Hispanic Americans Baseline Alcohol Survey (HABLAS): Effects of Container Size Adjustments on Estimates of Alcohol Consumption Across Hispanic National Groups

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ABSTRACT. Objective: This study was conducted to examine discrepancies in alcohol consumption estimates between a self-reported standard quantity–frequency measure and an adjusted version based on respondents' typically used container size. **Method:** Using a multistage cluster sample design, 5,224 Hispanic individuals 18 years of age and older were selected from the household population in five metropolitan areas of the United States: Miami, New York, Philadelphia, Houston, and Los Angeles. The survey-weighted response rate was 76%. Personal interviews lasting an average of 1 hour were conducted in respondents' homes in either English or Spanish. **Results:** The overall effect of container adjustment was to increase estimates of ethanol consumption by 68% for women (range across Hispanic groups: 17%–99%) and 30% for men (range: 14%–42%). With the exception of female Cuban American, Mexican American, and South/Central American beer drinkers and male Cuban American wine drinkers, all percentage differences between unadjusted and container-adjusted estimates were positive. Second, container adjustments produced the largest change for volume of distilled spirits, followed by wine and beer. Container size adjustments generally produced larger percentage increases in consumption estimates for the higher volume drinkers, especially the upper tertile of female drinkers. **Conclusions:** Self-reported alcohol consumption based on standard drinks underreports consumption when compared with reports based on the amount of alcohol poured into commonly used containers. (*J. Stud. Alcohol Drugs, 73,* 120–125, 2012)

IN POPULATION SURVEYS, IT IS DESIRABLE that measures of alcohol use should be as unbiased, reliable, and valid as possible. At the same time, such measures must be based on questions that respondents are willing and able to answer meaningfully. Driven in part by findings of substantial undercoverage of alcohol sales data in population surveys and journaling methods (Heeb and Gmel, 2005; Lemmens, 1994; Stockwell et al., 2004), the potential for bias in alcohol consumption measures has been a recurring focus of investigation in alcohol research. The ramifications are numerous: Inaccurate measurement can be expected to have an impact on estimates of risk factors for alcohol use, screening for risky drinking behavior in clinical and public health contexts (e.g., Caetano and Mills, 2011) and estimates of associations between consumption and alcohol-related problems (Kerr et al., 2009).

Actual drink sizes—measured via photographic, pouring, or verbal estimation methods—often differ from "standard" sizes assumed in survey research (Kaskutas and Graves, 2000; Kerr et al., 2005; Lemmens, 1994; Williams et al., 1994). Although the effect varies by beverage type, the general trend is that adjustments for container size or pouring level typically produce higher consumption estimates and improve survey coverage of alcohol sales data (Kerr and Greenfield, 2007). This article examines discrepancies in alcohol consumption estimates between a standard quantity–frequency measure and an adjusted version based on respondents' typically used container size. The subjects comprise a large sample of U.S. Hispanics (Puerto Ricans, Cuban Americans, Mexican Americans, and South/Central Americans) from the Hispanic Americans Baseline Alcohol Survey (HABLAS). Although standard drink measurement methods typically underestimate actual consumption, the extent of the effect also varies by culture/ethnicity, perhaps because of different drinking patterns and norms (Fryer et al., 2004; Kaskutas and Graves, 2000; Kaskutas and Kerr, 2008; Lemmens, 1994; Witbrodt et al., 2008). However, there have been no major examinations of this issue with U.S. Hispanics, who constitute roughly 15% of the present U.S. population (U.S. Census Bureau, 2008a) and who are expected to reach 30% by the year 2050 (U.S. Census Bureau, 2008b).

In the present study, we first documented the effect of container adjustments on alcohol consumption associated among U.S. Hispanics. Predicted differences are complicated by two opposing influences. In previous work, the extent of underreporting has generally increased at higher drinking levels and at higher socioeconomic levels (in particular, education; Kaskutas and Graves, 2000, 2001; Kaskutas and Kerr, 2008; Kerr et al., 2009). In the HABLAS sample, Puerto Ricans and Cuban Americans show large differences

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in each of these variables, with Puerto Ricans consuming more alcohol and reporting lower levels of education (for an overview of sociodemographic differences between HABLAS subgroups, see Caetano et al., 2009). Consequently, Puerto Ricans and Cuban Americans could show higher levels of discrepancy but for different reasons.

Second, we examined a set of multivariable models to tease apart these opposing influences. Curiously, no studies have explored multivariable predictive models of underreporting (but see Kerr et al., 2009, for an approach that comes closest to doing this). In the present study, differences between Hispanic subgroups were explored, adjusting for several common demographic background characteristics. Given the robustness of bivariate education and baseline drinking level effects reported previously (Kaskutas and Graves, 2000, 2001; Kaskutas and Kerr, 2008; Kerr et al., 2009), we expected each of those variables to uniquely predict underreporting across all outcomes. Less consistently reported effects of past studies (e.g., involving gender or age) were expected to be eliminated once baseline consumption level was controlled for in the analyses.

Method

The HABLAS used a multistage cluster sample design in five metropolitan areas of the United States: Miami, New York, Philadelphia, Houston, and Los Angeles. These areas were selected for their relatively large Hispanic subpopulations. After providing written consent to participate, 5,224 individuals were interviewed, for a weighted response rate of 76%. Present analyses were restricted to respondents who were current drinkers (had at least one standard drink in the past 12 months; N = 2,773) who reported drinking wine, beer, or distilled spirits (n = 1,720, n = 2,231, n = 1,562, respectively, and not mutually exclusive). After weighting, respondents were representative of the Hispanic civilian noninstitutionalized population ages 18 and older in sites where data collection occurred. Methodological details for the HABLAS can be found in Caetano et al. (2008).

Measures

Covariates. Hispanic national origin was assessed through self-identification. In models predicting underreporting, education and unadjusted volume (discussed below) were controlled because of anticipated covariation between these variables and underreporting. Gender and age were controlled in regression models because of the known associations of these variables with alcohol intake. Education was coded in four categories: (a) no high school diploma (reference group); (b) high school diploma or General Educational Development (GED) credential; (c) some college, technical, or vocational school; and (d) 4-year college degree, or any graduate or professional school.

Unadjusted alcohol consumption variables. Respondents who had at least one standard drink in the past year were asked a series of quantity–frequency questions about wine, beer, and distilled spirits. Wine was referred to as "wine, a punch containing wine, or wine coolers," beer as "beer or malt liquor," and distilled spirits as "drinks containing whiskey or liquor, including scotch, bourbon, gin, vodka, rum, tequila, aguardiente, and so on."

For frequency questions, eight response options and associated numeric recodes (in occasions per year) were "once a day or more" (365), "nearly every day" (286), "three or four times a week" (182), "once or twice a week" (78), "two or three times a month" (30), "about once a month" (12), "less than once a month but at least once a year" (6), and "less than once a year" (.5). For quantity questions, eight valid response options and associated numeric recodes were "17 or more in a single day" (17), "12 to 16 in a single day" (14), "at least 8 but less than 12" (9.5), "5, 6, or 7" (6), and four separate response options corresponding to options "4" through "1" (4, 3, 2, and 1). For each beverage, quantity and frequency questions were multiplied to obtain the unadjusted number of standard drinks consumed in the past year and were converted to a weekly scale.

Alcohol consumption variables adjusted for container size. Adjusted volumes based on container size and pour level were estimated with a photographic method adapted from Russell et al. (1997). Although pouring methods (e.g., Kerr et al., 2009) have been shown to be most accurate, photographic methods are a sufficient alternative when time or resource constraints preclude more involved approaches (see Kaskutas and Kerr, 2008, for a validation study). For each beverage type, drinkers of that beverage were presented with a photograph booklet of 75 common alcohol containers and were asked to indicate up to three typical containers they used when consuming that beverage. Container types included a range of wine/martini glasses (ranging from a maximum volume of 5 to 22 oz.); shot/brandy and other glasses for distilled spirits (1–20 oz.); mugs, tumblers, and other plastic cups (8–28 oz.); closed beer, distilled spirits, and wine jugs/bottles (including coolers and miniatures; 1.7–102 oz.); and beer cans (12–24 oz.). Pictures of open bottles and cups were drawn to scale; up to 28 lines corresponding to measured volumes were overlaid on the container picture and were labeled with letters. Closed bottles and cans were not drawn to scale but were always pictured adjacent to a common Coca-Cola can to set the frame of reference. After identifying a container, respondents indicated which of the labeled lines corresponded to the level of alcohol they typically poured into that container. Instructions for distilled spirits emphasized the volume of distilled spirits—not total drink size—poured into containers.

Volumes from all container responses for a given beverage type were averaged to arrive at a final average volume per beverage for each respondent. Before averaging, two corrections were applied to container volumes for distilled spirits. First, to account for mixed drinks, maximum volume of distilled spirits for any container was capped at 3 oz. Second, 52 subjects were excluded from subsequent analysis because they reported consumption of large volumes of distilled spirits from large bottles at virtually impossible rates (e.g., consuming 102 oz. of distilled spirits three times a day). Average container size in ounces was multiplied by the unadjusted number of drinks per year (from quantity–frequency questions) to arrive at separate adjusted estimates of the ounces consumed per year of wine, beer, and distilled spirits. For current drinkers, implied ethanol consumption per year was estimated by computing a weighted sum of these three beverage-specific estimates separately for unadjusted and container-adjusted volumes. Weights corresponded to the most recent estimates of the average proportion of ethanol in wine (.1145), beer (.0465), and distilled spirits (.37) in the United States (Kerr et al., 2006). Final estimates were converted to standard drinks per week (Doernberg and Stinson, 1985).

Statistical analyses

Stata 11.0 (StataCorp LP, College Station, TX) was used for all analyses. To examine underreporting across gender and Hispanic subpopulations, mean volume estimates were computed separately for wine, beer, distilled spirits, and overall ethanol content for men and women of each Hispanic group. To examine characteristics of individuals that are associated with underreporting, we used logistic regression to predict whether adjusted estimates exceeded unadjusted estimates. Four sets of models were examined, corresponding to wine, beer, distilled spirits, and ethanol content.

Results

Sample characteristics

Women represented 52% of the sample. Cuban Americans were older (M_{men} = 49.9 years, SD = 1.0; M_{women} = 50.6 years, SD = 1.5) and Mexican Americans were younger (M_{men} = 37.3 years, SD = 0.6; M_{women} = 38.3 years, SD = 0.8). The mean age of Puerto Ricans (M_{men} = 39.8 years, SD = 1.0; M_{women} = 41.2 years, SD = 1.0) and South/Central Americans (M_{men} = 39.8 years, SD = 0.8; M_{women} = 41.7 years, SD = 0.8) was around 40 years. South/Central Americans reported the highest grade/year completed (M = 12.7 years), followed by M = 12.5 years for Cuban Americans, M = 12.2 years for Puerto Ricans, and M = 10.8 years for Mexican Americans.

TABLE 1. Estimated mean volume consumed and standard errors for unadjusted and container-adjusted measurement methods, by Hispanic group and gender

	Puerto Ricans		Cuban Americans		Mexican Americans		South/Central Americans		Total	
Variable	Estimate *M* (*SE*)	%Δ	Estimate *M* (*SE*)	%Δ	Estimate *M* (*SE*)	%Δ	Estimate *M* (*SE*)	%Δ	Estimate *M* (*SE*)	%Δ
Women										
Wine, *n* = 135–232		146		62		71		46		77
Unadjusted	3.7 (2.0)		3.4 (1.6)		0.7 (0.15)		3.5 (1.4)		3.0 (0.8)	
Adjusted	9.1 (7.0)		5.5 (3.1)		1.2 (0.4)		5.1 (2.3)		5.3 (2.0)	
Beer, *n* = 123–188		62		-10		-22		0		35
Unadjusted	6.8 (3.1)		2.1 (0.6)		1.8 (0.4)		1.9 (0.3)		3.4 (0.9)	
Adjusted	11.4 (8.3)		1.9 (0.6)		1.4 (0.3)		1.9 (0.3)		4.6 (2.5)	
Distilled spirits, *n* = 95–154		106		118		50		100		94
Unadjusted	1.8 (0.4)		1.7 (0.5)		1.8 (0.8)		1.8 (0.6)		1.8 (0.3)	
Adjusted	3.7 (0.8)		3.7 (1.4)		2.7 (1.4)		3.6 (1.0)		3.5 (0.6)	
Ethanol, *n* = 183–254		99		57		17		46		68
Unadjusted	8.0 (2.6)		4.6 (1.2)		2.9 (0.6)		5.0 (1.3)		5.3 (0.9)	
Adjusted	15.9 (7.7)		7.2 (2.6)		3.4 (1.0)		7.3 (2.2)		8.9 (2.4)	
Men										
Wine, *n* = 199–267		72		-8		41		54		38
Unadjusted	4.7 (1.1)		3.7 (2.2)		4.4 (1.1)		2.8 (0.5)		3.9 (0.7)	
Adjusted	8.1 (2.4)		3.4 (1.3)		6.2 (1.8)		4.3 (1.2)		5.4 (0.8)	
Beer, *n* = 352–400		20		15		10		24		16
Unadjusted	10.2 (1.4)		6.1 (1.0)		10.4 (1.3)		7.4 (1.5)		8.6 (0.7)	
Adjusted	12.9 (2.3)		7.0 (1.2)		11.0 (1.4)		9.2 (2.0)		10.1 (0.9)	
Distilled spirits, *n* = 198–253		59		62		72		104		69
Unadjusted	5.9 (1.0)		3.4 (0.7)		4.3 (1.7)		2.8 (0.5)		4.2 (0.5)	
Adjusted	9.4 (2.0)		5.5 (1.3)		7.4 (3.3)		5.7 (1.2)		7.1 (1.1)	
Ethanol, *n* = 395–403		42		14		23		40		30
Unadjusted	15.4 (1.8)		8.8 (1.4)		13.5 (2.0)		9.4 (1.6)		11.9 (0.9)	
Adjusted	21.9 (3.1)		10.0 (1.6)		16.6 (2.7)		13.2 (2.3)		15.5 (1.3)	

Notes: All estimates are in standard drinks per week. Beverage-specific estimates were calculated for drinkers of that beverage; ethanol estimates were calculated for drinkers of any beverage.

Unadjusted and adjusted wine, beer, distilled spirits, and ethanol consumption

Adjusted estimates of ethanol consumption increased by 68% for women (range across Hispanic groups: 17%–99%; last column, Table 1) and 30% for men (range: 14%–42%). In general, respondents' container-adjusted weekly alcohol consumption exceeded estimates derived from standard quantity–frequency questions. With the exception of female Cuban American beer drinkers, female Mexican American beer drinkers, female South/Central American beer drinkers, and male Cuban American wine drinkers, all percentage differences between unadjusted and container-adjusted estimates were positive. As can be seen in the last column of Table 1, container adjustments produced the largest changes for volume of distilled spirits, followed by wine and beer. There was wide variation in containers used for consumption of distilled spirits. Large distilled spirits glasses were reported as the primary container by 17% of drinkers of distilled spirits (maximum size = 6–9 oz.; $M_{\text{pour volume}}$ = 2.72 oz.). This was followed by small shot glasses (16%; maximum size = 1–1.5 oz.; M_{pour} = 1.06 oz.), miscellaneous glasses (12%; maximum size = 5–8 oz.; M_{pour} = 3.15 oz.), and small plastic cups (12%; maximum size = 8–9 oz.; M_{pour} = 2.63 oz.).

Although men drank more than women, women underreported more across all four outcome measures. For wine, beer, and ethanol, the percentage increase for women was at least double that of men (77% vs. 38%, 35% vs. 16%, and 68% vs. 30%, respectively). However, there were some deviations from this trend by Hispanic group. For Cuban Americans, this gender difference was observed for wine, distilled spirits, and ethanol, but it was reversed for beer. For Mexican Americans, a larger percentage increase was observed among women for wine, but this pattern was reversed for beer and distilled spirits, and effects on overall ethanol were comparable across genders. Finally, among South/Central Americans, men underreported more than women for both wine and beer, but effects on distilled spirits and ethanol volume estimates were similar across gender. Additional analyses (not shown) by volume tertile revealed that, across all beverages, underreporting became more pronounced at higher levels of (unadjusted) intake.

Preliminary runs of regression models demonstrated that interactions between Hispanic group, gender, and unadjusted volume level did not reach significance. In the main effect models, the pattern of differences across Hispanic groups varied by beverage type. For wine, container adjustments were less likely to exceed the standard for Mexican Americans relative to Cuban Americans (odds ratio [OR] = 0.53, SE = 0.10, $p < .001$) and Puerto Ricans (OR = 0.44, SE = 0.10, $p < .001$), and the likelihood of exceeding the standard was higher for Puerto Ricans than for South/Central Americans (OR = 1.53, SE = 0.28, $p < .05$). For beer, container adjustments were more likely to exceed the standard for Puerto Ricans relative to Mexican Americans (OR = 1.69, SE = 0.41, $p < .05$), but for distilled spirits, adjustments for Puerto Ricans were less likely to exceed the standard relative to South/Central Americans (OR = 0.50, SE = 0.13, $p < .01$). For overall ethanol consumption across all drinkers, Mexican Americans were less likely to exceed the standard relative to Cuban Americans (OR = 0.60, SE = 0.10, $p < .01$), Puerto Ricans (OR = 0.55, SE = 0.10, $p < .001$), and South/Central Americans (OR = 0.65, SE = 0.11, $p < .05$). Underreporting became less likely with age for beer (OR = 0.86, SE = 0.06, $p < .05$) and ethanol (OR = 0.89, SE = 0.04, $p < .01$). Although men were two times more likely to underreport beer volume than women (OR = 2.19, SE = 0.46, $p < .001$), no adjusted gender differences were observed for other beverages. There were consistent education effects across all beverages, with underreporting becoming more pronounced at higher education levels. Underreporting was also more likely at higher volumetric intake levels.

Discussion

Consistent with many past comparisons in diverse populations (Fryer et al., 2004; Kaskutas and Graves, 2000, 2001; Kaskutas and Kerr, 2008; Lemmens, 1994; Witbrodt et al., 2008), underreporting of alcohol volume consumed was found across most beverage types and total ethanol intake. Adjustments based on container size typically produced the largest discrepancies for women and for distilled spirits compared with other beverages, and the discrepancy became larger at higher consumption levels.

Kerr et al. (2009) reported decreases in container size–adjusted beer consumption estimates for Hispanic women, although they did not distinguish Hispanic subgroups. We found that this trend is driven largely by Mexican American women and (to a lesser extent) Cuban American women. In contrast, South/Central American women showed no discrepancy for beer, and container adjustments increased volume estimates for female Puerto Rican beer drinkers by 62%. Multivariable models generally replicated previously documented effects, such as more positive discrepancies at higher levels of education (Kerr et al., 2009) and higher levels of regular intake (e.g., Kaskutas and Graves, 2000). This suggests that some of the factors contributing to underreporting operate similarly across diverse cultures. Also as expected, age and gender effects were generally not significant for wine, distilled spirits, or ethanol in the multivariable models, although both effects remained significant for beer.

Two important consequences stem from the present findings. First, researchers interested in drinking and its effects on health and society should try to develop new and more accurate approaches to assessing alcohol consumption at the moment of reporting. These types of methodological innovations are preferred over post hoc adjustments to the data (e.g., based on beverage-specific weights and/or by factors the effect is qualified by, such as age, gender, and education); given the variability across studies in the magnitude of underreporting, the values such weights should have is not clear. The apparent underreporting of consumption by research subjects has been acknowledged in the literature for some time, but it has not resulted in systematic discussion of the topic among researchers, and no consensus regarding how to correct it has emerged in the field. Specifically, pouring methods—and in particular, methods for distilled spirits that incorporate adjustments for ice and mixed drinks (e.g., Kerr et al., 2005, 2009)—need to be more thoroughly examined. Simplified variations (e.g., photographic methods) on these methods need to be validated (e.g., see Kaskutas and Kerr, 2008, for wine and beer) for use in large-scale population surveys to accurately gauge the extent of the effect on per capita consumption estimates. These are important issues: The existence of significant underreporting implies that effects of a given increase in alcohol consumption on a number of outcomes will overestimate these effects because the outcome will be associated with underestimated amounts of alcohol. According to the findings herein, outcomes would require 68% more drinking for women and 30% more drinking for men.

Finally, two factors minimize the potential impact of the underreporting of consumption: Most alcohol consumption occurs in the form of beer, which, although affected by potential underreporting, is not the most affected beverage. Also, men are responsible for most of the alcohol consumption across cultures (Caetano et al., 2011; Greenfield and Rogers, 1999), and the apparent underestimation by men is smaller than that by women.

Strengths and weaknesses

This study collected detailed information on alcohol consumption from representative samples of Hispanic national groups in five large metropolitan areas of the United States and is one of the largest investigations of differences in the size of standard drinks and commonly used alcohol containers. The survey achieved a high response rate (76%), and face-to-face interviews were conducted in English or Spanish, allowing for the selection of Spanish-speaking respondents and for the collection of detailed data on a variety of topics. Although a quantity–frequency method was used to derive volume estimates, graduated-frequency methods have been shown in some studies to produce slightly higher consumption estimates (Stockwell et al., 2004; but see also Heeb and Gmel, 2005). However, the focus in this study was on discrepancy rather than on absolute volume, and there is no literature suggesting that discrepancy would depend on whether a quantity–frequency or graduated-frequency method was used.

Finally, the findings for distilled spirits should be interpreted with caution. Although our estimates of percentage deviations are within the range of previously reported estimates in other populations (e.g., Gill and Donaghy, 2004; Kaskutas and Graves, 2001), time constraints precluded the use of recent methods that more accurately account for likely sources of variation in volume of distilled spirits, such as ice content and the use of mixed drinks (Kerr et al., 2005, 2009).

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