

Original Studies

Reducing Alcohol Overpouring and Underreporting

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Introduction

The amount of spirits in a self-reported 'standard drink' can vary widely. Two studies involving 198 college drinkers and 82 professional bartenders investigate whether the shape of one's glass unknowingly influences how much alcohol one pours by 20-30%. The results indicate that even professional bartenders poured 20% more alcohol into short, wide glasses (tumblers) than they did into tall, slender (highball) glasses, but they believed the opposite to be true. Furthermore, education and careful attention did not eliminate this tendency to overpour. To concerned consumers and influential decision makers, two practical solutions are suggested: Use tall, slender 'highball' glasses, or use glasses with alcohol-levels etched on them.

Key Words: Alcohol, "standard drink" self-reports, spirits, consumption, visual illusions, Piaget, estimation, perceptual biases, college drinkers, bartenders

Introduction

When pouring and drinking spirits, the amount of alcohol in a drink can vary widely.¹⁻⁴ Although correction efforts have been suggested,⁵⁻⁶ an important unaccounted source of bias in one's self-reported consumption of spirits may have to do with the shape of the glass into which a drink is poured.

Two of the most common glass shapes into which spirits are poured are elongated "highball" glasses and short, wide "tumblers." Using similar glasses, Wansink & van Ittersum⁷ found that people have a tendency to pour 28% more breakfast juice into short, wide glasses than into slender ones holding the same volume. This overpouring is the result of two perceptual biases: First, people generally estimate tall glasses as holding more liquid than wide ones of the same volume.⁸⁻⁹ Second, people focus their pouring attention on the height of the liquid they are pouring and insufficiently compensate for its width.⁷

Suppose a person wanted to pour a target volume of alcohol, such as a 44.3 ml "shot". The perceptual bias caused by this vertical-horizontal illusion could lead one to unknowingly pour more alcohol into a short, wide glass than they would have into a tall, slender, glass.

Because a person generally consumes most (approximately 92%) of what they serve themselves,¹⁰ this issue of pouring accuracy is relevant to policy makers, health professionals, responsible consumers, law enforcement, and those interested in alcohol addiction and abuse. Two studies examine whether education and increased concentration can help reduce this potential bias.

Study 1.

Will Education Reduce the Overpouring of Alcohol by College Students?

Method

Participants. One hundred ninety-eight students of legal drinking age from the University of Illinois at Urbana-Champaign (42.9% female) were recruited through a variety of elective courses. They were given partial course credit for their involvement in the university-approved study.

Procedure. A 2 x 2 between-subjects design manipulating glass shape (short, wide vs. tall, slender) and pouring education and practice (low vs. high) was examined across four different drink replications. As participants arrived at the study, each was alternatively assigned to one of two pouring education and practice conditions (low vs. high). In the low pouring education and practice condition, participants conducted one practice pour (using a 1.5 ounce shot glass as a measure), after which the actual pouring for the experiment began. Participants in the high education condition received the same treatment, but were asked to conduct ten practice pours before beginning their actual pouring for the experiment.

Participants were supplied with full 1500 ml rum and whiskey bottles that had been refilled with brown tea and with 1500 ml gin and vodka bottles that had been refilled with water. Half of the participants were given tall, slender 355 ml (“highball”) glasses and half were given short, wide 355 ml (“tumbler”) glasses. Participants were then asked to pour the amount of liquor that one would pour into four popular college mixed-drinks – a vodka tonic, rum and Coke, whiskey on the rocks, and gin and tonic. The correct amount they should have poured was 44.3 ml (1.5 ounces) for each of the drinks.

After pouring, participants were asked to estimate how much they thought they had actually poured. The volume of how much he or she had poured for each of the drinks was then measured.

Following a distraction task, the participants were then shown the tumbler and the highball glass in a rotated order and asked to estimate the total capacity of each glass.

Analysis. A MANOVA indicated that the type of drink and the interactions between the type of drink and the independent variables and covariates were not significant ($p > .10$) for either the actual or the perceived volumes poured. Because none of the covariates had a main effect on the amount of liquor poured ($p > .10$), the data were pooled.

Results and Discussion

Consistent with prior findings, people believed the slender 355 ml glasses held significantly more than the short, wide 355 ml glasses (346.72 vs. 329.89 ml; $F(1, 192) = 5.46, p < .05, \eta^2 = .03$). Predictably, this visual estimation bias corresponded to an opposite bias when they were pouring. They poured 29.75% more into short, wide glasses than tall, slender glasses (59.09 vs. 45.54 ml; $F(1, 189) = 31.89; p < .01, \eta^2 = .14$). There was a general tendency to pour past the 44.3 ml benchmark. Although this is especially exaggerated with short, wide glasses, participants who poured into these glasses still believed they poured less than those who poured into the tall, narrow glasses (44.64 vs. 46.10 ml; $F(1, 189) = 7.03, p < .01, \eta^2 = .04$).

[Insert Table 1]

The shape of glasses still continued to influence those who were given 10 practice pours only moments earlier ($F(1, 189) = 0.36, p > .10, \eta^2 = .00$). Although education and practice reduced the general tendency to over-pour, it still did not do so for the short, wide glasses (60.85 vs. 57.26 ml; $F(1, 89) = 0.86, p > .10, \eta^2 = .01$). To extend the findings of Study 1 to a policy-relevant context, highly experienced pourers –professional bartenders will next be examined in their own bars.

Study 2.

Can Alcohol Overpouring be Reduced by Bartenders?

Method

Participants. Ninety-five Philadelphia bartenders (61.6% male) were approached on a Sunday or Monday evening and offered \$4.00 to take part in a study on “alcohol and other consumer behavior-related issues.” The 86 bartenders who agreed to participate (61.6% male) had an average of 6.3 years of bartending experience.

Procedure. A 2 x 2 between-subjects design manipulated glass shape (short, wide vs. tall, slender) and the amount of attention (low vs. high) allocated to the pouring task. Each bartender was asked to pour the well-established standard amount of alcohol (44.3 ml or 1.5 ounces) using the same 1500 ml bottles and glasses used in Study 1.

Bartenders in the low-attention condition were simply asked to pour the amount of rum in a rum and Coke, the amount of gin in a gin and tonic, the amount of vodka in a vodka tonic, and the amount of whiskey in a whiskey on the rocks. The order in which they poured the drinks was randomized. Bartenders in the high-attention condition were also asked to pour the same four drinks, but the experimenter encouraged them to “please take your time” before they poured each drink.

Analysis. Bartenders in the high-attention condition took approximately twice the time to pour each drink as those in the low attention condition (3.7 vs. 1.9 seconds), and they agreed more strongly with a 9-point scale question that they “had paid close attention to how much they poured” (2.00 vs. 7.05; $F(1, 84) = 306.52, p < .01, \eta^2 = .79$). As in Study 1, a repeated-measures MANOVA indicated that there were no main effects or interactions across the types of drinks or the order poured. More experienced bartenders poured an average of 10.25% less liquor than less

experienced bartenders (48.20 vs. 53.14 ml; $F(1, 78) = 8.38$; $p < .05$, $\eta^2 = .09$).

Results and Discussion

The results were consistent with those of Study 1. Despite an average of 6.3 years of experience, bartenders poured 20.52% more into short, wide glasses than tall, slender glasses (55.51 vs. 46.06 ml; $F(1,78) = 31.91$; $p < .001$, $\eta^2 = .29$). The normative bias was to overpour into short, wide glasses rather than to underpour into tall, slender glasses (see Table 2).

[Insert Table 2]

Bartenders who paid less attention while pouring, poured more into the short, wide glasses than into the tall, slender glasses (59.44 vs. 47.91 ml; $F(1, 36) = 22.01$; $p < .01$, $\eta^2 = .38$). If bartenders paid careful attention while pouring, the effect was reduced (49.72 vs. 44.89 ml; $F(1, 38) = 18.60$; $p < .01$, $\eta^2 = .33$), but not eliminated. They still overpoured.

[Insert Figure 1]

Implications for Controlling Alcohol Consumption

The consistent conclusion of these studies is that people – even professional bartenders – unknowingly pour 20-30% more alcohol into short, wide glasses than into tall, slender ones but they believe the opposite is true. This bias is not sufficiently reduced by education, practice, concentration, or experience. Although these studies focused on pouring, both lab and field studies show that what is typically poured is typically drunk,¹¹ especially when served by a bartender.¹²

This 20-30% overpouring that glass shapes can encourage needs to be accounted for when collecting and analyzing self-reports of “standard” drinks. If this had been a wide-scale epidemiological study, alcohol consumption per glass would have been underreported by as much a quarter.

To account for or to correct such biases, additional questions should be added to the surveys of self-reports. People drinking spirits should be asked the type or shape of glasses they typically drink from (short, wide versus tall, slender), and they should be asked whether they pour freehand or with the help of a measurement aid (such as a shot glass). This information can then be used to adjust reported alcohol consumption in a way that better reflects an actual level of consumption.

There are a wide range of people who would like to better control alcohol consumption because of the negative consequences related to overconsumption. Those in the hospitality industry want to decrease costs (via serving size) without decreasing satisfaction. Those in public policy want to increase safety. Those dealing with alcohol counseling want to increase responsible drinking and decrease abuse. Unfortunately, neither education, practice, concentration, or experience eliminated the perceptual pouring bias caused by glass shape.

If short tumblers lead people – even bartenders – to pour more alcohol than tall highball glasses, there are two easy solutions: 1) use tall glasses, or 2) use glasses with alcohol-level marks etched on them.

Summary Box

- People pour 20-30% more into short, wide glasses than into tall, slender glasses, but they wrongly believe the opposite.
- Professional bartenders poured 20% more into tumblers than into highball glasses of the same volume.
- “Standard drink” self-report studies should ask questions about the glass shapes into which one pours
- Two easy solutions to overpouring are to use or request tall, slender “highball” glasses or to use glasses that have alcohol-level marks etched on to them.
- Realize that when drinking from a tumbler, two drinks equals two and a half.

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TABLE 1. Glass Shapes Bias the Alcohol Pouring of College Drinkers ^a

	Tall, Slender “Highball” Glass (in mls)			Short, Wide “Tumbler” Glass (in mls)			<i>F</i> -values (<i>p</i> -values in parentheses)		
	Low pouring experience (1 trial)	Higher pouring Experience (10 trials)	Average	Low pouring Experience (1 trial)	Higher pouring Experience (10 trials)	Average	Glass Shape	Experience	Glass Shape x Experience
Perceived capacity of glass	356.47 (221.12)	336.38 (145.10)	346.7 2	333.73 (137.06)	325.75 (138.51)	329.89	5.46* (<i>p</i> <.01)	0.64 (<i>p</i> =.59)	0.51 (<i>p</i> =.68)
Actual volume poured	48.88 (16.22)	42.20 (13.31)	45.54	60.85 (17.89)	57.26 (18.90)	59.60	31.89* (<i>p</i> <.01)	4.08* (<i>p</i> =.02)	0.36 (<i>p</i> =.78)
Perceived volume poured	46.33 (3.83)	45.86 (2.90)	46.10	44.66 (4.16)	44.62 (4.20)	44.64	7.03* (<i>p</i> <.01)	0.38 (<i>p</i> =.77)	0.25 (<i>p</i> =.88)

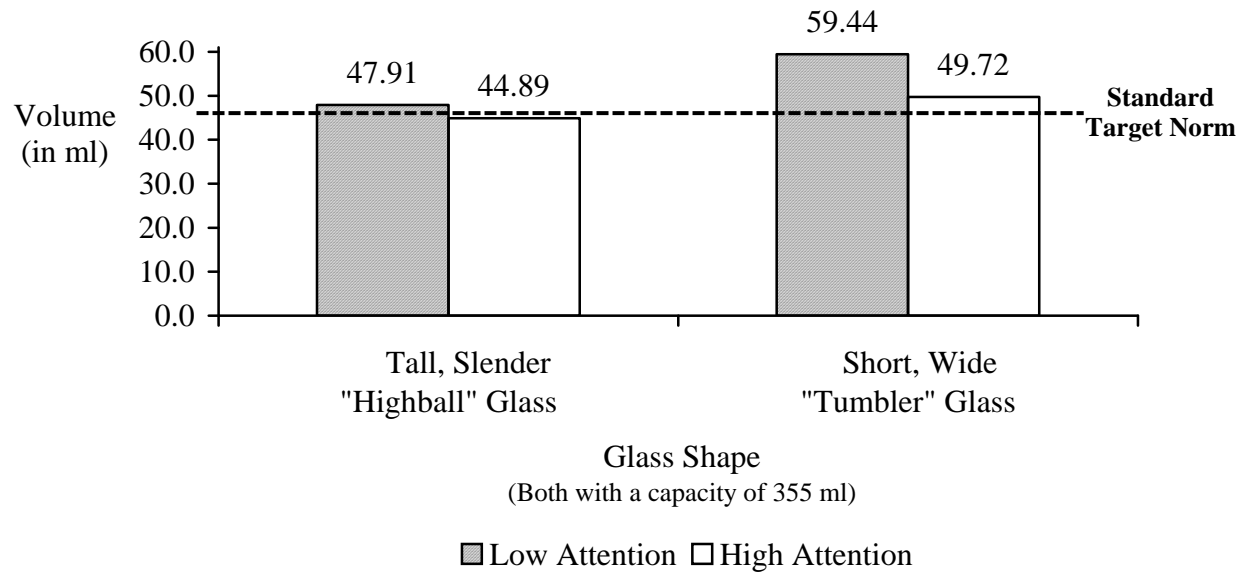
* $p < .05$ ^a Standard deviations are in parentheses

TABLE 2. Glass Shapes Bias the Pouring of Even Careful Bartenders ^a

Amount Poured	Tall, Slender “Highball” Glass (in mls)			Short, Wide “Tumbler” Glass (in mls)			<i>F</i> -values (<i>p</i> -values in parentheses)		
	Low Attention	High Attention	Average	Low Attention	High Attention	Average ^e	Glass Shape	Attention	Attention x Glass Shape
All Drinks	47.91 (2.58)	44.89 (2.42)	46.40	59.44 (10.81)	49.72 (3.66)	54.58	31.91* (<i>p</i> <.01)	20.19* (<i>p</i> <.01)	9.16* (<i>p</i> <.01)
Rum	48.12 (2.60)	45.22 (3.57)	46.67	60.24 (11.30)	48.41 (4.89)	54.33	24.43* (<i>p</i> <.01)	22.44* (<i>p</i> <.01)	11.86* (<i>p</i> <.01)
Vodka	47.47 (2.90)	44.59 (3.03)	46.03	59.36 (9.92)	49.82 (4.89)	54.59	37.38* (<i>p</i> <.01)	20.77* (<i>p</i> <.01)	10.23* (<i>p</i> <.01)
Whiskey	46.94 (3.77)	44.74 (3.02)	45.84	58.68 (11.21)	50.82 (4.98)	54.75	29.81* (<i>p</i> <.01)	10.58* (<i>p</i> <.01)	5.88* (<i>p</i> =.02)
Gin	49.12 (4.72)	45.00 (4.22)	47.06	59.48 (13.79)	49.82 (6.55)	54.65	15.15* (<i>p</i> <.01)	12.82* (<i>p</i> <.01)	3.68 (<i>p</i> =.08)

* *p* < .05^a Standard deviations are in parentheses

FIGURE 1. Bartenders Overpour into Short, Wide Glasses



Appendix

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Both authors declare that the answer to the questions on your competing interest form bmj.com/cgi/content/full/317/7154/291/DC1 are all “No” and therefore have nothing to declare).

Both Wansink and Van Ittersum contributed fully in the design, data collection, analysis, and writing of the paper. Both contributors accept full responsibility for the work and/or the conduct of the study. Both had access to the data, and both agreed to submit the work to the British Medical Journal.

There were no sponsors of this research and both authors are independent and not sponsored by companies or competing interests. Because the studies involved perception and estimation, standard consent forms were signed and were sufficient for institutional approval. Debriefings were made following the pouring.

The implications of this research are important for both researchers studying alcohol intake (which could easily be underestimated if wide glasses were used) and pouring accuracy is relevant to policy makers, health professionals, responsible consumers, law enforcement, and those interested in alcohol addiction and abuse. Professors Wansink and van Ittersum generated over 100 refereed papers in