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Whether men or women are responsible for size of gender gap in alcohol consumption depends on alcohol measure: A study across U.S. states

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Abstract

Smaller gender differences in alcohol consumption are often interpreted to mean something about women's drinking, for example, that women are increasing consumption to men's levels. However, prior research is unclear. This study sought to determine whether variation in size of gender differences in alcohol consumption across U.S. states was due to male or female consumption. Data from the 2005 Behavioral Risk Factor Surveillance System were used to test the hypothesis that variation in size of gender differences would be associated with women's, but not men's consumption. Pearson's correlations examined associations between gender-specific values of and gender differences in consumption in each state. The size of gender difference was associated with proportion of female, but not male, drinkers. Conversely, size of gender difference was associated with male frequency, five-plus frequency, volume, and risky drinking, but not female frequency, five-plus frequency, volume, or risky drinking. These findings suggest that smaller gender differences in cross-sectional studies cannot be interpreted as due to women's alcohol consumption.

Keywords

Alcohol consumption; gender; woman's role

1. Introduction

There has been longstanding, widespread concern that women and men are becoming more similar in alcohol consumption levels and patterns and that these similarities are due to women increasing their consumption to men's levels (Clark-Flory, 2008; Fillmore, 1984; Morris, 2008; Riddoch, 2009). In the scientific literature, this is known as the convergence hypothesis (Bergdahl, 1999; Bloomfield, Gmel, Neve, & Mustonen, 2001; Fillmore, 1984; McPherson, Casswell, & Pledger, 2004; Neve, Drop, Lemmens, & Swinkels, 1996; Temple, 1987). However, prior research is inconclusive about whether gender differences in alcohol consumption are in fact decreasing (Bergdahl, 1999; Bloomfield, Gmel, Neve, & Mustonen, 2001; Fillmore, 1984; Grucza, Norberg, Bucholz, & Bierut, 2008; Keyes, Grant, & Hasin, 2008; Kuntsche et al., 2011; McPherson, et al., 2004; Neve, Diederiks, Knibbe, & Drop, 1993; Neve, et al., 1996; Saelan, Moller, & Koster, 1992; Simpura & Karlsson, 2001; Temple, 1987; Wilsnack, Kristjanson, Wilsnack, & Crosby, 2006) and, if so, whether decreases are due to increases in female alcohol consumption.

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There is an assumption (Kuntsche, et al., 2011), often repeated in the popular press, that increases in women's drinking and convergence are due to feminism and increases in gender equality (Clark-Flory, 2008; Morris, 2008; Riddoch, 2009). While the relationship between changes in gender equality and changes in alcohol consumption has not yet been examined in a longitudinal framework, a growing evidence base now relates area-level gender equality and health [see (Ackerson & Subramanian, 2008; Idrovo & Casique, 2006; Jun, Subramanian, Gortmaker, & Kawachi, 2004; Kawachi, Kennedy, Gupta, & Prothrow-Stith, 1999; Koenen, Lincoln, & Appleton, 2006; Pallitto & O'Campo, 2005; Palma-Solis, Vives-Cases, & Álvarez-Dardet, 2008; Stanistreet, Swami, Pope, Bambra, & Scott-Samuel, 2007)] and a small literature now examines relationships between area-level gender equality and alcohol patterns and problems (Bond et al., 2010; Rahav, Wilsnack, Bloomfield, Gmel, & Kuntsche, 2006). This literature uses ecological and multi-level analyses to examine associations between geographic variation in area-level gender equality and gender differences in alcohol use/problems.

One challenge in the area-level gender equality and alcohol literature is that it remains unclear whether smaller gender differences in alcohol consumption in some geographic areas are due to higher levels of women's consumption, lower levels of men's consumption, or some combination of the two. In spite of this lack of clarity, such research – here examples from the tobacco as well as the alcohol literature – often interprets smaller gender differences as meaning something about women's health behavior (Hitchman & Fong, 2010; Rahav et al., 2006). In other words, smaller gender differences are often assumed to indicate higher levels of women's drinking. However, this may not be the case. A recent study found that reductions in size of gender differences in adolescent drunkenness in Western European countries and the U.S. were due to reduction in boys' drunkenness, not an increase in girls' drunkenness (Kuntsche, et al., 2011). Whether smaller gender differences are due to variation in men's or women's drinking may not matter for convergence theory (Bergdahl, 1999; Bloomfield, et al., 2001; Fillmore, 1984; McPherson, et al., 2004; Neve, et al., 1996; Temple, 1987). However, gender-specific drivers of drinking convergence matter for decisions about prevention, intervention, resource allocation and for countering public opinion that blames increases in gender equality for increases in women's drinking.

With the goal of informing interpretations in the nascent literature examining whether area-level gender equality explains geographic variation in gender differences in alcohol consumption and women's alcohol consumption, this study uses data from the Behavioral Risk Factor Surveillance System (BRFSS) to determine whether variation in the size of gender differences in five alcohol consumption measures across 50 US states and Washington D.C. are due to male or female alcohol consumption in each case. Based on widespread assumptions regarding the relationship between size of the gender difference in alcohol consumption and women's alcohol consumption, the hypothesis is that variation in the size of gender differences across states will be more highly associated with women's than men's alcohol consumption and that this pattern of association will be consistent across alcohol measures.

2. Methods

This study was determined to be exempt by the University of California, Berkeley Committee on the Protection of Human Subjects.

2.1 Data source

BRFSS is an annual telephone survey, conducted since 1984, that tracks health status and health-related behaviors of adults in U.S. states and territories, with the goal of providing both national and state-level estimates. Each year, more than 350,000 adults are interviewed

(CDC, 2009). The BRFSS database was selected because of the large sample size in each state, which is designed to be state-representative, provides estimates for each state of multiple gender-disaggregated alcohol measures. BRFSS methods have been described in detail elsewhere (Nelson, Holtzman, Waller, Leutzinger, & Condon, 1998). 2005 data were used because they include data from all 50 states and Washington D.C. and because they were close in year to state-level predictors used in a larger study of which this is one component. The BRFSS includes both core and optional modules. Core modules are administered in each state that participates in the survey in that year; optional modules are administered in a subset of states every few years. Alcohol use has been a core module since 1984 and includes quantity, frequency, and frequency of consuming five or more (five-plus) drinks items. Some recent surveys have included an optional binge drinking module (2003, 2004, and 2008) in subsets of states. The optional binge drinking module expands on the single frequency of five-plus question in the core module with questions regarding quantity on the most recent five-plus occasion, as well as other questions about this recent five-plus drinking occasion. Published data from these modules (Stahre, Naimi, Brewer, & Holt, 2006) are used in volume calculations. Cooperation rates for each state in 2005 ranged from 58.7% to 85.3% for a total sample across states of 349,901, with 176,303 drinkers. The median sample across states was 5,635 (range = 2,813 – 23,302). The minimum number of drinkers per state was 496 for men (in Alabama) and 500 for women (in West Virginia). [See Table 1].

2.2 Measures

Dependent variables were state-level estimates of proportion of drinkers and, among drinkers, mean frequency of alcohol consumption, mean frequency of five-plus drinks, mean volume of alcohol consumption, and proportion drinking in risky patterns. These variables were determined for women’s, men’s, and gender differences in drinking for each alcohol measure. Drinker status was defined as having consumed one or more drink of beer, wine, or liquor in the past 30 days. The state-level estimates were gender disaggregated proportions of those who reported drinking at least one alcoholic beverage in the past 30 days. Drinking frequency was the number of days over the past 30 on which drinkers reported drinking one or more drinks containing alcohol. Responses that reported frequency of drinking on a weekly basis were multiplied by 4.29 to obtain 30-day frequency. The state level estimate was the gender-disaggregated mean frequency of drinking among drinkers. Frequency of five-plus drinking was the number of days over the past 30 on which drinkers reported drinking five or more drinks containing alcohol. The state level estimate was the gender-disaggregated mean frequency of five-plus drinking among drinkers. *Volume* was calculated for drinkers using a modified version of indexing (Armor & Polich, 1982), as developed and used in a recent study using BRFSS data (Stahre et al., 2006). This involved 1) subtracting frequency of five-plus drinking to get the adjusted frequency, 2) multiplying the adjusted frequency by usual quantity, 3) multiplying frequency of five-plus drinking by the sex- and age-specific binge quantity Stahre et al. estimated from the 2003 optional binge drinking module, and 4) adding the volumes from steps 2 and 3. Indexing improves upon traditional quantity-frequency measures by accounting for binge drinking days. The modified indexing method uses sex- and age-specific estimates of five-plus quantity obtained from the optional binge drinking module in the 2003 BRFSS, rather than population-average replacements for estimates of five-plus quantity, which reduces undercoverage. Usual quantity, used to create the volume variable, was capped at maximum number of drinks for people reporting usual quantities greater than 24. Indexing was only completed for people reporting usual quantity of less than five. The state level estimate was the gender-disaggregated mean volume among drinkers. Risky drinking was defined as both having one or more occasions of five-plus consumption in the past 30 days and having 30-day volume greater than 60 for men and 30 for women. The state-level estimate was the gender-disaggregated proportion of risky drinkers among drinkers. Gender differences for each alcohol measure were calculated by subtracting the value for women from the value for men.

2.3 Analysis

Tests of proportion and t-tests were used to describe overall differences in drinking by men and women. Pearson's correlations examined the strength of association between gender-specific estimates and gender differences in state-level drinker status, frequency, and volume. Percent and mean estimates use sampling and post-stratification weights. Sample size varied depending on the alcohol measure under consideration [See Table 1]. Sensitivity analyses excluding all observations where data were missing on one or more of the alcohol measures were conducted. These analyses resulted in the same pattern of findings, with no changes in level of significance or direction of associations, but a few small changes in strength of association in some cases.

3. Results

Overall, 54% of respondents had consumed at least one alcoholic beverage in the past 30 days. A higher proportion of men than women (61% versus 46%) had consumed alcohol. Among drinkers, men drank more frequently than women (9.1 versus 6.5 days), consumed 5+ more frequently (1.5 versus 0.4 days), and consumed more total volume (31.6 drinks versus 14.1). Also, a higher proportion of male than female drinkers were considered risky drinkers (38% versus 20%). All differences were significant at the $p<.001$ level.

Alcohol consumption by men and women, as well as gender differences in consumption, varied across states [See Table 1]. For example, the proportion of male drinkers ranged from 32% (Utah) to 74% (Wisconsin, Connecticut) and proportion of female drinkers ranged from 23% (Utah) to 62% (Wisconsin). The mean volume for male drinkers ranged from 23 (New Jersey) to 46 (Nevada) and for female drinkers ranged from 10 (Oklahoma) to 18 (Utah). However, the same pattern existed within each state and alcohol measure, where, in each case, men drank more or more often than women.

In addition, men's and women's drinking within states were highly correlated. The first row of Table 2 shows that men's and women's lower risk drinking (i.e., any drinking and frequency of drinking) were more correlated than higher risk drinking (i.e., frequency of five-plus, volume, and risky drinking). Correlation coefficients ranged from .965 ($p<.001$) for proportion of drinkers to .438 ($p<.05$) for frequency of five-plus.

Row 2 of Table 2 shows the correlation between the size of gender difference and men's and women's drinking. Consistent with the hypothesis that size of gender differences would be more highly associated with women's than men's drinking, the size of the gender difference in drinker status was negatively associated with the proportion of women reporting current drinking ($r=-.428$, $p<.01$). This means that more women drank in places with smaller gender differences. The association between male current drinking and the size of the gender difference was not significant. Conversely, the size of the gender difference was positively associated with men's mean drinking frequency ($r=.366$, $p<.01$), mean five-plus frequency ($r=.947$, $p<.001$), mean volume ($r=.928$, $p<.001$), and proportion considered risky drinkers ($r=.776$, $p<.001$). These positive associations mean that men drank more frequently, at higher volumes, and had more risky drinking patterns in states with larger gender differences. The size of the gender difference was not associated with women's frequency, five-plus frequency, volume, or risky drinking.

4. Discussion

Consistent with widespread assumptions, the size of gender differences in alcohol consumption was hypothesized to be more highly associated with women's than men's consumption. Findings for the current drinking measure were consistent with the hypothesis; smaller gender differences in current drinking were negatively associated with the proportion of current drinking women and were not associated with the proportion of men drinking. However, findings for all of the other alcohol measures considered were inconsistent with the hypothesis. In the cases of frequency, five-plus frequency, volume, and risky drinking, the size of gender differences were associated with men's drinking in each case but not with women's drinking. Thus, variation across geographic areas in the size of gender differences in amount of alcohol consumed cannot be assumed to be due to increases in the amount of alcohol women consume. Rather, it appears that this variation may be due more to variation in levels of men's drinking. This finding is consistent with the recent Kuntsche et al. (2011) paper examining convergence in male and female adolescent drunkenness in European countries and the United States. The Kuntsche et al. (2011) paper examined changes in mean frequency of drunkenness by adolescent boys and girls in 23 countries and concluded that the size of gender differences in Western European countries and the U.S. was influenced by boy's frequency more than girl's frequency. A further analysis (by this author) of the 2005/2006 boys' and girls' country-level estimates presented in Table 2 of the Kuntsche et al. paper as well as gender differences in these estimates leads to the same conclusion as the current study. Specifically, male and female drunkenness were highly correlated, but variation in the size of gender differences was due more to male than female drinking.

Further, it was also hypothesized that the pattern of associations between gender differences and male and female drinking would be consistent across alcohol measures. Findings were not consistent across all alcohol measures. However, findings were similar across measures of the amount of alcohol consumed. In addition, while not the original purpose, this study found that the size of gender differences varied across alcohol measure. This has been found previously (Keyes, et al., 2008; Wilsnack, Vogeltanz, Wilsnack, Harris, & IRGGA, 2000). In fact, consistent with previous research (Dawson & Archer, 1992; Wilsnack, et al., 2000), the gender difference appeared to widen with more risky consumption indicators. That larger gender differences in the more risky consumption indicators were associated with male rather than female consumption suggests that variation in levels of male risky drinking patterns (rather than female risky drinking patterns) may warrant the bulk of public health attention, at least in the United States.

Findings from this study should be interpreted in light of the study's limitations. First, this study uses cross-sectional data. This is appropriate for answering the study question of whether the size of the gender difference can be interpreted as meaning something about women's drinking. However, using cross-sectional data makes it impossible to assess changes in gender differences as well as men's and women's drinking over time, which is the real goal of convergence analysis. However, as the goal of this study was to inform design of multi-level analyses, the design is appropriate for this purpose. Second, this study measures alcohol consumption over the past 30 days. In contrast to questions about alcohol consumption in the past 12 months, questions about alcohol consumption in the past 30 days may exclude infrequent light drinkers and intermittent heavy or binge drinkers (Greenfield & Kerr, 2008). Frequency or volume of drinking, when asked about for 30 versus 28 days, may also be affected by the number of weekends in the time reference category (Greenfield & Kerr, 2008). Depending on survey period, seasonality may also come into play with a 30-day measure. However, each state conducts interviews each month per a defined protocol (CDC, 2009), which may counteract some of these limitations. Third, this study uses measures of five-plus drinking for both men and women. This influences not only the frequency of five-plus drinking measure, but also volume and risky drinking. Many recommend different binge drinking cut-offs for men and women (NIAAA, 2004; Wechsler, Dowdall, Davenport, & Rimm, 1995). Unfortunately, the 2005 BRFSS survey only included questions assessing frequency of consuming five or more drinks. Thus, our calculations may underestimate frequency of heavy episodic drinking and, therefore, volume and risky drinking for women. Some efforts to address this limitation was made by using age and sex specific replacements for five-plus occasions in volume calculations and using a lower threshold of drinking frequency for women than men in risky drinking calculations. However, others argue that current evidence is insufficient to recommend such gender adjustments (Graham, Wilsnack, Dawson, & Vogeltanz, 1998). Further, alcohol-related consequences and dependence were not assessed in the BRFSS, and thus could not be considered.

This study also has strengths. It addresses a question that is key to interpretation of the burgeoning body of area-level gender equality research, namely whether variation in the size of gender differences across geographic settings can be assumed to be due to variation in women's drinking. The findings suggest that cross-sectional snapshots of geographic variation in size of gender differences in alcohol consumption cannot be interpreted as evidence of variation in women's alcohol consumption. Multi-level or ecologic studies of variation across geographic areas should not include only gender difference measures without also including indicators of men's and women's drinking to aid interpretation. It is worth noting that while examinations of gender convergence in drinking have implications for gender studies and alcohol culture studies, the public health implications of finding smaller or larger gender differences are unclear. If the goal of a multi-level analysis is to identify factors to explain geographic variation in women's drinking with the goal of developing interventions to reduce alcohol-related harm among women, women's drinking and not gender differences should be used as the outcome. In contrast, if the goal of the multi-level analysis is to identify factors that explain geographic variation in harms due to excessive alcohol consumption, the research should focus on identifying factors that explain variation in men's (rather than women's) drinking, as males (and not females) appear as consistently the source of alcohol-related harm (Graham et al., 2011).

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Table 1

Sample sizes and alcohol consumption by sex and by state

	Sample size		Drinkers		Monthly freq		Monthly 5+ freq		Monthly volume		Risky drinkers	
State	**M, n= 134,047**	**F, n= 215,854**	**M, n= 134,046**	**F, n= 215,854**	**M, n= 78,072**	**F, n= 93,172**	**M, n= 77,740**	**F, n= 93,482**	**M, n= 75,990**	**F, n= 91,424**	**M, n= 75,990**	**F, n= 91,424**
U.S.			61%	46%	9.08	6.47	1.53	0.45	31.59	14.12	38%	20%
Alabama	1,064	2,133	50%	29%	8.94	5.90	1.77	0.43	39.45	17.11	37%	23%
Alaska	1,302	1,511	67%	52%	9.16	5.97	1.79	0.43	34.29	13.25	37%	20%
Arizona	1,763	2,947	65%	49%	9.49	7.48	1.87	0.42	35.44	14.95	37%	22%
Arkansas	1,936	3,344	48%	31%	8.28	5.85	1.60	0.51	31.74	13.88	35%	20%
California	2,418	3,716	65%	47%	9.12	6.77	1.57	0.33	33.97	14.61	38%	19%
Colorado	2,428	3,551	69%	55%	9.51	6.77	1.44	0.43	29.98	13.89	37%	19%
Connecticut	2,038	3,216	74%	61%	9.23	7.58	1.19	0.29	25.41	14.47	32%	20%
Delaware	1,621	2,571	63%	52%	9.63	6.62	1.48	0.55	30.71	15.04	37%	23%
D.C.	1,504	2,239	69%	55%	10.10	8.25	1.21	0.52	28.67	16.99	37%	26%
Florida	3,062	5,128	63%	48%	10.42	7.60	1.70	0.47	38.76	16.37	39%	22%
Georgia	2,053	4,011	55%	38%	8.96	6.13	1.51	0.36	30.73	12.79	37%	19%
Hawaii	2,577	3,839	62%	41%	10.79	6.70	2.38	0.52	42.05	14.94	45%	23%
Idaho	2,197	3,537	54%	42%	10.28	6.76	1.70	0.39	32.26	13.94	39%	20%
Illinois	1,876	3,201	63%	50%	8.34	5.78	1.60	0.61	29.77	14.34	41%	22%
Indiana	2,136	3,499	58%	43%	8.40	5.45	1.71	0.53	33.39	14.34	38%	21%
Iowa	1,985	3,066	63%	48%	9.60	5.69	2.13	0.48	33.92	12.87	45%	23%
Kansas	3,256	5,370	54%	38%	8.20	5.19	1.34	0.42	26.63	11.34	35%	21%
Kentucky	2,075	4,553	44%	27%	8.31	4.95	1.90	0.49	32.22	11.45	40%	19%
Louisiana	1,018	1,918	51%	37%	9.18	6.13	1.93	0.74	34.91	15.47	42%	26%
Maine	1,558	2,402	64%	53%	10.60	7.69	1.43	0.49	33.08	15.29	36%	19%
Maryland	3,338	5,294	66%	51%	8.50	6.51	1.16	0.35	27.01	12.68	29%	17%
Massachusetts	3,412	5,494	72%	59%	10.20	7.31	1.52	0.51	33.30	15.70	35%	20%
Michigan	4,587	7,549	63%	51%	8.97	6.04	1.51	0.59	31.40	15.16	40%	24%
Minnesota	1,136	1,693	72%	58%	8.93	6.19	1.69	0.46	28.48	13.49	40%	20%

	Sample size		Drinkers		Monthly freq		Monthly 5+ freq		Monthly volume		Risky drinkers	
State	M, n= 134,047	F, n= 215,854	M, n= 134,046	F, n= 215,854	M, n= 78,072	F, n= 93,172	M, n= 77,740	F, n= 93,482	M, n= 75,990	F, n= 91,424	M, n= 75,990	F, n= 91,424
Mississippi	1,477	2,962	47%	28%	8.29	5.49	1.75	0.50	31.66	13.74	36%	21%
Missouri	2,004	3,160	58%	46%	8.81	5.91	1.48	0.55	27.70	13.45	39%	23%
Montana	2,017	2,966	67%	50%	9.43	6.96	1.60	0.54	32.95	16.58	41%	22%
Nebraska	3,274	5,058	65%	50%	8.23	5.48	1.56	0.59	27.97	12.55	41%	21%
Nevada	1,528	1,633	67%	52%	10.65	7.06	2.00	0.54	45.88	15.60	42%	21%
New Hamp.	2,444	3,594	72%	57%	10.42	7.79	1.10	0.47	28.20	15.91	32%	22%
New Jersey	5,304	8,359	66%	53%	8.12	6.50	1.00	0.37	23.27	13.54	33%	17%
New Mexico	2,159	3,426	59%	45%	8.85	6.16	1.25	0.31	25.47	12.23	29%	15%
New York	2,934	4,862	63%	51%	8.99	6.32	1.33	0.36	27.60	12.99	37%	20%
North Carolina	6,183	11,078	50%	36%	8.65	6.63	1.17	0.35	25.61	13.26	34%	20%
North Dakota	1,629	2,381	67%	52%	7.87	4.94	1.35	0.48	27.22	11.81	42%	22%
Ohio	2,778	4,720	64%	46%	8.65	5.67	1.67	0.36	30.73	12.31	39%	18%
Oklahoma	5,063	8,644	53%	32%	7.23	4.70	1.58	0.45	28.85	10.38	41%	18%
Oregon	4,655	7,360	65%	52%	10.63	7.79	1.50	0.44	32.12	15.12	35%	19%
Pennsylvania	4,957	8,421	63%	48%	8.40	5.73	1.49	0.52	30.03	13.15	39%	22%
Rhode Island	1,485	2,491	67%	56%	10.40	7.03	1.61	0.39	34.21	15.44	37%	21%
South Carolina	3,323	5,117	55%	39%	9.67	6.75	1.54	0.53	32.26	15.07	40%	21%
South Dakota	2,844	4,071	66%	51%	8.26	5.25	1.48	0.44	26.56	11.58	41%	21%
Tennessee	1,748	3,001	42%	28%	8.95	6.28	0.92	0.50	29.59	15.73	35%	26%
Texas	2,439	4,073	60%	39%	8.66	6.15	1.61	0.45	34.45	13.29	41%	19%
Utah	2,124	3,013	32%	23%	9.20	6.45	1.79	0.59	32.95	17.55	40%	25%
Vermont	2,726	4,037	70%	58%	11.71	7.98	1.49	0.40	34.02	15.24	37%	20%
Virginia	2,167	3,326	61%	49%	9.67	6.98	1.27	0.36	29.52	13.99	34%	18%
Washington	9,094	14,208	67%	55%	9.69	7.62	1.20	0.38	27.21	14.72	32%	18%
West Virginia	1,360	2,193	40%	24%	8.00	5.19	1.88	0.62	35.63	12.68	37%	21%
Wisconsin	2,001	2,899	74%	62%	9.57	6.39	1.84	0.63	34.66	15.16	45%	24%
Wyoming	1,990	3,019	62%	47%	9.07	6.02	1.22	0.47	28.81	12.19	36%	20%

Table 2

Associations between male, female, and gender differences in state-level alcohol measures

	Drinker status		Monthly freq		5+ monthly		Volume		Risky Drinking	
	Men	**Women**	**Men**	**Women**	**Men**	**Women**	**Men**	**Women**	**Men**	**Women**
Women	.965***		.835***		..438**		.466***		.498***	
Gender diff	−.177	−.428**	.366**	−.207	.947***	.128	.928***	.102	.776***	−.148