

Are Some Drinkers Resistant to Hangover? A Literature Review

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Abstract: To assess the incidence of hangover we: (1) reviewed the experimental and survey literature; (2) performed secondary analyses on two large population surveys; and (3) calculated the incidence of hangover among young adults participating in several randomized trials we conducted on the aftereffects of heavy drinking. Survey data included adults admitted for alcohol detoxification, community adults who ever got “tipsy” or “high”, adolescents in high school who ever drank heavily, adults who drank heavily in the past 12 months, and university students. Most of the experimental trials brought participants to intoxication. The consistency of findings across study designs, populations, and referenced time period suggests that around 23% of the population may be resistant to hangover. Since propensity for hangover may affect drinking patterns, further research on the consequences and predictors of hangover insensitivity is warranted.

Keywords: Alcohol, hangover, aftereffects, heavy drinking, intoxication, drinking problems.

INTRODUCTION

Hangover is validly defined by symptoms including headache, nausea, thirst, and fatigue (see Rohsenow *et al.*, 2006). The causes of hangover are unknown, although etiological hypotheses have been proposed and reviewed elsewhere [1-3]. Since cognitive and physical impairment can occur the day after heavy drinking in the absence of these symptoms, we use the term “hangover” to refer to the cluster of physical symptoms people attribute to excessive drinking and we use “residual effects” to refer to the broader array of outcomes the day following heavy drinking.

There is a small body of literature on the residual effects of heavy drinking on next-day neurocognitive and occupational performance [4-20]. There are fewer studies that focus on the incidence of hangover in the general drinking population. The question of whether the propensity for hangover varies across individuals exposed to comparable amounts of alcohol is relatively unexplored. This latter question is of interest because hangover insensitivity may affect the likelihood of progression to problem drinking. To explore the question of variations in propensity for hangover, we examined published surveys that report on the experience of hangover for various drinking populations and time referents (last time drank excessively, previous year, ever), and the experimental literature reporting on the incidence of hangover among participants to whom alcohol had been administered.

METHODS

We employed several methods to conduct this review. First, we reviewed the literature using bibliographic search engines (e.g., Medline) with the key words: hangover, alcohol after effects, alcohol residual effects. This search yielded surveys that included questions on the experience of hangover among various populations and experimental studies

involving alcohol administration that also reported on hangover incidence among participants. Second, we analyzed datasets from population surveys of drinking practices to calculate the incidence of hangover for respondents whose drinking behaviors put them at risk for hangover. Third, we used data from our own alcohol administration studies on the residual effects of moderate/heavy drinking on next-day neurocognitive and occupational performance and hangover.

RESULTS

Survey Studies

We identified four relevant survey studies: one of alcoholics; two of college students; and another of adults residing in a rural Michigan community. Additionally, we analyzed data from two other surveys, one of a national sample of adolescents and the other of a national sample of US adults.

Pristach, Smith, and Whitney [21] administered a drinking history questionnaire to 43 problem drinkers immediately prior to detoxification at an in-patient alcoholism treatment service. Despite chronic heavy drinking, 50% reported no hangover in the previous year and 23% reported never having experienced a hangover.

As part of the Tecumseh Community Health Study [22], Harburg, *et al.* [23] studied the incidence of hangover and withdrawal symptoms in a random sample of adults residing in a rural Michigan community. Questionnaires on drinking practices were sent to 2,272 individuals, of which 1,679 (74%) responded. Drinking respondents were asked whether they had experienced any of a list of 8 symptoms after “the last time they had more to drink than intended or got drunk.” Past drinkers who no longer drank (N=191), lifetime abstainers (N=215) and persons who said they drank but never got “tipsy, high or drunk” (N=162) were eliminated from analysis. Although the symptoms included some that have not been validated for hangover (e.g., blackout), 23% percent of men and 23% of women reported experiencing none of the symptoms.

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Slutske *et al.* [24] surveyed college students regarding their previous-year hangover experience. Thirteen percent of 1,216 participants reported none of 13 individual symptoms, although some of these symptoms (e.g., thirst, dehydration) could occur in the absence of previous day drinking. Verster [25] surveyed a sample of 500 Dutch university students, of which 462 (92.4%) completed drinking questionnaires. Of those who drank alcohol (n=429), 149 (35%) reported not experiencing a hangover in the previous 12 months.

We analyzed Waves 1 and 2 of the National Longitudinal Survey of Adolescent Health (Add Health), a school-based, longitudinal, nationally representative survey, to determine the percent of respondents who drank ≥ 5 drinks on one drinking occasion (≥ 4 if female) who had experienced hangover. The sample was selected first through a stratified random sample of all schools in the United States, and next through a group of 27,000 from a core sample of each community, including selected populations which were over-sampled [26]. Subjects who responded to two waves were included in this analysis (n=14,208). Respondents were in grades 7-12 during the time period of September 1994 to August 1996. Respondents were asked the number of times they were "hung over" in the past 12 months. Of respondents who ever consumed five (four if women) or more drinks on a single drinking occasion in the past 12 months at both time points (n=1,676), 22.3% did not experience hangover at either time point (n=369).

We also analyzed the 2001-2002 National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), a national survey of 43,093 non-institutionalized adults ages 18 and older [27]. NESARC did not ask specifically about hangover but it did ask respondents who reported ever consuming alcohol (n=34,827) whether they had experienced "bad aftereffects that people may have when the effects of alcohol are wearing off" in the past 12 months or ever. Three of the bad aftereffects (nausea, rapid heart beat, severe headache) are similar to the validated items from studies of experimental induction of hangover [28], and other items are typical of withdrawal, including: trouble falling or staying asleep; shaking; anxiety; unusual restlessness; and sweating. Of those who had ever consumed ≥ 5 drinks in a single day (≥ 4 for women) in the past 12 months, 26.7% had not experienced any of the bad aftereffects. Of those had ever consumed that much alcohol, 20.4% had not experienced any bad aftereffects.

Thus, across the six survey studies, a mean of 23.6% (range: 13% - 35%) of drinkers, or heavy drinkers, reported not having experienced hangover symptoms during varied time periods. This range included adolescents, episodic heavy drinkers, and problem drinkers.

Experimental Studies

Few experimental studies have reported on the incidence of hangover the day after controlled experimental alcohol administration. We located five published studies and present data from our own research.

Verster *et al.* [29] administered ethanol (1.4 g/kg body weight) or placebo to 48 healthy volunteers. Of the 24 receiving ethanol, all reported hangover the next morning. Myrsten, *et al.* [30] administered alcohol (1.43 g/kg body weight) to 12 healthy males, of which 2 (16.7%) reported

hangover. Linkola, *et al.* [31] administered alcohol to 7 healthy men, of which 4 (57%) reported no hangover. Sainio *et al.* [32] administered alcohol (1.75 g/kg body weight) to 27 healthy men, of which 1 (3.7%) reported no hangover.

Chapman [1] administered beverage alcohol to 91 (50 males, 41 females) healthy young adult occasional or moderate drinkers. Ten received 1.0 ml/kg of alcohol (mean peak BrAC: 0.066 g%); 10 received 1.25 ml/kg (mean peak BrAC: 0.11 g%); 60 received 1.5 ml/kg (mean peak BrAC: 0.13 g%); and another 11 received 1.75 ml/kg (mean peak BrAC: 0.14 g%), with a mean BrAC across participants of 0.129 g%. Thirty-two percent of participants reported no hangover the next morning.

Howland *et al.* [33] combined data from three crossover studies on the effects of an evening of heavy drinking on next-day neurocognitive and/or occupational performance. Under the alcohol condition, 172 participants received beverage targeting 0.10 or 0.12 g% BrAC (mean achieved BrAC = 0.115 g %). After an 8-hour opportunity for sleep, participants were awakened, received breakfast, and completed a questionnaire that included rating severity of hangover and 8 related symptoms on Likert-type scales [20]. Twenty-four percent of participants reported no hangover (0 on the hangover severity question), with no gender differences.

Across the six experimental studies, 78 of 333 (23.4%; range: 0% - 47%) participants to whom alcohol was administered reported no hangover.

DISCUSSION

Despite variations in study design, populations, and time referred, there was striking consistency in the proportion of exposed populations who report not experiencing hangover. Clearly, the likelihood of hangover following a given drinking occasion is related to the peak blood alcohol concentration achieved on that occasion. (Although Chapman's [1970] data suggest that this relationship may not be linear.). Nonetheless, it is probable that other factors may also contribute to hangover incidence. These factors could be classified as: characteristics of the beverage(s) consumed; characteristics of the drinking occasions; and characteristics of the individual.

With respect to characteristics of beverages, such as congener content, evidence is mixed. Pawan [34] administered to each of 20 male participants alcoholic beverages (red wine, white wine, rum, whiskey, gin, vodka, and brandy), at 1.5 ml ethanol/kg body weight, that varied across sessions in congener content. Hangover effects the next morning were proportional to congener content, with brandy yielding the most severe effects and vodka yielding the least. Comparing high congener bourbon to low congener vodka, Chapman [1] found more severe hangover among study participants receiving 1.5 ml of ethanol per kg of bourbon than among those receiving comparable amounts of vodka, although this difference was not apparent at lower doses of ethanol. Howland *et al.* [33] did not observe significant differences in hangover incidence when study participants received bourbon, 7.2% beer, or vodka when targeted BrAC was 0.10 - 0.12 g%. Thus, there is not compelling evidence to support the notion that the incidence of hangover simply reflects beverage congener content.

Table 1. Summary of Findings

Investigators	Study Type	Population Studied	Time Referent	% Without Hangover
Pristach, <i>et al.</i> (1983)	Survey	43 alcoholics	Past year Ever	50% 25%
Harburg <i>et al.</i> (1993)	Survey	Community rural adult drinkers	Last time drank too much	23%
Slutske, <i>et al.</i> (2003)	Survey	Drinking university students	Past 12 months	13%
Verster (2006)	Survey	Drinking university students	Past 12 months	35%
Calculated by authors from ADD Health data	Survey	Adolescents who drank heavily at least 1 time in 4 years	Past 4 years	23.3%
Calculated by authors from NESARC data	Survey	National sample of drinking adults	Heavy drinking past 12 months Ever	26.7% 20.4%
Summary of surveys: Mean % of drinkers without hangover				23.6%
Verster, <i>et al.</i> 2003	Experimental Alcohol Administration	Healthy males and females	Day after alcohol administration	0%
Myrsten <i>et al.</i> 1980	Experimental Alcohol Administration	Healthy Males	Day after alcohol administration	16.7%
Linkola <i>et al.</i> 1979	Experimental Alcohol Administration	Healthy Males	Day after alcohol administration	47%
Sainio <i>et al.</i> 1976	Experimental Alcohol Administration	Healthy Males	Day after alcohol administration	3.7%
Chapman (1970)	Experimental Alcohol Administration	Young adults	Day after alcohol administration	32%
Howland <i>et al.</i> In press	Experimental Alcohol Administration	Young adults	Day after alcohol administration	24%
Summary of experimental studies: % of all participants, who received alcohol, without hangover				23.4%

We could find no literature that examined the effects of drinking circumstances on hangover incidence. Factors that might be investigated include: whether the occasion involved drinking alone or with others; whether a social drinking event was convivial or discordant; food consumption prior to, during, or after drinking; tobacco use while drinking; concomitant medications or illegal drugs; exercise while drinking (e.g., dancing); and pre-drinking mood and fatigue status.

Several individual characteristics could be related to hangover insensitivity. In a cross-sectional study of college students, Earleywine [35] found that personality risk for alcoholism, as measured by the MacAndrew Scale [36], significantly predicted respondents' reported frequency of hangover symptoms experienced over the previous year, after controlling for gender, average drinks per occasion, and paternal alcoholism. Harburg *et al.* [23], in their community survey, found that several personality traits predicted hangover incidence and that these traits appeared in regression analysis more important than the amount of alcohol consumed. In a survey of college students, Newlin and Pretorius [37] found that sons of alcoholic fathers reported experiencing more frequent and severe hangover than sons of non-alcoholic fathers. Wall *et al.* [38] found that among a sample

of white college students, those with a certain alcohol dehydrogenase polymorphism (ADH 1 B*2) experienced more severe hangover than those without this allele. Thus, incidence of hangover might reflect the distribution of individual personality, familial or genetic traits in the population.

None of the studies we located was designed to test a hypothesis about resistance to hangover and thus the evidence we present is by nature speculative. Given Schuckit's [39] evidence that insensitivity to alcohol's effects predicts subsequent onset of alcoholism, it is possible that resistance to hangover is part of general alcohol insensitivity and thus a risk factor. Alternatively, as Earleywine [35] suggests, hangover might induce drinking to mitigate symptoms, thus increasing problematic drinking.

It would be important to investigate the degree to which alcohol insensitivity predicts later problem drinking and individual difference factors related to hangover. The purposes of this brief communication, therefore, are to frame the question in hopes of stimulating further research on predictors and long-term consequences of hangover insensitivity and encourage investigators to report the incidence of hangover using a standard metric (e.g., none, mild, moderate, severe).

Learning Objectives:

- Survey and experimental alcohol administration studies suggest that a proportion of the population may be resistant to hangover.
- Resistance does not appear related to beverage congener content.
- Resistance may be related to personality and/or familial traits, including genetics.

Future Research Questions:

- Is there a hangover resistance subpopulation?
- If so, what factors predict this characteristic?
- Does hangover resistance affect drinking patterns?
- Is hangover resistance a transient or stable individual trait?

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