



Development and Reliability Testing of a Fast-Food Restaurant Observation Form for Use in Beverage Tax Evaluations

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Fast-food restaurants are designed to be convenient and low-cost sources of food and beverages. Some studies suggest that over 30% of individuals consume fast food on a given day.^{1,2} Fast-food restaurants may offer cheaper meal options in the form of combination and value meals, which generally package a soft drink, side item, and main entrée for one discounted price. One study in fast-food restaurants found that 58% of all purchases at major hamburger chains included a beverage of which more than 75% were soft drinks, and that beverages included in combination meals had, on average, 197 calories.³ Regular soft drinks are just one example of sugar-sweetened beverages (SSBs). SSBs are the leading source of added sugar in the U.S. diet⁴ and are associated with cardiovascular disease, obesity, type 2 diabetes, osteoporosis, and dental caries.^{5,6,7}

SSB taxes have been proposed as a policy mechanism to reduce SSB consumption and generate revenue, which may be used for health promotion programs. To date, beverage taxes have been passed in eight U.S. jurisdictions.⁸ However, in one jurisdiction, Cook County, IL, the Sweetened Beverage Tax was subsequently repealed.⁹ Of the eight jurisdictions, six imposed taxes on SSBs only, while two levied taxes on both SSBs and artificially sweetened beverages (ASBs).⁸

As part of a larger beverage tax evaluation, we sought to assess the impact of beverage taxes on the local retail food environment. Using a natural experimental design, we evaluated pre- and post-tax changes in short- and long-term outcomes impacted by beverage taxes in two jurisdictions: Oakland, CA, and Cook County, IL. Because fast-food restaurants are a significant source of community access to SSBs, we sought to understand the impact of a beverage tax on availability, pricing, and price promotional strategies (including marketing) within fast-food restaurants. We developed the [Beverage Tax Fast-Food Restaurant Observation Form](#) using the observation tool from the Bridging the Gap Community Obesity Measures Project, which was found to be reliable.¹⁰

To assess the reliability of the Beverage Tax Fast-Food Restaurant Observation Form, we conducted an inter-rater reliability (IRR) study in the summer of 2017 in 32 fast-food restaurants in Joliet, IL, a racially/ethnically diverse, mid-sized city in the Chicago metropolitan area. The purpose of this brief is to report on the development and IRR results of the overall form and individual measures.

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Key Findings

- The Beverage Tax Fast-Food Restaurant Observation Form provides reliable measurements of SSBs and ASBs in fast-food restaurants.
- The average percent agreement for dichotomous and categorical variables was 0.99.
- The average kappa statistic for dichotomous and categorical variables was 0.88 (“almost perfect” agreement).
- The average ICC for the two categories of continuous variables was 0.91.

Methods

INSTRUMENT AND MEASURES

The Beverage Tax Fast-Food Restaurant Observation Form was designed to assess beverage product availability, pricing, and price promotions as well as fast-food restaurant characteristics and product marketing displayed on the property and the building of the fast-food restaurant. The form includes potentially taxed (i.e., SSBs and ASBs) and non-taxed beverage products (i.e., unsweetened beverages). Beverage products fall into 9 categories including fountain drinks, soda, sports drinks, energy drinks, ready-to-drink tea and coffee, juice, children’s beverages, bottled water, and milk.

Products were selected by examining national market shares and the representativeness of products in the given beverage markets. Product sizes were selected by examining manufactured sizes for each brand.

Availability, regular price, sale presence, and sale type and price were recorded for each beverage product. Two types of sales were included on the form: reduced price (RP) and other type of sale. A RP sale is an advertised reduced price on a single

product. The other sale type is used when the RP sale type is not appropriate (e.g., buy one get one free).

In some fast-food restaurants, fountain drinks are offered instead of bottled beverages. To capture ASBs and SSBs served in fountain drinks, we assessed cup size by documenting the number of ounces. Data on the availability of fountain drinks, the presence or absence of free refills, and whether the fountain drink service station is self-serve were also recorded.

Fast-food restaurant characteristics were also included as measures on the form. In our study, fast-food restaurants were defined as those where ordering and payment occurred at the counter. Fast-food restaurants were categorized into 8 types including burger and fries, Mexican/Latin American, fried chicken/fried fish, sandwich or sub shop, sandwich/pastry, pizzeria/Italian, Chinese/Pan-Asian, and other. Additional categories for fast-food restaurant characteristics included whether the fast-food restaurant was a standalone building or part of a larger retail space; whether ordering, pick-up, and payment occurred at the counter; the number of exterior walls visible from the parking lot and/or street; whether water was available and free; whether security features were present; and whether features such as outdoor seating, exterior and interior play area, on-site parking, and drive-thru were present.

Exterior marketing was recorded for 11 types of beverage products (i.e., regular soda, diet soda, regular energy drink, diet energy drink, regular sports drink, diet sports drink, juice drinks, 100% juice, bottled water, unflavored milk, and flavored milk). For exterior marketing, counts of all advertisements and advertisements listed as price promotions found on the fast-food restaurant exterior (e.g., windows, doors) and property (e.g., fencing, light post) were recorded.

RELIABILITY STUDY DESIGN

The IRR study for this form was conducted in Joliet, IL, which has the fourth largest population (~148,000) in Illinois and is located about 40 miles south of Chicago, IL. Joliet was manually divided into 10 geographic areas by ArcGIS 10.4. Median household income was computed for each of the areas and, to achieve a representative sample, the selection of fast-food restaurants for observation was stratified across 8 of the 10 geographic areas by income.

To select fast-food restaurants, a random seed point was generated within each geographic area. When present, 2 chain fast-food restaurants and 2 non-chain fast-food restaurants closest to the seed point were selected per area using Google Maps and Yelp. We defined chain fast-food restaurants as those that were franchised or had a corporate headquarters. If a fast-food restaurant type was absent in any geographic area, the other fast-food restaurant type was selected within the same area. For example, if a non-chain fast-food restaurant was absent in a geographic area, a chain fast-food restaurant in that area was selected as the replacement. If that area did not have any additional fast-food restaurants to sample, the closest seed point in any of the 10 geographic areas within Joliet, IL, was selected to find the replacement. If a fast-food restaurant was closed or

data collectors were asked to leave during data collection, a replacement fast-food restaurant was sampled. Our final sample consisted of 32 fast-food restaurants including 6 burger and fries, 5 Mexican/Latin American, 3 fried chicken/fried fish, 6 sandwich or sub shop, 5 pizzeria/Italian, 2 Chinese/Pan-Asian, and 5 fast-food restaurants were classified as “other.”

DATA COLLECTION PROCEDURES

Data collection occurred during a two-week period in the summer of 2017. Two graduate students were hired to conduct the audits. Before data collection began, both individuals received a training that included: a review of the Beverage Tax Fast-Food Restaurant Observation Form; a review of the Protocol Manual; field practice exercises; and a discussion period for questions on the form itself. While data collectors visited the fast-food restaurants together, the forms were completed independently.

DATA ANALYSIS

All data analyses were performed using Stata/SE 14.2. Percent agreement and kappa statistics were used for the IRR analysis of 6 types of dichotomous and categorical variables: availability, sale, sale type, fast-food restaurant characteristics, fountain drinks, and exterior marketing. Percent agreement is the proportion of responses for a given measure where both data collectors agreed. The kappa statistic is a chance-corrected measure of agreement for dichotomous or categorical variables.¹¹ Kappa statistics in the range of 0.81–1.00 are considered “almost perfect” agreement, 0.61–0.80 are considered “substantial” agreement, 0.41–0.60 are considered “moderate” agreement, 0.21–0.40 are considered “fair” agreement, 0.00–0.20 are considered “slight” agreement, and anything less than 0.00 is considered “poor” agreement.¹²

Two-way random intraclass correlation coefficients (ICCs) were used to assess IRR for 3 categories of continuous variables: regular price, sale price-RP, and fountain drink cup size by ounce. The ICC is only a valid measure of IRR when there is enough variation in the variable being assessed.¹³ To ensure adequate variation for analyses, we calculated overall ICCs for each category of continuous variables instead of ICCs for each individual continuous variable. For example, the overall ICC for regular price was based on all regular price observations across all fast-food restaurants.

The IRR analysis of exterior marketing variables from the original version of the form was restricted to dichotomous variables indicating the presence of given advertisements (e.g., regular soda advertisements) rather than the tallies indicating the number of advertisements. Due to challenges on the part of data collectors in properly filling in the tallies, we do not consider the tallies from the original version of the form to be reliable nor do we consider them appropriate for analyses. To further improve the reliability of exterior marketing, we subsequently modified this section and tested its reliability in food stores in Joliet.¹⁴

Observations with missing values were excluded from this analysis. We did not conduct IRR analyses for variables that had an insufficient sample size of observations (i.e., < 10 pairs). For kappa statistics, we excluded observations for dichotomous variables whose prevalence was very high (i.e., > 0.8) or very low (i.e., < 0.2). One limitation of using kappa statistics is that if the distribution of one variable is highly skewed (i.e., the prevalence of a specific category is high), the kappa statistic may be low because the level of agreement expected due to chance alone is very high.¹⁵ Because of this, we only report kappa statistics for dichotomous variables that have an average prevalence across the two data collectors between 0.2 and 0.8 for the choice coded as “yes”. This restriction was not applicable for categorical variables (i.e., fast-food restaurant type and the number of exterior walls visible from the parking lot and/or street). Given this exclusion criterion, we have percent agreement estimates for a greater number of variables than we have kappa statistics.

Sub-questions (e.g., regular price for 12 oz Coca-Cola) were assessed for reliability when data collectors agreed on the

relevant parent questions (e.g., availability of 12 oz Coca-Cola). Specifically, for analyses of regular price and sale variables (and ounces for fountain drinks), observations were only included if both data collectors agreed that a given product was available within the fast-food restaurant. For sale type variables, observations were included only if both data collectors agreed the product was available and the product was on sale. For sale price variables, observations were included only if both data collectors agreed the product was available, the product was on sale, and the sale RP type was present. For measures of fountain drinks, observations were only included if both data collectors agreed on the presence of a fountain drink service station. Otherwise, we only compared availability for each cup size. For exterior marketing, this IRR analysis only compared the presence of advertisements for specific beverage types if data collectors agreed on whether beverage advertisements were present on the given part of the fast-food restaurant exterior.

Results

Overall, our kappa statistics, percent agreement, and ICC estimates for 32 fast-food restaurants in Joliet, IL, showed high agreement between data collectors. We were able to evaluate 10 dichotomous and categorical variables with a kappa statistic. Table 1 shows that kappa statistics ranged from 0.75 to 1.00 (“substantial” to “almost perfect” agreement) for the 10 dichotomous and categorical variables, with an average of 0.88 (“almost perfect” agreement).

TABLE 1 Kappa Summary Table

VARIABLE NAME	Kappa
AVERAGE	0.88
Fast-Food Restaurant Type	1.00
Number of Exterior Walls Visible from Parking Lot or Street	0.79
Does the restaurant have outdoor seating?	0.83
Does the restaurant have a drive-thru?	1.00
Does the restaurant have free water accessible to customers?	0.75
Fountain Drinks Availability: Small	0.75
Fountain Drinks Availability: Medium	0.94
Fountain Drinks Availability: Large	0.81
Building Exterior: Any Advertisement for Any Beverages	0.93
Building Exterior: Any Advertisement for Regular Soda	1.00

We were able to calculate percent agreement for 92 dichotomous and categorical variables. Table 2 shows that the average percent agreement was 0.99, ranging from 0.84 to 1.00. All categories had an average percent agreement above 0.90. Because there were no observed sales in the fast-food restaurants, we were not able to assess any sale type variables. [Appendix 1](#) shows a list of the 92 dichotomous and categorical variables we were able to evaluate.

TABLE 2 Percent Agreement Summary Table (including the 10 dichotomous and categorical variables with kappa statistics)

CATEGORY	Number of Variables	Average (Range)
OVERALL	92	0.99 (0.84 – 1.00)
Availability	56	0.99 (0.88 – 1.00)
Sale	2	1.00 (1.00 – 1.00)
Fast-Food Restaurant Characteristics	17	0.97 (0.84 – 1.00)
Fountain Drinks	2	0.94 (0.89 – 1.00)
Exterior Marketing	15	0.98 (0.90 – 1.00)

Table 3 shows that the average ICC for the 2 categories of continuous variables was 0.91. The ICC for regular price was very high at 0.99. The ICC for fountain drink cup size was 0.83. Because auditors did not observe any sales in the fast-food restaurants, we were not able to assess the category of sale price variables.

The IRR results for this form were consistent when we conducted a sensitivity analysis. For our primary analysis, we

excluded all observations with a missing value. If one data collector missed a variable while the other data collector reported a value for that variable, the two observations were not compared, nor were they counted as a disagreement and thus, they were not part of the IRR analysis. As a sensitivity analysis, we did, however, include these observations and treat them as disagreements in computing percent agreement and kappa statistics. This slightly decreased the average kappa statistic for dichotomous and categorical variables from 0.88 to 0.87 and the average percent agreement from 0.99 to 0.96.

TABLE 3 Intraclass Correlation Coefficient Summary Table

CATEGORY	ICC
AVERAGE	0.91
Fountain Drink Cup Size (Ounces)	0.83
Regular Price	0.99

Discussion

Findings from this study suggest that the IRR for most of the measures fell in the “almost perfect” range, as indicated by the average kappa statistic for 10 dichotomous and categorical variables of 0.88, the average percent agreement for dichotomous and categorical variables of 0.99, and the average ICC for continuous variables of 0.91. These estimates are comparable to those reported for the fast-food restaurant observation tool used in the Bridging the Gap Community Obesity Measures Project¹⁶ and the Nutrition Environment Measures Study in Restaurants.¹⁷

Overall, we found the Beverage Tax Fast-Food Restaurant Observation Form provides reliable measurements of SSBs, ASBs, and other beverage products in fast-food restaurants. This supports the use of this form in future studies evaluating the availability, pricing and marketing of beverage products at fast-food restaurants.

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APPENDIX 1

Dichotomous and Categorical Variables Evaluated

Kappa: N=10

AVAILABILITY Fountain Drinks (Small, Medium, Large)

EXTERIOR MARKETING Building Exterior (Any Advertisement: Any Beverages, Regular Soda)

FAST-FOOD RESTAURANT CHARACTERISTICS "Does the restaurant have outdoor seating?"; "Does the restaurant have drive-thru?"; "Is free water accessible to customers?"; Number of Exterior Walls Visible from Parking Lot or Street, Restaurant Type

Percent Agreement: N=82

AVAILABILITY Red Bull (8.4 oz, 16 oz), Red Bull Sugarfree (8.4 oz, 16 oz), Aquafina Water (16.9 oz, 20 oz), Arizona Green Tea (23 oz), Arizona Zero Calorie Green Tea (23 oz), Capri Sun 100% Juice (6 oz), Capri Sun Juice (6 oz), Chocolate Milk Any Fat % (8 oz), Coca-Cola (12 oz, 16.9 oz, 20 oz), Dasani Water (16.9 oz, 20 oz), Diet Coke (12 oz, 16.9 oz, 20 oz), Diet Pepsi (12 oz, 20 oz), Fountain Drinks (Kids, XL, XXL), Gatorade (20 oz, 32 oz), Gatorade G2 (20 oz, 32 oz), Ice Mountain (16.9 oz, 20 oz), LaCroix Sparkling Water (12 oz), Milk 1% Unflavored (8 oz), Milk 2%, Unflavored (8 oz), Milk Skim Unflavored (8 oz), Milk Whole Unflavored (8 oz), Minute Maid (Cranberry Cocktail) (12 oz, 15.2 oz), Minute Maid 100% Juice (Orange) (12 oz, 15.2 oz),

Monster (16 oz), Monster Zero Ultra (16 oz), Pepsi (12 oz, 20 oz), Powerade (20 oz, 32 oz), Powerade Zero (20 oz, 32 oz), Pure Leaf Sweet Tea (18.5 oz), Pure Leaf Unsweetened Tea (18.5 oz), Tropicana (Cranberry Cocktail) (12 oz, 15.2 oz), Tropicana 100% Juice (Orange) (12 oz, 15.2 oz)

SALE Fountain Drinks (Medium, Large)

EXTERIOR MARKETING Building Exterior (Any Advertisement: 100% Juice, Bottled Water, Diet Energy Drink, Diet Soda, Diet Sports Drink, Flavored Milk, Juice Drink, Regular Energy Drink, Regular Sports Drink, Unflavored Milk; Price Promotion Advertisement: Any Beverages), On Property (Any Advertisement: Any Beverages; Price Promotion Advertisement: Any Beverages)

FAST-FOOD RESTAURANT CHARACTERISTICS Location of the Restaurant (a Food Court or a Mall, a Shared Space with a Gas Station or Convenience Store, a Shared Space with a Grocery or Department Store, a Shared Space with Another Restaurant), "Is the food order paid for at the counter?"; "Is the food order picked up at the counter?"; "Is the food order placed at the counter?"; Features Available at the Restaurant (Bars on Windows, Exterior Play Area, Indoor Play Area, Parking On-Site, Plexiglass or Other Dividers at Cash Register)

FOUNTAIN DRINKS "Are free refills offered for fountain beverages at this location?"; "Is the fountain beverage machine self-serve?"