2014). On the analytical side, software packages such as Stata, Mplus, and R have brought within reach the complex longitudinal analyses required to model multiple influences on multiple levels and time points. Unfortunately, most of the event-level studies available today report linear associations between a given exposure (e.g. number of friends present) and the number of drinks consumed in a given day, evening, or situation but not a threshold (e.g. 4+/5+), thus making it unclear whether binge drinking occurred or not (for an exception, see Kuntsche & Labhart, 2013a).

### ***Interventions***

Based on the reviewed literature on prevention of, and interventions for, binge drinking, we conclude that, despite the fact that many publications seem to address binge drinking, there are surprisingly few studies that actually report it as an outcome. In terms of the effectiveness of interventions to reduce binge drinking, there is evidence for small effects across different intervention approaches (e.g. brief interventions including personalised and normative feedback and drinking reduction strategies) as well as different populations (e.g. college students, young adults, patients in healthcare setting, and workers in their place of work). However, most of the evidence is derived from studies with young adults, and more specifically, college students. In recent years, many binge drinking interventions have been taken into the digital and mobile sphere. Delivery of interventions via the Internet, email and text messaging has shown some promise but the effects are generally weak. Future research needs to address the limitations of the current literature; few studies to date have tested interventions that use online social

networks and smartphone apps. Studies requiring longer term follow-up intervals may benefit from using more fine-grained assessment methods such as ecological momentary assessment, and rigorous randomised trials are needed that test interventions against active comparator conditions. Although several reviews and meta-analyses provide an overview of currently available evidence, the specific kind, content, or component of, or control group used in, the interventions subsumed under the same name (e.g. BI or personalised normative feedback) vary considerably from one study to the other, thus making comparisons difficult. Consequently, the observed effects must be very strong and robust to appear significant despite these differences in methodology and comparison. Moreover, ending a night out in emergency care may in itself be such a dreadful experience that it will lead the admitted person to reflect on their alcohol use regardless of whether they were the subject of an additional intervention or not. This may, as a consequence, limit the possibility of detecting intervention effects when comparing these individuals with a similar control group. Finally, future research should also seek to identify effective intervention components, for example through the use of factorial designs, since available studies frequently test a combination of components, which makes it impossible to differentiate between what works and what does not.

### ***General conclusion***

Being one of the most important concepts in alcohol research, interest in and published evidence on binge drinking has increased considerably over the past decades. Nevertheless, several challenges remain. For example, it is important to further analyse the differential effects of single-occasion and frequent binge drinking, to generate better knowledge about the neurotoxic effects of binge drinking particularly on the developing adolescent brain, and to more precisely determine what intensity constitutes a single binge. It is also important to further disentangle the effects and investigate interactions of psychosocial determinants on binge drinking at different levels (e.g. situation, individual and environment). Recent developments in data collection techniques (e.g. using personal cell phones) and statistical software have opened up the opportunity to conduct complex longitudinal analyses to test multiple influences on multiple levels and time points. Finally, there are still too few prevention or intervention studies that explicitly address binge drinking, particularly in populations other than young adults. This is regrettable since online social networks and smartphone apps offer exciting opportunities to prevent and reduce binge drinking.

### **Acknowledgements**

The authors would like to thank Gabriel Noble for his assistance with the literature research, Chrissie Gmel and Edith Bacher for their assistance with the literature references, and Elaine Sheerin for the English copy editing.

### **Disclosure statement**

No potential conflict of interest was reported by the authors.

## Funding

The work on the paper was partly funded by Addiction Switzerland. In addition, EK was supported by a Vidi grant (The Netherlands Organisation for Scientific Research, NWO [grant number 452-13-003]) and JT by the California Tobacco-Related Disease Research Program (TRDRP, [grant number 25FT-0009]).

## Note

1. Hedges'  $g$  is equivalent to Cohen's  $d$  but more appropriate for small sample sizes.

## ORCID

Johannes Thrul  <http://orcid.org/0000-0001-8929-9579>

## References

- Abar, C. C., Turrissi, R. J., & Mallett, K. A. (2014). Differential trajectories of alcohol-related behaviors across the first year of college by parenting profiles. *Psychology of Addictive Behaviors*, *28*, 53–61. doi:10.1037/a0032731
- Abbey, A. (2002). Alcohol-related sexual assault: A common problem among college students. *Journal of Studies on Alcohol* (Suppl. 14), 118–128.
- Abbey, A., McAuslan, P., & Ross, L. T. (1998). Sexual assault perpetuation by college men: The role of alcohol, misperception of sexual intent, and sexual beliefs and experiences. *Journal of Social and Clinical Psychology*, *17*, 167–195.
- Abebe, D. S., Hafstad, G. S., Brunborg, G. S., Kumar, B. N., & Lien, L. (2015). Binge drinking, cannabis and tobacco use among ethnic norwegian and ethnic minority adolescents in Oslo, Norway. *Journal of Immigrant and Minority Health*, *17*, 992–1001. doi:10.1007/s10903-014-0077-9
- Adams, Z. W., Kaiser, A. J., Lynam, D. R., Charnigo, R. J., & Milich, R. (2012). Drinking motives as mediators of the impulsivity-substance use relation: Pathways for negative urgency, lack of premeditation, and sensation seeking. *Addictive Behaviors*, *37*, 848–855. doi:10.1016/j.addbeh.2012.03.016
- Ames, G. M., & Bennett, J. B. (2011). Prevention interventions of alcohol problems in the workplace: A review and guiding framework. *Alcohol Research and Health*, *34*, 175–187.
- Anderson, P. (2007). *Binge drinking and Europe*. London: Institute of Alcohol Studies. Retrieved from London.
- Babor, T., Higgins-Biddle, J., Saunders, J., & Monteiro, M. (2001). *AUDIT – The alcohol use disorders identification test: Guidelines for use in primary care* (2nd ed.). Geneva: World Health Organization.
- Babor, T. F., Caetano, R., Casswell, S., Edwards, G., Giesbrecht, N., Graham, K., ... Rossow, I. (2010). *Alcohol: No ordinary commodity*. Oxford: Oxford University Press.
- Baer, J. S., Stacy, A., & Larimer, M. (1991). Biases in the perception of drinking norms among college students. *Journal of Studies on Alcohol*, *52*, 580–586.
- Balodis, I. M., Potenza, M. N., & Olmstead, M. C. (2009). Binge drinking in undergraduates: Relationships with sex, drinking behaviors, impulsivity, and the perceived effects of alcohol. *Behavioural Pharmacology*, *20*, 518–526. doi:10.1097/FBP.0b013e328330c779
- Barnes, G. M., Welte, J. W., Hoffman, J. H., & Tidwell, M.-C. O. (2010). Comparisons of gambling and alcohol use among college students and noncollege young people in the United States. *Journal of American College Health*, *58*, 443–452. doi:10.1080/07448480903540499

- Beckjord, E., & Shiffman, S. (2014). Background for real-time monitoring and intervention related to alcohol use. *Alcohol Research*, *36*, 9–18.
- Bendtsen, P., Damsgaard, M. T., Huckle, T., Casswell, S., Kuntsche, E., Arnold, P., & Holstein, B. E. (2014). Adolescent alcohol use: A reflection of national drinking patterns and policy? *Addiction*, *109*, 1857–1868. doi:10.1111/add.12681
- Berman, A. H., Gajecki, M., Sinadinovic, K., & Andersson, C. (2016). Mobile interventions targeting risky drinking among university students: A review. *Current Addiction Reports*, *3*, 166–174. doi:10.1007/s40429-016-0099-6
- Bhochhibhoya, A., Hayes, L., Branscum, P., & Taylor, L. (2015). The use of the internet for prevention of binge drinking among the college population: A systematic review of evidence. *Alcohol Alcoholism*, *50*, 526–535. doi:10.1093/alcalc/aggv047
- Black, N., Mullan, B., & Sharpe, L. (2016). Computer-delivered interventions for reducing alcohol consumption: Meta-analysis and meta-regression using behaviour change techniques and theory. *Health Psychology Review*, *10*, 341–357. doi:10.1080/17437199.2016.1168268
- Bonar, E. E., Rosenberg, H., Hoffmann, E., Kraus, S. W., Kryszak, E., Young, K. M., ... Bannon, E. E. (2011). Measuring university students' self-efficacy to use drinking self-control strategies. *Psychology of Addictive Behaviors*, *25*, 155–161. doi:10.1037/a0022092
- Borges, G., & Loera, C. R. (2010). Alcohol and drug use in suicidal behaviour. *Current Opinion in Psychiatry*, *23*, 195–204. doi:10.1097/YCO.0b013e3283386322
- Borsari, B., & Carey, K. B. (2003). Descriptive and injunctive norms in college drinking: A meta-analytic integration. *Journal of Studies on Alcohol*, *64*, 331–341.
- Braker, A. B., & Soellner, R. (2016). Alcohol drinking cultures of European adolescents. *European Journal of Public Health*, *26*, 581–586. doi:10.1093/eurpub/ckw033
- Brewer, R. D., & Swahn, M. H. (2005). Binge drinking and violence. *Journal of the American Medical Association*, *294*, 616–618.
- Cabrera-Nguyen, E. P., Cavazos-Rehg, P., Krauss, M., Bierut, L. J., & Moreno, M. A. (2016). Young adults' exposure to alcohol- and Marijuana-related content on Twitter. *Journal of Studies on Alcohol and Drugs*, *77*, 349–353.
- Cahalan, D., & Room, R. (1974). *Problem drinking among American men* (Vol. 7). New Brunswick, NJ: Rutgers Center of Alcohol Studies.
- Carlson, S. R., & Johnson, S. C. (2012). Impulsivity is not always associated with student drinking: A moderation study of impulsivity and drinking by positive alcohol expectancies. *Addictive Behaviors*, *37*, 556–560. doi:10.1016/j.addbeh.2011.12.007
- Carter, A. C., Brandon, K. O., & Goldman, M. S. (2010). The college and noncollege experience: A review of the factors that influence drinking behavior in young adulthood. *Journal of Studies on Alcohol and Drugs*, *71*, 742–750. doi:10.15288/jsad.2010.71.742
- Centers for Disease Control and Prevention. (2004). Alcohol-attributable deaths and years of potential life lost – United States, 2001. *MMWR Morbidity and Mortality Weekly Report*, *53*, 866–870.
- Charitonidi, E., Studer, J., Gaume, J., Gmel, G., Daeppen, J. B., & Bertholet, N. (2016). Socioeconomic status and substance use among Swiss young men: A population-based cross-sectional study. *BMC Public Health*, *16*, 333. doi:10.1186/s12889-016-2949-5
- Chassin, L., Pitts, S. C., & Prost, J. (2002). Binge drinking trajectories from adolescence to emerging adulthood in a high-risk sample: Predictors and substance abuse outcomes. *Journal of Consulting and Clinical Psychology*, *70*, 67–78.
- Chauhan, P., Ahern, J., Galea, S., & Keyes, K. M. (2016). Neighborhood context and binge drinking by race and ethnicity in New York City. *Alcoholism, Clinical and Experimental Research*, *40*, 785–793. doi:10.1111/acer.13011
- Cheng, H., & Furnham, A. (2013). Correlates of adult binge drinking: Evidence from a British cohort. *PLoS ONE*, *8*, e78838. doi:10.1371/journal.pone.0078838

- Cherpitel, C. J., Ye, Y., Moskalewicz, J., & Swiatkiewicz, G. (2015). Does brief intervention work for heavy episodic drinking? A comparison of emergency department patients in two cultures. *Alkohol Narkom*, 28, 145–162. doi:10.1016/j.alkona.2015.05.001
- Choi, N. G., & DiNitto, D. M. (2011a). Heavy/binge drinking and depressive symptoms in older adults: Gender differences. *International Journal of Geriatric Psychiatry*, 26, 860–868. doi:10.1002/gps.2616
- Choi, N. G., & DiNitto, D. M. (2011b). Psychological distress, binge/heavy drinking, and gender differences among older adults. *American Journal on Addictions*, 20, 420–428. doi:10.1111/j.1521-0391.2011.00149.x
- Clarke, N. C., Field, M., & Rose, A. K. (2015). Evaluation of a brief personalised intervention for alcohol consumption in college students. *PLoS ONE*, 10, e0131229. doi:10.1371/journal.pone.0131229
- Cleveland, M. J., Reavy, R., Mallett, K. A., Turrisi, R., & White, H. R. (2014). Moderating effects of positive parenting and maternal alcohol use on emerging adults' alcohol use: Does living at home matter? *Addictive Behaviors*, 39, 869–878. doi:10.1016/j.addbeh.2014.01.028
- Cooper, M. L., Kuntsche, E., Levitt, A., Barber, L., & Wolf, S. (2016). A motivational perspective on substance use: Review of theory and research. In K. J. Sher (Ed.), *Oxford handbook of substance use disorders* (pp. 375–421). New York, NY: Oxford University Press.
- Courtney, K. E., & Polich, J. (2009). Binge drinking in young adults: Data, definitions, and determinants. *Psychological Bulletin*, 135, 142–156. doi:10.1037/a0014414
- Courtney, K. E., & Polich, J. (2010). Binge drinking effects on EEG in young adult humans. *International Journal of Environmental Research and Public Health*, 7, 2325–2336. doi:10.3390/ijerph7052325
- Cox, W. M., Fadardi, J. S., & Klinger, E. (2006). Motivational processes underlying implicit cognition in addiction. In R. W. Wiers & A. W. Stacy (Eds.), *Handbook of implicit cognition and addiction* (pp. 253–266). Thousand Oaks, CA: Sage.
- Cox, W. M., & Klinger, E. (1988). A motivational model of alcohol use. *Journal of Abnormal Psychology*, 97, 168–180.
- Cox, W. M., & Klinger, E. (1990). Incentive motivation, affective change, and alcohol use: A model. In W. M. Cox (Ed.), *Why people drink – Parameters of alcohol as a reinforcer* (pp. 291–314). New York, NY: Gardner Press.
- Crabbe, J. C., Harris, R. A., & Koob, G. F. (2011). Preclinical studies of alcohol binge drinking. *Annals of the New York Academy of Sciences*, 1216, 24–40. doi:10.1111/j.1749-6632.2010.05895.x
- Crane, D., Garnett, C., Brown, J., West, R., & Michie, S. (2015). Behavior change techniques in popular alcohol reduction apps: Content analysis. *Journal of Medical Internet Research*, 17, e118. doi:10.2196/jmir.4060
- Crutzen, R., Giabbanelli, P. J., Jander, A., Mercken, L., & de Vries, H. (2015). Identifying binge drinkers based on parenting dimensions and alcohol-specific parenting practices: Building classifiers on adolescent-parent paired data. *BMC Public Health*, 15, 747. doi:10.1186/s12889-015-2092-8.
- Czapla, M., Simon, J. J., Friederich, H. C., Herpertz, S. C., Zimmermann, P., & Loeber, S. (2015). Is binge drinking in young adults associated with an alcohol-specific impairment of response inhibition? *European Addiction Research*, 21, 105–113. doi:10.1159/000367939
- D'Angelo, J., Kerr, B., & Moreno, M. A. (2014). Facebook displays as predictors of binge drinking: From the virtual to the visceral. *Bulletin of Science, Technology & Society*, 34, 159–169. doi:10.1177/0270467615584044
- Dawson, D. A., Grant, B. F., Stinson, F. S., & Chou, P. S. (2004). Another look at heavy episodic drinking and alcohol use disorders among college and noncollege youth. *Journal of Studies on Alcohol*, 65, 477–488. doi:10.15288/jsa.2004.65.477

- Dawson, D. A., Li, T.-K., & Grant, B. F. (2008). A prospective study of risk drinking: At risk for what? *Drug and Alcohol Dependence*, *95*, 62–72. doi:10.1016/j.drugalcdep.2007.12.007
- Dedert, E. A., McDuffie, J. R., Stein, R., McNeil, J. M., Kosinski, A. S., Freiermuth, C. E., & Williams, J. W. (2015). Electronic interventions for alcohol misuse and alcohol use disorders: A systematic review. *Annals of Internal Medicine*, *163*, 205–214. doi:10.7326/M15-0285
- Department of Health. (2016). *Health risks from alcohol: New guidelines*. Retrieved from <https://www.gov.uk/government/consultations/health-risks-from-alcohol-new-guidelines>
- Desrivieres, S., Krause, K., Dyer, A., Frank, J., Blomeyer, D., Lathrop, M., & Schumann, G. (2008). Nucleotide sequence variation within the PI3 K p85 alpha gene associates with alcohol risk drinking behaviour in adolescents. *PLoS ONE*, *3*, e1769. doi:10.1371/journal.pone.0001769
- Diep, P. B., Schelleman-Offermans, K., Kuntsche, E., De Vries, N., & Knibbe, R. A. (2016). Direct and indirect effects of alcohol expectancies through drinking motives on alcohol outcomes among students in Vietnam. *Addictive Behaviors*, *52*, 115–122. doi:10.1016/j.addbeh.2015.09.009.
- Diestelkamp, S., Drechsel, M., Baldus, C., Wartberg, L., Arnaud, N., & Thomasius, R. (2016). Brief in person interventions for adolescents and young adults following alcohol-related events in emergency care: A systematic review and european evidence synthesis. *European Addiction Research*, *22*, 17–35. doi:10.1159/000435877
- Dietze, P. M., & Livingston, M. (2010). The relationship between alcohol supply source and young people's risky drinking and alcohol-related problem behaviours in Victoria, Australia. *Australian and New Zealand Journal of Public Health*, *34*, 364–367. doi:10.1111/j.1753-6405.2010.00567.x
- Dietze, P. M., Livingston, M., Callinan, S., & Room, R. (2014). The big night out: What happens on the most recent heavy drinking occasion among young Victorian risky drinkers? *Drug and Alcohol Review*, *33*, 346–353. doi:10.1111/dar.12117
- Donaldson, C. D., Handren, L. M., & Crano, W. D. (2016). The enduring impact of parents' monitoring, warmth, expectancies, and alcohol use on their children's future binge drinking and arrests: A longitudinal analysis. *Prevention Science*, *17*, 606–614. doi:10.1007/s1121-016-0656-1
- Dotson, K. B., Dunn, M. E., & Bowers, C. A. (2015). Stand-alone personalized normative feedback for college student drinkers: A meta-analytic review, 2004 to 2014. *PLoS ONE*, *10*, e0139518. doi:10.1371/journal.pone.0139518
- Dumas, T. M., Graham, K., Bernards, S., & Wells, S. (2014). Drinking to reach the top: Young adults' drinking patterns as a predictor of status within natural drinking groups. *Addictive Behaviors*, *39*, 1510–1515. doi:10.1016/j.addbeh.2014.05.019
- Dumas, T. M., Wells, S., Flynn, A., Lange, J. E., & Graham, K. (2014). The influence of status on group drinking by young adults: A survey of natural drinking groups on their way to and from bars. *Alcoholism: Clinical and Experimental Research*, *38*, 1100–1107. doi:10.1111/acer.12314
- Eisenberg, D., Golberstein, E., & Whitlock, J. L. (2014). Peer effects on risky behaviors: New evidence from college roommate assignments. *Journal of Health Economics*, *33*, 126–138. doi:10.1016/j.jhealeco.2013.11.006
- Elder, R. W., Lawrence, B., Ferguson, A., Naimi, T. S., Brewer, R. D., Chattopadhyay, S. K., ... Task Force on Community Preventive, S. (2010). The effectiveness of tax policy interventions for reducing excessive alcohol consumption and related harms. *American Journal of Preventive Medicine*, *38*, 217–229. doi:10.1016/j.amepre.2009.11.005
- Elisau, P., Williams, G., Bourke, M., Clough, G., Harrison, A., & Verma, A. (2015). Factors associated with the prevalence of adolescent binge drinking in the urban areas of greater Manchester. *European Journal of Public Health*. doi:10.1093/eurpub/ckv115



- Fairlie, A. M., Wood, M. D., & Laird, R. D. (2012). Prospective protective effect of parents on peer influences and college alcohol involvement. *Psychology of Addictive Behaviors, 26*, 30–41. doi:10.1037/a0023879
- Field, M., & Cox, W. M. (2008). Attentional bias in addictive behaviors: A review of its development, causes, and consequences. *Drug and Alcohol Dependence, 97*, 1–20. doi:10.1016/j.drugalcdep.2008.03.030
- Field, M., Wiers, R. W., Christiansen, P., Fillmore, M. T., & Verster, J. C. (2010). Acute alcohol effects on inhibitory control and implicit cognition: Implications for loss of control over drinking. *Alcoholism, Clinical and Experimental Research, 34*, 1346–1352. doi:10.1111/j.1530-0277.2010.01218.x
- Fjær, E. G., Pedersen, W., von Soest, T., & Gray, P. (2016). When is it OK to be drunk? Situational and cultural variations in the acceptability of visible intoxication in the UK and Norway. *The International Journal on Drug Policy, 29*, 27–32. doi:10.1016/j.drugpo.2015.12.002
- Foster, S., Held, L., Gmel, G., & Mohler-Kuo, M. (2016). Geographical variation in the prevalence of heavy drinking in young Swiss men. *The European Journal of Public Health, 26*, 850–855. doi:10.1093/eurpub/ckv247
- Fowler, L. A., Holt, S. L., & Joshi, D. (2016). Mobile technology-based interventions for adult users of alcohol: A systematic review of the literature. *Addictive Behaviors, 62*, 25–34. doi:10.1016/j.addbeh.2016.06.008
- Foxcroft, D. R., Moreira, M. T., Almeida Santimano, N. M. L., & Smith, L. A. (2015). Social norms information for alcohol misuse in university and college students. *Cochrane Database of Systematic Reviews, 12*, CD006748. doi:10.1002/14651858.CD006748.pub4
- Giancola, P. R., Josephs, R. A., Parrott, D. J., & Duke, A. A. (2010). Alcohol Myopia revisited: Clarifying aggression and other acts of disinhibition through a distorted lens. *Perspectives on Psychological Science, 5*, 265–278. doi:10.1177/1745691610369467
- Gilligan, C., Kuntsche, E., & Gmel, G. (2012). Adolescent drinking patterns across countries: Associations with alcohol policies. *Alcohol and Alcoholism, 47*, 732–737. doi:10.1093/alcalc/ags083
- Gmel, G., Kuntsche, E., & Rehm, J. (2011). Risky single-occasion drinking: Bingeing is not bingeing. *Addiction, 106*, 1037–1045. doi:10.1111/j.1360-0443.2010.03167.x
- Gmel, G., Rehm, J., & Kuntsche, E. (2003). Binge drinking in Europe: Definitions, epidemiology, and consequences. *Sucht, 49*, 105–116.
- Gonzalez, V. M., Reynolds, B., & Skewes, M. C. (2011). Role of impulsivity in the relationship between depression and alcohol problems among emerging adult college drinkers. *Experimental and Clinical Psychopharmacology, 19*, 303–313. doi:10.1037/a0022720
- Gossrau-Breen, D., Kuntsche, E., & Gmel, G. (2010). My older sibling was drunk – Younger siblings' drunkenness in relation to parental monitoring and parent-child relationship. *Journal of Adolescence, 33*, 643–652.
- Gottfredson, N. C., & Hussong, A. M. (2013). Drinking to dampen affect variability: Findings from a college student sample. *Journal of Studies on Alcohol and Drugs, 74*, 576–583.
- Grant, V. V., Stewart, S. H., & Mohr, C. D. (2009). Coping-anxiety and coping-depression motives predict different daily mood-drinking relationships. *Psychology of Addictive Behaviors, 23*, 226–237. doi:10.1037/a0015006
- Gruenewald, P. J., Mitchell, P. R., & Treno, A. J. (1996). Drinking and driving: Drinking patterns and drinking problems. *Addiction, 91*, 1637–1649.
- Guo, G., Li, Y., Owen, C., Wang, H., & Duncan, G. J. (2015). A natural experiment of peer influences on youth alcohol use. *Social Science Research, 52*, 193–207. doi:10.1016/j.ssresearch.2015.01.002
- Gustafson, D. H., McTavish, F. M., Chih, M. Y., Atwood, A. K., Johnson, R. A., Boyle, M. G., & Shah, D. (2014). A smartphone application to support recovery from alcoholism: A randomized clinical trial. *JAMA Psychiatry, 71*, 566–572. doi:10.1001/jamapsychiatry.2013.4642



- Hahm, H. C., Kolaczyk, E., Jang, J., Swenson, T., & Bhindarwala, A. M. (2012). Binge drinking trajectories from adolescence to young adulthood: The effects of peer social network. *Substance Use & Misuse, 47*, 745–756. doi:10.3109/10826084.2012.666313
- Ham, L. S., & Hope, D. A. (2003). College students and problematic drinking: A review of the literature. *Clinical Psychology Review, 23*, 719–759.
- Harakeh, Z., de Looze, M. E., Schrijvers, C. T., van Dorsselaer, S. A., & Vollebergh, W. A. (2012). Individual and environmental predictors of health risk behaviours among Dutch adolescents: The HBSC study. *Public Health, 126*, 566–573. doi:10.1016/j.puhe.2012.04.006
- Harrell, Z. A., & Karim, N. M. (2008). Is gender relevant only for problem alcohol behaviors? An examination of correlates of alcohol use among college students. *Addictive Behaviors, 33*, 359–365. doi:10.1016/j.addbeh.2007.09.014
- Harris, S. K., Sherritt, L., Van Hook, S., Wechsler, H., & Knight, J. R. (2010). Alcohol policy enforcement and changes in student drinking rates in a statewide public college system: a follow-up study. *Substance Abuse Treatment, Prevention, and Policy, 5*, 18. doi:10.1186/1747-597X-5-18
- Hauck-Filho, N., Teixeira, M. A. P., & Cooper, M. L. (2012). Confirmatory factor analysis of the Brazilian version of the drinking motives questionnaire-revised (DMQ-R). *Addictive Behaviors, 37*, 524–527. doi:10.1016/j.addbeh.2011.11.023
- Haugland, S. H., Strandheim, A., & Bratberg, G. (2012). Is high-risk use of intoxicants more common among adolescents who have seen their parents intoxicated? *Tidsskrift for den Norske Laegeforening, 132*, 410–413. doi:10.4045/tidsskr.11.0623
- He, J., Assanangkornchai, S., Cai, L., & McNeil, E. (2016). Disparities in drinking patterns and risks among ethnic majority and minority groups in China: The roles of acculturation, religion, family and friends. *Drug and Alcohol Dependence, 159*, 198–206. doi:10.1016/j.drugalcdep.2015.12.028
- Hiatt, C., Laursen, B., Stattin, H., & Kerr, M. (2015). Best friend influence over adolescent problem behaviors: Socialized by the satisfied. *Journal of Clinical Child and Adolescent Psychology, 1–14*. doi:10.1080/15374416.2015.1050723
- Hibell, B., Guttormsson, U., Ahlström, S., Balakireva, O., Bjanason, T., Kokkevi, A., & Kraus, L. (2012). *The 2011 ESPAD report – Substance use among students in 36 European countries*. Stockholm: ESPAD. Retrieved from Stockholm.
- Hicks, J. A., Fields, S., Davis, W. E., & Gable, P. A. (2015). Heavy drinking, impulsivity and attentional narrowing following alcohol cue exposure. *Psychopharmacology (Berl), 232*, 2773–2779. doi:10.1007/s00213-015-3912-3
- Hill, K. G., White, H. R., Chung, I.-J. J., Hawkins, J. D., & Catalano, R. F. (2000). Early adult outcomes of adolescent binge drinking: Person- and variable-centered analyses of binge drinking trajectories. *Alcoholism: Clinical and Experimental Research, 24*, 892–901.
- Hingson, R. W., & Zha, W. (2009). Age of drinking onset, alcohol use disorders, frequent heavy drinking, and unintentionally injuring oneself and others after drinking. *Pediatrics, 123*, 1477–1484. doi:10.1542/peds.2008-2176
- Huang, R., Ho, S. Y., Wang, M. P., Lo, W. S., & Lam, T. H. (2016). Sociodemographic risk factors of alcohol drinking in Hong Kong adolescents. *Journal of Epidemiology and Community Health, 70*, 374–379. doi:10.1136/jech-2015-206418
- Hurst, P. M., Harte, D., & Frith, W. J. (1994). The grand rapids dip revisited. *Accident Analysis and Prevention, 26*, 647–654.
- Ibanez, M. I., Camacho, L., Mezquita, L., Villa, H., Moya-Higueras, J., & Ortet, G. (2015). Alcohol expectancies mediate and moderate the associations between big five personality traits and adolescent alcohol consumption and alcohol-related problems. *Frontiers in Psychology, 6*, 1838. doi:10.3389/fpsyg.2015.01838

- Inchley, J., Currie, D., Young, T., Samdal, O., Torsheim, T., Augustson, L., ... Barnekow, V. (Eds.). (2016). *Growing up unequal: Gender and socioeconomic differences in young people's health and well-being. Health behaviour in school-aged children (HBSC) study: International report from the 2013/2014 survey*. Copenhagen: WHO Regional Office for Europe.
- Jones, B. T. (2004). Changing alcohol expectancies: Techniques for altering motivations for drinking. In W. M. Cox & E. Klinger (Eds.), *Handbook of motivational counseling: Concepts, approaches, and assessment* (pp. 373–387). New York, NY: Wiley.
- Kachadourian, L. K., Pilver, C. E., & Potenza, M. N. (2014). Trauma, PTSD, and binge and hazardous drinking among women and men: Findings from a national study. *Journal of Psychiatric Research, 55*, 35–43. doi:10.1016/j.jpsychires.2014.04.018
- Kaner, E. F., Beyer, F., Dickinson H. O., Pienaar, E., Campbell, F., Schlesinger, C., ... Burnand, B. (2007). Effectiveness of brief alcohol interventions in primary care populations. *Cochrane Database of Systematic Reviews, 2*, CD004148. doi:10.1002/14651858.CD004148.pub3
- Karam, E., Kypri, K., & Salamoun, M. (2007). Alcohol use among college students: An international perspective. *Current Opinion in Psychiatry, 20*, 213–221. doi:10.1097/YCO.0b013e3280fa836c
- Kaynak, O., Winters, K. C., Cacciola, J., Kirby, K. C., & Arria, A. M. (2014). Providing alcohol for underage youth: What messages should we be sending parents? *Journal of Studies on Alcohol and Drugs, 75*, 590–605.
- Kelly, Y., Goisis, A., Sacker, A., Cable, N., Watt, R. G., & Britton, A. (2016). What influences 11-year-olds to drink? Findings from the millennium cohort study. *BMC Public Health, 16*, 169. doi:10.1186/s12889-016-2847-x
- Kendler, K. S., Gardner, C. O., Hickman, M., Heron, J., Macleod, J., Lewis, G., & Dick, D. M. (2014). Socioeconomic status and alcohol-related behaviors in mid- to late adolescence in the avon longitudinal study of parents and children. *Journal of Studies on Alcohol and Drugs, 75*, 541–545.
- Kerr, W. C., Greenfield, T. K., Bond, J., Ye, Y., & Rehm, J. (2009). Age-period-cohort modelling of alcohol volume and heavy drinking days in the US national alcohol surveys: divergence in younger and older adult trends. *Addiction, 104*, 27–37. doi:10.1111/j.1360-0443.2008.02391.x
- Keyes, K. M., Li, G., & Hasin, D. S. (2011). Birth cohort effects and gender differences in alcohol epidemiology: A review and synthesis. *Alcoholism, Clinical and Experimental Research, 35*, 2101–2112. doi:10.1111/j.1530-0277.2011.01562.x
- Klima, T., Skinner, M. L., Haggerty, K. P., Crutchfield, R. D., & Catalano, R. F. (2014). Exploring heavy drinking patterns among black and white young adults. *Journal of Studies on Alcohol and Drugs, 75*, 839–849.
- Kohler, S., & Hofmann, A. (2015). Can motivational interviewing in emergency care reduce alcohol consumption in young people? A systematic review and meta-analysis. *Alcohol and Alcoholism, 50*, 107–117. doi:10.1093/alcalc/agu098
- Krebs, C. P., Lindquist, C. H., Warner, T. D., Fisher, B. S., & Martin, S. L. (2009). College women's experiences with physically forced, alcohol- or other drug-enabled, and drug-facilitated sexual assault before and since entering college. *Journal of American College Health, 57*, 639–647. doi:10.3200/jach.57.6.639-649
- Kristjansson, A. L., Sigfusdottir, I. D., & Allegrante, J. P. (2013). Adolescent substance use and peer use: A multilevel analysis of cross-sectional population data. *Substance Abuse Treatment, Prevention, and Policy, 8*, 27. doi:10.1186/1747-597x-8-27
- Kuendig, H., Plant, M. A., Plant, M. L., Miller, P., Kuntsche, S., & Gmel, G. (2008). Alcohol-related adverse consequences: Cross-cultural variations in attribution process among young adults. *European Journal of Public Health, 18*, 386–391. doi:10.1093/eurpub/ckn007

- Kuipers, M. A., Jongeneel-Grimen, B., Droomers, M., Wingen, M., Stronks, K., & Kunst, A. E. (2013). Why residents of Dutch deprived neighbourhoods are less likely to be heavy drinkers: The role of individual and contextual characteristics. *Journal of Epidemiology and Community Health*, *67*, 587–594. doi:10.1136/jech-2012-201242
- Kuntsche, E., & Bruno, R. (2015). Moody booze: Introducing the special section on affect regulation and substance use. *Drug and Alcohol Review*, *34*, 569–570. doi:10.1111/dar.12349
- Kuntsche, E., & Gmel, G. (2013). Alcohol consumption in late adolescence and early adulthood – Where is the problem? *Swiss Medical Weekly*, *143*, w13826. doi:10.4414/smw.2013.13826
- Kuntsche, E., Knibbe, R. A., Gmel, G., & Engels, R. C. M. E. (2006a). Replication and validation of the drinking motive questionnaire revised (DMQ-R, Cooper, 1994) among adolescents in Switzerland. *European Addiction Research*, *12*, 161–168.
- Kuntsche, E., Knibbe, R. A., Gmel, G., & Engels, R. C. M. E. (2006b). Who drinks and why? A review of socio-demographic, personality, and contextual issues behind the drinking motives in young people. *Addictive Behaviors*, *31*, 1844–1857. doi:10.1016/j.addbeh.2005.12.028
- Kuntsche, E., Knibbe, R. A., Gmel, G., & Engels, R. C. M. E. (2007). Drinking motives as mediators of the link between alcohol expectancies and alcohol use among adolescents. *Journal of Studies on Alcohol and Drugs*, *68*, 76–85.
- Kuntsche, E., & Kuendig, H. (2012). Beyond self-reports: Drinking motives predict grams of consumed alcohol in wine-tasting sessions. *Experimental and Clinical Psychopharmacology*, *20*, 318–324. doi:10.1037/a0027480
- Kuntsche, E., Kuendig, H., & Gmel, G. (2008). Alcohol outlet density, perceived availability, and adolescent alcohol use: A multi-level structural equation model. *Journal of Epidemiology and Community Health*, *62*, 811–816. doi:10.1136/jech.2007.065367
- Kuntsche, E., Kuntsche, S., Knibbe, R. A., Simons-Morton, B. G., Farhat, T., Hublet, A., & Demetrovics, Z. (2011). Cultural and gender convergence in adolescent drunkenness. *Archives of Pediatrics and Adolescent Medicine*, *165*, 152–158. doi:10.1001/archpediatrics.2010.191
- Kuntsche, E., & Labhart, F. (2013a). Drinking motives moderate the impact of pre-drinking on heavy drinking on a given evening and related adverse consequences – An event-level study. *Addiction*, *108*, 1747–1755. doi:10.1111/add.12253
- Kuntsche, E., & Labhart, F. (2013b). Using personal cell phones for ecological momentary assessment. An overview of current developments. *European Psychologist*, *18*, 3–11. doi:10.1027/1016-9040/a000127
- Kuntsche, E., & Labhart, F. (2014). The future is now-using personal cellphones to gather data on substance use and related factors. *Addiction*, *109*, 1052–1053. doi:10.1111/add.12540
- Kuntsche, E., & Meyer, M. (2002). Abschreckung oder Ansteckung? Wenn Kinder der Meinung sind, dass ihre Eltern zu viel rauchen oder trinken [Deterrence or contagation? When children think that their parents smoke or drink too much]. *SuchtMagazin*, *28*, 20–32.
- Kuntsche, E., & Müller, S. (2012). Why do young people start drinking motives for first-time alcohol consumption and links to risky drinking in early adolescence. *European Addiction Research*, *18*, 34–39. doi:10.1159/000333036
- Kuntsche, E., Nic Gabhainn, S., Roberts, C., Windlin, B., Vieno, A., Bendtsen, P., ... Wicki, M. (2014). Drinking motives and links to alcohol use in 13 European countries. *Journal of Studies on Alcohol and Drugs*, *75*, 428–437.
- Kuntsche, E., Otten, R., & Labhart, F. (2015). Identifying risky drinking patterns over the course of Saturday evenings: An event-level study. *Psychology of Addictive Behaviors*, *29*, 744–752. doi:10.1037/adb0000057
- Kuntsche, E., Rehm, J., & Gmel, G. (2004). Characteristics of binge drinkers in Europe. *Social Science and Medicine*, *59*, 113–127. doi:10.1016/j.socscimed.2003.10.009
- Kuntsche, E., & Silbereisen, R. K. (2004). Parental closeness and adolescent substance use in single parent and two-parent families in Switzerland. *Swiss Journal of Psychology*, *63*, 85–92.

- Kuntsche, E., Stewart, S. H., & Cooper, M. L. (2008). How stable is the motive-alcohol use link? A cross-national validation of the drinking motive questionnaire revised among adolescents from Switzerland, Canada, and the United States. *Journal of Studies on Alcohol and Drugs*, *69*, 388–396.
- Kuntsche, E., von Fischer, M., & Gmel, G. (2008). Personality factors and alcohol use: A mediator analysis of drinking motives. *Personality and Individual Differences*, *45*, 796–800. doi:10.1016/j.paid.2008.08.009
- Kuntsche, E., Wicki, M., Windlin, B., Roberts, C., Nic Gabhainn, S., van der Sluijs, W., & Demetrovics, Z. (2015). Drinking motives mediate cultural differences but not gender differences in adolescent alcohol use. *Journal of Adolescent Health*, *56*, 323–329. doi:10.1016/j.jadohealth.2014.10.267
- Kuntsche, E., Wiers, R. W., Janssen, T., & Gmel, G. (2010). Same wording, distinct concepts? Testing differences between expectancies and motives in a mediation model of alcohol outcomes. *Experimental and Clinical Psychopharmacology*, *18*, 436–444. doi:10.1037/a0019724
- Kuntsche, S., Plant, M. L., Plant, M. A., Miller, P., & Gmel, G. (2008). Spreading or concentrating drinking occasions – Who is most at risk? *European Addiction Research*, *14*, 71–81. doi:10.1159/000113721
- Kwok, K. H., & Yuan, S. N. (2016). Parental socioeconomic status and binge drinking in adolescents: A systematic review. *American Journal on Addictions*. doi:10.1111/ajad.12461
- Lac, A., & Donaldson, C. D. (2016). Alcohol attitudes, motives, norms, and personality traits longitudinally classify nondrinkers, moderate drinkers, and binge drinkers using discriminant function analysis. *Addictive Behaviors*, *61*, 91–98. doi:10.1016/j.addbeh.2016.05.006
- Lammers, J., Kuntsche, E., Engels, R. C. M. E., Wiers, R. W., & Kleinjan, M. (2013). Mediation relations of substance use risk profiles, alcohol-related outcomes, and drinking motives among young adolescents in the Netherlands. *Drug and Alcohol Dependence*, *133*, 571–579. doi:10.1016/j.drugalcdep.2013.07.030
- Lange, J. E., & Voas, R. B. (2001). Defining binge drinking quantities through resulting blood alcohol concentrations. *Psychology of Addictive Behaviors*, *15*, 310–316.
- Laslett, A.-M., Room, R., Ferris, J., Wilkinson, C., Livingston, M., & Mugavin, J. (2011). Surveying the range and magnitude of alcohol's harm to others in Australia. *Addiction*, *106*, 1603–1611. doi:10.1111/j.1360-0443.2011.03445.x
- Lee, K. (2012). Gender-specific relationships between alcohol drinking patterns and metabolic syndrome: The Korea national health and nutrition examination survey 2008. *Public Health Nutrition*, *15*, 1917–1924. doi:10.1017/s136898001100365x
- Legleye, S., Janssen, E., Spilka, S., Le Nezet, O., Chau, N., & Beck, F. (2013). Opposite social gradient for alcohol use and misuse among French adolescents. *The International Journal on Drug Policy*, *24*, 359–366. doi:10.1016/j.drugpo.2012.12.007
- Leigh, B. C., & Stacy, A. W. (2004). Alcohol expectancies and drinking in different age groups. *Addiction*, *99*, 215–227.
- Lenk, K. M., Erickson, D. J., Nelson, T. F., Winters, K. C., & Toomey, T. L. (2012). Alcohol policies and practices among four-year colleges in the united states: Prevalence and patterns. *Journal of Studies on Alcohol and Drugs*, *73*, 361–367.
- Leung, R. K., Toumbourou, J. W., & Hemphill, S. A. (2014). The effect of peer influence and selection processes on adolescent alcohol use: A systematic review of longitudinal studies. *Health Psychology Review*, *8*, 426–457. doi:10.1080/17437199.2011.587961
- Lewis, M. A., & Neighbors, C. (2004). Gender-specific misperceptions of college student drinking norms. *Psychology of Addictive Behaviors*, *18*, 334–339. doi:10.1037/0893-164x.18.4.334
- Lynch, A. D., Coley, R. L., Sims, J., Lombardi, C. M., & Mahalik, J. R. (2015). Direct and interactive effects of parent, friend and schoolmate drinking on alcohol use trajectories. *Psychology & Health*, *30*, 1183–1205. doi:10.1080/08870446.2015.1040017

- Martens, M. P., Pederson, E. R., LaBrie, J. W., Ferrier, A. G., & Cimini, M. D. (2007). Measuring alcohol-related protective behavioral strategies among college students: Further examination of the protective behavioral strategies scale. *Psychology of Addictive Behaviors, 21*, 307–315. doi:10.1037/0893-164x.21.3.307
- Martino, S. C., Ellickson, P. L., & McCaffrey, D. F. (2009). Multiple trajectories of peer and parental influence and their association with the development of adolescent heavy drinking. *Addictive Behaviors, 34*, 693–700. doi:10.1016/j.addbeh.2009.04.006
- Maurage, P., Joassin, F., Speth, A., Modave, J., Philippot, P., & Campanella, S. (2012). Cerebral effects of binge drinking: Respective influences of global alcohol intake and consumption pattern. *Clinical Neurophysiology, 123*, 892–901. doi:10.1016/j.clinph.2011.09.018
- McMurrin, M. (Ed.). (2012). *Alcohol-related violence: Prevention and treatment* (Vol. 57). Chichester: Wiley-Blackwell.
- Melotti, R., Lewis, G., Hickman, M., Heron, J., Araya, R., & Macleod, J. (2013). Early life socio-economic position and later alcohol use: Birth cohort study. *Addiction, 108*, 516–525. doi:10.1111/add.12018
- Miller, P., Zinkiewicz, L., Hayley, A., Sonderlund, A., Litherland, S., Medew-Ewen, T., ... Graham, K. (2016). Barroom aggression among Australian men: Associations with heavy episodic drinking, conformity to masculine norms, and personal and perceived peer approval of barroom aggression. *Journal of Studies on Alcohol and Drugs, 77*, 421–430.
- Miller, W. R., & Rollnick, S. (2002). *Motivational interviewing: Preparing people for change* (2nd ed.). New York, NY: The Guilford Press.
- Milward, J., Khadjesari, Z., Fincham-Campbell, S., Deluca, P., Watson, R., & Drummond, C. (2016). User preferences for content, features, and style for an app to reduce harmful drinking in young adults: Analysis of user feedback in app stores and focus group interviews. *JMIR mHealth and uHealth, 4*, e47. doi:10.2196/mhealth.5242
- Mohamed, S., & Ajmal, M. (2015). Multivariate analysis of binge drinking in young adult population: Data analysis of the 2007 survey of lifestyle, attitude and nutrition in Ireland. *Psychiatry and Clinical Neurosciences, 69*, 483–488. doi:10.1111/pcn.12284
- Mohler-Kuo, M., Dowdall, G. W., Koss, M. P., & Wechsler, H. (2004). Correlates of rape while intoxicated in a national sample of college women. *Journal of Studies on Alcohol, 65*, 37–45.
- Moreno, M. A., Christakis, D. A., Egan, K. G., Brockman, L. N., & Becker, T. (2012). Associations between displayed alcohol references on Facebook and problem drinking among college students. *Archives of Pediatrics & Adolescent Medicine, 166*, 157–163. doi:10.1001/archpediatrics.2011.180
- Moreno, M. A., Cox, E. D., Young, H. N., & Haaland, W. (2015). Underage college students' alcohol displays on Facebook and real-time alcohol behaviors. *Journal of Adolescent Health, 56*, 646–651. doi:10.1016/j.jadohealth.2015.02.020
- Mushquash, A. R., Sherry, S. B., Mackinnon, S. P., Mushquash, C. J., & Stewart, S. H. (2014). Heavy episodic drinking is a trait-state: A cautionary note. *Substance Abuse, 35*, 222–225. doi:10.1080/08897077.2013.876486
- Mustonen, H., Makela, P., & Lintonen, T. (2016). Situational drinking in private and public locations: A multilevel analysis of blood alcohol level in Finnish drinking occasions. *Drug and Alcohol Review, 35*, 772–784. doi:10.1111/dar.12432
- Naimi, T. S., Blanchette, J., Nelson, T. F., Nguyen, T., Oussayef, N., Heeren, T. C., ... Xuan, Z. (2014). A new scale of the U.S. alcohol policy environment and its relationship to binge drinking. *American Journal of Preventive Medicine, 46*, 10–16. doi:10.1016/j.amepre.2013.07.015
- National Health and Medical Research Council. (2016). *Alcohol guidelines: Reducing the health risks*. Retrieved from <https://www.nhmrc.gov.au/health-topics/alcohol-guidelines>



- National Institute on Alcohol Abuse and Alcoholism. (2004). NIAAA council approves definition of binge drinking. *NIAAA Newsletter Winter 2004*. Retrieved from [http://pubs.niaaa.nih.gov/publications/Newsletter/winter2004/Newsletter\\_Number3.pdf](http://pubs.niaaa.nih.gov/publications/Newsletter/winter2004/Newsletter_Number3.pdf)
- Neal, D. J., & Carey, K. B. (2007). Association between alcohol intoxication and alcohol-related problems: An event-level analysis. *Psychology of Addictive Behaviors, 21*, 194–204. doi:10.1037/0893-164x.21.2.194
- Neighbors, C., Lee, C. M., Atkins, D. C., Lewis, M. A., Kaysen, D., Mittmann, A., ... Larimer, M. E. (2012). A randomized controlled trial of event-specific prevention strategies for reducing problematic drinking associated with 21st birthday celebrations. *Journal of Consulting and Clinical Psychology, 80*, 850–862. doi:10.1037/a0029480
- Neighbors, C., Lee, C. M., Lewis, M. A., Fossos, N., & Larimer, M. E. (2007). Are social norms the best predictor of outcomes among heavy-drinking college students? *Journal of Studies on Alcohol and Drugs, 68*, 556–565.
- Németh, Z., Kuntsche, E., Urbán, R., Farkas, J., & Demetrovics, Z. (2011). Why do festival goers drink? Assessment of drinking motives using the DMQ-R SF in a recreational setting. *Drug and Alcohol Review, 30*, 40–46. doi:10.1111/j.1465-3362.2010.00193.x
- Newton, A. S., Dong, K., Mabood, N., Ata, N., Ali, S., Gokiart, R., ... Wild, T. C. (2013). Brief emergency department interventions for youth who use alcohol and other drugs: A systematic review. *Pediatric Emergency Care, 29*, 673–684. doi:10.1097/PEC.0b013e31828ed325
- Norstrom, T., & Rossow, I. (2016). Alcohol consumption as a risk factor for suicidal behavior: A systematic review of associations at the individual and at the population level. *Archives of Suicide Research, 20*, 489–506. doi:10.1080/13811118.2016.1158678
- O'Malley, P. M., & Johnston, L. D. (2002). Epidemiology of alcohol and other drug use among American college students. *Journal of Studies on Alcohol, 63* (Suppl. 14), 23–39. doi:10.15288/jsas.2002.s14.23
- O'Rourke, L., Humphris, G., & Baldacchino, A. (2016). Electronic communication based interventions for hazardous young drinkers: A systematic review. *Neuroscience and Biobehavioral Reviews, 68*, 880–890. doi:10.1016/j.neubiorev.2016.07.021
- Olthuis, J. V., Zamboanga, B. L., Ham, L. S., & Van Tyne, K. (2011). The utility of a gender-specific definition of binge drinking on the AUDIT. *Journal of American College Health, 59*, 239–245. doi:10.1080/07448481.2010.497523
- Paljarvi, T., Koskenvuo, M., Poikolainen, K., Kauhanen, J., Sillanmaki, L., & Makela, P. (2009). Binge drinking and depressive symptoms: A 5-year population-based cohort study. *Addiction, 104*, 1168–1178. doi:10.1111/j.1360-0443.2009.02577.x
- Pape, H., Rossow, I., & Storvoll, E. E. (2015). Is drinking with parents associated with high-risk drinking among adolescents? *European Addiction Research, 21*, 291–299. doi:10.1159/000381673
- Park, A., Kim, J., Gellis, L. A., Zaso, M. J., & Maisto, S. A. (2014). Short-term prospective effects of impulsivity on binge drinking: Mediation by positive and negative drinking consequences. *Journal of American College Health, 62*, 517–525. doi:10.1080/07448481.2014.929579
- Paschall, M. J., Bersamin, M., & Flewelling, R. L. (2005). Racial/Ethnic differences in the association between college attendance and heavy alcohol use: A national study. *Journal of Studies on Alcohol, 66*, 266–274. doi:10.15288/jsa.2005.66.266
- Patrick, M. E., & Terry-McElrath, Y. M. (2017). High-intensity drinking by underage young adults in the United States. *Addiction, 112*, 82–93. doi:10.1111/add.13556
- Pearson, M. R. (2013). Use of alcohol protective behavioral strategies among college students: A critical review. *Clinical Psychology Review, 33*, 1025–1040. doi:10.1016/j.cpr.2013.08.006
- Pedersen, W., Bakken, A., & von Soest, T. (2015). Adolescents from affluent city districts drink more alcohol than others. *Addiction, 110*, 1595–1604. doi:10.1111/add.13005

- Pedersen, W., & von Soest, T. (2013). Socialization to binge drinking: A population-based, longitudinal study with emphasis on parental influences. *Drug and Alcohol Dependence*, *133*, 587–592. doi:10.1016/j.drugalcdep.2013.07.028
- Perkins, H. W. (2002). Social norms and the prevention of alcohol misuse in collegiate contexts. *Journal of Studies on Alcohol*, *14*(Suppl.), 164–172.
- Perkins, H. W. (2003). *The social norms approach to preventing school and college age substance abuse: A handbook for educators, counselors, and clinicians*. San Francisco, CA: Jossey-Bass.
- Petit, G., Kornreich, C., Verbanck, P., & Campanella, S. (2013). Gender differences in reactivity to alcohol cues in binge drinkers: A preliminary assessment of event-related potentials. *Psychiatry Research*, *209*, 494–503. doi:10.1016/j.psychres.2013.04.005
- Petit, G., Maurage, P., Kornreich, C., Verbanck, P., & Campanella, S. (2014). Binge drinking in adolescents: A review of neurophysiological and neuroimaging research. *Alcohol and Alcoholism*, *49*, 198–206. doi:10.1093/alcalc/agt172
- Pew Research, C. (2016). Smartphone Ownership and Internet Usage Continues to Climb in Emerging Economies. Retrieved from <http://www.pewglobal.org/2016/02/22/smartphone-ownership-and-internet-usage-continues-to-climb-in-emerging-economies/files/5771/smartphone-ownership-and-internet-usage-continues-to-climb-in-emerging-economies.html>
- Plant, M. A., & Plant, M. L. (2006). *Binge Britain: Alcohol und the national response*. Oxford: Oxford University Press.
- Prado Jde, A., Kerr-Correa, F., Lima, M. C., da Silva, G. G., & Santos, J. L. (2012). Relations between depression, alcohol and gender in the metropolitan region of Sao Paulo, Brazil. *Cien Saude Colet*, *17*, 2425–2434.
- Pumper, M. A., & Moreno, M. A. (2013). Identifying high-risk alcohol users in first-year college students: Attitude, intention, and facebook. *Journal of Alcoholism & Drug Dependence*, *1*, 128. doi:10.4172/2329-6488.1000128
- Quinn, P. D., & Fromme, K. (2011). Alcohol use and related problems among college students and their noncollege peers: The competing roles of personality and peer influence. *Journal of Studies on Alcohol and Drugs*, *72*, 622–632. doi:10.15288/jsad.2011.72.622
- Rehm, J., Mathers, C. D., Popova, S., Thavorncharoensap, M., Teerawattananon, Y., & Patra, J. (2009). Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. *Lancet*, *373*, 2223–2233. doi:10.1016/S0140-6736(09)60746-7
- Rehm, J., Shield, K. D., Joharchi, N., & Shuper, P. A. (2012). Alcohol consumption and the intention to engage in unprotected sex: Systematic review and meta-analysis of experimental studies. *Addiction*, *107*, 51–59. doi:10.1111/j.1360-0443.2011.03621.x
- Reinert, D. F. & Allen, J. P. (2002). The alcohol use disorders identification test (AUDIT): A review of recent research. *Alcoholism: Clinical and Experimental Research*, *26*, 272–279.
- Richmond-Rakerd, L. S., Slutske, W. S., Heath, A. C., & Martin, N. G. (2013). Effects of sibship size and composition on younger brothers' and sisters' alcohol use initiation: findings from an Australian twin sample. *Alcoholism, Clinical and Experimental Research*, *37*, 1016–1024. doi:10.1111/acer.12052
- Ridout, B., Campbell, A., & Ellis, L. (2012). 'Off your Face(book)': Alcohol in online social identity construction and its relation to problem drinking in university students. *Drug and Alcohol Review*, *31*, 20–26. doi:10.1111/j.1465-3362.2010.00277.x
- Robinson, E., Jones, A., Christiansen, P., & Field, M. (2015). Drinking like everyone else: Trait self-control moderates the association between peer and personal heavy episodic drinking. *Substance Use & Misuse*, *50*, 590–597. doi:10.3109/10826084.2014.991407
- Roerecke, M., & Rehm, J. (2010). Irregular heavy drinking occasions and risk of ischemic heart disease: A systematic review and meta-analysis. *American Journal of Epidemiology*, *171*, 633–644. doi:10.1093/aje/kwp451.

- Room, R. (2001). Intoxication and bad behaviour: understanding cultural differences in the link. *Social Science and Medicine*, 53, 189–198.
- Rossow, I., & Kuntsche, E. (2013). Early onset of drinking and risk of heavy drinking in young adulthood—a 13-year prospective study. *Alcoholism: Clinical and Experimental Research*, 37, E297–E304. doi:10.1111/j.1530-0277.2012.01924.x
- Rulison, K. L., Wahesh, E., Wyrick, D. L., & DeJong, W. (2016). Parental influence on drinking behaviors at the transition to college: the mediating role of perceived friends' approval of high-risk drinking. *Journal of Studies on Alcohol and Drugs*, 77, 638–648.
- Ryabov, I. (2015). Relation of peer effects and school climate to substance use among Asian American adolescents. *Journal of Adolescence*, 42, 115–127. doi:10.1016/j.adolescence.2015.04.007
- Sajber, D., Tahiraj, E., Zenic, N., Peric, M., & Sekulic, D. (2016). Alcohol drinking among kosovar adolescents: An examination of gender-specific sociodemographic, sport, and familial factors associated with harmful drinking. *Substance Use & Misuse*, 51, 533–539. doi:10.3109/10826084.2015.1122064
- Saunders, J. B., Aasland, O. G., Babor, T. F., de la Fuente, J. R., & Grant, M. (1993). Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. *Addiction*, 88, 791–804.
- Schaffer, M., Jeglic, E. L., & Stanley, B. (2008). The relationship between suicidal behavior, ideation, and binge drinking among college students. *Archives of Suicide Research*, 12, 124–132. doi:10.1080/13811110701857111
- Schelleman-Offermans, K., Kuntsche, E., & Knibbe, R. A. (2011). Associations between drinking motives and changes in adolescents' alcohol consumption: A full cross-lagged panel study. *Addiction*, 106, 1270–1278. doi:10.1111/j.1360-0443.2011.03423.x
- Schmidt, C. S., Schulte, B., Seo, H. N., Kuhn, S., O'Donnell, A., Kriston, L., ... Reimer, J. (2016). Meta-analysis on the effectiveness of alcohol screening with brief interventions for patients in emergency care settings. *Addiction*, 111, 783–794. doi:10.1111/add.13263
- Scholly, K., Katz, A. R., & Kehl, L. (2014). Examining factors associated with heavy episodic drinking among college undergraduates. *Health Psychology Research*, 2, 1457. doi:10.4081/hpr.2014.1457
- Schwinn, T. M., & Schinke, S. P. (2014). Alcohol use and related behaviors among late adolescent urban youth: Peer and parent influences. *Journal of Child & Adolescent Substance Abuse*, 23, 58–64.
- Scott-Sheldon, L. A., Carey, K. B., & Carey, M. P. (2008). Health behavior and college students: Does Greek affiliation matter? *Journal of Behavioral Medicine*, 31, 61–70. doi:10.1007/s10865-007-9136-1
- Scott-Sheldon, L. A. J., Carey, K. B., Kaiser, T. S., Knight, J. M., & Carey, M. P. (2016). Alcohol interventions for Greek letter organizations: A systematic review and meta-analysis, 1987 to 2014. *Health Psychology*, 35, 670–684. doi:10.1037/hea0000357
- Scott-Sheldon, L. A. J., Terry, D. L., Carey, K. B., Garey, L., & Carey, M. P. (2012). Efficacy of expectancy challenge interventions to reduce college student drinking: A meta-analytic review. *Psychology of Addictive Behaviors*, 26, 393–405. doi:10.1037/a0027565
- Seid, A. K., Hesse, M., & Bloomfield, K. (2016). 'Make it another for me and my mates': Does social capital encourage risky drinking among the Danish general population? *Scandinavian Journal of Public Health*, 44, 240–248. doi:10.1177/1403494815619536
- Shin, S. H., Hong, H. G., & Jeon, S. M. (2012). Personality and alcohol use: The role of impulsivity. *Addictive Behaviors*, 37, 102–107. doi:10.1016/j.addbeh.2011.09.006
- Simons, J. S., Wills, T. A., & Neal, D. J. (2014). The many faces of affect: A multilevel model of drinking frequency/quantity and alcohol dependence symptoms among young adults. *Journal of Abnormal Psychology*, 123, 676–694. doi:10.1037/a0036926



- Simons-Morton, B., Haynie, D., Liu, D., Chaurasia, A., Li, K., & Hingson, R. (2016). The effect of residence, school status, work status, and social influence on the prevalence of alcohol use among emerging adults. *Journal of Studies on Alcohol and Drugs*, 77, 121–132.
- Skinner, M. L., Kristman-Valente, A. N., & Herrenkohl, T. I. (2016). Adult binge drinking: Childhood sexual abuse, gender and the role of adolescent alcohol-related experiences. *Alcohol and Alcoholism*, 51, 136–141. doi:10.1093/alcalc/aggv093
- Standardizing Measurement of Alcohol-related Troubles. (2013). *Standardizing measurement of alcohol-related troubles (project SMART)*. Warsaw: Institute of Psychiatry and Neurology. Retrieved from Warsaw: <http://www.alcsmart.ipin.edu.pl/>
- Soler-Vila, H., Galan, I., Valencia-Martin, J. L., Leon-Munoz, L. M., Guallar-Castillon, P., & Rodriguez-Artalejo, F. (2014). Binge drinking in Spain, 2008–2010. *Alcoholism: Clinical and Experimental Research*, 38, 810–819. doi:10.1111/acer.12275
- Soloski, K. L., Kale Monk, J., & Durtschi, J. A. (2016). Trajectories of early binge drinking: A function of family cohesion and peer use. *Journal of Marital and Family Therapy*, 42, 76–90. doi:10.1111/jmft.12111
- Song, E. Y., Smiler, A. P., Wagoner, K. G., & Wolfson, M. (2012). Everyone says It's OK: Adolescents' perceptions of peer, parent, and community alcohol norms, alcohol consumption, and alcohol-related consequences. *Substance Use & Misuse*, 47, 86–98. doi:10.3109/10826084.2011.629704
- Stafstrom, M. (2014). Influence of parental alcohol-related attitudes, behavior and parenting styles on alcohol use in late and very late adolescence. *European Addiction Research*, 20, 233–240. doi:10.1159/000357319
- Stautz, K., & Cooper, A. (2013). Impulsivity-related personality traits and adolescent alcohol use: A meta-analytic review. *Clinical Psychology Review*, 33, 574–592. doi:10.1016/j.cpr.2013.03.003
- Steiner, S., Schori, D., & Gmel, G. (2014). Excessive alcohol consumption in young men: is there an association with their earlier family situation? A baseline-analysis of the C-SURF-study (cohort study on substance use risk factors). *Swiss Medical Weekly*, 144, w14007. doi:10.4414/smw.2014.14007
- Steinka-Fry, K. T., Tanner-Smith, E. E., & Grant, S. (2015). Effects of 21st birthday brief interventions on college student celebratory drinking: A systematic review and meta-analysis. *Addictive Behaviors*, 50, 13–21. doi:10.1016/j.addbeh.2015.06.001
- Stewart, S. H., & Conrod, P. J. (2008). *Anxiety and substance use disorders: The vicious cycle of comorbidity*. New York, NY: Springer.
- Stickley, A., Koyanagi, A., Kuposov, R., McKee, M., Roberts, B., Murphy, A., & Ruchkin, V. (2013). Binge drinking among adolescents in Russia: Prevalence, risk and protective factors. *Addictive Behaviors*, 38, 1988–1995. doi:10.1016/j.addbeh.2012.12.009
- Substance Abuse and Mental Health Services Administration. (2009). Results from the 2008 national survey on drug use and health: national findings. Office of Applied Studies. Retrieved from <http://www.oas.samhsa.gov>
- Suffoletto, B., Kristan, J., Chung, T., Jeong, K., Fabio, A., Monti, P., & Clark, D. B. (2015). An interactive text message intervention to reduce binge drinking in young adults: A randomized controlled trial with 9-month outcomes. *PLoS ONE*, 10, e0142877. doi:10.1371/journal.pone.0142877
- Sugarman, D. E., & Carey, K. B. (2007). The relationship between drinking control strategies and college student alcohol use. *Psychology of Addictive Behaviors*, 21, 338–345. doi:10.1037/0893-164x.21.3.338
- Sweeting, H., & Hunt, K. (2015). Adolescent socioeconomic and school-based social status, smoking, and drinking. *Journal of Adolescent Health*, 57, 37–45. doi:10.1016/j.jadohealth.2015.03.020

- Taylor, B., Shield, K. D., & Rehm, J. (2011). Combining best evidence: A novel method to calculate the alcohol-attributable fraction and its variance for injury mortality. *BMC Public Health, 11*, 265. doi:10.1186/1471-2458-11-265
- Testa, M., VanZile-Tamsen, C., Livingston, J., & Koss, M. P. (2004). Assessing women's experiences of sexual aggression using the sexual experiences survey: Evidence for validity and implications for research. *Psychology of Women Quarterly, 28*, 256–265.
- The ESPAD Group. (2016). *ESPAD Report 2015: Results from the European School Survey Project on Alcohol and Other Drugs*. Lisbon: European Monitoring Centre for Drugs and Drug Addiction (EMCDDA). Retrieved from Lisbon: [http://www.espad.org/sites/espad.org/files/ESPAD\\_report\\_2015.pdf](http://www.espad.org/sites/espad.org/files/ESPAD_report_2015.pdf)
- Thurl, J., & Kuntsche, E. (2016). Interactions between drinking motives and friends in predicting young adults' alcohol use. *Prevention Science, 17*, 626–635. doi:10.1007/s11121-016-0660-5
- Timberlake, D. S., Hopfer, C. J., Rhee, S. H., Friedman, N. P., Haberstick, B. C., Lessem, J. M., & Hewitt, J. K. (2007). College attendance and its effect on drinking behaviors in a longitudinal study of adolescents. *Alcoholism: Clinical and Experimental Research, 31*, 1020–1030. doi:10.1111/j.1530-0277.2007.00383.x
- Timko, C., Sutkowi, A., Pavao, J., & Kimerling, R. (2008). Women's childhood and adult adverse experiences, mental health, and binge drinking: The California women's health survey. *Substance Abuse Treatment, Prevention, and Policy, 3*, 15. doi:10.1186/1747-597x-3-15
- Tomcikova, Z., Veselska, Z. D., Geckova, A. M., van Dijk, J. P., & Reijneveld, S. A. (2015). Adolescents' drinking and drunkenness more likely in one-parent families and due to poor communication with mother. *Central European Journal of Public Health, 23*, 54–58. doi:10.21101/cejph.a3951
- Tomczyk, S., Isensee, B., & Hanewinkel, R. (2015). Moderation, mediation – Or even both? School climate and the association between peer and adolescent alcohol use. *Addictive Behaviors, 51*, 120–126. doi:10.1016/j.addbeh.2015.07.026
- Toomey, T. L., Lenk, K. M., & Wagenaar, A. C. (2007). Environmental policies to reduce college drinking: An update of research findings. *Journal of Studies on Alcohol and Drugs, 68*, 208–219.
- Toomey, T. L., Miazga, M. J., Lenk, K. M., Erickson, D. J., Winters, K. C., & Nelson, T. F. (2011). Enforcing alcohol policies on college campuses: Reports from college enforcement officials. *Journal of Drug Education, 41*, 327–344.
- Townshend, J. M., Kambouropoulos, N., Griffin, A., Hunt, F. J., & Milani, R. M. (2014). Binge drinking, reflection impulsivity, and unplanned sexual behavior: Impaired decision-making in young social drinkers. *Alcoholism, Clinical and Experimental Research, 38*, 1143–1150. doi:10.1111/acer.12333
- Tragesser, S. L., Sher, K. J., Trull, T. J., & Park, A. (2007). Personality disorder symptoms, drinking motives, and alcohol use and consequences: Cross-sectional and prospective mediation. *Experimental and Clinical Psychopharmacology, 15*, 282–292. doi:10.1037/1064-1297.15.3.282
- Treno, A. J., Gruenewald, P. J., & Ponicki, W. R. (1997). The contribution of drinking patterns to the relative risk of injury in six communities: A self-report based probability approach. *Journal of Studies on Alcohol, 58*, 372–381.
- Tucker, J. S., Pollard, M. S., de la Haye, K., Kennedy, D. P., & Green, H. D., Jr (2013). Neighborhood characteristics and the initiation of marijuana use and binge drinking. *Drug and Alcohol Dependence, 128*, 83–89. doi:10.1016/j.drugalcdep.2012.08.006
- Turrisi, R., Mallett, K. A., Mastroleo, N. R., & Larimer, M. E. (2006). Heavy drinking in college students: Who is at risk and what is being done about it? *The Journal of General Psychology, 133*, 401–420. doi:10.3200/GENP.133.4.401-420

- Urberg, K. A., Luo, Q., Pilgrim, C., & Degirmencioglu, S. M. (2003). A two-stage model of peer influence in adolescent substance use: individual and relationship-specific differences in susceptibility to influence. *Addictive Behaviors*, *28*, 1243–1256.
- Van Damme, J., Hublet, A., De Clercq, B., McAlaney, J., Van Hal, G., Rosiers, J., ... Clays, E. (2016). Context matters: Student-perceived binge drinking norms at faculty-level relate to binge drinking behavior in higher education. *Addictive Behaviors*, *59*, 89–94. doi:10.1016/j.addbeh.2016.03.011
- Van der Veen, J. W., Cohen, L. M., & Watson, N. L. (2013). Utilizing a multimodal assessment strategy to examine variations of impulsivity among young adults engaged in co-occurring smoking and binge drinking behaviors. *Drug and Alcohol Dependence*, *127*, 150–155. doi:10.1016/j.drugalcdep.2012.06.026
- van der Vorst, H., Engels, R. C. M. E., & Burk, W. J. (2010). Do parents and best friends influence the normative increase in adolescents' alcohol use at home and outside the home? *Journal of Studies on Alcohol and Drugs*, *71*, 105–114.
- Viner, R. M. & Taylor, B. (2007). Adult outcomes of binge drinking in adolescence: Findings from a UK national birth cohort. *Journal of Epidemiology and Community Health*, *61*, 902–907. doi:10.1136/jech.2005.038117
- Voogt, C. V., Kuntsche, E., Kleinjan, M., Poelen, E., & Engels, R. (2014). Using ecological momentary assessment to test the effectiveness of a web-based brief alcohol intervention over time among heavy-drinking students: Randomized controlled trial. *Journal of Medical Internet Research*, *16*, e5. doi:10.2196/jmir.2817
- Voogt, C. V., Poelen, E. A. P., Kleinjan, M., Lemmers, L. A. C. J., & Engels, R. C. M. E. (2013). The effectiveness of the 'what do you drink' web-based brief alcohol intervention in reducing heavy drinking among students: A two-arm parallel group randomized controlled trial. *Alcohol and Alcoholism*, *48*, 312–321. doi:10.1093/alcalc/ags133
- Wagenaar, A. C., Salois, M. J., & Komro, K. A. (2009). Effects of beverage alcohol price and tax levels on drinking: A meta-analysis of 1003 estimates from 112 studies. *Addiction*, *104*, 179–190.
- Walters, S. T. (2000). In praise of feedback: An effective intervention for college students who are heavy drinkers. *Journal of American College Health*, *48*, 235–238. doi:10.1080/07448480009599310
- Washburn, I. J., Capaldi, D. M., Kim, H. K., & Feingold, A. (2014). Alcohol and marijuana use in early adulthood for at-risk men: Time-varying associations with peer and partner substance use. *Drug and Alcohol Dependence*, *140*, 112–117. doi:10.1016/j.drugalcdep.2014.04.001
- Weafer, J., & Fillmore, M. T. (2008). Individual differences in acute alcohol impairment of inhibitory control predict ad libitum alcohol consumption. *Psychopharmacology (Berl)*, *201*, 315–324. doi:10.1007/s00213-008-1284-7
- Weafer, J. & Fillmore, M. T. (2013). Acute alcohol effects on attentional bias in heavy and moderate drinkers. *Psychology of Addictive Behaviors*, *27*, 32–41. doi:10.1037/a0028991
- Weafer, J., & Fillmore, M. T. (2015). Alcohol-related cues potentiate alcohol impairment of behavioral control in drinkers. *Psychology of Addictive Behaviors*, *29*, 290–299. doi:10.1037/adb0000013
- Wechsler, H., Davenport, A., Dowdall, G. W., Moeykens, B., & Castillio, S. (1994). Health and behavioural consequences of binge drinking in college – A national survey of students at 140 campuses. *Journal of the American Medical Association*, *272*, 1671–1677.
- Wechsler, H., & Isaac, N. E. (1992). 'Binge' drinkers at Massachusetts colleges. Prevalence, drinking style, time trends, and associated problems. *Journal of the American Medical Association*, *267*, 2929–2931.
- Wellman, R. J., Contreras, G. A., Dugas, E. N., O'Loughlin, E. K., & O'Loughlin, J. L. (2014). Determinants of sustained binge drinking in young adults. *Alcohol, Clinical and Experimental Research*, *38*, 1409–1415. doi:10.1111/acer.12365

- Werch, C. E., & Gorman, D. R. (1988). Relationship between self-control and alcohol consumption patterns and problems of college students. *Journal of Studies on Alcohol*, 49, 30–37.
- Whitehill, J. M., Pumper, M. A., & Moreno, M. A. (2015). Emerging adults' use of alcohol and social networking sites during a large street festival: A real-time interview study. *Subst Abuse Treat Prev Policy*, 10, 21. doi:10.1186/s13011-015-0016-3
- Wicki, M., Kuntsche, E., & Gmel, G. (2010). Drinking at European universities? A review of students' alcohol use. *Addictive Behaviors*, 35, 913–924. doi:10.1016/j.addbeh.2010.06.015
- World Health Organization. (2000). *International guide for monitoring alcohol consumption and related harm*. Retrieved from [http://whqlibdoc.who.int/hq/2000/WHO\\_MSD\\_MSB\\_00.4.pdf](http://whqlibdoc.who.int/hq/2000/WHO_MSD_MSB_00.4.pdf)
- World Health Organization. (2014). *Global status report on alcohol and health*. Retrieved from [http://www.who.int/substance\\_abuse/publications/global\\_alcohol\\_report/en/](http://www.who.int/substance_abuse/publications/global_alcohol_report/en/)
- World Health Organization. (2016). *The STEPS instrument and support materials*. Retrieved from <http://www.who.int/chp/steps/instrument/en/>
- Wurdak, M., Wolstein, J., & Kuntsche, E. (2016). Effectiveness of a drinking-motive-tailored emergency-room intervention among adolescents admitted to hospital due to acute alcohol intoxication – A randomized controlled trial. *Preventive Medicine Reports*, 3, 83–89. doi:10.1016/j.pmedr.2015.12.009
- Xuan, Z., Blanchette, J., Nelson, T. F., Heeren, T., Oussayef, N., & Naimi, T. S. (2015). The alcohol policy environment and policy subgroups as predictors of binge drinking measures among US adults. *American Journal of Public Health*, 105, 816–822. doi:10.2105/AJPH.2014.302112
- Zarzar, P. M., Jorge, K. O., Oksanen, T., Vale, M. P., Ferreira, E. F., & Kawachi, I. (2012). Association between binge drinking, type of friends and gender: A cross-sectional study among Brazilian adolescents. *BMC Public Health*, 12, 257. doi:10.1186/1471-2458-12-257
- Zhang, J., Bray, B. C., Zhang, M., & Lanza, S. T. (2015). Personality profiles and frequent heavy drinking in young adulthood. *Personality and Individual Differences*, 80, 18–21. doi:10.1016/j.paid.2015.01.054
- Zucker, R. A., Wong, M. M., Clark, D. B., Leonard, K. E., Schulenberg, J. E., Cornelius, J. R., & Puttler, L. I. (2006). Predicting risky drinking outcomes longitudinally: What kind of advance notice can we get? *Alcoholism: Clinical and Experimental Research*, 30, 243–252.