

REVIEW ARTICLE

Binge Drinking in Childhood and Adolescence

Epidemiology, Consequences, and Interventions

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SUMMARY

Background: Episodic excessive alcohol consumption ("binge drinking") among children and adolescents has become a serious public health problem in Germany and is associated with a variety of risks.

Methods: Selective literature search of the Ovid Medline database from 1998 to 2008.

Results: Episodic excessive alcohol consumption is associated not only with somatic complications, but also with traffic accidents and other types of accident, violent behavior, and suicide. The more frequently a child or adolescent drinks to excess, and the younger he or she is, the greater is the risk of developing an alcohol-related disorder (alcohol misuse or dependence syndrome). In the USA, brief motivational interventions have been shown to have a small to medium-sized beneficial effect in reducing further binge drinking and its complications.

Conclusions: The intervention HaLT ("Stop," also an acronym for Hart am Limit—"near the limit") is performed in a number of regions in Germany. Further types of brief motivating intervention should be developed and evaluated to prevent the development of alcohol-related disorders, where indicated, in children and adolescents that engage in binge drinking.

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Key words: alcohol consumption, child health, adolescent health, alcohol dependence, short-term treatment

According to recent reports by the German Federal Commissioner for Narcotic Drugs (Bundesdrogenbeauftragte), the number of adolescents (aged up to 20 years) treated in hospital for alcohol poisoning more than doubled between 2000 and 2007, from 9500 to 23 165. Their "binge drinking" style of consumption attracts media descriptions such as "Komasaufen" ("coma swilling") or "Kampfftrinken" ("combat drinking") at so-called "flat-rate parties." About 3800 of these patients were between 10 and 15 years old; the group of intoxicated adolescent girls has particularly increased.

This article aims to provide up-to-date epidemiological data and recent results on the etiology and clinical consequences of episodic excessive alcohol consumption among adolescents. In addition, we present a practical tool for everyday clinical routine: brief motivational interventions to prevent further binge drinking events and their associated complications. The authors report on the evidence recently presented in a meta-analysis of randomized controlled studies.

Methods

The literature search on binge drinking used the Ovid Medline database, with the Basic Search function, specifications "including related terms"; years 1999–2008; terms "adolesc* AND heavy drink*," resulting in 140 sources. The choice was narrowed down by studying the abstracts, concentrating on publications dating from 2005 and after. The search on brief motivational interventions for binge drinking was similar, using the terms "adolesc* AND heavy drink* AND brief intervent*," resulting in 336 sources. In this case, the choice was narrowed by studying those abstracts explicitly relating to controlled studies of brief interventions. To supplement all this, our literature search also included current specialist book publications and publications from government departments such as the Federal Center for Health Education (Bundeszentrale für gesundheitliche Aufklärung, BZgA) and the Federal Commissioner for Narcotic Drugs.

Definition of "binge drinking"

Excessive episodic consumption of alcohol is usually referred to these days as "binge drinking." The definition of this term is vague, however. On the one hand, it is used in the German-speaking countries as a synonym for "Rauschtrinken", which is really a combination of binge drinking and loss of control. In the USA, "binge drinking" is usually related to a time window of 2 hours,

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TABLE 1

Total amount of alcohol consumed (in grams of alcohol)*1 per week in 2004, 2005, and 2007 (3)

	Total			12 to 15 years			16 to 17 years		
	2004	2005	2007	2004	2005	2007	2004	2005	2007
Male	59.7	47.2	71.1	26.6	17.6	26.1	126.5	107.6	154.2
Female	27.5	19.8	28.7	14.8	9.0	15.9	54.1	41.7	52.6
Total	44.2	34.1	50.4	20.9	13.5	21.1	92.2	76.1	104.6

*1 0.3 L beer corresponds to approx. 13 g; 0.2 L wine to 16 g; 0.04 L spirits (40%) to approx. 14 g

TABLE 2

Thirty-day prevalence of binge drinking (at least 5 standard units of alcohol per drinking occasion), percent (15- to 16-year-olds) (2)

	Total		Boys		Girls	
	2003	2007	2003	2007	2003	2007
Once or twice	30.1	26.9*	28.8	24.5	31.3	29.1
3 to 5 times	17.2	17.5	18.5	20.7	15.9	14.7
6 to 9 times	6.0	7.3*	7.7	8.5	4.5	6.2*
At least 10 times	5.8	6.9*	8.1	9.8*	3.6	4.2
Total	59.1	58.7	63.1	63.5	55.3	54.2

*1 Significant changes ($p < 0.5$) compared to 2003

BOX 1

"Alcohol expectancies" (2)

Reasons for drinking and expectations of effect reported by 15- to 16-year-olds:

- It's really fun (76%)
- I feel more sociable (65%)
- I feel happy/relaxed (51% each)
- I forget my problems (41%)

whereas in Germany it relates to a vaguely designate "drinking occasion." Binge drinking is usually defined as the consumption of at least 4 (for girls) or 5 (for boys) standard units of alcohol (e.g., 0.3 L beer, 0.2 L wine, or 0.04 L spirits) with the aim of becoming drunk (1).

Epidemiology

Exemplary for Germany are the telephone sample surveys carried out by the BZgA (12- to 17-year-olds) and the international comparison ESPAD studies (European School Survey Project on Alcohol and other Drugs; written questionnaire, 15- to 16-year-olds).

The life-time prevalence for consumption of any alcohol in 2007 was 95% among 15- to 16-year-olds (2), and the 12-month prevalence was 93% (no significant differences between the sexes). In 2007, the average male 16- to 17-year-old consumed 154 g alcohol per week. This corresponds to about 11 0.3-L glasses of beer or 2.5 bottles of wine—markedly higher than female adolescent consumption (3) (table 1).

In 2007, about half of the respondents (boys and girls) had had their first experience of alcohol as early as the age of 12 (no significant difference between the sexes). Fifty percent reported their first experience of being drunk at the age of 14. The 30-day prevalences of binge drinking are shown in table 2.

The question as to whether binge drinking increased significantly between 2003 and 2007 cannot be answered on the basis of the ESPAD data. However, they do show a

clear shift towards a higher frequency of drinking events per month. Boys tend to drink more often than girls.

In European comparison, adolescent Germans are at the top of the binge drinking table (30-day prevalence) along with Dutch and Danish adolescents (e1). Southern European countries show much lower prevalence rates (Turkey, Portugal, France).

Developmental psychology perspectives

In Western-orientated societies, learning to handle alcohol appropriately is one of the obligatory developmental tasks of adolescence. Adolescents try to use alcohol consumption to help solve some of the developmental tasks that are relevant in adolescence. Drinking alcohol demonstrates autonomy, "being grown up," and thus appears to support the achievement of separation from the parents. In addition, it can help adolescents find supposed solutions to interpersonal developmental tasks such as securing high status within the peer group and starting to approach contact (including erotic contact) with others of the same age (box 1). In most cases functional social adult roles are adopted and patterns of excessive alcohol consumption are dropped during later development ("maturing out").

A systematic review of the state of research in Europe distinguishes two divergent strands of motivation for binge drinking (4):

- Group 1 drink in the expectation of fun, exciting experiences, pleasure, and facilitation of social

contact. The aim is to overcome social inhibitions; the expectation of increased sexual activity plays a large role in this (for both sexes).

- Group 2 drink to reduce tension, overcome stress, and as a kind of self-medication to regulate negative affect.

Risk factors

Only a minority continue excessive alcohol consumption into later stages of life. In these adolescents, risk factors present early in life combine with problematic consequences of this consumption pattern (*box 2*).

A large percentage of adolescents who report binge drinking also consume other psychotropic substances. High-school students in the 9th to 12th grades who were in a binge drinking group had a higher 30-day prevalence than their "non-binge-drinking" peers of tobacco use (61% vs. 34%), cannabis use (59% vs. 28%) and the use of other illegal drugs (34% vs. 10%) (7).

Risks and negative consequences

Road traffic accidents are the main cause of death among adolescents, and among 15- to 20-year-olds a third of all fatal road accidents are associated with drinking alcohol (e3). Adolescents who binge drink more often ride a bicycle without a helmet. They also more often drink-drive, or are the passenger of a drink-driver. In the USA, 50% of all head injuries in adolescents are associated with alcohol consumption (25) (*box 3*).

After road traffic and other accidents, and the consequences of violence, suicide is in third place as a cause of death in adolescents. When associated with comorbid psychological disorders such as depression, anxiety disorders, and phobias or stressful life events, binge drinking increases the risk of suicide and attempted suicide. Binge drinking girls in the 8th grade had double the risk of attempted suicide compared to girls of the same age who did not drink (8). In an analysis of the National Risk Behavior Survey in the USA carried out in high-school students in the 9th to 12th grades, the risk of attempted suicide associated with binge drinking was 4.3-fold the risk without binge drinking (9).

Binge drinking is associated with earlier sexual activity and frequently changing sexual partners. It is also associated with a higher rate of unwanted (teenage) pregnancy, sexually transmitted diseases, infertility, and drinking during pregnancy with the risk of alcohol-related damage to the fetus. The risk to adolescent girls of becoming the victim of unwanted sexual activity increases to about three times if they binge drink. Just under 50% of a population of adolescent girls who reported sexual assault had consumed alcohol or other psychotropic substances beforehand (10).

Repeated excessive drinking events markedly increase the risk of developing an alcohol-related disorder (ICD-10, harmful use/dependence syndrome). Particular risk constellations include, in addition to social and genetic factors, starting drinking early in life and frequent drinking events. Adolescents who start to drink regularly

BOX 2

Risk factors for binge drinking (4–6, e2)

- Low socioeconomic status
- Large amount of disposable (pocket) money
- Sensation/novelty seeking, combined either with low self-control and/or with delinquency and having delinquent friends
- Externalizing behavioral abnormalities such as social behavioral disorders or untreated ADHD
- Drinking as a coping strategy for emotional problems (especially in adolescent girls)
- Excessive drinking among peers
- A conflictual relationship with parents and an inconsistent or laissez-faire parenting style
- High-risk pattern of consumption in the parents
- Genetic conditions that against a background of unfavorable environmental factors will predispose to harmful use of alcohol (nature/nurture interaction and correlation)

BOX 3

Main risks and negative consequences associated with alcohol in adolescents (8, 11, e3)

- Among adolescents, diseases typically associated with alcohol, such as cardiovascular or digestive disorders, are less significant than immediate somatic complications of intoxication (e.g., aspiration of vomit, hypothermia)
- Of particular importance are risks related to alcohol-associated road traffic accidents, violent behavior (both victim and assailant), and suicidal behavior

BOX 4

Characteristics of motivational interviewing (19)

- Maintain an empathetic attitude, avoiding confrontation
- Build up confidence in self-effectiveness
- Work together to develop and agree therapeutic goals
- Promote discrepancy awareness (cognitive dissonance) and willingness to change
- Ask open questions ("W" questions); encourage the patient to take an active role in the interview
- Reflect back to the patient what you have heard
- In your feedback, emphasize positive aspects, avoid negative broodings
- Summarize, give structure
- Give practical advice

BOX 5

Elements of the brief motivational intervention (20)

- Emphasize personal responsibility for altering alcohol consumption
- Talk about motivation for drinking and the possible negative consequences of drinking
- Evaluate the personal pattern of drinking and risk
- Indicate various future scenarios assuming that drinking behavior is altered or maintained
- Set goals in relation to alcohol consumption
- Set up rules in order to reach the goals

TABLE 3

Efficacy of brief interventions on binge drinking by college students in the USA: meta-analysis of randomized controlled intervention studies at various follow-up intervals

Criterion and follow-up interval	Number of studys	Weighted effect sizes, d_{+}
Three weeks after intervention	18	0.19 (0.07; 0.32)* ¹
– Reduced amount of alcohol	13	0.17 (0.03; 0.31)
– Frequency of binge drinking	9	0.02 (-0.08; 0.12)
– Alcohol-related problems		
Three months after intervention	38	0.13 (0.06; 0.19)
– Reduced amount of alcohol	27	0.18 (0.10; 0.26)
– Frequency of binge drinking	33	0.15 (0.08; 0.21)
– Alcohol-related problems		
Three to six months after intervention	19	0.11 (0.02; 0.20)
– Reduced amount of alcohol	12	0.11 (0.01; 0.22)
– Frequency of binge drinking	12	0.22 (0.12; 0.23)
– Alcohol-related problems		

Data from (21); *¹ 95% confidence interval in parentheses; d_{+} , weighted standardized differences between experimental and control group

BOX 6

German Federal model project HaLT ("Hart am Limit") (23)

- **Proactive HaLT**
 - Public information and awareness raising about the risks of binge drinking
 - Promotion of consistent implementation of the youth protection law through the formation of suprainsitutional advisory bodies
- **Reactive HaLT**
 - In emergency departments, adolescents are encouraged in "bridging interviews" to take up the offer of group or individual counseling in youth addiction counseling centers
 - Adventurous training activities such as climbing or diving can satisfy the desire for "on the edge" experiences in an organized framework ("the legal buzz")
 - Psychoeducational content about high-risk patterns of alcohol consumption and an individual "risk check" complete the intervention; in case of need, the patient can be passed on to further individualized help.

before the age of 15 are at four times the risk of developing alcohol dependence compared to those who do not start regular drinking until they are 20 (24). If we could shift the age at which drinking starts by 5 years, the risk of significant alcohol-related problems would drop by 50% (12).

Neurobiological perspectives

By increasing the effectiveness of the inhibiting neurotransmitter GABA (gamma-aminobutyric acid) and simultaneously reducing the activity of the stimulating neurotransmitter glutamate, alcohol consumption has a sedative effect that has a damping effect on cognitive and motor abilities. At the same time, alcohol use is associated with an increase in CNS activity in certain regions of the brain such as the limbic system. The release of endorphins and dopamine, both of which are effective neurotransmitters in the so-called reward system, is increased (13). Memory and learning functions are reduced via the alcohol-induced drop in glutamate activity and the reduced stimulation of a specific glutamate receptor (N-methyl-D-aspartate, NMDA), which is associated with improved learning ability and retentiveness. The repeated depression of the glutamate-NMDA system can lead to compensatory overexcitability of the NMDA receptors during phases of alcohol abstinence. The system, already impaired because of the NMDA overexcitability, is put under additional, potentially toxic stress by the increased glucocorticoid release triggered by each short-term withdrawal phase. Through this mechanism, episodic binge drinking can develop a neurotoxic effect. Verbal and nonverbal cognitive limitations and impairment of spatial orientation that outlast both the drunken state and the withdrawal ("hangover") can be the result (13).

Adolescents show brain maturation processes continuing beyond the age of 20. The prefrontal cortex and limbic system in particular (especially the hippocampus and amygdala) undergo increased myelination and restructuring of the synapses. It is assumed that these maturation processes make the adolescent brain susceptible to "neurotoxic stress." In adolescents, early onset of drinking and alcohol misuse over several years are associated with a subsequent reduction in volume of the hippocampus (14). Experimental studies in rodents have shown that compared to the adult brain, the adolescent brain is particularly sensitive to the effects of alcohol, and that irreversible neurodegenerative damage can be induced (15).

Brief motivational interventions

Adolescents tend to underestimate how drunk they are, and describe repeated excessive drinking as harmless. Even when from a medical point of view their pattern of consumption is unambiguously high-risk, they describe themselves as at most an "occasional party drinker." In most cases, medical treatment for alcohol poisoning at a hospital emergency department is their first contact with the support system. This "on the edge" brush with their own vulnerability in the setting of the emergency

department promotes a readiness to change the high-risk pattern of alcohol use, if the right intervention is used (16). Classical interventions such as individual counseling combined with psychoeducational elements and the offer of self-help groups are not reliable in effectively modifying drinking behavior, and in addition they are time-consuming and personnel-intensive. A more effective approach has been shown to be manualized brief interventions in one to four sessions lasting 30 to 60 minutes each, carried out by trained staff at the hospital. The interventions are carried out in accordance with a semistructured outline (manual) and using worksheets. Emphasis is laid on motivational interviewing techniques (17). These techniques were developed for highly ambivalent adult clients of the addiction support system. In this view, motivation is not a stable condition, but a changeable, interactive process that is strongly influenced by the style of the counselor/therapist. Characteristics of motivational interviewing are shown in *box 4*. According to a meta-analysis, the average effect size of motivational interviewing in the area of alcohol consumption in adults is moderate, and at 3 months after intervention it is $d = .41$ (d = effect; standardized difference between a group with motivational interviewing and a group without. A moderate effect is between .40 and .70) (18).

Various controlled studies have demonstrated efficacy of brief motivational interventions for adolescents and young adults treated in emergency departments for excessive alcohol consumption (17, 20). Some of the effects remained stable for 12 months (number of binge drinking events, mean blood alcohol concentration), but many target variables remained unchanged (alcohol-associated injuries, drink-driving). Elements of a brief motivational intervention are shown in *box 5*.

In a meta-analysis of randomized controlled intervention studies of the efficacy of brief interventions on binge drinking among college students in the USA, at various follow-up intervals, smaller effect sizes were shown (21) (*table 3*).

Among unmotivated adolescents, who took part in a brief intervention not of their own volition (e.g., as mandated by campus police), a brief motivational intervention proved superior to a standard intervention. Brief motivational interventions from the adult support system were adapted for adolescents, and to increase acceptance peers were included in the intervention setting. Brief interventions with two booster sessions were superior to the regular brief interventions. A preventive approach that incorporates the main part of the findings presented is the German project HaLT ("Stop"—also an acronym for Hart am Limit = "close to the limit" or "on the edge") (*box 6*) (22).

Conflict of interest statement

The authors declare that no conflict of interest exists according to the guidelines of the International Committee of Medical Journal Editors.

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Key messages

- The prevalence of binge drinking in adolescence remains at the same high level with a tendency to more frequent drinking events. Just under 60% of 15- to 16-year-olds have been drunk one or more times during the last month.
- Among these adolescents, diseases typically associated with alcohol, such as cardiovascular or digestive disorders, are less significant than immediate somatic complications of intoxication (e.g., aspiration of vomit, hypothermia).
- Of particular importance are risks related to alcohol-associated road traffic accidents, violent behavior (both victim and assailant, and including sexualized violence) or suicidal behavior.
- The risk of developing alcohol dependence increases with the frequency of binge drinking and early onset of a pattern of excessive drinking.
- In US studies, brief motivational interventions carried out in the same hospital that provides the emergency treatment have proved effective in preventing further binge drinking events and their associated negative consequences. There is a need for further research into how far these results are applicable to Germany.

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