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The association between alcohol misuse and suicidal behaviour

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Summary

Despite recent small reductions in overall suicide rates, rates among those aged 25-44 have remained high. Rising alcohol consumption may partly account for this and is often correlated with suicide rates, especially in the young. There is evidence to suggest alcohol misuse predisposes to suicidal behaviour through its depressogenic effects and promotion of adverse life events, and both behaviours may share a common genetic predisposition. Acute alcohol use can also precipitate suicidal behaviours through induction of negative affect and impairment of problem-solving skills, as well as aggravation of impulsive personality traits, possibly through effects on serotonergic neurotransmission. Effective interventions for problem drinking may help reduce suicide rates. At a public health level, reducing overall alcohol consumption may be beneficial, and the measures shown to be most effective in this regard are those that aim to restrict availability of alcohol.

Introduction

Suicide rates have increased globally by 60% over the past 45 years and it has been estimated to represent 1.8% of the total burden of disease in 1998 (World Health Organisation, 2005a). Despite a recent drop in overall suicide rates in the USA (World Health Organisation, 2004) and England and Wales (Office for National Statistics, 2005), rates in males aged 25-44 have remained relatively constant, or even risen, especially in Ireland and Scotland (Samaritans, 2005). It is the second most common cause of death in young males in most industrialised countries, and the most common in some (e.g. Ireland, Sweden). Possible reasons for this have included rising unemployment, drug misuse, increased availability of methods used for suicide, HIV infection, media exposure, family breakdown, lessened social integration, increase in psychiatric disorders, male reluctance to seek help, and greater acceptability of suicide as an option (Hawton, 1998). One of the more compelling is the relationship of alcohol dependence (and to a lesser degree, alcohol abuse) to suicide and suicidal behaviour. Although alcohol consumption among adults has fallen in most developed countries since 1980, it has risen in developing countries, countries of the former Soviet Union, and the UK and Ireland. Ireland, in particular, has seen consumption double since 1970 (OECD Health Data, 2005). Patterns of drinking have also changed, with young people being more likely to binge drink (Firel et al, 1999).

The relationship between alcohol misuse and suicidal behaviour can be conceptualised in a number of different ways. It can be examined from a perspective of biological, psychological or social effects, or it can be analysed by the temporal relationship between the use of alcohol and the suicidal behaviour. Terms such as “acute risk factors”, “potentiating factors”, “proximal risk factors”, “acute risk factors” and “precipitants” have been variously used to describe events temporally close to the actual suicidal behaviour. Other terms, such as “predisposing factors”, “constant-risk factors” and “distal risk factors” have been used to describe events more distant from the suicidal behaviour (Hufford, 2001). A distinction can also be drawn between suicide attempts and completed

suicide, as the characteristics of the two populations can be quite different, particularly in respect to gender. Therefore, this review will examine both types of suicidal behaviour, and will examine risk factors as *predisposing* or *precipitating*, even though the distinction between these can be sometimes arbitrary. For instance, on an epidemiological level, levels of alcohol consumption have frequently been shown to be associated with the suicide rate (Stack, 2000), but this association, if causal, can be seen as both predisposing and precipitating.

In this paper, the evidence for the link between alcohol misuse and suicide will be examined, then the evidence for, and reasons for, alcohol as both a predisposing and precipitating factor that may mediate this link. Finally, the implications for suicide prevention will be discussed.

Evidence for a link between alcohol misuse and suicide

This relationship, between per capita alcohol consumption and suicide mortality, is complex and varies internationally. In a review of literature on suicide, Stack (2000) found that 55 studies from 89 done, in 17 countries showed that the greater the alcohol consumption, the greater the suicide rate. The strength of the association varied considerably, with a one litre per capita increase in consumption associated with an increase in suicide of 2.6% in France and 16% in Norway. Ramstedt (2001) also found wide regional differences in Europe, with the suicide rate being more responsive to changes in alcohol consumption in low-consumption countries (i.e. Scandinavia) than medium or high-consumption (i.e. Mediterranean) countries.

In contrast, Makela (1996) found no significant effect overall, but did find that the suicide rate in those less than 50 years old was significantly associated with per capita alcohol consumption. A more significant association between alcohol and suicidal behaviour in younger age groups has also been shown by blood alcohol measurements in suicide attempters (Suokas and Lonnqvist, 1995), follow-up studies of alcohol dependent subjects (Preuss et al, 2003), and psychological autopsy studies (Pirkola et al, 2000). Ramstedt (2001) found that the association was stronger in younger people in northern and central European countries, the difference possibly being a more intoxication-oriented drinking pattern, and subsequently more binge drinking.

Most studies find that male suicide victims are more likely than females to have a history of alcohol misuse (Pirkola et al, 2000) or to have detectable blood alcohol at autopsy (Ohberg et al, 1996), one exception being the forensic study by Garlow (2002) which found no difference between men and women in the percentages of victims who were ethanol positive. It should, however, be pointed out that men have a higher prevalence of heavy drinking and intoxication than women in the general population, so a higher prevalence of alcohol misuse among male suicide victims may not reflect any particular susceptibility among men to suicide-promoting effects of alcohol. Indeed, Ramstedt (2001) found that female alcohol abusers committed suicide more often compared to women in general than did male abusers in comparison with men in general, and hypothesised that female alcohol abusers may be relatively more at risk of suicidal

behaviour because they are more exposed to social stigmatisation and weakened social integration than men.

Alcohol as a predisposing risk factor

That alcohol dependence is a significant risk factor for all types of suicidal behaviour would appear to be beyond dispute (Cornelius et al, 1995). The role of alcohol abuse alone is less clear, as some studies have failed to find an association between it and suicide (Lesage et al, 1994). Traditionally, it has been stated that the lifetime risk of suicide in those with alcohol dependence is 15%, with the risk being similar throughout the lifetime of the disorder. However, this figure has been challenged by Inskip et al (1998), who, using modern computerised curve modelling techniques, found the lifetime risk of suicide to be 7% in those with alcohol dependence, which is still considerably more than the risk for the general population.

In psychological autopsies in Northern Ireland and Finland respectively (Foster et al, 1997; Henrikssen et al, 1993) 44% and 43% of suicide victims were found to be suffering from alcohol abuse or dependence. Pirkola et al (1999), examined 106 adolescent suicides (13-22 years) found that 42% had an alcohol use disorder and these were more likely to have co-morbid mental disorders, antisocial behaviour, disturbed family backgrounds and life events.

In a prospective study, Rossow and Amundsen (1995) followed up 40,000 Norwegian conscripts over 40 years and examined the prevalence of alcohol abuse among suicides. The relative risk (RR) of suicide among alcohol abusers was estimated at 6.9. In contrast with epidemiological studies demonstrating greater risk in younger age groups, alcohol abusers aged 40 and over had a RR of 12.8 and those less than 40 years a risk of 4.5. The lifetime risk of suicide (before the age of 60 years) was estimated as 4.76% in those categorised as alcohol abusers. Alcohol dependence has also been found to be associated with attempted suicide, for example by Chignon et al (1998), who conducted a cross-sectional study examining 507 alcohol-dependent patients, and found that 25% had attempted suicide in their lifetime. The attempter group also had a younger age of onset of alcohol dependence.

Among those with alcohol use disorders, the severity of the disorder (as measured by heavier drinking pattern, alcohol-related medical problems, and duration of alcoholism) distinguishes alcoholics who die from suicide from those that do not (Conner and Duberstein, 2004).

Why is alcohol misuse a predisposing factor?

1) Comorbidity

The depressogenic effects of alcohol are well known (Regier et al, 1990) and where both conditions co-exist, the depressive illness can sometimes be identified as independent of the alcohol abuse, or may even pre-date it. It is clear, though, that when both disorders are present together, there is a greater risk of suicidal behaviour.

Chignon et al (1998) found that alcoholic suicide attempters were more likely to be depressed than non-alcoholic attempters. In another study of alcohol dependent patients, Driessen et al (1998) found that the greatest risk for suicidal ideation was in those who also had co-morbid anxiety and depressive disorders or personality disorders. Cornelius et al (1995) found that level of suicidality was the symptom which most strongly distinguished between depressed alcoholics and two other groups with depression and alcohol dependence alone. Other distinguishing factors were low self-esteem and greater impulsivity. In psychological autopsy studies, 89% of alcohol dependent suicides were found to have another psychiatric diagnosis by Foster et al (1997), with 25% of these having unipolar depression, and Henrikssen et al (1993) found 22% of alcohol-dependent suicide victims to have major depression.

There is also some evidence that the effects of alcohol on suicidal behaviour are not mediated through depression. In the US National Co-Morbidity Survey (Borges et al, 2000) it was found that alcohol and drug abuse predicted subsequent suicide attempts, but this relationship was independent of socio-demographic factors and co-morbid mental disorders. Also, Schuckit et al (1997) differentiated between substance-induced and independent depressive episodes in alcoholics, and found that 41% of alcoholics had had depressive episodes, with 26% being substance induced and 15% independent. Those who had independent episodes were more likely to have attempted suicide than those with alcohol-dependent episodes.

2) Adverse life events

Kendall (1983) and Lester (1992) have proposed that alcohol abuse leads to lowered self esteem, and ultimately increased risk of suicide, through a process of negative life events (such as marital separation and work problems), loss of social networks and social isolation. In a study of adult suicides, Pirkola et al (2000) found that 35% were alcohol misusers, and these were more often male, young, divorced, separated or recently unemployed. Preuss et al (2002) also found that current unemployment, separation or divorce distinguished alcohol-dependent individuals with a history of suicide attempts from alcohol-dependent individuals without such a history. In another study comparing depressed alcoholics with never depressed alcoholics, Roy (1996) found that the depressed alcoholics had more suicide attempts, but also more life events than the other group. It was proposed that life events are a risk factor for secondary depression in alcoholics. In particular, disruptions in interpersonal relationships are the most common

negative life event occurring before suicide in alcoholics (Duberstein et al, 1993; Heikkinen et al 1994).

3) Genetic predisposition

Alcohol misuse and suicidal behaviour may share a common genetic predisposition. Because of the evidence for serotonergic dysfunction in suicidal behaviour (Mann et al, 1999), genes involved in serotonin metabolism and regulation have been studied most. For instance, Nielsen et al (1998), using association and sib-pair linkage analysis of a polymorphism in intron 7 of the Tryptophan Hydroxylase gene, found significant evidence for linkage to suicidality, severe suicide attempts and alcoholism. This suggests that a variant in the TPH gene may predispose individuals to suicidality and other behaviours thought to be influenced by serotonin.

Another well-studied gene is the serotonin transporter gene (5-HTTLPR), a polymorphism of which has been associated with mood disorders (Collier et al, 1996), alcohol dependence (Sander et al, 1998) and increased risk for suicide attempts (Preuss et al, 2001). There is, however, much conflicting data about these associations, with Gorwood et al (2000), for example, confirming that the S-allele is associated with an increased risk for suicide attempts but not with alcohol dependence or comorbid depression.

Alcohol as a precipitating risk factor

The acute effects of alcohol intake have been implicated in suicidal behaviour as much as the chronic effects of alcohol misuse. Post-mortem studies have shown detectable blood alcohol in 28.3% of suicides in San Diego (Mendelson and Rich, 1993), 28.9% in Georgia (Garlow, 2002), 20% in the Netherlands (Hansen et al, 1995), and 35.9% in Finland (Ohberg et al, 1996), in significantly more males than females in the latter study. In a similar study, Ferrada-Noli et al (1996) detected blood alcohol in 45% of suicide victims, but only found organic signs of alcohol abuse at autopsy in 33%, suggesting that the presence of alcohol at autopsy reflected “incidental intake rather than habitual over-consumption”.

The Accident & Emergency Department provides an opportunity to assess the contribution of alcohol to suicidal behaviour, soon after an event, although this is complicated by variation in length of time between intake of alcohol, the suicide attempt, and estimation of blood alcohol concentration, if indeed it is measured at all (Cherpitel et al, 2004). The method used by investigators most often is to interview attempters after the attempt, and assess self-reported alcohol consumption. For example, Kolacinski et al (1997) estimated that 30% of suicide attempters had “acted under the influence of alcohol”, but only 6% of them were dependent on alcohol. Merrill et al (1992) found that 46% of patients admitted after self-poisoning had consumed alcohol within 12 hours of the attempt. Three studies directly measured alcohol consumption (Suokas and Lonnqvist, 1995; Borges et al, 1996; McMahon and McGarry, 2001) by blood alcohol

measurement or breathalyser estimates. These found a significant association between suicide attempts and recent alcohol consumption. These studies found that 51-62% of attempters had recently consumed alcohol, figures higher than in most studies using self-report measures.

Why is alcohol misuse a precipitating risk factor?

1) Intoxication and psychological distress

Alcohol has a biphasic effect on emotion, with low doses often ameliorating negative affect, but higher doses producing central nervous system depressant effects (Hufford, 2001). Many adults and adolescents believe alcohol can be used as a form of self-medication, but unfortunately this effect reverses itself at higher levels of intoxication (Pihl and Smith, 1983), and can precipitate suicidal behaviour. Borges et al (2000) found that alcohol's effects were mainly on suicidal ideation and unplanned attempts rather than planned attempts, thus lending more evidence to the theory that acute intoxication is more significant, in relation to suicide, than chronic abuse.

2) Constricted thinking/ impaired problem solving

Young suicide attempters have been found to have difficulties with problem-solving style (Rotherham-Borus et al, 1990) and constricted thinking (Leenaars et al, 1999). Inability to generate alternative solutions is particularly associated with suicide attempts, and this, and other stages of problem-solving, are likely to be interfered with by alcohol (Hawton, 1994).

3) Aggression/ impulsivity

It is probably not the case that all individuals with alcohol abuse and dependence are prone to suicidal behaviour, but what makes some more vulnerable are particular personality traits. Experimental, individual-level, and macro-level studies all support an association between alcohol and violence to others (Lipsey et al, 1997), which is probably causal, but very complex with regard to which individuals are susceptible and the degree of provocation that may be necessary. In the case of suicide, or violence to the self, those with more impulsive and aggressive traits are known to be at greater risk of suicidal behaviour (Plutchik and van Praag, 1989; Horesh et al, 1999; Greenwald et al, 1994). In particular, individuals prone to "reactive aggression" (i.e. impulsive, angry responses to perceived threats, often of an interpersonal nature) seem to be at increased risk of suicide (Dodge and Coie, 1987). This is evidenced by the consistent finding that a diagnosis of borderline (or emotionally unstable) personality disorder is a potent risk factor for completed suicide (Cheng et al, 1997; Foster et al, 1999). It is plausible to conclude that excessive alcohol consumption would exacerbate these traits, leading to a direct effect on suicide risk, but also one through an increased propensity for interpersonal disruption.

Suominen et al (1997) compared suicide attempters in four groups: those with depression, those with alcohol dependence, those with both, and those with neither. They found that those with alcohol dependence alone had had lower suicidal intent and were more impulsive than those with depression alone, again suggesting that impulsivity may be an important factor. Comelius et al (1996) studied a group of alcoholics with co-morbid major depression, and found a significant association between recent very heavy drinking and recent suicide attempts. They also found that the quantity of alcohol drunk was higher in those who had made a recent suicide attempt, but was not associated with suicidal ideation. They concluded that recent heavy alcohol use primarily affects suicidality by increasing the likelihood of acting on suicidal ideation rather than by inducing suicidal ideation per se.

4) Biochemical effects of alcohol

There is some evidence that the common denominator in this complex relationship between alcohol, aggression, impulsivity and suicide may be serotonergic dysfunction. This is suggested by:

1. Post-mortem studies, measurement of serotonin metabolites in CSF, and assessment of the prolactin response to fenfluramine have consistently shown that serotonergic dysfunction is present in those who complete and attempt suicide, independent of alcohol use (Mann et al, 1999).
2. A deficient serotonergic system is also implicated as a predisposing factor to impulsivity and aggression, with strong evidence of lowered CSF 5-HIAA (the major metabolite of serotonin) levels in those with a history of aggression, as well as suicide attempts (Brown et al, 1982; Traskman-Bendz et al, 1992).
3. As already mentioned, consumption of alcohol can promote aggression and impulsive actions (Bushman and Cooper, 1990). Impulsiveness has been found to be significantly higher in non-depressed alcoholic suicide attempters than in depressed non-alcoholic attempters (Suominen et al, 1997). Alcohol is known to have profound effects on the serotonergic system. For example, consumption of a moderate dose of ethanol (0.8 g/kg body weight, or roughly 2-2.5 pints of normal-strength beer) causes a decrease of 20% in cerebral serotonin (and its precursor, tryptophan) in the average social drinker, reflecting a reduction in total serum concentrations probably caused by activation of the enzyme tryptophan pyrrolase (Badawy et al 1995). Chronic alcohol use is also associated with upregulated 5HT₂ receptors, probably reflecting low 5HT function (Virkunnen et al, 1994). This is particularly true of the “Type II alcoholics” (Cloninger, 1987), usually men, who have an early onset of alcoholism, antisocial traits and high impulsivity, suggesting that serotonergic dysfunction may predispose to specific subtypes of alcohol dependence that may be associated with higher suicidal risks (Gorwood, 2001).

Badawy (1998) synthesized these links into the “serotonin deficiency hypothesis of alcohol-induced aggressive behaviour”, proposing that susceptible individuals exhibit a marked depletion of their brain serotonin after alcohol consumption, rendering them prone to aggression. Some support for this theory has been found in studies on non-aggressive subjects, but has not been examined in those known to be aggressive after alcohol consumption. Tryptophan depletion can induce a negative mood in normal subjects (Young et al, 1988), cause reversal of antidepressant-induced remission in patients with depression (Delgado et al, 1990), and increase aggressive responding to provocation (Pihl et al, 1995). The same mechanism could also lead to suicidal behaviour.

As well as serotonin, research has shown an effect of alcohol on monoamine oxidase activity (Hallman et al, 1996) and brain cholecystokinin receptors in rats (Harro et al, 1994) which have both been found to be affected in those who attempt and complete suicide. However, these may merely function as markers of suicidal activity, rather than having any causal effect.

Conclusions

Although the link between alcohol misuse and suicidal behaviour is robust, this relationship is very complex. The long-term effects of alcohol misuse are probably mediated through interrelated effects on mood and social processes. Those not actually dependent on alcohol are at risk through the short-term effects of alcohol on mood, cognitive processes and impulsivity. Young people appear to be particularly susceptible to alcohol-associated suicidal behaviour, and the pattern of drinking, especially binge-drinking, may be of relevance. Conner and Duberstein (2004) have proposed a conceptualisation of suicide among alcoholics that includes aggression/impulsivity, alcoholism severity, hopelessness and negative affect as predisposing factors, and interpersonal life events and depression as precipitating factors.

Much needs to be done to elucidate what determines the risk for an individual, whether it is the amount consumed, the pattern of drinking, certain personality traits, psychiatric comorbidity, or genetic predisposition.

Implications for suicide prevention

As already stated, national suicide rates tend to rise with greater per capita consumption of alcohol. It has also been shown that reducing levels of consumption can lead to reduced overall suicide rates in Scandinavia, and Canada (Smart and Mann, 1990). In the former USSR, from 1984-1990, the political process of *perestroika* (restructuring), with much stricter controls on alcohol and raised prices, led to significantly lower alcohol consumption. During this time the suicide rate fell by 32% for men and 19% for women, compared to decreases of 8% and 17% respectively in 22 other European countries (Wassermann and Varnik, 1998). Of course, this association is not necessarily causal, but coupled with the evidence of an effect of alcohol misuse on suicidal behaviour, it does

suggest that prevention and appropriate treatment of alcohol misuse can be a key factor in reducing suicide rates.

Public health measures that have been shown to be most effective in limiting alcohol misuse include taxing alcoholic beverages, restricting consumption, enforcement of stricter drink-drive laws and interventions aimed at servers of alcohol (Jernigan et al, 2000). Birckmayer and Hemenway (1999) examined the suicide rate in those aged 18-20 in the United States, and found the rate to be 8% higher in states where the minimum legal drinking age was 18, compared to 20 years of age. They estimated that lowering the drinking age to 18 in all states would lead to 125 more suicides per year in the 18-20 age group. A more restrictive policy is “selective prohibition” (Watt and Naidu, 2002), whereby those with a history of alcohol-related violence are prohibited from buying alcohol. Those at risk of mental health problems (including suicide) could voluntarily opt in to this scheme.

The Surgeon General’s Call To Action To Prevent Suicide (U.S. Public Health Service, 1999) places much emphasis on the role of substance abuse, including raising awareness of resources for assessment and treatment of substance abuse disorders, improving the ability of primary care providers to recognise and treat them, and eliminating barriers to their treatment in insurance programmes. A Cochrane review (Dinh-Zarr et al, 2003) concluded that interventions for problem drinking may reduce injuries, including suicide and suicide attempts, although the exact effect size was difficult to ascertain. Because of the high levels of co-morbidity with alcohol use disorders, treatment must have a broader scope. It has been estimated that more effective treatment of depression, alcohol-related disorders and schizophrenia could reduce suicide rates by about 20.5% (Bertolote et al, 2003).

The World Health Organisation (World Health Organisation, 2005b) suggests that measures to restrict availability and consumption of alcohol (e.g. increased taxes and restrictions on the hours of sale) are the best way to reduce the alcohol-related burden, but also emphasises that policies should be guided by local considerations, such as patterns of drinking. A recent relaxation in the licensing laws in England and Wales, allowing some premises to serve alcohol 24 hours a day, does not follow this reasoning, and has been criticised by the Royal College of Physicians, Police Federation and the British Association for Emergency Medicine (The Guardian, 23rd November, 2005). Whichever strategies are adopted, they need to be comprehensive, involving mental health professionals, health promotion agencies and general practitioners, and they particularly need the support of government and those who are involved in the alcohol industry to prevent the public receiving mixed messages on the subject of alcohol.

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Declaration of Interest

None

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