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Demographic groups likely affected by regulating sugar-sweetened beverage portion sizes

Natalie R Smith^{1,2}, Anna H Grummon³, Leah Frerichs¹

¹Department of Health Policy and Management, Gillings School of Global Public Health UNC Chapel Hill

²Carolina Population Center, UNC Chapel Hill

³Harvard Center for Population and Development Studies, Harvard TH Chan School of Public Health

Abstract

Introduction—Sugar-sweetened beverages (SSBs) are a key driver of obesity. Portion size regulations typically limit the volume of unsealed SSB containers to 16 fluid ounces. These regulations could reduce SSB consumption, but whom these policies would affect remains unknown. We evaluated demographic groups likely affected by national portion size regulations modeled on policy language and scope from New York City (NYC) and California.

Methods—Data from adults (18–65 years, $n=6,594$) in the National Health and Nutrition Examination Survey (2013–16) was used to classify individuals as ‘likely affected’ if they consumed an SSB >16oz from a potentially regulated food source during at least one eating occasion. Two classifications of affected food sources were evaluated: 1) excluding convenience stores (NYC scope) and 2) including convenience stores (California scope). In 2020, analyses used logistic regression to examine associations between affected status and age (<35, ≥35 years), sex, race/ethnicity (non-Hispanic white, non-Hispanic Black, Hispanic), education (no college degree, college degree), and income (<185%, ≥185% of Federal Poverty Line).

Results—Portion size regulations would affect 8.87% of adults (NYC scope) and 14.71% of adults (California scope). Regulations had a greater potential effect on adults who are <35 years, male, and without a college degree (all p -values < 0.05). Differences between demographic groups would be larger in magnitude using California’s policy scope.

Conclusions—Portion size regulations would likely have greater effect for younger, male, and lower-education adults. Policy effects would likely be larger if these regulations are written to encompass more food sources.

Corresponding author information: Natalie R Smith, 1101 McGavran-Greenberg Hall, CB #7411, Chapel Hill, NC, 27599-7411, 412-977-1217, natsmith@live.unc.edu.

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Introduction

Nearly four in ten US adults have obesity.¹ Obesity increases the risk of costly and preventable chronic diseases including cardiovascular disease, type 2 diabetes,² and at least thirteen cancers.³ A key driver of obesity is overconsumption of sugar-sweetened beverages (SSBs),^{4–6} and on any given day, over half of US adults report drinking an SSB.⁷ SSB consumption is higher among non-Hispanic Black and Hispanic adults than non-Hispanic white adults,⁷ as well as those with lower educational attainment and income.⁸

One policy option for addressing overconsumption of SSBs is portion size regulation. Unlike measures that increase prices or ban products, portion size regulations aim to decrease SSB intake by capping the total volume of SSBs for sale. Large portion sizes contribute to weight gain through overconsumption and excess energy intake,^{9–11} and emerging evidence suggests that portion size regulations can reduce SSB consumption.¹²

In 2012, New York City (NYC) became the first jurisdiction in the US to pass a portion size regulation.¹³ The regulation, adopted by the City Board of Health, prohibited food service establishments from selling SSBs in unsealed containers larger than 16 fluid ounces (16oz).¹³ Convenience stores such as 7-Eleven were exempt from the regulation, because the City Board of Health did not have jurisdiction over these stores.¹³ This policy was not implemented, as NYC was subsequently sued by industry and the regulation was struck down in 2014.¹³

More recently, legislators in California proposed a similar regulation that would prohibit the sale of unsealed SSBs larger than 16oz.¹⁴ Unlike the NYC regulation, California's proposal applied to all SSB retailers.¹⁴ Thus, the policy scope of California's proposal may be a meaningful improvement over the NYC regulation by including convenience stores, an important source of SSB calories, particularly for lower-income groups.^{15,16}

Despite the potential of portion size regulations, little is known about their potential reach or relative influence on different demographic groups. One study found that overweight and obese young adults were more likely to consume SSBs greater than 16oz, but did not assess potential differences by race/ethnicity or educational attainment,¹⁷ groups with known disparities in overall SSB consumption. Understanding potential differential effects between demographic groups will clarify the potential for portion size regulation to affect existing disparities in SSB intake. This study aims to describe the demographic groups that may be affected by a national SSB portion size regulation using definitions based on NYC and California's policy language and scope.

Methods

Analyses used the first day of 24-hour dietary recall data from adults (ages 18–65, $n=6,594$) participating in the two most recent cycles (2013–14, 2015–16) of the National Health and Nutrition Examination Survey (NHANES). Analyses classified individuals as “likely affected” by a regulation if they had at least one eating occasion wherein they consumed an SSB that was (1) larger than 16oz and (2) from a regulated source. Two dependent variables were constructed. The first, based on NYC's policy language and scope, defined regulated

sources as restaurants, fast food or pizza restaurants, bars/taverns, sports/entertainment facilities, and street vendors, similar to previous work.¹⁷ The second, based on California's proposed policy language and scope, included convenience stores in addition to the previously listed sources. SSBs were defined as non-diet, nonalcoholic beverages with added sugars containing at least 5 calories per 100g, including beverages such as sodas, sports drinks, energy drinks, fruit drinks, and pre-sweetened coffees and teas, but excluding 100% juice and sweetened milk.¹⁸

Analyses used logistic regression to examine associations between demographic characteristics and the probability of being affected by each portion size regulation while controlling for other characteristics. Analyses examined five demographic factors: age (<35, 35 years), sex (female, male), race/ethnicity (non-Hispanic white, non-Hispanic Black, Hispanic), education (no college degree, college degree), and income (<185%, >185% of the federal poverty line). Demographic differences in the predicted probability of being affected by portion size regulations were calculated using the method of recycled predictions. Statistical significance was assessed using 95% confidence intervals and all analyses were conducted in Stata version 16.1 in 2020, accounted for NHANES survey design, and controlled for NHANES cycle.

Results

Under a national regulation modeled on NYC's, which would exclude convenience stores, 8.87% of US adults would be affected. Age, sex, and education were differentially associated with the probability of being affected by this version of portion size regulation (Table 1 and Figure 1). Specifically, being younger than 35 was associated with a greater probability of being affected (+0.034, 95% CI=0.015, 0.053; i.e., younger people were 3.4 percentage points more likely to be affected than the older age group). Additionally, being male (+0.027, 95% CI=0.011, 0.042), and having less than a college degree (+0.045, 95% CI=0.025, 0.066) were each associated with a greater probability of being affected.

Under a national regulation modeled on California's proposed policy that would include all unsealed sources, 14.71% of US adults would be affected. As with the NYC version of the portion size regulation, age, sex, and education were associated with the probability of being likely affected (Table 1 and Figure 1). Specifically, being younger than 35 (+0.067, 95% CI=0.043, 0.091), being male (+0.069, 95% CI=0.049, 0.089), and having less than a college degree (+0.090, 95% CI=0.067, 0.113) were each associated with a greater probability of being affected. Analyses did not find evidence that either version of a national portion size regulation would have potential differential effects by race/ethnicity or income.

Discussion

More adults (~15% vs. ~9%) would be affected by a national portion size regulation if convenience stores were regulated alongside other venues. Under both versions of the regulation, younger individuals, males, and those with less education were more likely to be affected. These differences were larger in magnitude when assuming that convenience stores would be regulated. Of the demographic characteristics examined, having lower educational

attainment had the strongest association with being likely affected by portion size regulations, suggesting that these regulations could potentially help reduce persistent educational disparities in SSB intake.⁸ Despite having higher average daily SSB consumption,⁷ non-Hispanic Black and Hispanic individuals were not more likely than non-Hispanic white adults to be affected by portion size regulation (i.e., drink an SSB >16oz), possibly indicating important differences in the patterns of frequency and volume of SSB consumption among race/ethnicity groups.

Similar to previous work,¹⁷ analyses may have misclassified SSBs purchased from convenience stores and other establishments as unsealed, though it is possible that national regulations could be written to cover both sealed and unsealed beverages, similar to the policy proposed in Hawaii in 2014.¹⁹ Additionally, our estimates may over- or underestimate the effect of these policies if individuals respond or adapt to the regulation by seeking out alternative sources of large SSBs. Finally, no national portion size regulation has been proposed to date, despite growing interest at the state and local level. The expected differential effects in state and local jurisdictions may be different if those areas have different baseline demographics and consumption patterns than the US as a whole.

Portion size regulations are a promising policy option to reduce SSB consumption and associated health harms. Our results suggest that policymakers could maximize the reach of these policies by taking a broader definition of regulated establishments. Future work should clarify how these policies affect realized SSB consumption¹² and associated health outcomes.

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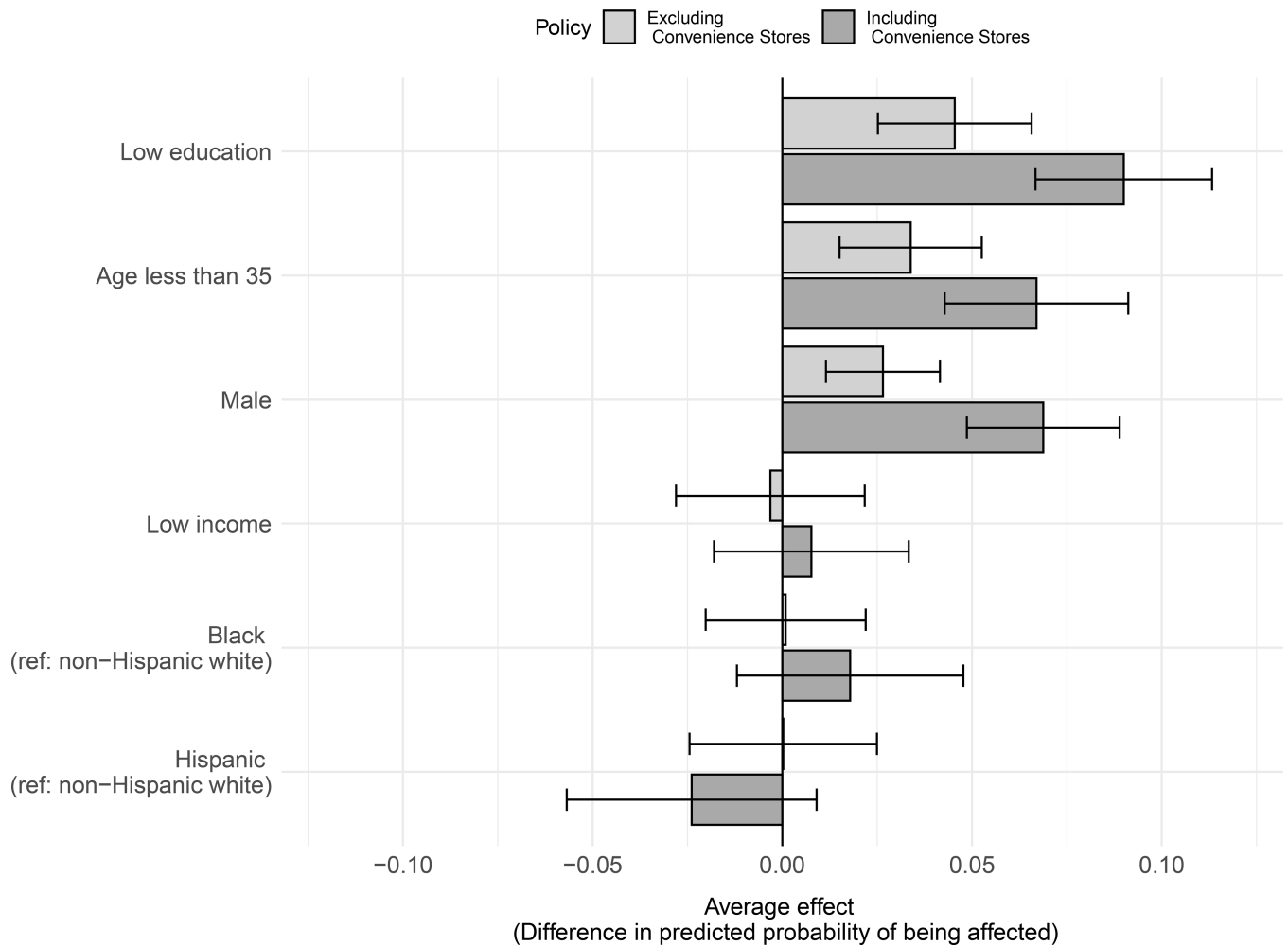


Figure 1:

Associations between demographic groups and predicted probability of being likely affected by a portion size regulation

Notes: Reference groups are college education, age 35–65, female, income greater than 185% of federal poverty line, and non-Hispanic white. Error bars depict 95% confidence interval limits. Intervals that do not cross zero are statistically significant ($p < 0.05$). Average effects and 95% confidence intervals calculated using margins command in Stata 16.1. Average effect is the difference in average predicted probability of being affected by a portion size regulation in the group of interest minus the reference group calculated using the method of recycled predictions. Average effects can be multiplied by 100% to yield approximate effects in percentage points (e.g., an average effect of 0.034 indicates a difference of approximately 3.4 percentage points). Regulated sources include restaurants, fast food or pizza restaurants, bars/taverns, sports/entertainment facilities, street vendors, and convenience stores.

Table 1:

Associations between demographic groups and predicted probability of being likely affected by a portion size regulation

Demographic	Excluding convenience stores ^a		Including convenience stores ^a	
	Average effect ^b	95% CI	Average effect	95% CI
Age less than 35 years (ref: age 35–65)	0.034	(0.015, 0.053)	0.067	(0.043, 0.091)
Male (ref: female)	0.027	(0.011, 0.042)	0.069	(0.049, 0.089)
Race/ethnicity (ref: non-Hispanic white)				
Non-Hispanic Black	0.001	(−0.020, 0.022)	0.018	(−0.012, 0.048)
Hispanic	0.000	(−0.024, 0.025)	−0.024	(−0.057, 0.009)
Low education (ref: college degree)	0.045	(0.025, 0.066)	0.090	(0.067, 0.113)
Low income (ref: income >185% of FPL)	−0.003	(−0.028, 0.022)	0.008	(−0.018, 0.033)

Note: Boldface indicates statistical significance (p<0.05). Analyses include 6,594 individuals from NHANES 2013–14 and 2015–16.

^aDependent variables differ based on whether they exclude or include convenience stores. Both version include restaurants, fast food or pizza restaurants, bars/taverns, sports/entertainment facilities, street vendors.

^bAverage effects and 95% confidence intervals calculated using margins command in Stata 16.1. Average effect is the difference in average predicted probability of being affected by a portion size regulation in the group of interest minus the reference group calculated using the method of recycled predictions. Average effects can be multiplied by 100% to yield approximate effects in percentage points (e.g., an average effect of 0.034 indicates a difference of approximately 3.4 percentage points).

CI, confidence interval. FPL, Federal Poverty Line. NHANES, National Health and Nutrition Examination Survey.