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Interactive Influences of Neighborhood and Individual Socioeconomic Status on Alcohol Consumption and Problems

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Abstract — Aims: To assess cross-level interactions between neighborhood and individual socioeconomic status (SES) on alcohol consumption and problems, and investigate three possible explanations for such interactions, including the double jeopardy, status inconsistency and relative deprivation hypotheses. **Methods:** Data from the 2000 and 2005 US National Alcohol Surveys were linked to the 2000 US Census to define respondent census tracts as disadvantaged, middle-class and advantaged. Risk drinking (consumption exceeding national guidelines), monthly drunkenness and alcohol problems were examined among low-, middle- and high-SES past-year drinkers ($n = 8728$). Gender-stratified, multiple logistic regression models were employed, and for outcomes with a significant omnibus F-test, linear contrasts were used to interpret interactions. **Results:** Cross-level SES interactions observed for men indicated that residence in advantaged neighborhoods was associated with markedly elevated odds of risk drinking and drunkenness for low-SES men. Linear contrasts further revealed a nearly 5-fold increased risk for alcohol problems among these men, relative to middle-SES and high-SES men also living in advantaged neighborhoods. Among women, neighborhood disadvantage was related to increased risk for alcohol problems, but there were no significant SES interactions. These findings did not support theories of double jeopardy and status inconsistency. **Conclusion:** Consistent with the relative deprivation hypothesis, findings highlight alcohol-related health risks among low-SES men living in affluent neighborhoods. Future research should assess whether this pattern extends to other health risk behaviors, investigate causal mechanisms and consider how gender may influence these.

INTRODUCTION

Heavy drinking is the third leading cause of preventable death in the USA (Mokdad *et al*., 2004) and, as with many health outcomes, is related to socioeconomic status (SES). Low SES has been associated with adverse alcohol outcomes such as frequent binge drinking, alcohol abuse and alcohol dependence (Dawson *et al*., 1995; Grant, 1997; Centers for Disease Control and Prevention, 2011). By contrast, high SES has been associated with being a current drinker and higher overall consumption, but lower levels of alcohol consumed per drinking occasion (Dawson *et al*., 1995; Casswell *et al*., 2003; Moore *et al*., 2005).

A growing number of studies suggest that neighborhood SES (NSES) can also influence alcohol use patterns, over and above the effects of individual-level SES. According to a recent review by Karriker-Jaffe (2011), there is evidence that residents of economically disadvantaged neighborhoods are at greater risk for heavy drinking, yet the research in this area is far from certain as some studies show null effects and others associate neighborhood affluence, rather than disadvantage, with increased alcohol consumption. In part, these mixed results reflect considerable variation in the operationalization of NSES, heavy drinking and other alcohol outcomes (ibid.). However, the absence of clear and robust effects also raises the question of whether NSES effects may be particularly nuanced (Galea *et al*., 2007), and conditioned by characteristics such as individual SES (ISES).

Some studies have found that the relationship between NSES and substance use varies by ISES. Boardman *et al*.'s (2001) Detroit Area study showed an overall positive association between neighborhood disadvantage and drug use that was most pronounced among poor respondents, and virtually absent among high-income respondents. Similarly, Chuang *et al*.'s (2007) Taiwanese study showed that the odds of any alcohol use increased with greater neighborhood disadvantage, but this was only true for low-SES respondents; no association existed among high-SES individuals.

Like similar studies in the broader field of public health, alcohol studies of cross-level SES interactions often have been atheoretical. This conspicuous limitation has spurred some researchers to call for *a priori* theorizing about how and why individual- and neighborhood-level SES might interact to influence health (e.g. see Diez Roux and Mair, 2010). Without understanding how and why the relationship between NSES and alcohol outcomes might vary by ISES, it is difficult to know what programmatic and policy efforts are needed to prevent future alcohol (and other health) problems among individuals who are at increased risk based simply on where they live.

In this study, we consider three theoretical explanations for why there might be interactive influences of neighborhood and individual SES on drinking patterns and problems. The first involves the concept of double jeopardy, or the idea that multiple forms of disadvantage pose greater risks to health than exposure to a single form of disadvantage (Ferraro and Farmer, 1996). This concept has been applied in studies examining multiple disadvantage in relation to problem drinking and drug and alcohol dependence (e.g. see Turner and Lloyd, 2003; Lloyd and Turner, 2008; Mulia *et al*., 2008; Zemore *et al*., 2011). In the current study, the double jeopardy hypothesis suggests that effects of living in a disadvantaged neighborhood would be worse among low SES (versus higher SES) residents, as they would be most exposed to stress and thus most likely to engage in heavy drinking and to experience alcohol problems. The studies led by Boardman *et al*. (2001) and Chuang *et al*. (2007) provide some support for this hypothesis.

A second possible explanation for cross-level SES interactions on alcohol outcomes relates to status inconsistency.

Introduced in studies of social stratification and mental health in the mid-twentieth century, status inconsistency refers to the situation in which an individual holds incongruent ranks on different dimensions of social status (e.g. both high education and a low-status occupation, or high income and low racial/ethnic status). Such discrepancy is posited to be a source of frustration and uncertainty leading to stress (Dressler, 1988), in part, because status-inconsistent individuals may have expectations of others that are not met, such as to be treated in ways commensurate with their high social ranking in one area. Conversely, they may not meet others' expectations of them (Jackson, 1962), for instance, if they are unfamiliar or at odds with the norms of those around them. According to the status inconsistency hypothesis, protective health effects associated with high ISES will vary with NSES, such that high-SES persons in disadvantaged neighborhoods will experience greater stress and greater risk for heavy drinking and alcohol problems compared with high-SES persons in more advantaged neighborhoods. Studies examining cross-level SES interactions with alcohol outcomes have not explored this hypothesis.

Theories of relative deprivation provide a third lens for understanding cross-level interactions of SES on heavy drinking and alcohol problems, and have gained currency in research linking income inequality with poor population health (Wilkinson, 1996, 2002; Kubzansky *et al*., 2001). According to Kawachi and Kennedy (1999), in a society with significant income inequality, low-SES persons will tend to compare themselves upwards with persons who are financially better off, and will feel frustrated by their relative deprivation. Importantly, because individuals strive to achieve the comforts that are 'customary for their community' (ibid., p. 224), the relative deprivation hypothesis implies that low-SES individuals living in high-SES neighborhoods would be most acutely aware of their relative deprivation, and experience high levels of frustration and stress. Applied to the study of alcohol problems, we would expect the effects of neighborhood advantage to vary by ISES, such that low-SES persons in advantaged neighborhoods would have higher levels of heavy drinking and alcohol problems compared with their higher-SES neighbors. To our knowledge, the relative deprivation hypothesis has been examined in one prior alcohol study investigating neighborhood effects and was not supported (Chuang *et al*., 2007).

The aim of our study is to begin to address current theoretical gaps in multilevel studies of the influence of SES on alcohol outcomes. Specifically, we assess cross-level interactions of NSES and ISES in predicting drinker status, drinking in excess of national low-risk guidelines (i.e. risk drinking), drunkenness and alcohol problems. In contrast to prior studies, we examine three theoretical explanations for why relationships between NSES and alcohol outcomes would differ by ISES.

METHODS

Data set

The current study uses data from the 2000 and 2005 National Alcohol Surveys (NAS). Both surveys involved computer-assisted telephone interviews using virtually identical interview protocols (allowing them to be analyzed together) with a randomly selected sample of US adults, and both included oversamples of African Americans, Hispanics and residents from sparsely populated US states. (For more details on the NAS methodology, see Midanik and Greenfield, 2003a.)

The 2000 NAS included 7613 respondents ages 18 and older (58% response rate), and the 2005 NAS included 6919 respondents ages 18 and older (56% response rate). Although these response rates are lower than those often seen in face-to-face surveys, they are typical for recent random-digit dial telephone surveys in the USA and should not be assumed to produce biased population estimates (Groves, 2006; Keeter *et al*., 2006). Analysis of the telephone-based 2000 NASs replicate subsamples, each of which is a random subsample with varying response rates, found that response rate was not associated with level of alcohol consumption reported (Greenfield *et al*., 2006). Moreover, an extensive series of methodological studies comparing identical NAS items collected in telephone versus face-to-face surveys showed comparable estimates for alcohol-related variables, despite typically higher response rates for the face-to-face surveys (Greenfield *et al*., 2000; Midanik and Greenfield, 2003b).

NAS data were matched with indicators of NSES from the 2000 Census (U.S. Census Bureau, 2002). Respondent addresses were first geocoded by a commercial firm. Following recommendations of Krieger *et al*. (2002), we evaluated the commercial geocoding, which achieved a 97% accuracy rate. Next, the geocoded NAS data were linked to indicators of NSES at the census tract level. US census tracts (which contain, on average, ~4000 individuals) are effective for delineating contextual determinants of health and substance use (Krieger *et al*., 2002; Karriker-Jaffe, 2011). Most cases (60%) had geocodes assigned based on street address; the remainder had a geocode assigned based on the ZIP Code centroid. Preliminary analyses were conducted to test for interactions of geocode precision and NSES. There were no significant interactions observed for any of the outcomes in separate analyses of men and women (all $P_s > 0.05$). Interactions of SES by survey year were also tested, and showed that men living in high-SES neighborhoods in the 2005 NAS sample were more likely to be current drinkers than their counterparts in the 2000 NAS sample, but this was the only difference seen.

The sample for the current study includes 13,231 adult respondents, ages 24 and older, who had census-linked data. Given the study's key interest in ISES (which was largely defined by education), the sample was restricted based on age to allow for attainment of higher education.

Measures

Individual-level SES

ISES was principally defined by educational attainment, given its greater stability compared with employment status and income (Duncan, 1996), and its strong associations with morbidity, mortality (Goldman and Smith, 2011), and adverse alcohol outcomes (Casswell *et al*., 2003; Mulia *et al*., 2006). Respondents with less than a high school diploma or equivalent were classified as low-SES; high school graduates and respondents who had attended some college or technical school were classified as middle-SES;

and college graduates were classified as high-SES. In addition, because study hypotheses also include elements of economic stress, persons classified as middle- and high-SES based on education were re-categorized as low SES if their past-year household income was below the federal poverty level. If household income data were missing, middle- and high-SES respondents were re-categorized as low-SES if they had applied for welfare or Temporary Assistance for Needy Families in the past year. Middle-SES was used as the reference group.

Neighborhood SES

NSES was based on composite indicators of socioeconomic disadvantage and affluence defined across three dimensions of NSES (financial resources, educational capital and employment opportunities). The items in each composite represent socially relevant markers of extremes in SES that are easily interpretable (Wilson, 1987; Krieger *et al*., 2002; Wagle, 2002). We employed two distinct composite measures to create NSES, recognizing that a lack of neighborhood disadvantage does not necessarily imply high levels of neighborhood advantage (Finch *et al*., 2010). Neighborhood disadvantage was defined using the proportions of adults without a high school diploma, males who were unemployed or not in the labor force, people with incomes below poverty, families with incomes below 50% of the US median, and households without access to a car. Neighborhood advantage was defined using the proportions of families with incomes above 150% of the US median, households with income from secondary sources such as rent or dividends, adults over age 25 with a 4-year college degree, and adults in management and professional occupations. The composite measures of disadvantage and advantage were validated in a preliminary study, and had high reliability (Cronbach's $\alpha = 0.89$ and 0.91, respectively; Karriker-Jaffe and Kaskutas, 2009). For the current analyses, neighborhoods were classified as low-SES if they were in the top 25% on neighborhood disadvantage, and high-SES if they were in the top 25% on neighborhood advantage. Other than a small subset of neighborhoods that were excluded because they were high on both disadvantage and advantage (0.8%), the remaining neighborhoods were classified as middle-SES, which was used as the reference group.

Drinking outcomes

Current drinker was a dichotomous variable indicating whether the respondent had consumed at least one alcoholic drink in the past 12 months. Two measures were used to assess adverse drinking patterns: risk drinking and monthly drunkenness. Risk drinking was a dichotomous variable indicating whether past-year drinkers had exceeded the low-risk guidelines for daily and weekly drinking put forth by the National Institute on Alcohol Abuse and Alcoholism (2005). The guidelines are gender-specific, with recommended limits for men being no more than 4 drinks per day and 14 drinks per week, and limits for women being no more than three drinks per day and seven drinks per week. Our indicator of regular, heavy drinking was monthly drunkenness, a dichotomous measure indicating whether past-year drinkers drank enough to feel drunk at least once a month. Frequency of drunkenness has been shown to be a strong predictor of alcohol-related problems (Midanik, 1999). Alcohol problems among past-year drinkers were captured by a dichotomous variable indicating whether the respondent either (a) experienced 2 or more of 15 negative consequences they attributed to their alcohol use, including social, legal, workplace or health consequences, and/or (b) reported experiencing at least one symptom in three or more of the seven domains of alcohol dependence as defined by the American Psychiatric Association (1994). These measures have been validated and used in previous studies based on NAS data over many years (Caetano and Tam, 1995).

Demographic control variables

Multivariate analyses adjusted for age (continuous), race/ethnicity (mutually exclusive dummy variables for African American, Hispanic and other, with Caucasian as reference), marital status/cohabitation (currently living with spouse/partner), employment status (dummy variables for unemployed and not in workforce, with employed as reference) and neighborhood urbanicity (proportion of residents inside urbanized areas or urbanized clusters, range 0–1). All multivariate models also included an indicator of geocoding precision (whether geocode was based on ZIP code match or street address) and an indicator of the survey year.

Analysis strategy

Because the national samples were selected by random-digit dialing, only 23% of the neighborhoods contained more than two respondents, and just 3% contained five or more (maximum was nine); thus, multilevel analytic strategies were not required (Snijders and Bosker, 1999). Given prior evidence of gender differences in the relationships between NSES and drinking outcomes (e.g. see Matheson *et al*., 2011), all multivariate analyses were gender-stratified. Multivariate logistic regression was used to test study hypotheses. Models included interactions of ISES and NSES, which were represented by four interaction terms (low ISES × low NSES, low ISES × high NSES, high ISES × low NSES, high ISES × high NSES). Thus, to assess distinct effects of low and high SES on the alcohol outcomes (Finch *et al*., 2010), the reference groups were middle-SES individuals and middle-class neighborhoods. For outcomes with a statistically significant omnibus *F*-test for the interaction of ISES and NSES (using $P < 0.10$, given the reduced statistical power for testing interactions; Frazier *et al*., 2004), two pairwise linear contrasts were used to evaluate each of the three theoretical hypotheses. Linear contrasts are an appropriate and efficient approach for testing effects of a given condition (e.g. neighborhood disadvantage) on outcomes across groups defined by specific levels of a second condition (e.g. ISES). To assess double jeopardy (i.e. greater adverse effects of neighborhood disadvantage on individuals of low versus higher SES), linear contrasts were used to compare alcohol outcomes in disadvantaged neighborhoods for low-SES individuals versus (a) high-SES and (b) middle-SES individuals. Status inconsistency (i.e. weaker protective effects of high ISES on residents of disadvantaged versus advantaged neighborhoods) was assessed by contrasting drinking outcomes for high-SES residents in disadvantaged neighborhoods versus (a) advantaged and (b) middle-class neighborhoods. To evaluate relative deprivation (i.e. worse alcohol outcomes among

low-SES versus higher-SES residents of advantaged neighborhoods), drinking outcomes were compared among residents of advantaged neighborhoods who had low SES versus (a) high and (b) middle SES. The Type I error rate was adjusted by hypothesis ($P < 0.025$ for each individual contrast). All models used weights to adjust for sampling and non-response. For outcomes other than drinker status, the sample was limited to past-year drinkers (68% of men, 60% of women). *Post hoc* descriptive analyses were also conducted to better understand our findings. These compared psychological distress, drinking norms and drunkenness norms across men with different levels of NSES and ISES.

RESULTS

Descriptive analyses

Table 1 shows individual- and neighborhood-SES differences in the proportion of respondents who reported any drinking, adverse drinking patterns (risk drinking and monthly drunkenness) and alcohol problems. At both the individual and neighborhood levels, there were positive SES gradients in the prevalence of alcohol use. By contrast, an inverse neighborhood-SES (NSES) gradient was seen in the proportion reporting alcohol problems. Across neighborhoods, a higher proportion of low-ISES residents (versus middle- and high-ISES residents) had alcohol problems, with the largest difference seen in advantaged neighborhoods: 11.8 versus 2.8% of low- and high-ISES residents reported alcohol problems, respectively. In disadvantaged and advantaged neighborhoods, low-ISES individuals also were most likely to report monthly drunkenness and risk drinking, although findings for risk drinking were non-significant. Notably, low-SES persons residing in advantaged neighborhoods showed the highest prevalence of risk drinking (50.2%) and monthly drunkenness (22.2%) in the entire study sample. Also seen in Table 1 are differences in the distributions of race/ethnicity, unemployment and marital status/cohabitation across ISES and NSES.

NSES and ISES: findings for men

In models including only NSES and ISES, both levels of SES were associated with drinker status among men, and suggested a positive SES gradient in the odds of being a current drinker (Model 1, Table 2). Adjusting for ISES, residence in a disadvantaged neighborhood was also associated with increased odds of alcohol problems, but not risk drinking or monthly drunkenness. By contrast, ISES was independently associated with adverse drinking patterns as well as alcohol problems: relative to middle-ISES male drinkers, high-ISES male drinkers had lower odds of risk drinking and low-ISES male drinkers had higher odds of monthly drunkenness.

Significant cross-level SES interactions were observed for risk drinking and monthly drunkenness in the fully adjusted model (Model 2, Table 2). Low-ISES male drinkers living in advantaged neighborhoods had greater odds of both risk drinking and monthly drunkenness. Low-SES male drinkers in disadvantaged neighborhoods also exhibited increased odds of risk drinking, but not monthly drunkenness. Taking

Table 1. Respondent characteristics and alcohol outcomes by neighborhood and individual SES

	Low-SES neighborhoods				Middle-SES neighborhoods				High-SES neighborhoods			
	Low ISES[a] $n = 1566$ (%)	Middle ISES[a] $n = 1532$ (%)	High ISES[a] $n = 641$ (%)	Overall $n = 3739$ (%)	Low ISES $n = 1287$ (%)	Middle ISES $n = 3327$ (%)	High ISES $n = 1755$ (%)	Overall $n = 6369$ (%)	Low ISES $n = 262$ (%)	Middle ISES $n = 1131$ (%)	High ISES $n = 1560$ (%)	Overall $n = 2953$ (%)
Demographics												
Male	39.6	48.3	51.6***	45.7[b]	44.6	46.0	50.6**	47.1[b]	49.5	44.0	54.3**	49.9[b]
Age (mean)	46.8	46.6	46.5	46.6[bbb]	49.2	48.3	46.6***	48.0[bbb]	48.9	49.4	46.9***	48.0[bbb]
Caucasian[c]	35.9	57.1	60.5***	49.9[bbb]	65.5	83.0	84.6***	80.4[bbb]	55.9	83.0	84.6***	82.0[bbb]
African American[2]	26.2	24.2	21.6***	24.5[bbb]	8.9	7.0	6.7***	7.2[bbb]	8.4	6.6	4.6***	5.7[bbb]
Hispanic/ Latino[c]	31.8	14.1	13.9***	20.5[bbb]	17.4	5.9	4.5***	7.5[bbb]	29.1	5.9	5.1***	7.1[bbb]
Unemployed[d]	9.0	3.6	2.9***	5.4[bbb]	5.0	2.2	1.5***	2.5[bbb]	6.1	2.9	1.8***	2.5[bbb]
Out of workforce[d]	43.9	31.5	22.7***	34.4[bbb]	44.6	29.7	22.1***	30.1[bbb]	40.0	32.2	20.2***	26.2[bbb]
Married/cohabit	56.4	66.5	63.8***	62.3[bbb]	62.8	74.1	76.1***	72.7[bbb]	60.8	71.1	78.4***	74.3[bbb]
Alcohol outcomes												
Current drinker	40.5	55.8	65.7***	52.0[bbb]	46.0	64.3	73.5***	63.6[bbb]	49.4	71.3	82.0***	75.5[bbb]
Risk drinking[e]	44.6	38.1	36.6	39.5	39.1	40.2	37.7	39.3	50.2	41.5	38.5	40.3
Monthly drunkenness[e]	13.1	7.9	6.8**	9.1	11.7	8.0	9.2	8.9	22.2	8.4	7.5***	8.5
Alcohol problems[e]	11.7	6.0	6.4**	7.7[bbb]	7.9	3.9	2.7***	4.0[bbb]	11.8	2.4	2.8***	3.0[bbb]

[a]ISES, individual SES; Low ISES, no high school diploma and/or household income below federal poverty level; Middle ISES, high school diploma/attended some college and income above poverty; High ISES, college degree and income above poverty.
[b]$P < 0.05$, [bbb]$P < 0.001$ for overall comparisons by neighborhood-level SES [χ^2 or F-test (continuous variables)].
[c]Single significance test (χ^2) for race/ethnicity.
[d]Single significance test (χ^2) for employment status.
[e]Among current drinkers. Risk drinking: drinking in excess of nationally recommended limits.
**$P < 0.01$, ***$P < 0.001$ for comparisons across ISES within a given NSES-level [χ^2 or F-test (continuous variables)].

Table 2. Multivariate models: logistic regression results for men

	Current drinker		Risk drinking[a]		Monthly drunkenness[a]		Alcohol problems[a]	
	AOR	(95% CI)	AOR	(95% CI)	AOR	(95% CI)	AOR	(95% CI)
Model 1								
Low ISES[b]	0.61**	(0.51, 0.72)	1.07	(0.86, 1.34)	1.66**	(1.22, 2.27)	2.38**	(1.68, 3.37)
High ISES[b]	1.51**	(1.29, 1.77)	0.73**	(0.62, 0.86)	0.86	(0.66, 1.12)	0.64*	(0.44, 0.95)
Low NSES[c]	0.77**	(0.66, 0.90)	0.95	(0.79, 1.15)	0.83	(0.63, 1.10)	1.45*	(1.04, 2.03)
High NSES[c]	1.44**	(1.21, 1.72)	1.11	(0.92, 1.33)	1.12	(0.85, 1.48)	0.88	(0.59, 1.32)
Model 2[d]								
Age	0.98**	(0.97, 0.99)	0.94**	(0.94, 0.95)	0.95**	(0.94, 0.96)	0.95*	(0.93, 0.96)
African American[e]	0.62**	(0.51, 0.77)	0.46**	(0.34, 0.62)	0.77	(0.51, 1.18)	1.47†	(0.94, 2.32)
Hispanic/Latino[e]	0.84	(0.69, 1.04)	0.85	(0.66, 1.10)	0.63**	(0.44, 0.90)	1.07	(0.69, 1.66)
Other race[e]	0.66*	(0.48, 0.91)	0.55**	(0.37, 0.83)	0.83	(0.47, 1.47)	1.09	(0.56, 2.10)
Married/cohabit	0.89	(0.77, 1.04)	0.76**	(0.63, 0.91)	0.51**	(0.40, 0.64)	0.70*	(0.51, 0.97)
Unemployed[f]	0.81	(0.56, 1.18)	1.30	(0.78, 2.15)	1.62	(0.90, 2.92)	2.42**	(1.26, 4.64)
Not in workforce[f]	0.81*	(0.67, 0.98)	0.95	(0.72, 1.27)	0.72	(0.47, 1.10)	1.27	(0.78, 2.08)
Low ISES[b]	0.62**	(0.52, 0.75)	0.70*	(0.49, 1.01)	1.20	(0.72, 2.02)	1.97**	(1.34, 2.91)
High ISES[b]	1.46**	(1.24, 1.72)	0.76*	(0.60, 0.98)	1.03	(0.70, 1.50)	0.77	(0.52, 1.14)
Low NSES[c]	0.80**	(0.68, 0.95)	0.79	(0.58, 1.08)	0.76	(0.50, 1.17)	1.21	(0.84, 1.75)
High NSES[c]	1.47**	(1.22, 1.77)	1.11	(0.81, 1.52)	0.96	(0.62, 1.48)	0.86	(0.55, 1.33)
Low ISES × Low NSES		—[g]	1.87*	(1.10, 3.18)	1.21	(0.58, 2.53)		—[g]
Low ISES × High NSES		—[g]	2.35*	(1.11, 4.94)	3.59**	(1.44, 8.96)		—[g]
High ISES × Low NSES		—[g]	1.23	(0.75, 2.02)	0.94	(0.47, 1.89)		—[g]
High ISES × High NSES		—[g]	0.90	(0.60, 1.36)	0.94	(0.52, 1.71)		—[g]
Obs. (Wtd. N)	5840 (6032)		3914 (4102)		3907 (4096)		3932 (4116)	

AOR, adjusted odds ratio; CI, confidence interval; ISES, individual socioeconomic status; NSES, neighborhood socioeconomic status; Obs, observations; Wtd. N, weighted sample size.
[a]Past-year drinkers only.
[b]Middle ISES is reference.
[c]Middle NSES is reference.
[d]Models also adjusted for survey year, precision of geocode and neighborhood urbanicity.
[e]White is reference.
[f]Employed is reference.
[g]Interaction was not significant; dropped from model.
†$P < 0.10$, *$P < 0.05$, **$P < 0.01$.

into account all covariates, linear contrasts revealed an elevated risk among low-SES men living in high-SES neighborhoods. These men had a 2-fold greater odds of risk drinking [adjusted odds ratio (AOR) = 2.39; 95% confidence interval (CI): 1.26–4.50; $P < 0.01$], and a 4-fold greater odds of monthly drunkenness (AOR = 4.46; 95% CI: 2.15–9.25; $P < 0.01$) relative to high-SES men living in such neighborhoods (data not shown in table). Low-SES men's risk for monthly drunkenness also exceeded that of middle-SES men in high-SES neighborhoods (AOR = 4.31; 95% CI: 2.01–9.26; $P < 0.01$). No other linear contrasts approached significance (all $P_s > 0.10$).

Low-ISES male drinkers also were at significantly greater risk for alcohol problems compared with the middle-ISES reference group. Linear contrasts again highlighted the large differences in alcohol-related risk among men who resided in advantaged neighborhoods: low-SES male residents had a nearly 5-fold increased odds of alcohol problems relative to high-SES and middle-SES male residents of such neighborhoods (AORs = 4.89 and 4.75, respectively, both $P < 0.01$).

NSES and ISES: findings for women

The results for current drinker status among women were very similar to those for men, indicating positive neighborhood- and individual-SES gradients in the odds of any drinking in the past year (Model 1, Table 3). Also as observed for men, women living in disadvantaged neighborhoods were at elevated risk for alcohol problems compared with women in middle-class (and advantaged) neighborhoods. While ISES was not independently associated with drinking in excess of national guidelines, low-ISES women were at increased risk for both monthly drunkenness (AOR = 1.88, $P < 0.01$) and alcohol problems (AOR = 1.96, $P < 0.05$) relative to middle-ISES women (Model 1, Table 3).

As there were no significant cross-level SES interactions in the fully adjusted models, the bottom portion of Table 3 presents the main effects models including all covariates. Associations of NSES and ISES with drinker status remained significant, as did the 2-fold greater odds of alcohol problems among women living in disadvantaged neighborhoods. However, the nearly 2-fold greater risk for monthly drunkenness and alcohol problems among women with low-ISES was reduced to non-significance in the fully adjusted models.

DISCUSSION

In this study, we examined interactive influences of neighborhood and individual SES on drinker status, adverse drinking patterns and alcohol problems in a large, multi-ethnic and nationally representative sample of US adults. We explored three theoretical explanations for these interactions based on the double jeopardy, status inconsistency and

Table 3. Multivariate models: logistic regression results for women

	Current drinker		Risk drinking[a]		Monthly drunkenness[a]		Alcohol problems[a]	
	AOR	(95% CI)	AOR	(95% CI)	AOR	(95% CI)	AOR	(95% CI)
Model 1								
Low ISES[b]	0.42**	(0.36, 0.49)	1.12	(0.87, 1.45)	1.88**	(1.19, 2.98)	1.96*	(1.09, 3.53)
High ISES[b]	1.70**	(1.47, 1.98)	1.09	(0.91, 1.30)	1.23	(0.79, 1.91)	1.38	(0.78, 2.45)
Low NSES[c]	0.71**	(0.61, 0.82)	1.01	(0.81, 1.25)	1.13	(0.75, 1.70)	2.41**	(1.36, 4.27)
High NSES[c]	1.47**	(1.25, 1.73)	1.05	(0.86, 1.28)	0.71	(0.42, 1.19)	0.82	(0.45, 1.52)
Model 2[d]								
Age	0.98**	(0.97, 0.98)	0.96**	(0.95, 0.96)	0.94**	(0.92, 0.95)	0.95**	(0.93, 0.97)
African American[e]	0.41**	(0.34, 0.49)	0.43**	(0.33, 0.57)	0.92	(0.54, 1.58)	0.69	(0.33, 1.43)
Hispanic/Latino[e]	0.40**	(0.33, 0.49)	0.88	(0.65, 1.19)	0.50*	(0.27, 0.93)	0.85	(0.39, 1.87)
Other race[e]	0.62**	(0.44, 0.88)	0.77	(0.43, 1.40)	0.59	(0.22, 1.62)	1.28	(0.38, 4.35)
Married/cohabit	0.87*	(0.76, 0.99)	0.78**	(0.65, 0.93)	0.43**	(0.29, 0.65)	0.49**	(0.28, 0.86)
Unemployed[f]	0.84	(0.58, 1.20)	1.00	(0.58, 1.71)	1.93	(0.86, 4.32)	2.23	(0.74, 6.73)
Not in workforce[f]	0.59**	(0.51, 0.69)	0.88	(0.72, 1.09)	0.94	(0.56, 1.57)	1.42	(0.80, 2.52)
Low ISES[b]	0.51**	(0.43, 0.60)	1.04	(0.79, 1.36)	1.44	(0.86, 2.42)	1.42	(0.74, 2.74)
High ISES[b]	1.47**	(1.25, 1.73)	0.98	(0.81, 1.19)	1.13	(0.71, 1.78)	1.19	(0.65, 2.17)
Low NSES[c]	0.78**	(0.66, 0.92)	1.01	(0.80, 1.27)	1.00	(0.62, 1.61)	2.07*	(1.13, 3.80)
High NSES[c]	1.45**	(1.22, 1.73)	1.12	(0.90, 1.40)	0.83	(0.49, 1.40)	0.92	(0.49, 1.76)
Obs. (Wtd. N)	6943 (6598)		3827 (3932)		3838 (3942)		3895 (3987)	

AOR, adjusted odds ratio; CI, confidence interval; ISES, individual socioeconomic status; NSES, neighborhood socioeconomic status; Obs, observations; Wtd. N, weighted sample size.
[a]Past-year drinkers only.
[b]Middle ISES is reference.
[c]Middle NSES is reference.
[d]Models also adjusted for survey year, precision of geocode and neighborhood urbanicity.
[e]White is reference.
[f] Employed is reference.
*$P < 0.05$.
**$P < 0.01$.

relative deprivation hypotheses. To our knowledge, this is the first study to examine these hypotheses in relation to adverse drinking patterns and alcohol problems among men and women in a nationally representative sample of US adults.

The relative deprivation hypothesis

Consistent with the relative deprivation hypothesis, we found significant cross-level SES interactions indicating that low-SES men living in advantaged neighborhoods are at particularly high risk for adverse drinking patterns. A striking finding of this study was that low-SES men residing in advantaged neighborhoods showed the greatest odds of risk drinking and monthly drunkenness, even exceeding those of their low-SES peers living in disadvantaged neighborhoods. While unexpected, this is consistent with several US and Canadian mortality studies which find the greatest mortality risk and rates to be among low-SES persons living in high-SES neighborhoods (Veugelers *et al*., 2001; Roos *et al*., 2004; Winkleby *et al*., 2006). This pattern also has been observed in a very recent, national study of Korean women, in which the highest risk of smoking was among low-SES women living in high-SES neighborhoods (Park *et al*., 2010).

Research previously has highlighted the burden of stigma and social exclusion that low-status individuals experience 'when they move outside the social spaces where they feel accepted and valued' (Pickett and Wilkinson, 2008, p. 324). For disadvantaged groups, there may be tradeoffs to living in affluent (and mostly white) neighborhoods. Indeed, some middle-class African Americans have specifically chosen to live in New York City's predominantly black, Harlem neighborhood, despite its economic disadvantages, in order to enjoy a sense of community and shielding from the everyday racism they experience in life outside of their neighborhood (ibid.).

Thus, it may be that low-SES male drinkers are more acutely aware of their relatively low status, and experience the greatest social exclusion when residing in affluent neighborhoods. This would be consistent with research suggesting that social cohesion is weaker in communities of high income inequality (Wilkinson, 1996; Kawachi and Kennedy, 1999). That this should affect the health and health behaviors of the most disadvantaged persons in high-SES neighborhoods is in keeping with a large literature demonstrating the profound importance of social ties and social integration to health (Berkman and Glass, 2000). Interpreted thus, the heavy drinking of low-SES men in high-SES neighborhoods could potentially represent a 'time-out' or way of coping with social marginalization. Further, to the extent that these men are drinking heavily with other men, perhaps also of low SES, risk drinking and drunkenness might represent ways in which marginalized men attempt to initiate, maintain or strengthen social bonds with others. The use of substances for the purposes of both coping with social exclusion and bonding with other marginalized persons has been described in ethnographic research (e.g. see Stead *et al*., 2001).

Alternatively, it could be argued that the heavy drinking of low-SES men in high-SES neighborhoods is characteristic of that group's drinking style in general. As seen in Table 1 and documented in the extant literature, low-SES

men have higher rates of heavy and binge drinking, and such findings could, conceivably, be driven by culturally ingrained drinking norms that differ from those of higher-SES men. While this should be investigated in future work, we began to explore this possibility in *post hoc* analyses of situational drinking and drunkenness norms (for a description of items, see Greenfield and Room, 1997). Low-SES men in disadvantaged and middle-class neighborhoods had more conservative drinking norms and, particularly, drunkenness norms (significantly lower mean scores) compared with low-SES men in advantaged neighborhoods. The more liberal drunkenness norms of low-SES men in advantaged neighborhoods thus appear to be anomalous, departing also from the conservative drunkenness norms of their higher-SES male neighbors.

The double jeopardy and status inconsistency hypotheses

Counter to expectations, we did not find support for the double jeopardy and status inconsistency hypotheses. Of note, two prior studies supportive of double jeopardy examined different outcomes (drug use and any alcohol use) and one was confined to an urban area. Given our null findings, we explored whether patterns of stress, a more proximate outcome than drinking patterns and problems, would support these theories. In keeping with the concept of double jeopardy, mean levels of psychological distress were significantly higher among low-SES (versus higher-SES) men living in disadvantaged neighborhoods. This suggests that there may be protective and countervailing effects operating (e.g., conservative drinking norms) which help to account for the null, alcohol findings for double jeopardy.

With regard to the null findings for status inconsistency, *post hoc* analyses revealed that mean levels of psychological distress were virtually identical among high-SES men living in disadvantaged, middle-class, and advantaged neighborhoods. One possible explanation may be that high-SES men have more numerous and robust, stress-buffering resources that help to shield them in a variety of neighborhood environments. Additionally, it may be that high-SES men residing in disadvantaged neighborhoods spend less time in and around their neighborhood than other low-SES residents. Research shows that residents of low-SES neighborhoods who have increased exposure to other, higher SES environments have better health than persons spending most of their time in an economically deprived neighborhood (Inagami *et al*., 2007).

It should be emphasized that the current findings supportive of relative deprivation pertained only to male drinkers, and not to women. In fact, there were no significant cross-level SES interactions found for women. Gender differences in the relationship between stress and substance use have been previously noted in the literature. Research suggests that men may be more likely than women to drink in response to stress (Armeli *et al*., 2000; Ayer *et al*., 2011), and to manifest stress through substance use disorders (Aneshensel *et al*., 1991). These gendered differences might reflect stronger cultural constraints against women's heavy drinking, which are likely to increase as women age, have children and take on mothering roles. The latter speculation is in line with findings from early multivariate models, in which the number of children one cared for was protective against all adverse drinking outcomes among women, but was non-significant among men (data not shown).

Study strengths and limitations

Our study has a number of strengths. First, this study utilizes data from a large, nationally representative, multi-ethnic sample of adults. It also examines several, distinct and meaningful alcohol outcomes that have been lacking in prior studies. Moreover, this study addresses the call for theoretically driven, epidemiological research on the interactive health effects of neighborhood and individual SES and examines theories with relevance beyond the alcohol field.

Despite these strengths, there are limitations that should be acknowledged. First, there is a general concern that interactions are often underpowered (e.g. see Frazier *et al*., 2004; Diez Roux and Mair, 2010). The ability to detect interactions depends upon sufficient heterogeneity within the sample and adequate cell sizes within a given stratum. In our study, low-SES persons in high-SES neighborhoods comprised the smallest cell by far. That we obtained consistently significant results for this group is a reflection of the strength and robustness of the effects. The other, relatively small cell in the sample was occupied by high-SES persons in low-SES neighborhoods, a subgroup used in evaluating the double jeopardy and status inconsistency hypotheses. Given the concerns raised in the literature about insufficient power to detect differences, we used significance levels of $P < 0.10$ for the omnibus F-test for the interaction of NSES and ISES. Future research should attempt to address these issues through careful sampling across and within strata. In addition, consideration should be given to alternative approaches such as propensity score matching, which allows one to examine the association of an exposure and outcome in groups of different sizes that are not particularly well-matched at the outset (Rosenbaum and Rubin, 1983, 1985).

Second, as this is a cross-sectional study, we are unable to infer either social causation or social selection. In studies of disadvantage and health, it is commonly held that individuals who engage in risk behaviors (e.g., those with substance use problems) may be subject to downward drift into disadvantaged neighborhoods and lower socioeconomic positions (Buu *et al*., 2007). However, our study found the greatest risk for adverse drinking patterns and problems to be among disadvantaged men living in the highest-SES neighborhoods, and thus this argument does not apply well here. In addition, because ISES was defined largely by educational attainment, which is commonly fixed in early adulthood, it seems somewhat less likely that heavy drinking men living in the most advantaged neighborhoods would drift downwards from a high to lower socioeconomic position. Consistent with this, 74% of low-SES male drinkers living in high-SES neighborhoods reported no schooling beyond high school.

In conclusion, this study highlights the alcohol-related health risks of low-SES individuals and residents of disadvantaged neighborhoods, and underscores the need for alcohol intervention and policy directed at these vulnerable populations. Importantly, our study also calls attention to the elevated health risks of low-SES men living in the most advantaged neighborhoods. Our findings suggest that the health benefits often associated with residence in affluent

neighborhoods might not extend to all residents, and, further, might vary by health outcome. These results provide support for theories of relative deprivation as applied to adverse drinking patterns among men. While interpretations of the relative deprivation hypothesis often emphasize the negative psychological effects of social comparison, it may be that social interactional processes occurring in communities of high inequality are also an important factor in the poorer health outcomes of disadvantaged residents. The potential roles of stigma and social exclusion warrant greater consideration in future theoretical and empirical efforts to elucidate mechanisms through which relative deprivation influences health. Replication of the current study's results with other, preferably longitudinal data (and with other health outcomes) would help to advance theory and inform the development of interventions that take into account the social conditions of neighborhoods where people live.

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