

## Neighborhood Disadvantage, High Alcohol Content Beverage Consumption, Drinking Norms, and Drinking Consequences: A Mediation Analysis

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**ABSTRACT** *Alcohol use can cause significant harm. We examined the relationships between neighborhood disadvantage, consumption of high-alcohol-content beverages (HACB), drinking norms, and self-reported drinking consequences using data from the 2000 and 2005 National Alcohol Surveys (N=9,971 current drinkers) and the 2000 Decennial Census. We hypothesized that (1) individuals living in disadvantaged neighborhoods would report more negative drinking consequences than individuals living in more affluent neighborhoods, and (2) this relationship would be mediated by HACB consumption and pro-drunkenness drinking norms. Neighborhood disadvantage was based on a composite measure of socioeconomic indicators from the 2000 Decennial Census (five-item composite,  $\alpha=0.89$ ). We measured high alcohol content beverage consumption in terms of whether respondents engaged in frequent or heavy consumption of malt liquor, fortified wine, or distilled spirits/liquor. The outcome was a dichotomous indicator of two or more of 15 past-year social, legal, work, and health consequences. Simultaneous, multivariate path modeling tested direct and indirect effects of neighborhood disadvantage, HACB consumption, and pro-drunkenness norms on consequences. Individuals living in disadvantaged neighborhoods reported significantly more negative drinking consequences than individuals living in more affluent neighborhoods. Consumption of high-alcohol-content beverages and pro-drunkenness norms did not mediate this relationship. However, heavy distilled spirits/liquor use was a significant mediator of other neighborhood characteristics (i.e., percent African American). Living in an African American neighborhood was related to increased spirits/liquor consumption and, in turn, reporting more negative drinking consequences. Greater scrutiny of advertising and tax policies related to distilled spirits/liquor is needed to prevent future drinking problems, especially in minority neighborhoods.*

**KEYWORDS** *Neighborhood disadvantage, Malt liquor, Fortified wine, Spirits/liquor, Drinking norms, Drinking consequences*

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### INTRODUCTION

Alcohol use can cause significant harm. Heavy alcohol use is associated with a variety of health and social problems including cardiovascular disease, several cancers, and liver cirrhosis, as well as drinking and driving, assaults, and domestic violence.<sup>1-5</sup>

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The neighborhoods where people live can affect their drinking behavior. This is especially true in disadvantaged neighborhoods where liquor stores are over-concentrated,<sup>6-8</sup> and alcohol is heavily promoted by commercial interests.<sup>9-11</sup>

Various theories have been used to explain how living in a disadvantaged neighborhood affects drinking behavior. For example, social ecological theory<sup>12</sup> suggests that the high concentration of liquor stores increases the physical availability of alcohol, and the heavy promotion of alcohol makes heavy drinking more socially acceptable and encourages consumption in disadvantaged neighborhoods. Studies have found that alcohol outlet density is associated with increased alcohol consumption and drinking problems or consequences,<sup>13-15</sup> and other studies have shown that alcohol advertising is associated with more positive attitudes regarding drinking, drinking initiation at younger ages, brand preference, and alcohol consumption.<sup>16-20</sup>

Several studies have investigated the effects of neighborhood disadvantage on substance use, but findings have been mixed.<sup>21</sup> Some studies have found that neighborhood disadvantage is associated with increased alcohol consumption, heavy drinking,<sup>22,23</sup> and drinking consequences.<sup>24</sup> For example, Cerda and colleagues<sup>22</sup> found that a one-unit increase in the proportion of adult residents living in poverty was associated with an 86 % increase in odds of heavy drinking. In contrast, other studies have found no support for the disadvantage hypothesis and substance use,<sup>25</sup> and still other studies have shown mixed results depending on the measure of neighborhood socioeconomic status<sup>26</sup> or the outcome examined.<sup>27,28</sup> Karriker and colleagues<sup>29</sup> found neighborhood disadvantage was associated with elevated risk of negative drinking consequences, particularly for White women and African American men but not to alcohol dependence symptoms. Although prior studies have examined neighborhood influences on drinking behavior, few studies have used large, nationally representative samples or examined different dimensions of neighborhood disadvantage or multiple outcomes. Even fewer have considered the pathways through which neighborhood disadvantage influences drinking problems or consequences. One important exception is the work by Chuang and colleagues<sup>30</sup> which used a national sample to model mediators of neighborhood effects on adolescent substance use. They found that peer substance use was an important mediator of the effects of neighborhood disadvantage on adolescent alcohol use. Understanding the mechanisms by which neighborhood disadvantage affects negative drinking consequences can help identify where to target prevention programs, policies, and resources.

Two potential mediators that may be important in understanding how living in a disadvantaged neighborhood affects drinking behavior are high-alcohol-content beverage consumption and pro-drunkenness norms. High-alcohol-content beverages include malt liquor beer (7 % alcohol by volume or ABV), fortified wines (17 % ABV), and distilled spirits/liquor (40 % ABV).<sup>31</sup> Malt liquor (e.g., Colt 45) and low-end fortified wines (e.g., Thunderbird) are inexpensive, highly available, and widely promoted in disadvantaged and African American neighborhoods.<sup>10,11,32</sup> In some disadvantaged African American neighborhoods, it is not uncommon to see more advertisements for malt liquor than food on the storefronts of food stores.<sup>32</sup> Distilled spirits are promoted in print media<sup>33</sup>; however, cognac and brandy have increasingly been marketed in outdoor advertising in African American and low-income neighborhoods.<sup>34</sup> Sex, glamour, prestige, and sophistication are common themes in such outdoor advertisements in disadvantaged neighborhoods.<sup>34</sup> The

promotion of high-alcohol-content beverages is of particular concern. Malt liquor consumption is associated with frequent daily drinking, heavy drinking,<sup>35,36</sup> and problem behaviors such as drug use, theft, disorderly conduct, assaults, and panhandling,<sup>37-40</sup> while consumption of spirits is associated with heavy and dependent drinking and cancer mortality.<sup>41</sup> Drinking norms reflect common rules regarding the appropriateness of drinking, and they help regulate social behavior.<sup>42</sup> The high availability and promotion of malt liquor and fortified wines in disadvantaged and African American neighborhoods may contribute to drinking norms favoring higher consumption of alcohol in general and to a greater use of high-alcohol-content beverages in disadvantaged neighborhoods. Some studies have found that norms or attitudes supportive of drunkenness are strongly related to heavy drinking and to drinking problems.<sup>35,43</sup> These pro-drunkenness norms also may be associated with consumption of high-alcohol-content beverages by drinkers who want to get drunk quickly.

The objectives of our study were to investigate whether (1) neighborhood disadvantage was associated with negative drinking consequences and (2) determine whether this relationship was mediated by high-alcohol-content beverage consumption (e.g., malt liquor, fortified wine, and spirits/liquor) and pro-drunkenness drinking norms. We hypothesized that (1) individuals living in disadvantaged neighborhoods would report more negative drinking consequences than individuals living in more advantaged neighborhoods, and (2) this relationship would be mediated by high-alcohol-content beverage consumption or pro-drunkenness drinking norms. Given the high availability and targeted marketing of high-alcohol-content beverages to African American consumers, we also examined whether effects varied by race/ethnicity and took into account neighborhood racial/ethnic composition.<sup>10,11,32</sup>

## METHODS

### Data

The data from our study come from the 2000 and 2005 National Alcohol Surveys (NAS). Both surveys involved computer-assisted telephone interviews with a randomly selected sample of US adults, including oversamples of African Americans, Hispanics, and residents from sparsely populated US states. The similarity in methods and their virtually identical interview protocols allows the two NAS datasets to be merged for more power for subgroup analyses and investigation of rare outcomes. For more details on the NAS methodology, see Midanik and Greenfield.<sup>44</sup>

The 2000 NAS included 7,613 respondents ages 18 years and older (58 % response rate), and the 2005 NAS included 6,919 respondents ages 18 years and older (56 % response rate). The sample for the current study includes 9,971 current drinkers who reported consuming at least one drink in the past 12 months. Although the response rates for the telephone surveys are lower than those often seen in face-to-face surveys, they are typical for recent random-digit dial telephone surveys in the US,<sup>45</sup> and do not necessarily produce biased population estimates.<sup>46,47</sup>

For this study, NAS data were geocoded and matched with indicators of neighborhood SES from the 2000 Census.<sup>48</sup> Respondent addresses were geocoded by a commercial firm (97 % accuracy rate). Next, the geocoded survey data were linked to indicators of neighborhood disadvantage at the census tract level, which contains, on

average, approximately 4,000 individuals. Census tract-level measures of neighborhood disadvantage can provide important information on contextual determinants of substance use.<sup>49-51</sup> 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 whether the relationship between neighborhood disadvantage and reporting negative drinking consequences differed depending on the geographic unit used to geocode the data. Results were similar using geocoded data based on a street address or a zip code centroid ( $p > 0.05$ , data available upon request).

### Neighborhood-Level Measures

The neighborhood indicators included neighborhood disadvantage, racial/ethnic composition, and urbanicity. Neighborhood disadvantage was a composite measure including 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. The measure of disadvantage was validated in a preliminary study<sup>51</sup> and had high reliability in the study sample (Cronbach's alpha=0.89,  $M=17.6$ ,  $SD=9.5$ ).

Models also adjusted for racial/ethnic composition and urbanicity because previous studies have shown that high-alcohol-content beverages are highly available and heavily promoted in African American urban neighborhoods.<sup>10,32,38</sup> Neighborhood racial/ethnic composition was represented by two variables: proportion Black/African American ( $M=9.9$ ,  $SD=19.4$ ) and proportion Hispanic/Latino ( $M=9.9$ ,  $SD=17.1$ ). Urbanicity was the proportion of residents in an urbanized area or urban cluster ( $M=74.2$ ,  $SD=37.7$ ). All neighborhood variables were square-root-transformed due to skewness.

### Individual-Level Measures

*Consumption of High-Alcohol-Content Beverages.* Three dichotomous variables indicated frequent or heavy consumption of high-alcohol-content beverages (malt liquor, fortified wine, and spirits/liquor). A beverage-specific series of items assessed how often respondents consumed each type of alcoholic beverage ("wine or a punch containing wine or wine coolers or fortified wine," "beer or malt liquor," and "drinks containing whiskey or any other liquor, including scotch, bourbon, gin, vodka, rum, and so on"). Eleven response options ranged from "never had [type of beverage]" to "three or more times a day." Frequent consumption of malt liquor was assessed with a follow-up question: "When you drink beer, about how much of the time do you drink malt liquor?" Response options included "nearly every time," "more than half of the time," "less than half of the time," "once in a while," and "never." Approximately 11 % of current drinkers reported any use of malt liquor. Responses were dichotomized such that respondents reporting use more than "once in a while" (about 4 % of current drinkers and 40 % of those reporting any use of malt liquor) were categorized as frequent malt liquor drinkers. Frequent consumption of fortified wine was assessed with a similar follow-up item: "When you drink wine, about how much of the time do you drink sherry, port, sake, or other fortified wine?" (same response options as for malt liquor). Approximately 21 % of current drinkers reported any use of fortified wine. As above, responses were dichotomized such that respondents reporting use more than "once in a while" (about 7 % of current drinkers and 30 % of those reporting any use of fortified wine) were categorized as frequent fortified wine drinkers. Heavy consumption of spirits/liquor was based on a follow-up series of

beverage-specific items that uses a graduated quantity–frequency format to assess the proportion of times respondents reported drinking “five or six drinks [containing whiskey, liquor, or spirits] or more,” “only three or four drinks,” and “only one or two drinks,” with five response categories ranging from “nearly every time” to “never.” The total volume of spirits/liquor consumed in the past year was calculated by a summative algorithm,<sup>52</sup> and respondents with total spirits/liquor volumes greater than one standard deviation above the sample mean were categorized as heavy spirits/liquor drinkers. We did not create a similar total volume measure for malt liquor and fortified wine consumption, because the NAS asked respondents about frequency of consuming malt liquor and fortified wines only.

*Pro-drunkenness Norms.* Pro-drunkenness norms were based on situational drinking and drunkenness norms.<sup>43</sup> Scores were based on five items assessing how much drinking is acceptable (no drinking, one or two drinks, “enough to feel the effects but not get drunk,” or “getting drunk is sometimes all right”) in different social situations, including at a party at someone else’s home, for a man out at a bar with friends, for a woman out at a bar with friends, for a couple of co-workers out for lunch, and when going to drive a car. Each item was dichotomized with “getting drunk is sometimes all right” coded as 1 and all other levels of drinking coded as 0. A total score was calculated (range=0–5), indicating the number of situations in which drunkenness was acceptable.

*Negative Drinking Consequences.* Negative drinking consequences experienced by past-year drinkers were captured by a dichotomous variable indicating whether the respondent had experienced two or more of 15 negative alcohol-related consequences, including social (such as getting into a fight while drinking), legal (such as being questioned or warned by a police officer because of drinking), workplace (such as drinking hurting chances for promotion, raises, or better jobs), and health consequences (such as drinking becoming a serious threat to physical health). The items have been validated and used in previous studies based on NAS data over many years,<sup>53</sup> and in this sample, the reliability was good (internal consistency measured by the Kuder–Richardson formula 20=0.73).

*Demographic Control Variables.* The path models adjusted for age (continuous), race/ethnicity (mutually exclusive dummy variables for African American, Hispanic, Asian/Pacific Islander, Native American/Alaska Native, and other race/ethnicity, with Caucasian as reference), marital status (currently living with spouse/partner versus not), number of children in the household (ranging from 0 to 5 or more), education (dummy variables for less than high school, high school graduate, and some college, with college degree as reference), employment status (dummy variables for unemployed and not in workforce, with employed as reference), and household income (dummy variables for \$20,000 or less in the past year; \$20,001–40,000; \$40,001–60,000; \$60,001–80,000; and missing income, with \$80,001 or more as the reference). Models also included indicators of geocoding precision (ZIP code match versus street address match).

### **Analysis Strategy**

To test study hypotheses, we used simultaneous, multivariate path modeling using Mplus.<sup>54</sup> In the context of multiple mediators that are expected to be correlated, this simultaneous estimation technique provides greater power for testing mediation

than would separate tests of each hypothesized mediator,<sup>55</sup> and it tests the influence of each mediator while adjusting for the relationships among all variables in the model. Specifically, in the full path model, neighborhood disadvantage was specified as being correlated with each of the other neighborhood characteristics, and all of the high-alcohol-content beverage variables were specified as correlated with one another. The mediation analysis followed procedures discussed in MacKinnon,<sup>56</sup> with mediated effects estimated using the MODEL INDIRECT sub-command, which provides estimates of both the indirect effects and their standard errors.

We used the robust weighted least-squares estimator (WLSMV) and theta parameterization, because the model contains both continuous and categorical variables.<sup>56</sup> The final path model was chosen based on comparisons of nested models using the DIFFTEST procedure,<sup>57</sup> because standard chi-square difference testing is not valid for models using WLSMV estimation. For each path in the overall model, statistically non-significant control variables were trimmed to preserve degrees of freedom; changes were confirmed as maintaining model fit using difference testing and fit indices, including the comparative fit index (CFI), Tucker–Lewis fit index, and the root mean square error of approximation (RMSEA).

After the full path model was specified, we examined subgroup differences by race/ethnicity and gender. As previously mentioned, high-alcohol-content beverages such as malt liquor are highly available and heavily promoted in African American neighborhoods.<sup>10,32</sup> Additionally, men are more likely to be consumers of high-alcohol-content beverages such as malt liquor than women.<sup>35,58</sup> We used multiple group analysis and difference tests to evaluate whether allowing paths to vary significantly improved the fit over models where paths were constrained to be equal across groups. Due to the limited sub-sample sizes for some of the racial/ethnic categories, we tested for differences in the path models for Whites, Blacks/African Americans, Hispanics/Latinos, and all others combined.

All analyses used weighted data to adjust for sampling and non-response by survey. 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 respondents (maximum was nine). Thus, multilevel analytic strategies were not required.<sup>59</sup> Because there were only a small number of respondents in each census tract, testing for spatial autocorrelation or spatial clustering of data was deemed unnecessary.

## RESULTS

### Descriptive Analyses

The weighted sample was half male (51 %), with an average age of 43 years (Table 1). The majority of respondents (76 %) were White/Caucasian, with 10 % Hispanic/Latino, 9 % Black/African American, 2 % Asian/Pacific Islander, 2 % Native American/Alaska Native, and 1 % another race/ethnicity. Two thirds (65 %) were married or living with a partner. Most (73 %) were employed; slightly more than half (56 %) had incomes of \$60,000/year or less, and 64 % had attended at least some college. For a more detailed description of the sample, see Karriker-Jaffe et al.<sup>60</sup>

Overall, 5.0 % of respondents reported experiencing two or more negative drinking consequences in the past year. Drinking consequences were common

**TABLE 1** Characteristics of the 2000 and 2005 National Alcohol Survey samples

	Total sample (Weighted N=9,307)	<2 Negative Consequences (N=8,838)	2+ Negative Consequences (N=469)	Pvalue
Sex				<0.001
Male	51.2 %	50.0 %	26.5 %	
Female	48.8 %	50.0 %	73.5 %	
Race/ethnicity				<0.001
Asian/Pacific Islander	2.3 %	2.3 %	2.1 %	
Black/African American	8.8 %	8.7 %	11.8 %	
Hispanic/Latino	9.9 %	9.7 %	13.5 %	
Native American/AK Native	1.7 %	1.6 %	3.8 %	
White	76.4 %	76.8 %	68.7 %	
Age (mean)	43.0 years	43.7 years	30.0 years	<0.001
Marital status				<0.001
Single	35.2 %	34.1 %	56.8 %	
Married/cohabit	64.8 %	65.9 %	43.2 %	
Number of children in home (mean)	0.77	0.77	0.81	>0.10
Education				<0.001
Less than high school	8.2 %	7.5 %	20.8 %	
High school graduate	27.4 %	27.1 %	34.5 %	
Some college	28.0 %	28.0 %	28.2 %	
College graduate	36.4 %	37.4 %	16.5 %	
Employment				<0.001
Employed	73.1 %	72.9 %	77.2 %	
Unemployed	3.9 %	3.6 %	8.7 %	
Not in workforce	23.0 %	23.5 %	14.1 %	
Income				<0.001
\$20,000 or less	16.6 %	15.9 %	30.3 %	
\$20,001–40,000	22.2 %	22.3 %	20.2 %	
\$40,001–60,000	17.2 %	17.4 %	13.3 %	
\$60,001–80,000	12.9 %	13.0 %	11.4 %	
\$80,001 or more	20.0 %	20.3 %	14.9 %	
High-alcohol-content beverage consumption				
Frequent malt liquor use	4.0 %	3.3 %	17.1 %	<0.001
Frequent fortified wine use	6.5 %	6.3 %	10.3 %	<0.001
High spirits/liquor volume	7.4 %	6.2 %	29.6 %	<0.001
Pro-drunkenness norms (mean)	0.28	0.25	0.94	<0.001
Neighborhood characteristics				
Socioeconomic disadvantage (mean)	17.60	17.44	20.45	<0.001
% African American (mean)	9.90	9.74	12.88	<0.05
% Hispanic/Latino (mean)	9.95	9.99	10.78	>0.10
% Urban (mean)	74.27	74.24	74.74	>0.10

among respondents living in disadvantaged and African American neighborhoods and among respondents who reported more pro-drunkenness norms and higher consumption of high-alcohol-content beverages, especially spirits/liquor (Table 1).

Correlations between neighborhood disadvantage and the proposed mediators are presented in Table 2. Tetrachoric correlations are presented for the association between two dichotomous variables; all others are Pearson correlation coefficients. Neighborhood disadvantage was significantly correlated with frequent malt liquor and fortified wine use but uncorrelated with pro-drunkness drinking norms.

### Path Analyses

Figure 1 shows all significant paths in the overall final model, with significant mediation pathways highlighted by bold arrows. All paths, including additional coefficients for the control variables, are presented in Table 3. The overall path model achieved excellent fit (see fit statistics included with Figure 1) and explained 47 % of the total variance in negative drinking consequences.

*Direct Effects.* Neighborhood disadvantage had significant direct paths to frequent malt liquor use, frequent fortified wine use, and to increased negative drinking consequences. Frequent malt liquor use, heavy spirits/liquor use, and pro-drunkness norms were significantly related to negative drinking consequences.

*Mediation Effects.* Consumption of high-alcohol-content beverages did not mediate the relationship between neighborhood disadvantage and negative drinking consequences, with all specific indirect effects yielding  $p > 0.10$ . However, heavy spirits/liquor use was a significant mediator of other neighborhood characteristics (i.e., percent African American, with standardized  $B = 0.02$ ,  $p < 0.05$ ). Percent African American was related to increased spirits/liquor consumption and, in turn, reporting

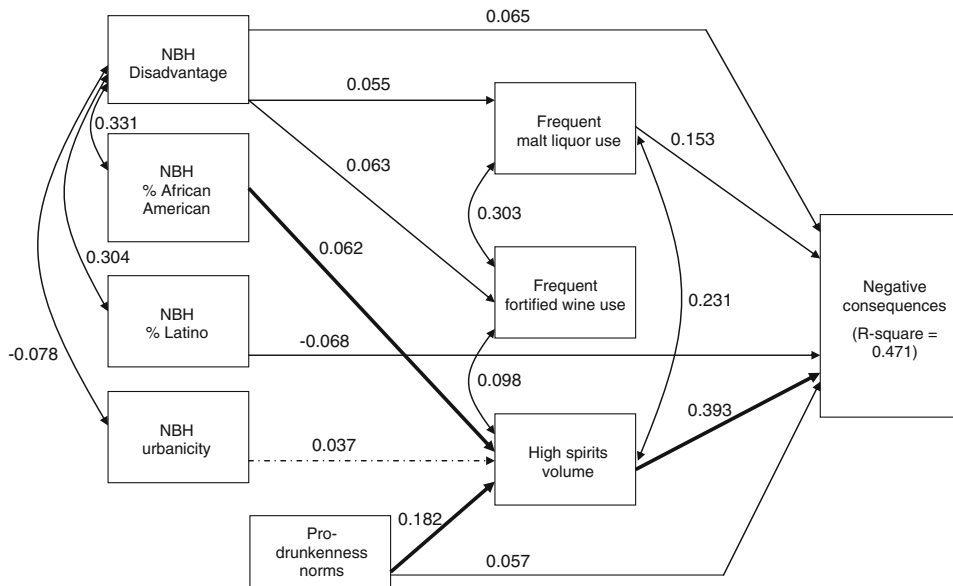
**TABLE 2** Correlations of neighborhood variables and proposed mediators

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Neighborhood disadvantage	1.00							
% African American	0.42***	1.00						
% Hispanic	0.34***	0.09***	1.00					
% Urban	-0.05***	0.26***	0.28***	1.00				
Frequent malt liquor use	0.08***	0.07***	0.04***	0.03**	1.00			
Frequent fortified wine use	0.05***	0.04***	0.02	0.01	0.30***	1.00		
High liquor/spirits volume	0.01	0.03**	0.00	0.02**	0.26***	0.10**	1.00	
Pro-drunkness norms	-0.02	-0.01	-0.01	0.01	0.07***	0.03*	0.14***	1.00
2+ Negative consequences	0.07***	0.03*	0.01	0.00	0.43***	0.15**	0.46***	0.20***

Tetrachoric correlations between two dichotomous variables indicated in *italics*

\* $P < 0.10$ , \*\* $P < 0.05$ , \*\*\* $P < 0.01$





**FIGURE 1.** Standardized coefficients from path model; estimated  $df=35$ ,  $CFI=0.960$ ,  $TLI=0.859$ ,  $RMSEA=0.033$ . Model adjusts for age, race, gender, income, education, employment, marital status, number of children and geocoding precision. NS paths from control variables were trimmed from model to preserve degrees of freedom. Only significant ( $p < .05$ ) paths are shown (dashed line represents marginally significant paths,  $p < .10$ ); Significant indirect paths indicated with bold arrows.

more negative drinking consequences. This effect appeared to be strongly mediated, as the residual direct effect of percent African American on negative consequences was not significant (see Table 3).

Pro-drunkness norms also did not mediate the relationship between neighborhood disadvantage and negative drinking consequences. However, pro-drunkness norms were significantly related to heavy spirits/liquor use, which resulted in a significant indirect path to negative drinking consequences, with standardized  $B= 0.07$ ,  $p < .01$ . This effect was not fully mediated, as a significant direct path remained between pro-drunkness norms and consequences (see Table 3).

*Subgroup Differences.* Subgroup analyses revealed few differences by gender or race/ethnicity with respect to our hypotheses (full models not shown). For example, consumption of high-alcohol-content beverages did not mediate the relationship between neighborhood disadvantage and negative drinking consequences for any racial/ethnic group (all  $p$ 's  $> .10$  for the specific indirect effect). We did find that the relationship between neighborhood disadvantage and frequent fortified wine use was significant and positive for Whites (standardized  $B=0.11$ ,  $p < .01$ ) and significant and negative for "others" (standardized  $B=-0.25$ ,  $p < .05$ ) but not statistically significant for either African Americans (standardized  $B=-0.06$ ,  $p > .10$ ) or Hispanics (standardized  $B=0.13$ ,  $p$ 's  $> .10$ ). Additionally, percent Hispanic was significantly associated with reduced negative consequences for women (standardized  $B=-0.15$ ,  $p < .01$ ) but not for men (standardized  $B=-0.04$ ,  $p > .10$ ).

TABLE 3 Standardized coefficients from overall path model predicting negative consequences of drinking

	2+ Negative consequences	Malt liquor	Fortified wine	Liquor/spirits	Pro-drunkennes norms	Neighborhood disadvantage	% African American	% Hispanic	% Urban
Neighborhood disadvantage	0.07**	0.06*	0.06**	-0.02					
% African American	-0.02	0.03	0.00	0.06**					
% Hispanic	-0.07**	0.00	0.00	0.00					
% Urban	-0.02	0.03	0.00	0.04					
Pro-drunkennes norms	0.06**	0.03	0.04	0.18***					
Frequent malt liquor use	0.15**								
Frequent fortified wine use	-0.01								
High liquor/spirits volume	0.39***								
Male	0.09***	0.10***	0.04*	0.19***	0.12***	0.02*	-0.02**	0.01	-0.01
Age	-0.36***	-0.28***	-0.06**	0.08***	-0.34***	-0.02	-0.02**	-0.02	-0.04**
Married/cohabit	-0.05	-0.05*	-0.06**	-0.08***	-0.06***	-0.01	-0.04***	-0.02	-0.08***
Children in home				-0.11***	-0.08***	0.01	-0.07***	-0.02	-0.20***
Race/ethnicity (vs. White)									
Asian/Pacific Islander	-0.03	0.04	0.07**		0.01	0.00	0.04***	0.07***	0.06**
Black/African American	-0.02	0.07**	0.06**		-0.08***	0.24***	0.58***	0.03***	0.13***
Hispanic/Latino	-0.02	-0.01	0.01		-0.09***	0.17***	0.12***	0.44***	0.14***
Native Amer./AK Native	0.03	0.03	0.00		-0.02	0.04***	0.04***	0.02*	-0.01

**TABLE 3 (continued)**

	2+ Negative consequences	Malt liquor	Fortified wine	Liquor/spirits	Pro-drunkenness norms	Neighborhood disadvantage	% African American	% Hispanic	% Urban
Other	-0.08**	0.07**	0.00		-0.03	0.00	0.02*	0.07***	0.03**
Education (vs. college graduate)									
Less than high school	0.11***	0.11***		0.04		0.11***	-0.01	0.03**	-0.09***
High school graduate	0.10***	0.06		0.02		0.08***	-0.02*	-0.04**	-0.14***
Some college	0.05	0.06		0.05*		0.05***	-0.02*	0.01	-0.08***
Employment (vs. employed)									
Unemployed					0.05***	0.01	0.01	0.02*	0.01
Not in workforce					0.06***	0.03**	0.01	0.01	0.02
Income (vs. >\$80,001/year)									
\$20,000 or less		0.09**				0.25***	0.01	0.02	-0.07***
\$20,001-40,000		0.01				0.20***	0.00	0.01	-0.10***
\$40,001-60,000		-0.01				0.12***	-0.01	0.01	-0.08***
\$60,001-80,000		0.03				0.07***	0.00	0.00	-0.05***
Missing income		0.01				0.09***	0.01	0.01	-0.01
Geocoding precision						0.00	-0.02	0.00	-0.03**
R-squared	0.47	0.17	0.02	0.11	0.13	0.20	0.35	0.21	0.11

\*P<0.10, \*\*P<0.05, \*\*\*P<0.01

## DISCUSSION

### **Neighborhood Disadvantage and Negative Drinking Consequences**

As hypothesized, individuals living in disadvantaged neighborhoods reported more negative work, legal, and health consequences due to their drinking than individuals living in more affluent neighborhoods. Social ecological theory suggests that negative drinking consequences are higher in disadvantaged neighborhoods because of the social and economic conditions under which individuals live.<sup>12</sup> Individuals living in disadvantaged neighborhoods often work in low wage jobs with less autonomy and control over their work, and problem drinking might be less tolerated in such work environments.<sup>61</sup> Because crime rates are higher in disadvantaged neighborhoods than in more affluent neighborhoods,<sup>62–65</sup> individuals living in disadvantaged neighborhoods are also more likely to come in contact with local police. This is particularly true for African Americans who are about one and half times (1.4) times more likely than their White peers to be detained by the police.<sup>66</sup> Additionally, lower-income individuals report poorer health, in general, than higher-income individuals.<sup>67–69</sup>

It was not surprising that malt liquor and fortified wine consumption was higher among individuals living in disadvantaged neighborhoods. Lower income individuals are some of the biggest consumers of malt liquor and low-end fortified wines.<sup>70–72</sup> It is likely the low cost of malt liquor and low-end fortified wines increases their availability and consumption among individuals living in disadvantaged neighborhoods. In 2012, the price of a 40-ounce bottle of Colt 45 malt liquor was less than a gallon of milk in Washington, DC, a city with one of the highest costs of living.<sup>73,74</sup>

Higher consumption of malt liquor and distilled spirits/liquor was associated with reporting more negative drinking consequences. Previous studies have also shown that malt liquor use is associated with heavy drinking and more aggressive behavior and to a variety of nuisance crimes<sup>35,37–39</sup>; other studies have shown that distilled spirits/liquor consumption is linked to heavy and dependent drinking, liver cirrhosis, and other health problems such as head and neck cancer mortality.<sup>41</sup> It is possible that the relationships between consumption of high-alcohol-content beverages and negative drinking consequences are due to heavy drinking in general. However, using logistic regression models, we verified in this sample that the findings were robust after adjustment for total annual volume of alcohol consumed.

### **Neighborhood Disadvantage, High Alcohol Content Beverage Consumption, Drinking Norms, and Drinking Consequences**

Contrary to our hypothesis, and despite the significant associations of neighborhood disadvantage with malt liquor and fortified wine use, the relationship between neighborhood disadvantage and negative drinking consequences was not significantly mediated by our high-alcohol-content beverage consumption or drinking norm variables. Other psychosocial variables not explored in this study (e.g., psychosocial distress) might be intermediate variables between neighborhood disadvantage and negative drinking consequences. Studies have shown that low-income individuals report higher levels of psychological distress,<sup>75–77</sup> and some studies have reported that higher levels of psychological distress are associated with increased alcohol consumption and drinking problems.<sup>78–80</sup>

Although our mediation hypotheses were not supported, we found that living in a neighborhood with a higher proportion of African Americans was associated with heavy distilled spirits/liquor use and, in turn, reporting more negative drinking consequences. One plausible explanation for this finding might be related to the marketing practices of the alcohol industry. To diversify its consumer base, the alcohol industry has used a variety of marketing strategies to reach African Americans, including ethnic-oriented advertisements on billboards in predominately African American neighborhoods (see <http://www.epi.umn.edu/alcohol/maltphotos/index.shtml>) and product placement of products such as vodka in African American-oriented reality television shows.<sup>81</sup> It is also plausible that the heavy consumption of distilled spirits/liquor among African Americans reflects consumer preference and demand. Graves and Kaskutas found that African Americans preferred distilled spirits such as vodka and whiskey to wine.<sup>82</sup>

Individuals with pro-drunkenness norms consumed more distilled spirits/liquor and, in turn, experienced greater drinking consequences. It is likely individuals with pro-drunkenness norms seek higher-alcohol-content beverages because of their higher alcohol content and the ability to get drunk more quickly.

### **Strengths and Limitations**

Our study is the first to report that living in a neighborhood with a higher proportion of African Americans is associated with heavy distilled spirits/liquor use and, in turn, reporting more negative drinking consequences. This finding is noteworthy as consumption of distilled spirits/liquor in the US has steadily increased since the mid-1990s.<sup>41</sup> Other strengths of our study include the use of a large national, multi-ethnic sample, validated measure of neighborhood disadvantaged, and the large variance (47 %) explained by our overall path model.

Several limitations of our study should also be noted. First, our study is cross-sectional, making it difficult to infer causality about whether living in a disadvantaged neighborhood leads to increased malt liquor and fortified wine consumption or whether the reverse is true. A recent literature review revealed that the relationship between indicators of neighborhood socioeconomic status and substance use did not differ markedly for cross-sectional and longitudinal study designs.<sup>50</sup>

Second, the telephone response rates for our alcohol survey data were somewhat low (56–58 %). Evidence suggests that non-response bias, if present, should have little impact on results related to consumption measures. A series of methodological studies comparing identical questions in telephone and in-person surveys has found comparable estimates across modality for mean alcohol consumption<sup>45,83</sup> and only modest and inconsistent mode effects for alcohol harms.<sup>84</sup>

Third, our malt liquor and fortified wine consumption measures assessed frequency of consuming malt liquor and fortified wine only. Frequency measures have limitations as they do not take into account how much alcohol an individual consumes. Despite these limitations, we found significant effects between neighborhood disadvantage and malt liquor and fortified wine consumption and between malt liquor consumption and drinking consequences. Our results highlight some of the challenges of including measures of high-alcohol-content beverages such as malt liquor in large, national surveys.

### **Implications**

Future studies are needed to identify what aspects of disadvantaged neighborhoods contribute to negative drinking consequences. Once identified, public policies can be

developed to alter aspects of disadvantaged neighborhoods that contribute to drinking problems (e.g., higher concentrations of liquor stores). Especially needed are large, longitudinal studies that examine how changes in the socioeconomic characteristics of neighborhoods (e.g., income, educational levels) influence alcohol outcomes. A number of neighborhoods in major US cities have undergone gentrification over the past few decades, making it possible to compare rates of drinking problems prior and following gentrification.<sup>32</sup>

Future studies also should monitor advertising policies related to distilled spirits as well as current tax policy on distilled spirits/liquor. In the US, per capita distilled spirits/liquor sales have increased slowly since 1994, while taxes on distilled spirits/liquor have declined in real value during this period.<sup>41</sup> Studies have shown that increases in taxes on alcohol are associated with reductions in alcohol consumption and drinking problems such as traffic crashes.<sup>85-87</sup>

## CONCLUSION

Understanding the context in which negative drinking consequences occur is important to reducing future drinking problems. Our results suggest that where an individual lives can affect the types of alcohol outcomes they experience. We found that living in disadvantaged neighborhood was associated with reporting more drinking consequences even after adjusting for individual socioeconomic and race/ethnicity variables. We also found neighborhood racial/ethnic composition was related to negative drinking consequences and that heavy distilled spirits use was an important intermediate variable in this relationship. Prior research has emphasized malt liquor as a possible contributor to negative consequences in disadvantaged minority neighborhoods.<sup>37-40</sup> We argue that greater scrutiny of current advertising and tax policy in the US related to distilled spirits/liquor sales is needed to prevent future drinking problems.

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