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Heavy Alcohol Use Among Suicide Decedents Relative to a Nonsuicide Comparison Group: Gender-Specific Effects of Economic Contraction

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Abstract

Background—The primary objective of this gender-stratified study was to assess the rate of heavy alcohol use among suicide decedents relative to a nonsuicide comparison group during the 2008-09 economic crisis.

Methods—The National Violent Death Reporting System and the Behavioral Risk Factor Surveillance System were analyzed by gender-stratified multiple logistic regression to test whether change in acute intoxication (blood alcohol content ≥ 0.08 g/dl) before (2005-07), during (2008-09), and after (2010-11) the Great Recession mirrored change in heavy alcohol use in a living sample.

Results—Among men, suicide decedents experienced a significantly greater increase (+8%) in heavy alcohol use at the onset of the recession (AOR=1.15, 95% confidence interval [CI]=1.10-1.20) (relative to the pre-recession period) than did men in a nonsuicide comparison group (−2%). Among women, changes in rates of heavy alcohol use were similar in the suicide and nonsuicide comparison groups at the onset and after the recession.

Conclusions—Acute alcohol use contributed to suicide among men during the recent economic downturn. Among women who died by suicide, acute alcohol use mirrored consumption

in the general population. Women may show resilience (or men, vulnerability) to deleterious interaction of alcohol with financial distress.

Keywords

Suicide; Alcohol; Gender; Recession

INTRODUCTION

The world economy contracted sharply during 2008 and 2009. As mentioned in our previous research (Kaplan et al., 2015), although there is considerable evidence regarding the impact of contracting economies- especially levels of unemployment- on suicide mortality risk (Barr et al., 2012; Brenner, 1973; Luo et al., 2011; Maki and Martikainen, 2012; Phillips and Nugent, 2014), less is known about the role heavy alcohol consumption plays in the link between the economic conditions and suicide risk. Caan (2009) suggested that alcohol use could be the missing link between unemployment and suicide.

In the general population, economic recessions have been associated with declines in overall alcohol consumption (LaVallee and Yi, 2012, Ruhm and Black, 2002) as well as with increases in heavy alcohol use and related problems, particularly among those directly affected by the contraction (Davalos et al., 2012). This overall increase in high-risk drinking or heavy alcohol use (as defined below) during the 2008-09 economic crisis might explain the rise in alcohol-related suicides during a period when overall alcohol use declined.

Results from the literature show that the fraction of suicide decedents who were intoxicated increased during the recent economic contraction, with most demographic (age, gender, and racial/ethnic) groups adversely impacted (Kaplan et al., 2015). Male suicide decedents showed increased risk of alcohol intoxication within the first 2 years of the recession, whereas there was a lag effect among female suicide decedents, who had increased risk of intoxication in 2010-11. Equally important was that the increase in the prevalence of alcohol-involvement in suicides exceeded the rise in the overall suicide rate in the United States during the 2008-09 recession (Kaplan et al., 2015)

To address the issue of the contribution of alcohol to suicide during the 2008-09 economic crisis, this study used a natural experiment that capitalized on the U.S. National Violent Death Reporting System (NVDRS) and supplemented with data from the Behavioral Risk Factors Surveillance System (BRFSS) to ascertain the relative risk of acute alcohol use and intoxication among male and female suicide decedents during the recent economic recession.

MATERIALS AND METHODS

Study populations

Data for suicide decedents ages 20 years and older were obtained from the NVDRS. The NVDRS is a unique active surveillance system that provides detailed accounts of violent deaths that occur in the participating U.S. states (Karch et al., 2012). As of 2005, 16 states (Alaska, Colorado, Georgia, Kentucky, Maryland, Massachusetts, New Jersey, New Mexico,

North Carolina, Oklahoma, Oregon, Rhode Island, South Carolina, Utah, Virginia, and Wisconsin) contributed data to the NVDRS. These analyses were restricted to 2005-11 period using the 16 states. The data were gathered from coroner/medical examiner (C/ME) records, police reports, death certificates, and crime laboratories (including postmortem toxicology information).

Suicide decedents were identified as those with death certificates that listed International Classification of Diseases, 10th Revision, codes X60-84 or Y87.0 (World Health Organization, 1996). A detailed description of the sample characteristics appears elsewhere (Kaplan et al., 2013, Karch et al., 2012). Pooled 2005-11 NVDRS data yielded a total of 65,908 suicide decedents, including those tested and not tested for alcohol.

Nonsuicide comparison group

Subjects participating in the 2006-11 BRFSS were used as the comparison group. The BRFSS is conducted by states in coordination with the U.S. Centers for Disease Control and Prevention and is designed to be both state and nationally representative (Centers for Disease Control and Prevention, 2011). Computer-assisted telephone interviewing was used to assess binge drinking (hereafter referred to as “heavy alcohol use”). Respondents were asked, “Considering all types of alcoholic beverages, how many times during the past 30 days did you have 5 (for men)/4 (for women) or more drinks on an occasion?” Those reporting at least one occasion were considered heavy drinkers, whereas abstainers, non-monthly drinkers, and non-heavy drinkers were considered non-heavy users.

The BRFSS was chosen because state-specific data were available and the analysis could be restricted to the 16 states in the NVDRS. The 2005 BRFSS was not included because there was a change in the definition of binge drinking for women, reducing the threshold from 5 or more drinks to 4 or more drinks in a day. The pooled 2006-11 BRFSS in the 16 NVDRS states yielded 811,832 respondents aged 20 years and older. The objective of this study was to compare the change in heavy alcohol use over time in the suicide and nonsuicide samples. Thus, the alcohol consumption measures allow for comparison of population drinking patterns over time. Of course, the baseline and follow-up measures do not pertain to the same individuals. Nonetheless, the comparability over time in the identification of heavy occasions can be employed to evaluate relative changes in heavy drinking between decedents and living subjects during the economic crisis.

Study variables

For the NVDRS sample, the main dependent variable in the analysis was a blood alcohol concentration (BAC) at or above the legal limit for intoxication while driving in the United States (BAC $\geq$ 0.08 g/dl) versus below the limit (BAC $<$ 0.08 g/dl) (US Department of Transportation, 2015) at the time of death. The BAC variable is part of the C/ME toxicological investigation. In the 16 states studied, 69% of male ($n = 35,355$) and 73% of female ($n = 10,427$) suicide decedents were tested for alcohol.

BAC levels were first coded as a continuous measure in terms of weight by volume, and then classified as < 0.08 g/dl or ≥ 0.08 g/dl (National Institute on Alcohol Abuse and Alcoholism,

n.d.). To determine the effect of a higher cutoff point, a sensitivity analysis was performed using BAC 0.12 g/dl (data not shown), yielding similar results.

Sociodemographic variables, obtained from death certificates or interviews, included gender, age group (20-44, 45-64, and 65 years and older), and race/ethnicity (white, Black, American Indian/Alaska Native [AI/AN], Asian/Pacific Islander [Asian/PI], and Hispanic). Educational attainment, a measure of socioeconomic status, was classified as less than 12 years, 12 years or more, and a “missing” category (which was added to control for the effects of missing information). Economic contraction periods were defined as 2005-07 (before the economic downturn), 2008-09 (during the downturn), and 2010-11 (after the downturn). The pre-recession years were pooled as baseline to maximize statistical power. Mental health status in the BRFSS refers to participants who reported 14 or more days (Moriarty et al., 2003) in response to the following question: “Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?” In the NVDRS, decedents with mental health problems were those with evidence of being depressed at the time of death and/or evidence of a mental illness diagnosis. Ethics approval for the study was obtained from the Institutional Review Board at the University of California, Los Angeles.

Statistical methods

The fraction of decedents with a BAC 0.08 g/dl and the fraction of interview respondents with heavy alcohol use were estimated prior to, during, and after the downturn. Hereafter, decedents with BAC 0.08 or living subjects classified as heavy drinkers are referred to as “heavy alcohol users.”

Logistic regression models tested whether there was a difference between the NVDRS decedents and BRFSS sample in changes in the proportion of subjects classified as heavy alcohol users as measured before the economic crisis versus during and after the crisis. Models were stratified by gender, age, and race/ethnicity. The dependent variable was heavy alcohol use. Interaction terms between economic contraction periods (with 2005-07 as the referent category) and vital status (suicide versus nonsuicide as the referent) were included in the models to test whether the change in consumption varied among decedents relative to living comparison subjects (estimates are ratios of odds ratios). Models controlled for state of residence, educational attainment, and mental health problems. Estimates and standard errors were weighted to reflect the BRFSS complex sampling design and adjusted for nonresponse and poststratification using SAS Proc Surveylogistic (SAS Industries Inc., Cary, NC). In the analyses, weights, response, and poststratification parameters for NVDRS were constructed to reflect complete data.

RESULTS

Numbers of cases by characteristics, economic contraction periods, and vital status appear in Table 1. Rates of heavy alcohol use in the living sample and alcohol intoxication (BAC 0.08 g/dl) among suicide decedents during the study years appear in Table 2. Results show that among males in the living sample heavy alcohol use decreased by 2% during the downturn for most age and race/ethnic groups, but then increased by 12% in 2010-11

relative to 2008-09. For female living subjects, there was a small rise during the recession and then a larger increase after the recession. The prevalence of alcohol involvement in suicides increased for both genders and most age and race/ethnic groups. The increase occurred during the recession (2008-09) for male suicide decedents. Of note, annual numbers of male suicides increased from 4,869 to 5,209 or 340 deaths per year. The rise in heavy drinking among male suicide decedents could account for roughly 44 deaths per year among men in the NVDRS states. The increase was delayed until after the recession (2010-11) for female suicide decedents.

Table 3 presents interaction terms between vital status (suicide versus nonsuicide) and economic contraction periods. The logistic regression models showed that male suicide decedents experienced a significantly greater increase than living men in heavy alcohol use at the onset of the recession (relative to the pre-recession period). This finding was observed among males in all age categories and in all race/ethnic groups except for Asian/PI men (for whom the interaction term was not statistically significant).

Overall for women, there was no statistically significant difference in the change in heavy alcohol use both at the onset and after the downturn between the living sample and the suicide cases. However, older and Hispanic female suicide decedents were more likely than their living counterparts to be classified as heavy alcohol users at the onset of economic downturn.

DISCUSSION

Heavy alcohol use rose during the 2008-09 economic contraction and may have been a notable risk factor for suicide. Results for men show that alcohol involvement increased among decedents beyond the general population increase in heavy drinking, emphasizing the heightened importance of acute alcohol use as a risk factor for suicide among men during economic crises. The present study suggests that men may be at a heightened risk for alcohol-related suicide during economic contraction.

Creative alcohol control policies might reduce this risk. Several control measures have been shown to reduce alcohol-related harm and are relevant to curtailing alcohol-related suicide (Babor et al., 2010, Cook, 2007). For example, there are public health benefits from policies related to alcohol pricing, such as raising taxes (Cook, 2007), raising minimum (floor) prices (Stockwell et al., 2012), and pricing beverages according to alcohol content (i.e., concentrations of ethanol). Long hours of sale and high density of alcohol outlets (Giesbrecht et al., 2015, Popova et al., 2009), indicating easy access to alcohol, also may be important, if impulsive buying contributes to suicide during economic downturns.

Not only are alcohol control policies important, but equally so is investing in the public health and social welfare infrastructure to minimize the adverse effects of future economic downturns such as high unemployment and associated material deprivation (Cylus et al., 2014). For example, Scandinavian countries averted public health problems experienced by other countries (such as the United States) via generous social protection that de-escalated the health and social effects of the recent global economic shock (Norstrom and Gronqvist,

2015). More specifically, Sweden exhibited no marked increase in total suicide rates during the global 2008-09 economic crisis (Reeves et al., 2014). Three factors may have contributed to mental health resilience during the economic recession in Sweden. First, effective mental health treatment may have moderated the impact of the economic shocks on suicide by controlling depression associated with financial uncertainty. Second, active labor market programs may have helped the unemployed find work while providing other forms of support. Third, greater gender equality in the workplace may have attenuated the mental health risks of the economic shock.

Women appeared to be less vulnerable than men to the combined effects of heavy alcohol use and economic contraction. A recent epidemiological analysis suggests that stronger social network structures among women may have buffered them against the adverse interaction of drinking and financial distress (Tsai et al., 2015). On the other hand, previous work (Kaplan et al., 2014) has suggested that acute alcohol intoxication is an even greater suicide risk factor for women than for men. Perhaps during the economic contraction there was a ceiling effect, in that women were already at maximal suicide risk from heavy alcohol use.

These findings need to be considered in light of some data limitations. First, postmortem toxicology testing rates varied across the NVDRS states. Toxicology screening is often determined by availability of state funding. Unfortunately, current U.S. federal resources provided to the NVDRS states do not cover toxicological testing. However, all demographic subgroups had toxicological testing rates at or above a 65% level except those aged 60 years and older, whose testing rate was slightly lower (62%).

Second, NVDRS does not have information on the drinking patterns of the decedents while they were alive. It is conceivable that for some decedents this episode was their first time drinking heavily, perhaps in response to the economic crisis. Interestingly, there is evidence that individuals intoxicated at the time of death did not necessarily have a history of alcohol misuse prior to suicide (Kaplan et al., 2014).

Third, BRFSS has several well-known limitations, including low response rates, self-reported data, and unspecified time frames regarding hours (durations) of drinking episodes (Centers for Disease Control and Prevention, 2011). However, the BRFSS may nonetheless accurately reflect time trends in heavy alcohol use (Nelson et al., 2010). For example, both the BRFSS and the National Survey on Drug Use and Health (United States Department of Health and Human Services et al., 2011), showed similar change in heavy alcohol use between 2005 and 2011 (data not shown).

Taken as a whole, the findings suggest that during times of severe economic hardship, acute alcohol intoxication among male suicide decedents (unlike that for their female counterparts) exceeded the heavy alcohol use observed in a nonsuicide comparison group. The combination of alcohol intoxication and the economic downturn was a noteworthy suicide risk factor for men. Further research is needed to identify factors associated with increased use of alcohol among men who may be vulnerable to the psychological distress associated with economic hardship.

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Table 1

Numbers of living and deceased subjects

	Living sample (BRFSS)*			Suicide decedents (NVDRS)		
	2006-07	2008-09	2010-11	2005-07	2008-09	2010-11
All	254,394	275,367	299,362	18,885	13,418	13,462
Male	95,256	103,840	115,358	14,607	10,418	10,317
Age 20-44	29,165	28,293	30,720	7,297	4,826	4,671
Age 45-64	39,964	45,177	49,379	5,225	4,137	4,130
Age 65+	24,037	28,311	32,740	2,085	1,455	1,516
White	75,477	81,651	89,165	12,214	8,811	8,770
Black	7,003	7,820	9,053	1,103	750	646
AI/AN	1,803	1,967	1,994	228	155	147
Asian/PI	1,462	1,525	2,002	214	176	165
Hispanic	6,242	6,823	8,055	830	503	567
Female	159,138	171,527	184,004	4,278	3,000	3,145
Age 20-44	49,371	46,158	46,321	1,945	1,314	1,359
Age 45-64	62,186	70,466	75,010	1,901	1,371	1,463
Age 65+	44,190	51,604	58,740	432	315	323
White	123,650	131,279	139,295	3,727	2,601	2,735
Black	15,125	17,287	19,717	218	148	137
AI/AN	2,842	2,976	2,860	57	51	50
Asian/PI	1,822	2,042	2,381	105	97	82
Hispanic	10,990	12,166	12,881	167	101	138

AI/AN = American Indian/Alaska Native; BRFSS = Behavioral Risk Factor Surveillance System; NVDRS = National Violent Death Reporting System; PI = Pacific Islander. Ages 20 years; for 16 states.

* Unweighted numbers.

Table 2

Prevalence (%) of heavy alcohol use among living and deceased subjects

	<u>Living sample (BRFSS) *</u>			<u>Suicide decedents (NVDRS)</u>		
	2006-07	2008-09	2010-11	2005-07	2008-09	2010-11
All	14.4	14.2	16.0	22.2	23.8	24.1
Male	19.7	19.2	21.4	23.6	25.5	25.4
Age 20-44	27.4	27.1	30.5	28.3	30.8	29.8
Age 45-64	14.8	14.9	16.6	23.8	25.4	26.5
Age 65+	5.1	5.0	5.9	7.3	8.9	9.1
White	20.7	20.4	22.6	23.7	25.5	25.4
Black	14.1	13.9	15.7	16.3	20.1	17.6
AI/AN	21.5	18.6	21.4	39.8	46.7	47.6
Asian/PI	9.5	12.8	9.9	14.2	20.0	13.2
Hispanic	21.7	19.8	25.4	29.7	30.9	32.1
Female	9.3	9.6	10.8	17.5	17.8	19.8
Age 20-44	13.8	14.2	16.8	21.0	19.4	23.9
Age 45-64	7.1	7.7	8.3	16.4	18.3	18.7
Age 65+	1.8	1.9	2.0	6.7	8.3	7.2
White	10.2	10.5	11.5	17.6	17.8	19.4
Black	5.9	6.9	8.3	10.8	15.1	16.8
AI/AN	10.1	9.2	9.8	40.4	27.5	40.0
Asian/PI	4.5	5.8	7.7	8.2	11.6	12.7
Hispanic	8.0	7.6	9.9	21.9	23.5	27.6

AI/AN = American Indian/Alaska Native; BRFSS = Behavioral Risk Factor Surveillance System; NVDRS = National Violent Death Reporting System; PI = Pacific Islander. Ages 20 years; for 16 states. Heavy alcohol use in the BRFSS is binge drinking (5 drinks for men, 4 for women) at least once in the 30 days prior to interview and in NVDRS is blood alcohol content .08 g/dl.

* Weighted percentages.

Table 3

Changes in heavy alcohol use among suicide decedents relative to living subjects during the economic contraction

	2008-09 vs 2005/06-07 Adjusted Ratios of Odds Ratios (95% CI)	2010-11 vs 2005/06-07 Adjusted Ratios of Odds Ratios (95% CI)
All cases (n=798,122)	1.10 (1.06 - 1.14) ***	0.93 (0.90 - 0.97) ***
Male (n=349,796)	1.15 (1.10 - 1.20) ***	0.95 (0.91 - 0.99) *
20-44 (n=104,972)	1.14 (1.07 - 1.22) ***	0.88 (0.83 - 0.94) ***
45-64 (n=148,012)	1.07 (1.01 - 1.14) *	0.98 (0.91 - 1.04)
65+ (n=90,144)	1.27 (1.13 - 1.43) ***	1.02 (0.92 - 1.14)
White (n=276,088)	1.13 (1.07 - 1.18) ***	0.96 (0.91 - 1.01)
Black (n=26,375)	1.35 (1.13 - 1.62) **	0.84 (0.69 - 1.03)
AI/AN (n=6,294)	1.51 (1.09 - 2.10) *	1.38 (1.02 - 1.88) *
Asian/PI (n=5,544)	1.53 (0.88 - 2.64)	1.15 (0.75 - 1.75)
Hispanic (n=23,020)	1.21 (1.03 - 1.43) *	0.90 (0.76 - 1.07)
Female (n=525,092)	0.96 (0.92 - 1.01)	0.90 (0.86 - 0.95) ***
20-44 (n=146,468)	0.85 (0.80 - 0.90) ***	0.85 (0.80 - 0.91) ***
45-64 (n=212,397)	1.04 (0.98 - 1.11)	0.94 (0.88 - 1.01)
65+ (n=155,604)	1.25 (1.07 - 1.48) **	0.99 (0.85 - 1.16)
White (n=403,287)	0.97 (0.92 - 1.02)	0.92 (0.87 - 0.97) **
Black (n=52,632)	1.24 (1.04 - 1.48) *	0.94 (0.79 - 1.11)
AI/AN (n=8,836)	0.50 (0.36 - 0.71) ***	1.09 (0.77 - 1.54)
Asian/PI (n=6,529)	0.85 (0.45 - 1.60)	0.77 (0.35 - 1.70)
Hispanic (n=36,443)	1.01 (0.84 - 1.24)	0.95 (0.79 - 1.13)

AI/AN = American Indian/Alaska Native; Adjusted ratio of odds ratios estimates are interaction terms between time period and vital status. Main effects and control variables are included in the models but not presented; CI = confidence interval; PI = Pacific Islander. Estimates were weighted and adjusted for the BRFSS complex sampling design. N represents the total number of cases used in each model.

*
p < .05

**
p < .01

p < .001