

## Risks and interventions for adolescent alcohol abuse

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### ABSTRACT

Abuse of alcohol frequently causes neurological damage, and early use of alcohol significantly increases both structural and functional brain changes. Because of this impact, youth alcohol abuse needs to be considered in patients presenting with a range of neurological and psychiatric problems, including brain trauma, epilepsy, stroke, and neuropathies as well as psychiatric problems such as depression and anxiety. Early onset alcohol use has long-term detrimental effects on adult behaviour, health, and mood. This paper reviews empirical research on alcohol use in youth, what the key risks are, and what the major protective factors appear to be. This review also assesses when to intervene, where to intervene, who to target, what interventions have been proposed, and what may be the most effective. The conclusion is that youth abuse of alcohol is frequently overlooked by neurologists and other physicians. The best way to reduce such abuse is to provide universal interventions prior to development of significant alcohol use and abuse, ideally during the 12-14 year age period. While the most effective methods for prevention are not yet clear, they are likely to involve internet-based systems, and some already exist. Physicians and neurologists need to recognize how important prevention is to mitigate the major neurological and psychiatric impacts of alcohol abuse in youth, and actively support such preventative measures if

there is any realistic possibility of reducing the toll that alcohol abuse causes on developing brains.

**KEYWORDS:** alcohol abuse, adolescence, youth, brain, neurological, intervention, prevention

### INTRODUCTION

Consumption of alcohol is widespread in society and, while it is ubiquitous across human history for over 5,000 years [1], alcohol consumption has many major problems when abused. One of the primary reasons for this is captured in the following sentences: "Alcohol first effects the inhibitory centers of the brain, causing alertness; confidence; feelings of energy, warmth, and excitement; good mood; and dissipation of anxiety - a welcome, if temporary respite from stress and sadness. The disinhibition it causes accounts for its perennial popularity as a social lubricant at cocktail and dinner parties and romantic encounters" [2]. Nonetheless, alcohol use causes significant health and social problems. The World Health Organization reports that alcohol use single-handedly accounts for almost 4% of global health burden, with alcohol related deaths rising to a larger number than those caused by HIV, tuberculosis, or violence [3]. Alcohol abuse is often first seen in early youth, and the multitude of problems in this group have been identified in reports by several major groups, including the U.S. Surgeon General [4], who reports that adolescent alcohol use is a global problem with detrimental effects, and calls on the community to take action to minimize youth and underage alcohol consumption.

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Many neurological problems are significantly exacerbated by alcohol abuse. These include brain trauma [5], stroke [6, 7] and neuropathies [8, 9] as well as psychiatric problems such as depression [10, 11], anxiety [12] and suicide [13, 14]. Alcohol has also been found to increase mortality rates in conditions such as epilepsy [15]. Limitation of alcohol abuse may be an effective measure to reduce the incidence rates of these conditions.

Despite the long-standing awareness of the issue of alcohol abuse, only limited progress has been made to date in prevention, and most researchers indicate that underage drinking continues to be an important community health concern [4, 16-19]. The impacts include increased rates in many areas including drinking and driving, increased illicit drug use and abuse, acts of physical and sexualized violence, suicide and suicidal behaviour, criminality, and homicide [16-18, 20]. Other issues associated with alcohol abuse internationally include increased misuse of prescription drugs, and increases in the number of intentional injury-related behaviours [21].

There are a number of issues linked to the development of alcohol abuse, including poverty [22], normal developmental changes [4], genetic, social and psychological dynamics [23, 24], and the specific adolescent's social and cultural environments [16, 21, 25]. Other studies suggest alcohol use is determined by factors attributed to the individual (such as impulsivity, self-esteem, and childhood trauma) [23, 24], in conjunction with beliefs and opinions about external stimuli and environmental factors (such as familial and peer influences, social acceptability and availability) [24]. It is clear that youth abuse of alcohol leads to significant neurological impairments, with a recent review concluding that "these preventable and potentially reversible deficits may be progressive but if left unresolved such deficits eventually become major contributors to poor outcome (long term) and hamper adherence to treatment" [26]. Evidence also suggests that alcohol consumption in adolescents has other damaging long-term effects on maturing brains [4, 27]. These can manifest, in part, as a difference in maturational timing [4] where it is thought that limbic areas of the brain, (regulating

emotion and novelty seeking), develop before more self-regulatory areas in the frontal lobes [4, 25]. While questions remain as to the extent to which the brain is affected by alcohol, evidence appears to dictate that early onset alcohol use can be responsible for long-term impairments in cognitive and/or emotional processing [27].

Though it still remains uncertain as to which are the most important etiological issues in the development of alcohol abuse, a growing body of evidence has begun to show that intervention in youth does improve outcomes. Still, very few studies have demonstrated long-term benefits of intervention, and the question still remains regarding which interventions are the most effective in preventing adolescent alcohol use.

One of the reasons for this lack of clarity is uncertainty about the most appropriate age at which to intervene. Early-onset alcohol experimentation can begin as young as 9 years old [28], is often seen in youth aged 12 years old [4, 17], becomes more prevalent in youth aged 15-18 [16, 21, 23], and the age range from 18-20 boasts the highest alcohol dependency of any age group [4]. More recent suggestions, including those of the US Surgeon General [4], propose that interventions before the age of 15 are most appropriate since by that age approximately half of the US population has already had a full drink of alcohol.

Given these issues, it appears that intervening with youth to prevent subsequent alcohol abuse might reduce the well-recognized health and societal impacts. The goal of the present review is to examine the current evidence to help determine the most effective time and manner in which to intervene.

## **Risk and protective factors**

### **Risk**

As previously noted, there are many risk factors that have been shown to be involved in the development of alcohol disorders, and it is important to identify these in individual cases [17, 25, 29]. One factor is that problem-drinking among adolescents is often connected to binge drinking, frequently with a desire to get drunk as rapidly as possible, and it is also therefore

important to examine the quantity of alcohol consumed as an indicator of risk [17, 30]. Among the most commonly accepted risk factors are those supporting a key role for family and peer influences [16, 18, 19, 29-33]. Others have focused on strong suggestions of gender specific differences with regard to early alcohol use and abuse [17, 18, 29, 32, 34, 35].

Another promising topic for identification of those at risk for future alcohol use may be personality indicators [23, 29, 36, 37]. Some recent work has determined the personality factors that may contribute most to alcohol abuse include sensation seeking, impulsivity, anxiety, sensitivity, and hopelessness [18, 34, 38-44].

Another aspect of personality that may be relevant is aggression. The clear link between increased aggression with alcohol use has led to consideration of whether or not individuals who tend to be more aggressive are, in some sense, predisposed to consume alcohol more [45-47]. This “chicken or egg” remains unclear, i.e. does aggression cause drinking or does drinking cause aggression? Some have suggested that early aggressive behaviour predicts later alcohol use and alcohol-related aggression, and that aggressive individuals may be more likely to become heavy drinkers because of subcultural norms, situational context, self-medication, or to give themselves an excuse to act aggressively [47]. They suggested that antisocial behaviour is not only present in pre-alcoholics but also in children of alcoholics, and as a result some researchers have suggested early intervention in aggressive youth [46].

A final aspect of risk that needs consideration is that drinking is often viewed as a “rite of passage” for adolescent users [4], and furthermore that drinking is frequently enabled by adults in our culture, making it a more challenging belief to confront [48].

### **Protective factors**

In terms of alcohol abuse, protective factors are those that reduce the likelihood of developing problem behaviour, by mediating or moderating the effect of exposure to risk factors [49]. These can be divided into three main groups, genetic (predisposition), individual (personality and interpersonal), and environmental/contextual

(social and cultural) [50]. Unfortunately, with alcohol, the societal endorsement and acceptance of use make it more challenging to prevent early use, and the social acceptability may increase prevalence of use well into adulthood [2]. Increasing recognition of the personality factors involved in alcohol abuse (sensation seeking, impulsivity, anxiety, sensitivity, and hopelessness) allows these to be potentially recognized and targeted. Individuals with these personality factors may be the best targets for early intervention [18, 27, 34, 36, 38-40, 42-44]. Another group has suggested that youth with higher self-control of impulsive tendencies have a reduced risk of alcohol abuse, especially when detected early [51].

Several questions about prevention remain: how effective are these protective factors in eliminating drinking behaviour? Are they merely supports that help deter adolescent drinkers from developing alcohol use disorders, but not to stop drinking behaviour on the whole? And how do we utilize these protective factors in the context of intervention, if at all?

### **Interventions**

There is no doubt that adolescent alcohol use continues to be a concern among researchers, educators, parents and governments. What remains unanswered is how to reach this population and provide the most effective prevention strategies. One approach may include regulatory actions including more rigorous enforcement of the legal drinking age on behalf of the community at large [4]. Others suggest increasing taxes for alcohol, implementation of efficacious community programs aimed to prevent excessive drinking, and the development of a national media campaign aimed at the reduction of drinking behaviours in adolescence [17].

### **When to intervene**

Timing the intervention appropriately remains a critical consideration when determining the most effective prevention strategies. Adolescence is typically a time of exploration moving individuals toward autonomy, independence and transition, which is more often than not positive in nature [27]. During this period there are many changes in

on-going brain development [4, 25, 51]. Because the inhibitory control of the pre-frontal cortex is not completely developed at this stage of development [52], it is possible that for biological reasons adolescents may be at an elevated risk for the development of alcohol use disorders due to a more limited ability to control their alcohol use [25]. Ideally, therefore, the timing of any interventions should incorporate both social and biological factors.

Given that studies have suggested that there is no clear difference in the risk for youth aged 16-17 compared to young adults aged 18-20 [30], it suggests that any intervention occur prior to age 16. Another study suggests there may be heightened sensitivity to the neurotoxic effects of substances during adolescence, and recommends intervention prior to age 14, due to the increase in vulnerability to addiction when exposed at younger ages [27]. Other studies have supported this suggestion citing that use of alcohol, before age 14, is associated with an increased risk of future development of alcohol use disorders [17, 53].

Still others have suggested even earlier interventions, and propose that it may be possible to identify "delinquent behaviour" in individuals as young as 12-14 years old and recommend intervening prior to this age can prevent the youth's trajectory into a future of alcohol dependence [46]. When targeting this age range, studies have suggested that addressing self-control and attention problems in 12-year olds can reduce subsequent alcohol and drug-related problems [39].

As a result, the evidence to date suggests that individuals in the age range 12-14 may be the most appropriate target age group for intervention.

### **Where to intervene**

A number of investigators have suggested that school is the most appropriate place for both identification and intervention for those youth at risk of alcohol abuse [27, 46, 48, 50, 54, 55]. Others have suggested recognition and intervention in the home and in the community, utilizing both peer and parental support [18, 38, 56, 57]. Still others have suggested that medical settings become involved to help educate and moderate alcohol abuse in patients [4, 17, 18].

A more comprehensive intervention, involving an individual's family, school, and community, as well as government and policing bodies has been recommended in the US Surgeon General's report [4]. There are also questions about whether or not a harm-reduction approach is more appropriate than elimination of all alcohol use [18, 58].

Overall, the evidence supports a school-based approach as being the most feasible and cost-effective, possibly linked to an internet-based set of interventions.

### **Who should be the target for intervention?**

Since consumption of alcohol in youth is often characterized by binge drinking and drinking to get drunk, it has been suggested that youth who have been identified as problem drinkers, but who do not meet the criteria for dependence disorders, would be the most effective target population [20].

However, there is significant debate about whether it is better to target a select group of presumed high-risk individuals or to offer universal interventions. Selective or targeted intervention is often recommended due to its ability to address those most in need, and by offering the opportunity to individually tailor interventions [24]. Others have suggested that targeted intervention is more effective than universal intervention with regard to reducing alcohol misuse [22], and that this may be because targeted prevention programs change alcohol use by providing therapeutic interventions directly to the most at-risk population [22, 24]. There have been specific programs designed to provide such individualized programs, including Preventure, a school-based program designed to specifically target youth with known risk-factors for alcohol abuse [27, 54] and Climate Schools [50, 54, 55]. Both of these programs have recently been found to provide a long-term benefit of reduced problem drinking behaviour in adolescents. Additionally, the Preventure program has also been reported to reduce emotional effects such as depression [36].

In terms of the efficacy of universal programs the research to date is mixed. Some studies suggest that universal prevention programs are not very effective at preventing alcohol excesses in youth [23, 24], and that they may, in fact, increase

interest in substance abuse among youth with no prior experience with alcohol or drugs [59]. In contrast, others have suggested that universal interventions may have long-term effectiveness [33]. Reasons suggested for the lack of efficacy for some universal programs are firstly that they may have been instituted too late, i.e. that the youth were already engaging in high-risk behaviours, and secondly that because of the large numbers of individuals who do not end up abusing alcohol this reduces the perceived level of effectiveness even though large numbers of individuals may have been prevented from having alcohol problems subsequently [22, 24]. Taken together, it is clear that any intervention, universal or targeted, needs to be given early enough, and this suggestion is supported by findings that early intervention reduces the costs and occurrence of alcohol problems in youth [54]. It has also been suggested that universal intervention has the potential for highest public health benefits because it reaches a larger population [33].

In terms of subsequent drinking behaviour it appears that about 50% of problem drinkers in early adulthood can be characterized as “high-risk” [60]. This means that any program targeted only at this specific group, even if carefully characterized and very successful, would only address half of the population of problem drinkers in early adulthood. Therefore, universal intervention may be the only mechanism which has the possibility of minimizing subsequent problem drinking in both those at high-risk and in those who are not at high-risk in early youth (but who nonetheless subsequently develop alcohol abuse). This also appears to be the most cost-effective type of intervention. However, some programs have offered a combination of both targeted and universal programs, and claim that these may have the greatest overall benefits [22, 54]. This combination, nonetheless, is significantly more expensive than universal treatment and this factor may limit its applicability.

One other point to consider is whether or not parents should also be targeted, since the foundation of a child’s protective and risk factors for early onset substance use occurs in the home. For this reason it has been suggested that universal programs aimed at parents will also be

effective, especially if combined with school follow-up [33]. A study compared two such programs, Preparing for the Drug Free Years (now called the Guiding Good Choices program), and the Iowa Strengthening Families Program (now called the Strengthening Families Program for Parents and Youth: 10-14) and found that these programs were efficacious [61]. Thus, addition of involvement of parents is certainly warranted where resources allow this.

### **How to intervene**

It has been suggested that in order for a prevention program to be effective with youth, it must focus on critical transition times, dissuade negative peer influences, and endorse child/parent attachment, while supporting family supervision practices [61]. In contrast, others have suggested that to be effective, prevention programs in schools must appeal to their audience, be curriculum-based, user friendly, commercially attractive and require limited training and resources to implement [50]. Programs should also possess an interactive delivery, incorporate peer and social influence, teach competency and the ability to refuse drugs or alcohol, and will be most effective if approached from a harm reduction approach, rather than abstinence [55].

In terms of both screening and provision of programs, there is increasing support for implementing programs over the internet. This approach allows a large number of the desired characteristics of any interventions to be met, while also ensuring continuity of program content and delivery and easy updating capability [50, 55, 62]. Such approaches may also allow personalized feedback, depending upon the program. Other advantages include the benefit of minimal facilitator intervention, consistency of delivery of program content, the ability to reach a large and geographically dispersed population, and the ability to update and change information more easily, reducing cost to facilitators and researchers alike [27].

There is a gender difference in the early onset of alcohol use, with males far more likely to have alcohol abuse [17, 18, 29, 32, 34]. For this reason, there have been some suggestions that providing different interventions to males and females may

be appropriate given developmental and personality differences [35, 63]. Internet delivery would also allow different genders to receive varied information, as considered appropriate.

Taken together, it is clear that internet interventions (and screening as required) appear the most appropriate and cost-effective method to try and minimize subsequent alcohol abuse. The best methods for intervention, however, remain uncertain and future research is required to determine which specific methodology is most effective, and if this is sufficient alone or should be combined with other interventions in groups such as parents.

## CONCLUSION

This review suggests that abuse of alcohol by youth continues to be a major health and societal problem with significant negative outcome on a variety of neurological and psychiatric conditions. However, there remain large gaps in our knowledge about why this occurs and how best to prevent it. Current evidence suggests that the most appropriate, and cost-effective, intervention would be a universal intervention implemented to children ages 12-14 in a school setting. This would provide the opportunity to reach youth prior to the highest period of risk for development of alcohol abuse. An internet-based approach may be the most cost-effective. These ideas require appropriate testing in large community samples. Given the significance of this problem this should be a research priority.

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## CONFLICT OF INTERESTS

The authors report no potential conflict of interests.

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