

## Short Communication

## Energy contribution of sugar-sweetened beverage refills at fast-food restaurants

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**Abstract***Objective:* To identify demographic and consumer characteristics associated with refilling a soft drink at fast-food restaurants and the estimated energy content and volume of those refills.*Design:* Logistic and linear regression with cross-sectional survey data.*Setting:* Data include fast-food restaurant receipts and consumer surveys collected from restaurants in New York City (all boroughs except Staten Island), and Newark and Jersey City, New Jersey, during 2013 and 2014.*Subjects:* Fast-food restaurant customers (*n* 11 795) from ninety-eight restaurants.*Results:* Thirty per cent of fast-food customers ordered a refillable soft drink. Nine per cent of fast-food customers with a refillable soft drink reported refilling their beverage (3% of entire sample). Odds of having a beverage refill were higher among respondents with a refillable soft drink at restaurants with a self-serve refill kiosk (adjusted OR (aOR)=7.37, *P*<0.001) or who ate in the restaurant (aOR=4.45, *P*<0.001). KFC (aOR=2.18, *P*<0.001) and Wendy's (aOR=0.41, *P*<0.001) customers had higher and lower odds, respectively, of obtaining a refill, compared with Burger King customers. Respondents from New Jersey (aOR=1.47, *P*<0.001) also had higher odds of refilling their beverage than New York City customers. Customers who got a refill obtained on average 29 more 'beverage ounces' (858 ml) and 250 more 'beverage calories' (1046 kJ) than customers who did not get a refill.*Conclusions:* Refilling a beverage was associated with having obtained more beverage calories and beverage ounces. Environmental cues, such as the placement and availability of self-serve beverage refills, may influence consumer beverage choice.**Keywords**  
Sugar-sweetened beverages  
Fast food  
Nutrition  
Obesity

Obesity is a complex and ongoing public health problem<sup>(1)</sup>. Persistent daily energy imbalances have contributed to population-level weight gain over the past 40 years<sup>(2–4)</sup>. Indeed, the average American diet now includes 200–300 kcal/d (837–1255 kJ/d) more than 30 years ago<sup>(5)</sup>. Energy from the consumption of sugar-sweetened beverages (SSB) is the largest contributor to this increase<sup>(5,6)</sup>. It is not surprising then that the consumption of SSB is linked to weight gain<sup>(7–9)</sup>.

Fast-food restaurants are a prominent source of SSB energy<sup>(10,11)</sup>. This may be in part due to the popularity of fast-food combination meals, which include beverages<sup>(12)</sup>, and the prominence of soft drinks on fast-food menus<sup>(13)</sup>. Moreover, many fast-food restaurants offer free refills which

may encourage additional consumption of energy-dense beverages. Some fast-food restaurants have self-serve beverage stations that allow for free beverage refills, while other restaurants offer free refills on beverages but require customers to request a refill from restaurant staff.

There is very little research on consumer characteristics associated with SSB purchases at fast-food restaurants or on how different restaurant policies, such as the availability of refills, affect consumer choice<sup>(14)</sup>. To our knowledge, the present paper is the first that examines the odds of refilling a beverage in a fast-food restaurant, the contribution of self-serve refill stations to beverage exposure, and the effect of refills on the energy and volume of beverages obtained.

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## Methods

The data utilized for the present study were collected as part of a larger project evaluating New York City's (NYC) Sugary Drinks Portion Cap Rule<sup>(15)</sup>. Point-of-purchase surveys and receipts were collected from fast-food customers in the NYC metropolitan region using a customer intercept protocol. Data were collected at NYC and neighbouring Newark and Jersey City, New Jersey locations of the most common restaurant chains in Manhattan (McDonald's, Burger King, Subway, Wendy's and KFC) over several months in 2013 and 2014<sup>(16)</sup>. Restaurants were surveyed on weekdays during lunch (11.30–14.30 hours) and dinner (16.30–19.30 hours) periods. The Institutional Review Board of New York University Medical Center approved the study.

In July 2014, just after data collection was completed, researchers called each surveyed restaurant and asked two questions. The first was 'Does the restaurant offer free beverage refills of in-store purchases?' When restaurants reported offering refills on beverages we asked 'Do customers refill their own drink from a self-serve refill station or are refills provided behind the counter?' These data were collected later because the focus of the original study was not on the offering of free beverage refills.

The outcome variables for our analyses included: (i) a binary indicator for whether a customer ordered a beverage, including SSB (e.g. soft drinks, low-calorie drinks, sports drinks, lemonade), diet beverages, coffee, bottled water and unsweetened tea; (ii) a binary indicator for whether a customer reported refilling his/her beverage; (iii) estimated energy content of the beverage ('beverage calories', i.e. kilocalories; 1 kcal = 4.184 kJ); and (vi) estimated volume of the beverage ('beverage ounces', i.e. US fluid ounces; 1 US fl. oz = 29.5735 ml) (obtained from the receipt). We estimated beverage energy and volume using information listed on each restaurant chain's website. We doubled these estimates for refilled beverages.

Our analyses focus on the complex relationship of the above outcomes with the type of refill available (self-serve or not) and ordered beverage size. The primary predictor was a categorical variable with three levels: (i) no free refills available; (ii) free refills were available without a self-serve station; or (iii) free refills were available with a self-serve station. We used separate logistic regression models to estimate the odds of ordering any beverage for the full sample and the odds of refilling a beverage (based on responses to the survey question 'Did you refill your cup while in the restaurant?') among only the sample who ordered a refillable drink (e.g. non-pre-packaged beverages including soft drinks, tea, lemonade). We estimated meal energy, beverage energy and beverage volume using ordinary least squares for the sample of respondents who ordered a refillable soft drink. The primary treatment variable in the linear regression models was an interaction of the availability of free refills and the presence of self-serve

stations in the restaurant. All regression models included controls for consumer and meal characteristics including gender, race/ethnicity, age, education, employment status, meal time (lunch or dinner), meal type ('to go' or 'to stay'; à la carte or combo meal), average fast-food eating frequency per week, restaurant chain, state and survey period. We clustered all standard errors at the restaurant chain level. Analyses were done using the statistical software package Stata version 13.

## Results

We surveyed customers at sixty-one fast-food restaurant locations in NYC and thirty-seven in New Jersey.

In Table 1, we report characteristics for all survey respondents, for the sub-sample of respondents who ordered a refillable drink and for the sub-sample of respondents who reported refilling their drink. We collected receipts from 11 795 adults, of whom 3541 (30%) ordered a drink. Respondents were evenly distributed between males (53%) and females (47%). African American (43%) was the most frequently race/ethnicity reported, followed by Hispanic (31%), white (15%) and other race/ethnicities (10%). The age distribution across respondents was fairly uniform. Approximately 58% of the sample had a high-school degree or less, almost 65% were employed and 80% were surveyed during lunch time. Approximately 35% ordered their meal to stay in the restaurant and 18% purchased a combination meal.

The 30% of respondents who ordered a refillable soft drink were different from the rest of the sample. Proportionally, fewer females than males, and more whites and fewer respondents reporting other races compared with blacks and Hispanics, ordered a soft drink. Soft drink purchasers were more likely to consume their meal in the restaurant. More lunch-time purchases included a refillable drink than during dinner time. Meals with a beverage were more likely to have been a combination meal compared with all meals. Proportionally more purchases included a refillable drink at Burger King, KFC and Wendy's compared with McDonald's and Subway.

There were also differences between survey respondents who did and did not refill their soft drink. Fewer blacks refilled their soft drinks than Hispanics and respondents of other races. Unemployed respondents were more likely to get a refill. Respondents who refilled their beverage were more likely to eat in the restaurant. A greater portion of respondents who ordered a child or value size soft drink reported getting a refill compared with respondents who had larger drinks. Respondents at fast-food restaurants in New Jersey were more likely to get refills compared with respondents in NYC. Lastly, there was a difference in the distribution of refills by restaurant chain; customers at Burger King and KFC were more likely to get refills, while McDonald's and Wendy's consumers were less likely to refill

**Table 1** Descriptive statistics for fast-food consumers from ninety-eight fast-food restaurants in New York City, and Newark and Jersey City, New Jersey, 2013–2014

	Surveyed adult sample		All receipts with a refillable soft drink		$\chi^2$ test for association with non-beverage sub-sample	Reported refilling beverage		$\chi^2$ test for association with refillable soft drink sub-sample
	<i>n</i>	%	<i>n</i>	%	<i>P</i> value	<i>n</i>	%	<i>P</i> value
Sex								
Male	6267	53.1	1959	55.3	0.006	184	59.7	0.219
Female	5526	46.9	1581	44.7		124	40.3	
Missing	2	0.0	1	0.0		0	0.0	
Race/ethnicity								
White non-Hispanic	1778	15.1	585	16.5	<0.001	49	15.9	0.019
Black non-Hispanic	5014	42.5	1426	40.3		102	33.1	
Hispanic	3712	31.5	1237	34.9		121	39.3	
Other non-Hispanic	1146	9.7	253	7.1		30	9.7	
Missing	145	1.2	40	1.1		6	2.0	
Age (years)								
18–24	2395	20.3	718	20.3	<0.001	84	27.3	0.019
25–39	3894	33.0	1291	36.5		97	31.5	
40–49	2175	18.4	653	18.4		61	19.8	
50–64	2435	20.6	639	18.1		48	15.9	
65+	655	5.6	162	4.6		14	4.6	
Missing	241	2.0	78	2.2		4	1.3	
Education								
Some college or more	6899	58.5	2103	59.4	0.191	183	59.4	0.997
High-school degree or less	4866	41.3	1426	40.3		124	40.3	
Missing	30	0.3	12	0.3		1	0.3	
Employment status								
Not employed	4168	35.3	1137	32.1	<0.001	119	38.6	0.031
Employed	7617	64.6	2402	67.8		189	61.4	
Missing	10	0.1	2	0.1		0	0.0	
Meal time								
Lunch	9393	79.6	2916	82.4	<0.001	239	77.6	0.077
Dinner	2400	20.4	624	17.6		69	22.4	
Missing	2	0.0	1	0.0		0	0.0	
Meal location								
Took meal to go	7636	64.7	1826	51.6	<0.001	65	21.1	<0.001
Ate in the restaurant	4157	35.2	1714	48.4		243	78.9	
Missing	2	0.0	1	0.0		0	0.0	
Purchased combo meal								
No	9664	81.9	1764	49.8	<0.001	175	56.8	0.010
Yes	2131	18.1	1777	50.2		133	43.2	
Beverage size								
Value	218	1.9	218	6.2	<0.001	42	13.6	<0.001
Small	1777	15.1	1312	37.1		122	39.6	
Medium	1889	16.0	1641	46.3		123	39.9	
Large	697	5.9	374	10.6		22	7.1	
Restaurant chain								
Burger King	1733	14.7	620	17.5	<0.001	76	24.7	<0.001
KFC	537	4.6	264	7.5		33	10.7	
McDonald's	4121	34.9	1118	31.6		88	28.6	
Subway	4840	41.0	1280	36.2		104	33.8	
Wendy's	564	4.8	259	7.3		7	2.3	
State								
New York	5921	50.2	1795	50.7	0.483	121	39.3	<0.001
New Jersey	5874	49.8	1746	49.3		187	60.7	
<i>n</i>	11795		3541			308		

their beverage, compared with Subway customers. There were no statistically significant differences in beverage refills between groups within gender, education or the time of day the purchase was made. Refilled beverages were mostly SSB (90%). The remaining refilled beverages include diet beverages (9%) and other (1%; i.e. juice drinks, unsweetened tea).

Results from the multivariable logistic regression models are shown in Table 2. Among the full sample, African

Americans (adjusted OR (aOR)=0.68; 95% CI 0.59, 0.78) and respondents reporting other race (aOR=0.61; 95% CI 0.57, 0.64) had lower odds of ordering any beverage relative to whites. Respondents aged 65 years or older had increased odds of ordering a beverage (aOR=1.56; 95% CI 1.17, 2.09) relative to respondents aged 18–24 years. Among respondents who had a soft drink, there were no differences by age or race in the odds of getting refills. Customers who ordered a combination meal had

**Table 2** Adjusted odds of obtaining a beverage or beverage refill at ninety-eight fast-food restaurants in New York City, and Newark and Jersey City, New Jersey, 2013–2014\*

	Ordered beverage			Reported refilling beverage, among orders with a refillable soft drink		
	aOR	95 % CI	P value	aOR	95 % CI	P value
<b>Drink condition</b>						
No refills available	1.00	Ref.	–	–	–	–
Non-self-serve refills available	0.95	0.72, 1.27	0.737	1.00	Ref.	–
Self-serve refill kiosk present	1.07	0.98, 1.17	0.152	7.37	3.91, 13.89	<0.001
<b>Sex</b>						
Male	1.00	Ref.	–	1.00	Ref.	–
Female	0.99	0.88, 1.12	0.920	0.79	0.59, 1.05	0.098
<b>Race/ethnicity</b>						
White non-Hispanic	1.00	Ref.	–	1.00	Ref.	–
Black non-Hispanic	0.68	0.59, 0.78	<0.001	0.91	0.50, 1.65	0.744
Hispanic	0.90	0.76, 1.06	0.203	1.10	0.68, 1.79	0.696
Other non-Hispanic	0.61	0.57, 0.64	<0.001	1.22	0.69, 2.17	0.488
White non-Hispanic	0.73	0.43, 1.23	0.237	2.28	1.34, 3.88	0.003
<b>Age (years)</b>						
18–24	1.00	Ref.	–	1.00	Ref.	–
25–39	1.10	0.91, 1.32	0.324	0.77	0.60, 0.98	0.038
40–49	1.07	0.76, 1.53	0.689	0.84	0.51, 1.38	0.486
50–64	1.14	0.76, 1.72	0.523	0.63	0.43, 0.92	0.017
65+	1.56	1.17, 2.09	0.003	0.40	0.23, 0.68	0.001
Missing	1.28	0.81, 2.05	0.294	0.41	0.10, 1.63	0.207
<b>Education</b>						
High-school degree or less	1.00	Ref.	–	1.00	Ref.	–
Some college or more	1.06	0.93, 1.20	0.380	1.12	0.72, 1.76	0.607
<b>Employment status</b>						
Not employed	1.00	Ref.	–	1.00	Ref.	–
Employed	1.12	0.98, 1.28	0.095	0.81	0.64, 1.02	0.078
<b>Meal time</b>						
Lunch	1.00	Ref.	–	1.00	Ref.	–
Dinner	0.67	0.63, 0.70	<0.001	1.03	0.73, 1.46	0.859
<b>Meal location</b>						
Took meal to go	1.00	Ref.	–	1.00	Ref.	–
Ate in the restaurant	2.61	2.10, 3.24	<0.001	4.45	2.48, 7.99	<0.001
<b>Purchased combo meal</b>						
No	1.00	Ref.	–	1.00	Ref.	–
Yes	28.39	8.84, 91.14	<0.001	0.80	0.62, 1.05	0.108
<b>Beverage size</b>						
Value	–	–	–	1.00	Ref.	–
Small	–	–	–	0.46	0.38, 0.57	<0.001
Medium	–	–	–	0.34	0.17, 0.71	0.004
Large	–	–	–	0.39	0.16, 0.95	0.038
<b>Restaurant chain</b>						
Burger King	1.00	Ref.	–	1.00	Ref.	–
KFC	0.26	0.11, 0.62	0.002	2.18	1.76, 2.71	<0.001
McDonald's	1.99	1.81, 2.19	<0.001	1.18	0.85, 1.62	0.327
Subway	1.17	1.06, 1.28	<0.001	1.00	0.95, 1.06	0.881
Wendy's	1.65	1.53, 1.77	<0.001	0.41	0.36, 0.45	<0.001
<b>State</b>						
New York	1.00	Ref.	–	1.00	Ref.	–
New Jersey	0.93	0.75, 1.15	0.500	1.47	1.23, 1.75	<0.001
<b>Round</b>						
1	1.00	Ref.	–	1.00	Ref.	–
2	1.07	0.94, 1.23	0.295	1.71	1.12, 2.61	0.014
3	0.99	0.93, 1.06	0.779	0.69	0.41, 1.15	0.155
Reported fast-food eating frequency	1.01	1.00, 1.02	0.004	1.02	1.00, 1.04	0.132
<i>n</i>		11 795			3455	

aOR, adjusted OR; ref., reference category.

\*Please note that the odds ratios presented in each column are estimated using different samples and are thus not directly comparable.

considerably higher odds of having a beverage (aOR = 28.39; 95 % CI 8.84, 91.14), but not of refilling their soft drink. Further, respondents who ate at the restaurant had higher odds of both obtaining a beverage (aOR = 2.61; 95 % CI 2.10, 3.24) and of refilling the beverage (aOR = 4.45; 95 % CI 2.48, 7.99) compared with those who took

their meals to go. Although self-serve refill kiosks were not associated with the customer ordering any beverage, we did find among respondents with a beverage that the presence of a self-serve refill kiosk was highly associated with reporting having a refill (aOR = 7.37; 95 % CI 3.91, 13.89). Size of beverage was related to the odds of having

**Table 3** Regression-adjusted mean beverage volume and energy content, for the sub-sample of respondents who obtained a refillable beverage, at ninety-eight fast-food restaurants in New York City, and Newark and Jersey City, New Jersey, 2013–2014

Size	No refill				Refill			
	Beverage ounces*		Beverage calories†		Beverage ounces*		Beverage calories†	
	Mean	95 % CI	Mean	95 % CI	Mean	95 % CI	Mean	95 % CI
Any	29.3	28.2, 30.4	232.5	229.4, 235.7	58.7	48.5, 69.0	482.8	399.0, 566.6
Value	13.6	6.1, 21.0	100.7	80.8, 120.6	43.0	38.0, 48.0	351.0	262.8, 439.1
Small	22.5	17.9, 27.1	178.3	152.1, 204.5	51.9	44.5, 59.3	428.6	342.8, 514.3
Medium	33.4	31.5, 35.3	268.0	253.8, 282.2	62.8	49.8, 75.8	518.3	431.5, 605.4
Large	44.5	42.6, 46.5	342.6	313.2, 372.0	74.0	61.4, 86.5	592.9	507.0, 678.7

Adjusted means show the expected number of beverage ounces and beverage calories obtained for each combination of size and refill, with the assumption that the entire sample either refilled or did not refill a beverage of each available size. Results calculated using ordinary least-square regression models with the following covariates: presence of a self-serve station in the restaurant, the offering of free refills at the restaurant, respondent gender, race, age, education level, employment status, whether meal was had for lunch or dinner, the location the meal was had, whether a combination meal was ordered, the size of the beverage, the restaurant chain, state where the survey was collected, survey period and frequency of fast-food visits.

\*Estimated volume of the beverage (US fluid ounces; 1 US fl. oz = 29.5735 ml).

†Estimated energy content of the beverage (kilocalories; 1 kcal = 4.184 kJ).

a refill. In particular, relative to customers who ordered the smallest soft drink size, respondents who ordered small (aOR = 0.46; 95% CI 0.38, 0.57), medium (aOR = 0.34; 95% CI 0.17, 0.71) and large (aOR = 0.39; 95% CI 0.16, 0.95) beverages all had lower odds of having a refill. In contrast, those aged 25–39 years (aOR = 0.77; 95% CI 0.60, 0.98), 50–64 years (aOR = 0.63; 95% CI 0.43, 0.92) and 65 years or older (aOR = 0.40; 95% CI 0.23, 0.68) had lower odds of refilling a soft drink, compared with those aged 18–24 years. Finally, relative to customers at Burger King, customers at KFC (aOR = 2.18; 95% CI 1.76, 2.71) had higher odds of getting a refill while Wendy's customers had lower odds of obtaining a refill (aOR = 0.41; 95% CI 0.36, 0.45).

Based on our estimates, free soft drink refills were associated with increased exposure to beverage and total meal energy. Even after controlling for customer demographic and meal characteristics, we found that soft drink refills were associated with a customer obtaining an average additional 29 beverage ounces (858 ml) and 250 beverage calories (1046 kJ; Table 3). We found that free refills were associated with 330 additional total meal calories (1381 kJ; data not shown). This suggests customers who refilled their beverages did not offset the additional beverage energy with lower-energy food orders.

## Discussion

Our findings suggest that demographic, consumer and restaurant characteristics are all associated with fast-food restaurant customers obtaining soft drink refills. In particular, the availability of refills from self-serve beverage stations was associated with significantly larger odds of a customer refilling his/her drink. While this is true, only a small percentage (8.7%) of fast-food customers with a soft drink reported refilling their beverage. An even smaller percentage (2.6%) of all fast-food customers refilled their beverage. Yet, getting a refill was associated with

customers obtaining substantially more energy from SSB even after controlling for the size of the beverage.

The current study has several limitations. First, we do not know how representative this sample is of fast-food consumers because our street intercept sampling strategy is subject to non-random selection. Unfortunately, we do not have the response rate for the survey. A previous study using street intercept surveys reported a 60% response rate<sup>(17)</sup>. Second, we surveyed only customers arriving on foot at restaurants within three adjacent Northeast cities. We recognize that, outside this region, many fast-food eaters obtain their meal from drive-through windows. Regional differences in customer characteristics mean our results may not generalize to non-urban consumers. Third, we offered survey respondents a \$US 2 incentive for participation, which could have affected the participants' purchase decisions. Fourth, we do not have an objective measure for how much of each beverage was actually consumed. Thus, we limit our conclusions to obtained, rather than consumed, beverages. Fifth, we assume that a beverage was completely empty when refilled and that the refill completely filled the cup. These assumptions could have resulted in an overestimation of exposure to fast-food beverage energy and volume if the beverage was only partially consumed or refilled. Alternatively, our results may underestimate the true association if the beverage was refilled multiple times. Results from a sensitivity analysis in which we assumed that customers refilled only half of their beverage still found that the beverage refills contributed a substantial and statistically significant number of beverage calories (134 or 561 kJ more) and ounces (14 or 414 ml more; data not shown). Sixth, we did not collect information on stores' refill policies until after data collection occurred. We think it is unlikely that stores changed their policy during the interim period. Status quo bias, financial costs and space constraints of changing beverage dispensing systems reduce the likelihood of restaurants changing their beverage refill policy during the year and a half between the first data collection period and when we



re-contacted stores. Regardless, it is possible that some stores may have changed their refill policy or that the employees we spoke with inaccurately reported the availability of beverage refills at their restaurant. Thus, our estimates could be subject to measurement error bias.

Our findings suggest that one novel opportunity to reduce SSB consumption is to restrict the availability of self-serve beverage stations at fast-food restaurants. France recently passed such a proposal in fast-food chains and restaurants<sup>(18,19)</sup>. Based on our findings a similar domestic restriction could lead to reductions in the energy, volume and grams of sugar obtained from beverages among fast-food customers who order refillable beverages.

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