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Economic Recession, Alcohol, and Suicide Rates: Comparative Effects of Poverty, Foreclosure, and Job Loss

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Abstract

Introduction—Suicide rates and the proportion of alcohol-involved suicides rose during the 2008–2009 recession. Associations between county-level poverty, foreclosures, and unemployment and suicide rates and proportion of alcohol-involved suicides were investigated.

Methods—In 2015, National Violent Death Reporting System data from 16 states in 2005–2011 were utilized to calculate suicide rates and a measure of alcohol involvement in suicides at the county level. Panel models with year and state fixed effects included county-level measures of unemployment, foreclosure, and poverty rates.

Results—Poverty rates were strongly associated with suicide rates for both genders and all age groups, were positively associated with alcohol involvement in suicides for men aged 45–64 years, and negatively associated for men aged 20–44 years. Foreclosure rates were negatively associated with suicide rates for women and those aged ≥65 years but positively related for those aged 45–64 years. Unemployment rate effects on suicide rates were mediated by poverty rates in all groups.

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WCK led the writing and collaborated with NH, who led data development and statistical analyses with BHMcF, providing statistical expertise. MSK and NH acquired the data. MSK provided important intellectual content and helped draft the manuscript. RC and NG helped conceptualize ideas, interpret findings, and review drafts of the manuscript. All the authors reviewed and approved the final draft.

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Conclusions—Population risk of suicide was most clearly associated with county-level poverty rates, indicating that programs addressing area poverty should be targeted for reducing suicide risk. Poverty rates were also associated with increased alcohol involvement for men aged 45–64 years, indicating a role for alcohol in suicide for this working-aged group. However, negative associations between economic indicators and alcohol involvement were found for four groups, suggesting that non-economic factors or more general economic effects not captured by these indicators may have played a larger role in alcohol-related suicide increases.

INTRODUCTION

Population-level risks for suicide deaths are known to include both economic factors and substance misuse, particularly alcohol consumption. Suicide rates typically increase during recessions and have, in some cases, been the only alcohol-related mortality cause to rise because overall alcohol consumption volume tends to fall and driving tends to decrease.[1,2] However, studies have also found that alcohol problems and heavy drinking tend to rise in recessions and did so in the 2008–2009 recession (the official recession beginning in December 2007 and ending in June 2009) in the U.S.[3,4] This finding may explain why relationships between overall alcohol use and suicide can change during recessions. A recent study found that alcohol-involved suicides rose during both the 2008–2009 economic downturn and during the weak recovery period in 2010 and 2011 and accounted for a substantial proportion of the overall rise in suicide rates.[5] This rise in suicides was most evident among those aged 45–64 years[6] and was highlighted as a major factor, along with poisonings and liver cirrhosis, in the dramatic increase in midlife mortality rates among white non-Hispanic Americans from 1999 to 2013.[7] The present study investigates relationships among economic conditions, suicide rates, and alcohol-involved suicides in more detail by modeling connections among measures of housing foreclosures, unemployment, and poverty at the county level in 16 states where the National Violent Death Reporting System (NVDRS) collected data on the details of suicide death for the 2005–2011 period.

Economic conditions from 2008 through 2011 were historically severe in terms of housing prices, foreclosure activity, income loss, and persistently high rates of unemployment. Foreclosure rates began to rise in 2006 from a very low level, peaking in 2010, although patterns varied across states and counties.[8] Unemployment rates remained low through 2007 in most states and then rose quickly through 2008–2009, remaining higher than 9% through the fall of 2011. Importantly, long-term unemployment rates (27 weeks or longer) comprised more than 40% of the unemployed in 2010 and 2011.[9] Poverty rates generally rose more slowly than unemployment in 2008–2009 and then continued to rise through 2011. The official U.S. poverty rate increased during the recession from 12.5% in 2007 to 15% in 2011.[10]

Per capita alcohol consumption in the U.S. climbed from 1995 to 2008 but declined in 2009–2010 before resuming yearly increases in 2011.[11] Surveys found increased heavy drinking occasions from 2005 to 2010[11] and from 2001–2002 to 2012–2013.[12] Importantly, no increase was seen among those aged <25 years, whereas those in their 30s and 40s had more heavy occasions.[13]

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Consistent with research on previous recessions,[14] the suicide rate increased during the economic crisis.[6] People who died by suicide during the 2008–2009 recession were more likely to have been legally intoxicated (blood alcohol content [BAC] ≥0.08 g/dL) at the time of death than those before the recession.[5] During 2008–2009, the number of intoxication-related suicides among men increased by 8%, but changed little thereafter; for women, the rate of intoxication rose only 1% at the start of the recession, but jumped by 13% during 2010–2011. Recent studies have found effects of foreclosure rates on suicide rates at the state level with strongest relationships seen in adults aged 45–64 years,[8] and at the individual level in death records.[15] Unemployment rates have also been linked with suicide rates at the state level, again with the strongest effects among in those aged 45–64 years.[6]

To date, no study has attempted to disentangle the most salient features of the economic contraction relevant to suicide risk while also considering alcohol as a key risk factor for suicide. This study tested specific area-level economic stressors (population rates of poverty, foreclosures, and unemployment) against each other as risk factors for the prediction of:

1. suicide rates; and
2. an index reflecting the proportion of suicide deaths that are alcohol associated in excess of an expected percentage in each county based on demographic characteristics, suicide method, and an indicator for intimate partner problems.

METHODS

Data Sample

Data for suicide decedents aged ≥20 years were obtained from NVDRS, an active surveillance system that provides detailed accounts of violent deaths that occur in the participating states. In 2003, seven states participated (Alaska, Maryland, Massachusetts, New Jersey, Oregon, South Carolina, and Virginia). Currently and since 2005, 16 states (adding Colorado, Georgia, Kentucky, New Mexico, North Carolina, Oklahoma, Rhode Island, Utah, and Wisconsin) contributed data to NVDRS. In 2010, Ohio was added. The analyses were restricted to 2005–2011 using 16 states (excluding Ohio). The data were gathered from coroner/medical examiner records, police reports, death certificates, and crime laboratories. Suicide decedents were identified as those with death certificates that listed ICD-10 codes X60-84 or Y87.0.[16] The authors were unable to account for suicide decedents mis-classified as other manners of death such as undetermined. A detailed description of the sample characteristics appears elsewhere.[17–19] Pooled 2005–2011 NVDRS data yielded 68,284 suicide decedents aged ≥20 years.

Measures

The main outcome measures were:

1. the annual county suicide mortality rate; and
2. a measure of alcohol involvement in suicide mortality operationalized as the difference between the county-level observed and expected probabilities of a

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BAC at or above the legal limit for intoxication while driving in the U.S. (BAC ≥0.08 g/dL) versus below the limit[20] at the time of suicide.

The BAC is part of the coroner/medical examiner toxicologic investigation. Annual county suicides rates were computed from the number of gender-specific suicides for each county and the county population from the American Community Survey. In the 16 states, 68% of male (n=36,663) and 73% of female (n=10,747) suicide decedents were tested for BAC. BAC was coded as continuous measures of weight by volume and then classified as <0.08 g/dL or ≥0.08 g/dL. The cut point of BAC ≥0.08 g/dL was chosen to represent the BAC associated with binge drinking.[21] The observed probability refers to the county fraction of decedents with BAC ≥0.08 g/dL at the time of death. The expected probability was first estimated at the individual level using a gender-stratified logistic regression model adjusting for race/ethnicity (white, black, American Indian/Alaska Native, Asian/Pacific Islander, and Hispanic), age, method of suicide (firearm, hanging/suffocation, poisoning, and other), educational attainment (<high school, high school, >high school), and whether the decedent had an intimate partner problem. These control variables were chosen based on the authors' previous work.[17,18,22,23] The county-level expected probability was then computed by summing the probabilities per county and dividing by the total number of male or female (respectively) suicide decedents. A few decedents (2,477, 3%) were excluded because they had missing or invalid county data. There were a total of 4,904 county years.

County foreclosure rates were obtained from RealtyTrac[24] and represent the number of houses foreclosed over the total number of housing units in the county (per 100 per year). Yearly county unemployment rates were from the Bureau of Labor Statistics,[9] and yearly county poverty rates were from the Census Small Area Income and Poverty Estimate reports (from the American Community Survey).[25] Poverty thresholds vary by age, household size, and composition. For example, for one person aged <65 years in 2011, the threshold was $11,702 and for two adults and two children it was $22,811.

Statistical Analysis

Analyses of suicide rates utilized generalized estimating equations to predict county-level suicide rates across the 6 years of the study by gender and by three age groups. The authors did not estimate models by age for each gender because of unreliable (n<10) estimates for women in many counties with these finer groupings. Because of missing county years, models did not include lagged predictors nor control for autocorrelation. Economic predictor variables pertaining to foreclosure, poverty, and unemployment rates at the county level were included along with state and year indicator variables. County-level fixed effects were not included because with short time period these models could not be estimated. Models were estimated with each economic predictor separately and then all three together. Analyses of alcohol involvement focused on suicide decedents who were tested for alcohol. The unit of analysis was the "county year" and analyses were stratified by gender and by gender-specific age groups of 20–44, 45–64, and ≥65 years. Analyses were weighted by numbers of male or female (respectively) suicides tested for alcohol in each county year. Thus, county years with no male (or female) suicides tested for alcohol were excluded. Generalized estimating equations were employed with county years treated as repeated measures within counties. The generalized estimating equation distribution was normal

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(Gaussian) and the link function was the identity function. The correlation matrix was unstructured. The dependent variable was the difference (for each county year) between the observed percentages of suicides with BAC ≥0.08 g/dL minus the expected percentage of suicides with BAC ≥0.08 g/dL as described above. Histograms showed the dependent variable to be roughly Gaussian in distribution. State indicators were included to control for state-level fixed effects. Models were estimated with each economic predictor separately and then all three together. All analyses were performed in 2015 using Stata, version 13.

RESULTS

Table 1 presents the average rates for each outcome and economic predictor measure across counties in each year. Table 2 presents the results of models predicting county-level suicide rates in the 16 states from 2005 to 2011 for men and women and for the population in the three age groups. Suicide rates were most strongly associated with county-level poverty rates, with significant positive associations for both men and women and in each of the age groups of 20–44, 45–64 and ≥65 years. For women, foreclosure rates were significantly negatively related to suicide rates whereas no relationship was found for men. Results by age group for foreclosure rates differed with no relationship in the group aged 20–44 years, a significant and positive relationship in those aged 45–64 years, and a significant negative effect on suicide rates was found among those aged ≥65 years. These same effects were also seen in the models with only the foreclosure measure. Unemployment rates were not significantly related to suicide rates in any age group in models including all economic measures. In all single measure models, unemployment rates did have significant associations, suggesting that these effects may be mediated through their impact on poverty rates (Appendix Table 1).

Table 3 presents the results of models of the measure of alcohol involvement in suicides at the county level for men and women in three age groups. For men, a negative relationship with foreclosure rates was found in those aged 20–44 years only and a negative relationship with poverty rates was seen in the group aged 20–44 years, whereas a significant positive relationship with poverty rates was found among those aged 45–64 years. Also among men, a negative relationship with unemployment rates was seen in the group aged 45–64 years. No relationships between economic conditions and alcohol involvement in suicides were found in men aged ≥65 years. For female alcohol involvement in suicides, only one significant relationship with an economic indicator was found in any model. A negative association with unemployment rates was found in the group aged ≥65 years (Appendix Table 2).

DISCUSSION

Effects were found in relation to all three economic impact measures with the strongest overall impact on suicide rates from poverty rates. Unemployment rates, where significant, had a negative relationship with the alcohol-related suicide measure, indicating a greater impact on non-alcohol involved suicides. Although unemployment rates predicted suicide rates in all subgroups when unemployment was the only economic indicator, no relationships were found in the final models when poverty rates were included. Foreclosure

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rates were found to increase suicide rates among those aged 45–64 years but were associated with reduced suicide rates for women and those aged ≥65 years. The authors' previous study detailed the increase in suicide rates and alcohol-involved suicides during the recession and the weak recovery in 2010–2011, during which poverty rates continued to rise.

The present results link suicide rate increases to poverty rates at the county level for all population groups and link the proportion of alcohol-related suicides to poverty rates for men aged 45–64 years only. Suicides in this middle-aged male group have been shown to be strongly impacted by the job and financial circumstances in the recession.[26] This middle-aged group has also been shown to be the main source of suicide rate increases during the period of analyses.[6]

However, these results do not appear to explain fully the increased alcohol involvement in suicide risk related to the 2008–2009 recession found previously.[5] Although U.S. per capita alcohol sales declined in 2009–2010 before resuming yearly increases,[27] studies of survey data indicate increases in heavy drinking occasions from 2005 to 2010[11] and from 2001–2002 to 2011–2012.[12] These trends in alcohol use patterns may be associated with the recession generally rather than with specific economic impact measures and could be associated with the rise in alcohol-related suicides.

Findings of strong positive associations with poverty for suicide rates and for alcohol involvement in suicides suggest that this economic measure was most closely linked with suicides during the study period. Previous studies have found that area measures of poverty and socioeconomic disadvantage are associated with increased risk of suicide, particularly where smaller levels of geographic aggregation are utilized.[28,29,30] Research has also found that individuals in households with incomes below the poverty line were more vulnerable to alcohol problems when faced with social adversity, depressive symptoms, and stress.[31]

Foreclosure rates showed a more complicated pattern of relationships with negative associations with suicide rates for women and those aged ≥65 years but a positive relationship for those aged 45–64 years. This positive finding confirms the strongest relationship found in a state-level analysis.[8] Housing loss has been associated with drinking consequences and alcohol dependence, suggesting a potential relationship with alcohol involvement not found in these analyses.[32]

Surprisingly, unemployment rates were found to be unrelated to suicide rates and negatively related to alcohol-involved suicides for men aged 45–64 years and women aged ≥65 years in the final models. Significant associations of unemployment with suicide rates disappeared when poverty was included in the models, suggesting that these effects were mediated through poverty. This impact could occur through longer-term unemployment or vulnerable individuals. The negative association with alcohol involvement for working-aged men suggests that unemployment may increase suicide risk through other pathways while reducing alcohol consumption. This conclusion is suggested by analyses of earlier recessions[1] as well as in two recent studies where unemployment rates reduced heavy drinking[33] and alcohol-related fatal crashes.[2] However, higher unemployment rates have also

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predicted increased binge drinking days, self-reported drunk driving, and alcohol dependence during the past recession.[34]

Limitations

Analyses were limited to the 16 states where NVDRS was active during the period of analyses. Fortunately, suicide is a rare event, so the numbers of suicides per county year in some counties were small, complicating rate measures. These low numbers precluded yearly analyses in smaller areas where local variations would be observed. However, the county-level measures utilized herein do express more variation than the state-level measures used in other studies.[6,8] Potentially important area-level predictors not available for these analyses included divorce rates and mental health facilities. A limitation in relation to the impact of unemployment is that this study only has a measure of the overall unemployment rate rather than long-term unemployment. Measures of long-term unemployment, out of the work force, and underemployment are missed in the overall unemployment measures available yearly at the county level. Lagged effects of economic impacts may also be important but were not included owing to the short time period where data were available. A review of long-term unemployment and suicide found that the greatest risk was within the first 5 years (with relative risk of 2.5) with risk continuing at reduced levels.[35] Similarly, there may be lagged effects for foreclosure rates whereas poverty rates generally reflect a more persistent condition that better captures delayed impacts. Postmortem toxicology testing rates varied across NVDRS states. However, all demographic subgroups had toxicologic testing rates at or above 65% level, except those aged ≥60 years (62%).

CONCLUSIONS

These analyses did not find any relationship between unemployment and suicide rates as has been found in other studies in the U.S. and internationally when controlling for poverty rates.[36,37] Recognizing that data limitations preclude establishing causality, these results suggest that unemployment and foreclosure rates are not as directly detrimental as poverty. The finding that unemployment effects on suicide rates may be mediated through poverty has important implications for policies aimed at supporting the unemployed and directly reducing poverty in the U.S. This result is also consistent with findings that unemployment rates do not affect suicide rates in countries with the most generous unemployment protections.[37] County-level poverty rates reflect both each individual's difficulties and the general situation facing county residents. At an individual/family level, it may be the general lack of resources and opportunities for obtaining help in high-poverty areas that lead to higher suicide rates. People may also have been already near a breaking point before the recession such that further decline in economic circumstances pushed them to the most extreme response.

The importance of poverty rates in suicide risk is emphasized by current official U.S. Census poverty rates for those aged 18–64 years remaining at 13.5% in 2014 as compared with 10.8% in 2006, before the recession. Rates for other age groups also remain higher than those from 2006 despite years of economic recovery and substantial declines in the unemployment and foreclosure rates. Programs to reduce wide-ranging impacts of poverty

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on individuals are certainly needed. However, these analyses also draw attention to the importance of targeting suicide prevention efforts toward impoverished communities and incorporating alcohol control policies, alcohol abuse prevention, and treatment for alcohol misuse into such efforts.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Average Rates Across Counties for Economic Measures and Suicides by Subgroup and Alcohol Involvement[a]

Rate type	2005	2006	2007	2008	2009	2010	2011
Economic measures							
Unemployment	5.1	4.7	4.4	5.5	8.8	9.1	8.5
Foreclosure	1.9	3.2	4.7	6.7	8.2	9.0	6.5
Poverty	12.7	12.7	12.4	12.4	13.4	14.5	15.0
Suicide rates							
Overall	14.3	13.9	14.9	14.9	15.5	15.5	16.0
Men	24.3	23.3	24.9	24.8	26.0	26.0	26.4
Women	6.0	6.0	6.5	6.5	6.5	6.7	7.1
20–44	14.2	13.8	14.6	13.8	15.0	14.9	15.3
45–64	15.0	15.8	16.4	17.5	17.9	18.2	18.1
65 and older	14.7	12.4	14.3	14.4	14.0	14.2	15.1
% with BAC≥0.08	22.0	20.5	23.4	23.6	23.6	23.6	23.7

[a]Unemployment and poverty rates are per 100 population, foreclosure rates are per 1,000 population, suicide rates are per 100,000 population.

BAC, blood alcohol content

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Table 2

Estimated Associations Between County-level Foreclosure, Poverty, and Unemployment Rates and Suicide Rates[a]

Subgroup	Foreclosure rate (95% CI)	Poverty rate (95% CI)	Unemployment rate (95% CI)
Men	−0.925 (−1.874, 0.025)	**14.128 (8.834, 19.423)** **	5.402 (−1.561, 12.364)
Women	**−1.447 (−2.133, −0.760)** **	**8.884 (5.422, 12.347)** **	3.732 (−1.068, 8.532)
Age group			
20–44	0.266 (−0.834, 1.367)	**22.127 (15.731, 28.522)** **	1.879 (−6.309, 10.067)
45–64	**1.204 (0.056, 2.351)** *	**30.520 (23.383, 37.656)** **	−0.141 (−9.004, 8.722)
≥65	**−7.388 (−10.320, −4.456)** **	**22.891 (8.775, 37.006)** **	18.918 (−1.240, 39.076)

Notes: Boldface indicates statistical significance (*p<0.05; **p<0.001).

[a]Estimated from generalized estimating equations (GEE) models with state and year fixed effects.

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Table 3

Estimated Associations Between Foreclosure, Poverty, and Unemployment Rates and the Alcohol Positive Suicide Measure[a]

Subgroup	Foreclosure rate (95% CI)	Poverty rate (95% CI)	Unemployment rate (95% CI)
Men age group			
20–44	**−0.030 (−0.058, −0.002)** *	**−0.150 (−0.259, −0.042)** **	0.173 (−0.015, 0.362)
45–64	0.016 (0.009, 0.042)	**0.121 (0.029, 0.213)** *	**−0.145 (0.286, −0.004)** *
≥65	0.003 (−0.022, 0.028)	−0.026 (−0.121, 0.069)	0.098 (−0.061, 0.256)
Women age group			
20–44	0.014 (−0.018, 0.046)	−0.012 (−0.150, 0.125)	0.182 (−0.040, 0.405)
45–64	−0.015 (−0.050, 0.020)	−0.113 (−0.255, 0.029)	0.108 (−0.134, 0.351)
≥65	−0.010 (−0.046, 0.027)	0.186 (−0.011, 0.384)	**−0.356 (−0.635, −0.077)** *

Notes: Boldface indicates statistical significance (*p<0.05; **p<0.001).

[a]Estimated from generalized estimating equations (GEE) models with state and year fixed effects.a